CHAPTER 10 - UTILISATION

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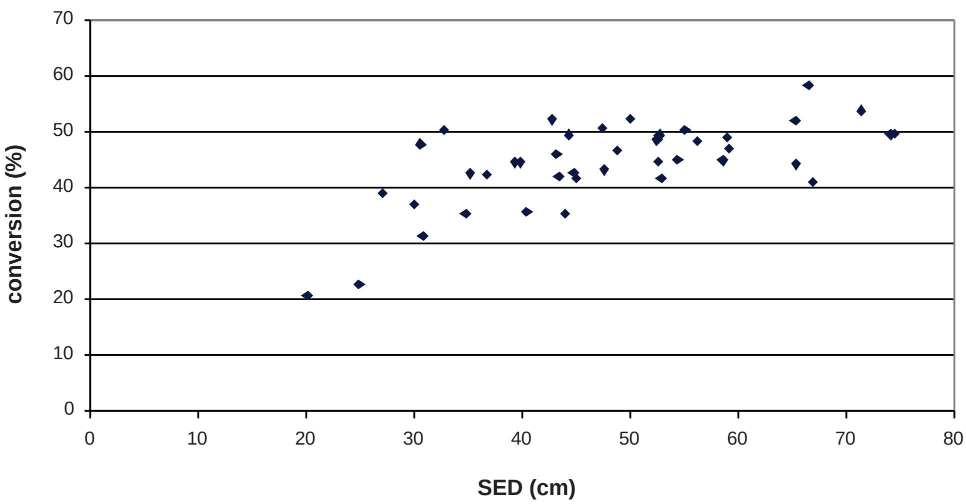
Although eucalypts have a reputation for being difficult to saw, they can be easily sawn if the basics are understood. Historically the sawing of large logs was seen as the best way to overcome stresses in the log. Preferred DBH targets were 75 cm, to yield several logs with an SED greater than 40 cm. New developments have seen successful sawing of small diameter logs into high quality products.

Table 22: Examples of FRI sawing studies

Species	Stand age (yrs)	Mean log SED (cm)	Conversion green (%)	Grade recovery (%)		
				Clear, dressing	Cuttings	Others
E. delegatensis	55	43	54	61	8	31
E. fastigata	40	55	51	45	35	20
E. regnans	55	53	51	61	25	14
E. sieberi	66	56	61	65	11	24

Source: Haslett 1988

There have been several detailed sawing studies in the last decade, often on trees from untended stands, but they have provided excellent information on species utilisation characteristics



Conversion rates for logs of a range of SED (Nicholas unpublished data)

E. fastigata sawing study

Sixteen pruned *E. fastigata* trees, aged 29 years, were harvested to produce 22 m^3 of pulp logs and 49 m^3 of sawlogs. The green and dry timber milled from the sawlogs was graded and defects assessed. The conversion rate was 49%. End-splitting reduced green timber volume by 4.9%. Kino was a major defect leading to 39% of clear timber being downgraded and between 18 and 26% of cuttings grades being downgraded.

Ignoring kino, pruned logs produced 30% of “clears” timber compared with 3% and 5% “clears” for the unpruned second and third logs. There was no internal decay associated with the pruning. After kiln drying and reconditioning there was negligible degrade but 8% of boards had internal checking and loss of timber volume from end-splitting increased to 6.5%.

E. fastigata veneer study

Utilisation studies conducted by Forest Research included a young fast-grown trial plantation of *E. fastigata* (at age 29 years, from Kaingaroa forest in the North Island). This plantation was pruned at a young age and thinned to low stockings, to allow rapid growth of clearwood outside the knotty core.

When the trees were felled, the pruned logs were sawn for lumber. A sample of the clear dimension boards was taken for green slicing on a Marunaka slicing lathe. Sliced veneer of thickness 0.6mm was produced and dried to current commercial standards. The resulting veneer was of high commercial quality indicating good potential for high-quality veneer from pruned plantation-grown *Eucalyptus* species.

Source: Roper and Hay, 2000

Species Comparison

The stringybark group of eucalypts is known for good sawing and timber properties. The species have earned this reputation from large sawlogs harvested at age 50 years and beyond, but most tree growers would prefer a shorter rotation.

A study to compare information at the individual tree level about wood properties, sawing and lumber drying behaviour, and sawn lumber characteristics of four promising eucalypt species at age 25 years was recently completed. The study involved two stringybarks, *E. muelleriana* and *E. globoidea*, a closely-related species, *E. pilularis*, and *E. fastigata*, an “ash” that has been planted extensively for short fibre pulp in the central North Island. Fifteen trees of each species were selected from an old species trial in Rotoehu Forest, Bay of Plenty. No pruning or thinning had been done. Some self-pruning had occurred and natural mortality had reduced the stocking in the *E. pilularis*, *E. muelleriana* and *E. globoidea* blocks from 1650 stems/ha to about 250 stems/ha. The *E. fastigata* had minimal natural mortality and had a stocking of 1,433 stems/ha.

A 5.5 m butt log was cut from each tree, then cross-cut to yield two 2.75 m logs. The first 2.75 m log was cut in half through the pith and then quarter-sawn. A Woodmizer™ mill was used to saw the second 2.75 m log in a flat-sawing pattern, maximising 150 × 40 mm and 100 × 40 mm dimensions.

Source: McKenzie, Ball & Roper 2000

For each of the species the average underbark diameter at 2.7 m was 29 cm for *E. pilularis*, 30 cm for *E. muelleriana*, 32 cm for *E, globoidea* and 42 cm for *E. fastigata*. Butt log heartwood percentage was similar for all species and ranged from 81.0%–84.8%. Discs were taken from each tree at the butt, at 2.7 m and 5.5 m, and at 6.0 m intervals up the stem beyond that. These revealed a trend of density increasing with distance up the tree for all four species. The basic wood density of the 5.5 m log, averaged for the 15 trees per species, was similar across species, 545 kg/m^3 for *E. pilularis*, 576 kg/m^3 for *E. muelleriana*, 559 kg/m^3 for *E. globoidea* and 533kg/m^3 for *E. fastigata*.

All boards were measured for width and thickness when green. After 12 months air drying, the boards were assessed to evaluate the effects of drying and quantify the characteristics of these species for utilisation as sawn timber. Differences in sawing and board distortion between species were small and dwarfed by tree-to-tree variation among species.

The *E. fastigata* trees were larger in diameter than the other species and had significantly more end splitting. However this did not result in increased board distortion. The *E. globoidea* had the best recovery of clear boards in the butt log and was superior to *E. muelleriana* and *E. pilularis* for clear boards in the second log. Stiffness and hardness of flat-sawn pieces were greater than quarter-sawn pieces, but some of this difference may be due to the increase in density with height up the stem. Bow and crook and shrinkage differed significantly between sawing styles, with the likely cause being tangential shrinkage. Quarter sawn boards had less shrinkage, less bow but more crook than flat-sawn boards. Stiffness was good for all species at 9-20 GPa.

In general, all four species were similar in appearance and wood characteristics and could be marketed together. *E. fastigata* is restricted to internal use, whereas *E. pilularis*, *E. muelleriana* and *E. globoidea* have durable heartwood and can be used externally.

Source: McConnochie and Low 2007

Sawing evaluation of 15-year-old *E. nitens*

A 15-year-old pruned stand of *E. nitens*, grown to about 55 cm diameter at breast height (DBH) at low stocking, provided 15 trees, preselected for a range of wood density, which were each evaluated for production of appearance grade lumber and rotary-peeled veneer. Lumber was sawn from the 5 m butt logs and veneer peeled from the second logs, originating from height 7-13 m.

Butt log quality was good, as pruning had been effective in restricting the knotty core, and there was little decay from branches in either butt logs or veneer billets. Longitudinal growth stresses varied widely between trees, resulting in log end-splitting, sawlog flitch movement during sawing and crook in sawn timber which substantially reduced timber conversion in some trees. Collapse and internal checking were prevalent in air-dried lumber, and numbers of checks varied widely between trees. Face-checking was found in boards from all trees after kiln-drying and reconditioning, and even those that met the criteria for clear grade had internal checks.

Veneer thickness varied unacceptably, caused probably by incorrect knife and pressure bar settings. Veneer splitting also varied between trees, tending to be worse in butt-log versus second-log veneers. Insufficient and uneven pre-heating of billets before peeling may have exacerbated splitting. Knots had a large impact on structural plywood veneer grades, and less than 8% of sheets from the second logs were acceptable compared with 87% of sheets from the pruned butt logs. Stiffness of veneer sheets was successfully measured using a sonic device (Pundit), and used to sort veneers for manufacture of laminated veneer lumber (LVL).

Source: McKenzie *et al.* 2003

E. nitens veneer study

Veneer peeled from *E. nitens* unpruned second logs was segregated into three stiffness (MoE) classes using an acoustic test. LVL was manufactured using sheets from each stiffness class and strength tested. The strength tests showed that the sheets were successfully segregated by the acoustic stiffness test. The *E. nitens* LVL had high strength and stiffness properties which were higher than LVL made from New Zealand-grown radiata pine veneer.

Source: Gaunt *et al.* 2002

Limited experience with New Zealand grown *E. microcorys* logs suggests that this species may be one of the easiest of all eucalypts to mill and dry, with minimal growth stresses and defective corewood.

Evaluation of *Eucalyptus globoidea* grown on Matakana Island

Five *E. globoidea* trees were selected, cut into sawlogs and sawn on a portable sawmill. The overall conversion to sawn timber of 59.5% was reduced to 42.2% when boards containing compression heart were removed. There was major distortion of sawn boards in the form of crook. When taking into account both the crook and surface checking from open air drying, the potential round log conversion to dressing and better grades reduced from 37% to 19.9%. Most of the high value uses for eucalypts are for clears and clear cutting grades. Accounting for both timber distortion and drying degrade, the round log conversion to these grades was a poor 12.6%. With only minor kino present and no apparent decay, the main factor contributing to the low clears recovery was the presence of numerous small intergrown knots, apparently resulting from epicormic shoots. Sample tree densities were high but there was considerable within and between-tree variation in occluded internal branch associated defects, effects of log end-splitting, distortion of timber off-the-saw and propensity for surface checking.

Source: Somerville and Gatenby 1996

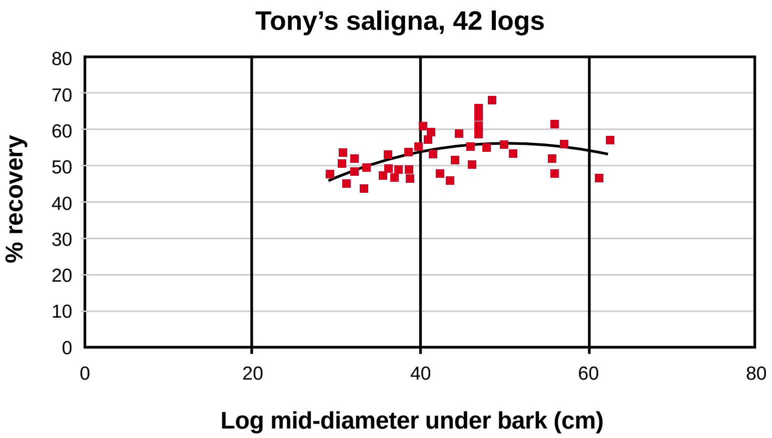
Sawing small diameter logs

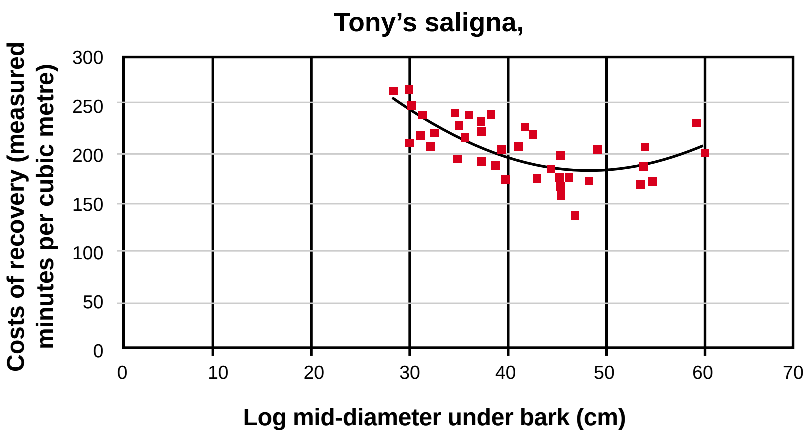
Northland farm foresters Dean Satchell and Richard Davies Colley have developed an efficient way of sawmilling small eucalypt logs with a Woodmizer™ mill. After initial successes on 12- and 19-year-old *E. muelleriana* they are validating and improving this system on a wider range of species.

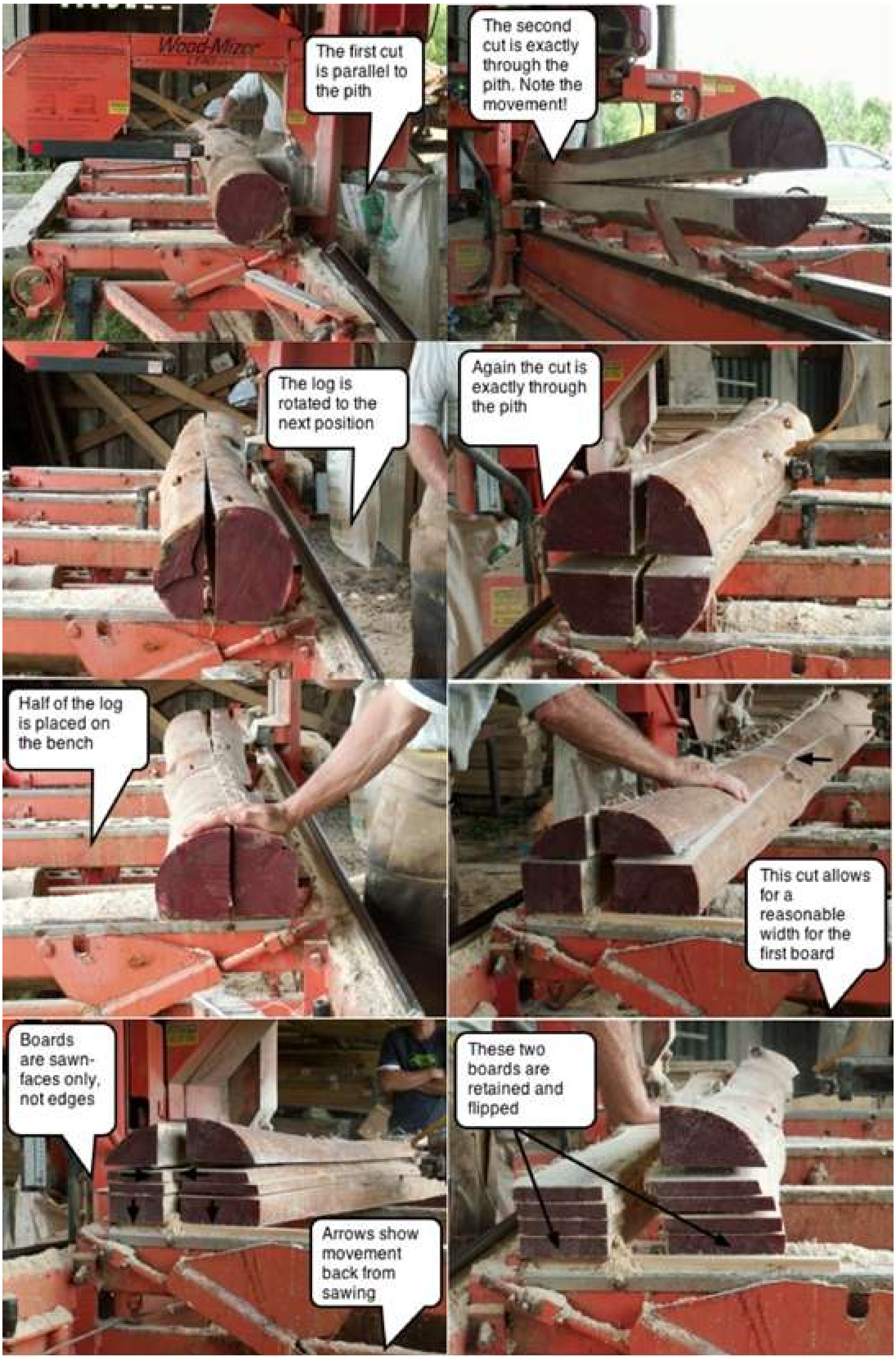
Stringybark eucalypts have very few, if any, compression fractures and little defective wood in the core of young trees, as well as negligible collapse, no internal checking, low shrinkage and the sapwood is resistant to lyctus borer. A high potential recovery of sawn timber is therefore possible.

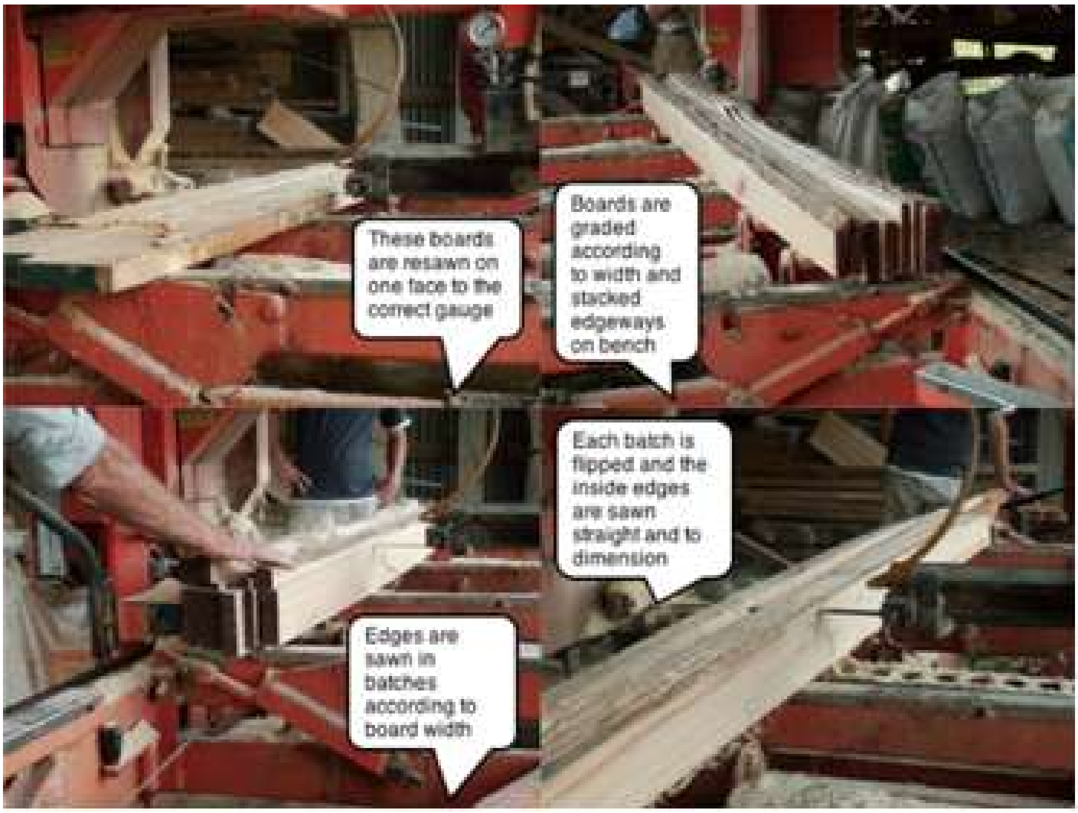
This sawmilling pattern produces quarter-sawn and straight boards from a quality, stable hardwood timber for high value end uses. The aim is to produce quality lumber efficiently and with a high recovery from small diameter logs. Sawn recovery is between 60% and 80% from this method. Log sizes trialled so far range between 250 mm SED and 415 mm SED, from trees 12 and 19 years old.

Milling time is presently about four hours per cubic metre recovered. For smaller logs recovery time increases, and further work is required to assess the economics such as break-even and optimum log size.






The first cut is parallel to the pith
The second cut is exactly through the pith. Note the movement!
The log is rotated to the next position
Again the cut is exactly through the pith
Half of the log is placed on the bench
This cut allows for a reasonable width for the first board
Boards are sawn-faces only, not edges
Arrows show movement back from sawing
These two boards are retained and flipped


These boards are resawn on one face to the correct gauge
Boards are graded according to width and stacked edgeways on bench
Each batch is flipped and the inside edges are sawn straight and to dimension
Edges are sawn in batches according to board width


This is the core of the tree, and will always split because stresses are in opposite directions each side
Despite being "quartersawn", boards with the core included will crack and be unstable in service, and must be avoided

Key Points

- Eucalypt sawlogs are relatively easy to saw if the right techniques are employed.
- Eucalypt logs can provide a reasonable percentage of clear length timber.
- Sawing conversions can range from 50-60%.
- New techniques for successful sawing of small diameter logs are being validated.
- Eucalypts produce acceptable appearance and engineering veneer products.

Suggested reading:

Gaunt *et al.* 2002

Haslett 1988 a & b 1990

Kininmonth *et al.* 1974

McConnochie & Low 2007

McKenzie, Ball & Roper 2000

McKenzie *et al.* 2003a & b

McKimm *et al.* 1988

Roper & Hay 2000