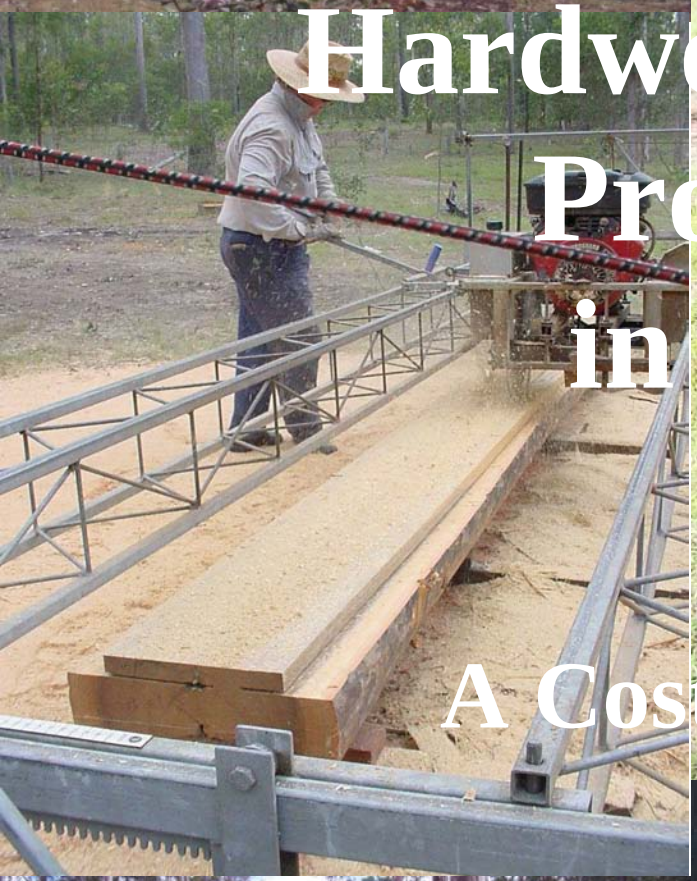



On-Farm-Value Adding of Mixed Hardwood Forest Products in SEQ.

A Cost Analysis.




Queensland Forestry research Institute

Agency for Food and fibre science

On-Farm Value-Adding of Mixed Hardwood Forest Products in SEQ

A Cost Analysis

Case Study 3

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THE PROJECT

The National Heritage Trust is funding a joint venture between the Mary Valley Sunshine Coast Farm Forestry Association (MVSCFFA) and the Queensland Forestry Research Institute (QFRI). The major objective of this project is to provide private landholders in the Mary River Catchment - Sunshine Coast area with confidence and skills in sustainable native forest management and to promote the integration of forest management into their normal farm management activities. Promotion and adoption of these skills in conjunction with a comprehensive resource assessment should lead to: -

- Retention of native forest on farms for sustainable wood production rather than clearing for pasture production or other developments,
- Better understanding of the ecological and silvicultural processes associated with native forests leading to improved management decisions on private lands,
- Readily available data on the private native forest resource for land use planning to maintain a viable rural industry incorporating sustainable wood production,
- Adoption of a high management standard for private native forest, based on the 'Code of Practice for Native Forest Timber Harvesting' currently being implemented on State Forests so that environmental values are protected and maintained, and
- Maintenance of biodiversty outside of nature reserves through the retention of greater areas of native forest on private lands.

These outcomes are being achieved by establishing a series of demonstration sites on private land as a focus for field days to provide a 'hands on' approach to imparting better forest management skills. Each site is documented in a detailed case study discussing the results, techniques and processes.

The overall goal is to establish a range of plots across the wet, moist and dry forest groups which illustrate stand management and environmental protection principles. A range of silvicultural practices, fire management and where appropriate, timber harvesting techniques based on the 'Code of Practice for Native Forest Timber Harvesting' will be demonstrated.

The project will raise the profile of native forest management and will promote the value of retaining more of our native forests as a productive farm enterprise and the skills necessary to achieve it. This will be further enhanced by the production of a user-friendly Silvicultural Manual for Native Forest Management on Private land, using information directly gleaned from these sites. To date two other case studies have been completed;

1. A case study in an Even Aged Regrowth Forest in SEQ
2. Investigating Techniques to Restore Productivity in a 'High-Graded' Dry Eucalypt Forest in SEQ

The site at Gundiah in the North of the project area has been selected as the fourth case study in the series. This case study investigates and compares returns to the landowner from a conventional harvest (selling straight to a mill) against those received from on site milling of the timber and marketing the sawn product. The study also investigates recovery rates and quality of the products and the marketability. The Gundiah property has been successfully managed for timber

production for over sixty years and this paper describes the history and management practices resulting in this quality forest. Further information on the project and other case studies in the series are available on our web site - www.widebay.net/forest

INTRODUCTION

Private native forest has long formed an important resource for the processing industry and a valuable alternative income source for landholders. In the past, timber harvested from native forest in Queensland on private land has equalled or exceeded that from Crown lands. Over the last five years this harvest has declined dramatically from 420,000 m^3 in 93/94 to 250,000 m^3 in 98/99 (*DPI-F98/99 Yearbook).*
As for native forest on Crown land, management of private native forest in Queensland has developed along 'selective logging' lines. However, the management regimes imposed by individual forest owners have led to a wide range of forest productivity levels.

Harvesting is one of the native forest owner's most important management decisions yet in the majority of cases the forest owner has little participation in the process other than selecting which merchant will buy the product. Few other primary products are sold with such little regard for the future viability and productivity of the crop. Unlike other forms of primary production, timber has an extended cycle of production and the specific skills and knowledge needed for well managed timber harvesting have traditionally been available only to those who have worked in the industry. Successful primary production today requires diversification across a range of enterprises. An example of this is evident in the growth of new industries such as olive and wine production in place of traditional enterprises such as grazing. Intensive investigation of the cropping and marketing requirements of these industries is routinely undertaken and implemented, and the same approach needs be undertaken for timber production.
To ensure long term viability, maximum productivity and returns, farm managers need to be aware of best management practices, the range and value of the products in their forests and how to obtain the best returns.

On farm value adding of forest operations is often promoted as a process ensuring a higher return for the grower, however this requires a broader range of skills and organisation than a traditional sale, namely:

1. Pre-harvest marketing survey,
2. Cutting and snigging or organising a cutter and snigger,
3. Milling or organising a miller,
4. Product grading and sorting,
5. Further processing if necessary - treatment, drying and dressing, and
6. Marketing and sales.

The gross value of the finished product may be many times that of the value of the standing tree. The objectives of this study are to investigate the techniques, limitations and cost / benefit of on farm value adding and marketing compared with the returns from a conventional harvest and sale of logs in the round.

The total harvest from the demonstration site was 233 m^3 of logs from an 18 ha block consisting of 190m^3 of sawlog (average 1.03 m^3) and 43 m^3 of landscape blocks. Of this 30.4 m^3 was sawn on site using a 10 year old Lewis® mobile mill and then marketed and sold independently of the landholder.

The case study will also consider the past management history of the property, pre and post harvest stand details and the forest management regime of Mark and Owen Thompson.

OBJECTIVES

The objectives of this trial are:

1. To provide a demonstration and focus site for field days and workshops for public education on sustainable native forest management (SNFM).

2. To investigate the returns from on and off farm value adding, marketing and sales against the returns from a conventional timber sale.

3. To investigate the marketing options for private native forest (PNF) owners for a range of round and sawn timbers.

4. To investigate the product quality, range and the recovery rates achieved from a mobile mill.

SITE

Selection and Location

Dry Sclerophyll forests, principally dominated by Spotted Gum, Grey Ironbark and Forest Red Gum form the majority of the forest type in the project area (Mary River Catchment). This occurs principally in the north of the project area where average farm size tends to be larger. Results from this work however have similar implications for all the forest types. The site also had to be easily accessible to the public with a timber stand ready for harvest. Due to the nature of the study, the co-operation and participation of the owner was critical.

Property Description

The selected property is located approximately 20 kilometres west of Tiaro, 50 km south west of Maryborough in south east Queensland. The property is 2,100 ha in area and 90% timbered, 50% of which is silviculturally managed for timber.

The majority of the property including the study area is undulating low hills with slopes generally less than 10˚ *(Speight 1984).* Soils tend to be duplex with fine textured sandy clay loam over a medium to heavy clay subsoil. Subsoils are often highly sodic and drainage is often poor. Mean annual rainfall is between 750 and 1000 mm. The property has been classified under the Regional Ecosystem Classification as RE 12.9/10.17 - 12.9/19.19 - tall open forest on Cainozoic to Proterozoic sediments (*Sattler & Williams 1999).* Conservation status - no concern at present (*EPA 1999*). Predominant species include: Spotted Gum (*Corymbia variegata*), and Red Bloodwood (C. *intermedia*), Grey Ironbark (*Eucalyptus sideroploia*), Broad Leaved Red Ironbark (*E. fibrosa*), White Mahogany (*E. acmenoides*), Grey Gum (*E.*

*propinqua*and *E. longirostrata*), Queensland Peppermint (*E. exserta*),Gum Topped Box (*E. moluccana*),Smooth Barked Apple (*Angophora leiocarpa*) and Brush Box (*Lophostemon sp. aff. L confertus*) is also often present in gully areas or as a sub canopy. The understory is a mix of grasses and shrubs including Black Wattle (*Acacia leiocalyx*), Hickory Wattle (*A. disparrima*) and Grass Tree (*Xanthorrhoea johnsonii*).

History

The property was gradually acquired over many years, the first portion (containing the study area) was selected in 1912 by Mark Thompson's father. At that stage the property was mainly used for grazing and as a home paddock for his Bullock and Horse teams. The teams were used for hauling and snigging timber in the district up to the 1930s. The block was harvested (down to 40cm log centre diameter) and then ring-barked at the time of selection, being completely cleared on the flats and mostly cleared on the slopes. Regrowth persisted through this period and due to the owners' subsequent interest in growing timber, began to be actively managed for timber production. In 1946 Mark bought an adjacent 860 acres (358 ha) specifically to grow timber as he considered it to be a good timber block.

This formalised his future management intentions, ie to maintain and manage the forest on his property for timber production as well as cattle grazing.

The study area was heavily harvested in 1953 with all timber over 40 cm centre diameter removed due to tight economic conditions. In the 1960s the forest was extensively treated (silviculturally thinned), maintaining around 60 stems per acre (144 per ha) on the basis of retaining healthy, vigorous trees at a good spacing (approx. 9 metres). In 1970 a large number of poles were harvested from the study area and since then only low intensity logging for girders or dying trees has taken place, usually to make up a load.

Figure 1. Spotted Gum stand typical of the harvest area

Current Farm Management

The farm has two main enterprises, cattle and timber production. Cattle graze the whole property. The prime grazing areas are generally not the best timber areas and are managed more for grass production. Timber production is carried out on 90% of the property but only 50% is considered good timber country worthy of treatment and further management. In these areas wide tree spacings are maintained for grass production and to maximise timber productivity. The property currently carries 700 head of cattle, plus they run a 700 ha forestry-grazing lease.

Stand Inventory

For the purposes of this study, a strip survey of the harvest block was carried out at 100 metre intervals, recording all trees > 10cm DBH in 10 metre strips running the length of the block.
Species, crown evaluation, log length, DBH, defects, product type and estimated volume of sawlog in treesd greater than 40 cm were also recorded. Landscaping timber and pole volumes were not estimated.
Tree size class distribution is presented below in Table 1.

Table 1 -Number of trees by DBH Class (cm) from strip survey data.

Strip	10-20	20-39	30-40	40-50	50-60	60-70	70+	Total Stocking
1	43	17	8	1	2	3	0	
2	17	7	7	4	5	3	1	
3	31	6	8	5	2	1	1	
Av. per ha	70	23	17.6	7.7	6.9	5.3	1.5	132

Species mix includes:

1. Spotted Gum - 53%
2. Grey Ironbark - 19%
3. Forest Red Gum - 9%
4. Gum Topped Box - 5%
5. Other - 14%

'Other' includes many non-commercial species however some species such as Red Bloodwood and Queensland Peppermint have been included in this category. Over 86% of the stand comprises commercial species suitable for timber production.

Standing volume of sawlog in trees greater than 40 cm DBH was derived from estimated log length and calculated using a one way volume table (Table 2).

Table 2 - Estimated-standing volume of sawlog in trees greater than 40 cm DBH.

Strip	Area (ha)	Volume (m^3)
1	0.56	7.56
2	0.44	19.3
3	0.33	11.156
Average Vol. / ha		**28.58**

HARVESTING

Harvest and Tree Selection

Annual harvests on the Thompson's property have averaged around 500 m^3 over the last 10 years on a rotation interval of 15-30 years. Anecdotal observations by the Thompsons indicate that the forest growth rate is exceeding the rate of harvest. In this current harvest the total sawlog cut was 190.242 m^3 and 43.013 m^3 of landscape block. This equates to 10.569 m^3/ha of the 28.58 m^3/ha standing or approximately 37 % of estimated standing sawlog volume. The total harvest time for cut and snig was two weeks.

Criteria for tree removal is directed at harvesting trees that have reached their maximum economic value, are showing signs of defect or poor health and will decline prior to the next harvest or are suppressed and unlikely to develop to potential. In this way harvesting is used as a tool for stand improvement. Criteria include:

- Optimum product size,
- Declining tree health, usually assessed by crown condition,
- Defect such as a vertical dead limb or suspected decay from old wounds,
- Bad Mistletoe infestation,
- Suppressed trees indicated by crown shape and condition.

Trees are not marked for removal. However before a tree is harvested, its probable product range is considered, this may be a pole, girder, saw log or landscape block. Poles were left standing to be removed later in the year when debarking is easier.
After a tree is cut, the log is examined to fit into either of three classes, girder, sawlog or landscape block.

1. Girder (main road standard girder) :

    - Minimum 9.6 m length
    - Minimum 450 mm small end diameter under bark
    - Straight
    - Desired species
    - Minimal pipe or branches

Figure 2. Base log, top log and landscape block cut from one tree

2. Sawlog :

    - Minimum 2.4 m long, increasing in .3 m increments, allowing .1 m for each cross cut
    - Minimum 30 cm small end diameter under bark
    - Limbs affecting less than 50% of the circumference of the log
    - End of log defect affecting less than 50% of the end section
    - Degree of bend, this varies with centre girth, (as a guide, - 40 cm - 2.5º, 40 - 49cm - 5º, 50 cm+ - 10º), often a bent log can be cut into 2 shorter straight logs.

3. Landscape Block :

    - Usually 2.4 m billets, occasional 2.1m accepted
    - As long as the recoverable sawn timber is worth more than the cost of the log (value judgement)

Owen Thompson carried out all tree selection, cutting and snigging. Owen has extensive experience in the harvesting process having harvested timber on his property for approximately 25 years as well as other contract harvesting.

The block was burnt some months before harvesting to facilitate access and reduce fuel loads prior to the harvesting process. This ensures the 'top disposal' burn, (disposal of the logging debris after harvest to promote regeneration), is not too intense and does not damage retained trees.

Cut

Trees were cut on a progressive face over the two week period using standard cutting and measuring equipment including:

- 084 Stihl chainsaw,
- Retractable measuring tape,

- Steel diameter tape,
- Axe,
- Wedges.

On average, 8-9 trees were removed per hectare. Directional felling was practiced to avoid damage or excess debris near retained trees. Logs were left full length wherever possible for ease of snigging and hauling. Bark thickness was calculated by removing and measuring a triangle of bark at the midpoint of each log, this measurement was then doubled and taken off the centre log diameter. Centre diameter under bark, log length and log class were written in timber crayon on each log.

Booking and Tallying

On completion of each section all logs were recorded on a field tally sheet and given a number. The number, length and centre diameter under bark were then written on the butt of the log using a paint pen. Eg. - **125 5.4 x 43**. This represents log number 125, log length 5.4 m x centre diameter 43 cm. The volume for each log was also calculated and tallied on the sheet using timber volume tables (centre diam. x length).

Snig

Snigging was carried out using two farm tractors:

1. 95.5 hp Fiat dozer with bull blade and a 3 point linkage 5 tonne winch.
2. 80 hp Fiat 2wd wheeled tractor with 3 point linkage hydraulic log grapple and front mounted hydraulic forks.

The dozer was used primarily to ensure clean access to each log, nudging it into a quick pick-up position where necessary. Some logs in difficult positions were snug using the dozer. It was also used to clean up the site, pushing debris into heaps for burning. The wheeled tractor was then able to grab the log and snig it to the log dump unimpeded. Due to the slight slopes, open country and near location of the log dumps, snig distances were short and minor in nature with no creek crossings or side cuts required.

Figure 3. Tractor and hydraulic grapple used for snigging.

Log Dump

Three log dumps were situated on level ground with good truck access, storage and room for sorting and loading. Logs were sorted into classes and length (short and long) for ease of inspection and loading. Girders were stored separately for a later sale.

SALE

On completion of harvesting three mills were given the opportunity to inspect the logs and bid on a competitive price basis. A summary of the successful bid is listed in Table 2.

Table 2. - Sale returns per m^3 of log.

Sale Returns per M^3			
Saw log	**Cut and snig**	**Royalty**	**Total at Dump**
	$22	**$82**	**$104**
Landscape log	**$22**	**$28**	**$50**

Hauling

Loading and hauling were the responsibility of the purchaser who transported a loader on a flat back semi, using that and a tri-axle jinker for haulage.

MOBILE MILLING

For the purpose of this trial a representative sample of approx 30 m^3 of sawlog was diverted to the mobile mill for processing and sale as a sawn product. For this trial, a range of activities were carried out prior to sawing including locating available mobile mills, a survey of likely markets and products and legislative requirements for the mobile mill and the sale of sawn product in Queensland.

Pre-Milling Survey

Using data from the stand assessment (predominant timber species, log sizes and quantity), a survey of was carried out by contacting a large number of timber and hardware merchants (via the Yellow Pages) in south-east Queensland. This verified demand, requirements and preferences for the size and form of the sawn product. The survey produced a list of products in demand and their potential value, forming the basis for the milling operation.

Saw Selection

A number of operators with a variety of mobile saws were considered. As most mobile circular saw mills perform to a similar standard, operator experience and availability was of a higher priority than make of saw. Consequently a 10-year-old, 200 mm Lewis® mill with an experienced operator was chosen. The operator also had visual stress grading certification, an important component when marketing the products.

Logs

The logs chosen for milling were a representative sample (including species) of the whole harvest, including large and small, defective and defect free logs, averaging approximately 1m³. All logs to be sawn had their ends waxed with Caltex Log Sealer ® to reduce end splitting and drying checks. A list of all logs sawn by the mobile mill is presented in Appendix 1. A list of logs and their specifications is attached (Appendix 1).

Sawn Wood

All sawn wood was visually graded according to AS 2082 and the TRADAC Visual Stress Grading of Timber Manual, into F14 or better (see Appendix 2), landscape or reject. The timber was then sorted into size class and product type and the length written in white ball marker ink on the end grain. A tally of all products sawn from each log was recorded as was its species, dimensions and defects enabling recovery rates against log size and defect to be calculated.

Recovery Rates

The 'Recovery Rate' is the calculation of the volume of sawn product against that of the log being sawn (Appendix 1). In this case the calculation was separated into 'A' grade wood and landscape material. Eg

Log no	**Species**	**Log Volume (m^3)**	**'A' Sawn Volume (m^3)**	**Recovery Rate**	**Sawn Landscape (m^3)**	**Recovery Rate**	**Total Recovery**
180	**GBX**	**0.867**	**0.403**	**46.5%**	**0.015**	**1.7%**	**48.2%**

Legislation

The requirements for the licensing of “portable (or mobile)” sawmill plants are determined by their **method of operation, <u>not</u> by their portability**.

A sawmill license is not required if the blade operation of the sawmill is the only function of the machine working automatically and the saw is moved through a stationary log by “manual” means only. That is, by pushing, pulling or by a manually operated pulley, and where the position of that saw is adjusted in relation to the

position of the log by similar “manual” means, providing that the log is not 'cut across a saw bench'. In all other cases a sawmilling license is required. The Lewis mill did not require a license.

Anyone involved in milling and/or selling of timber has obligations and should be familiar with the following Acts:

- *The Workplace Health and Safety Act 1995*
- *The Timber Utilisation and Marketing Act 1987*
- *The Environmental Protection Act 1994*
- *The Diseases in Timber Act 1975*

In accordance with Part 2 of the Workplace Health and Safety Regulations associated with the Act, a Certificate of Registration of a Registrable Workplace is required where the workplace employs more than two persons (including the employer, a self-employed person or a person employed part-time or full-time*)* between 1 February and 31 January of the next year. In this case the workplace did not require registration

Sawn Timber Marketing Legislation

All timber was sold in accordance with the Timber Utilisation and Marketing Act, 1987. Under this Act any lyctid susceptible timber must be treated before sale.
Lyctid borer, also known as the powder post beetle, is a recognised timber pest in Queensland. The larvae of this insect feed on the starch in the sapwood of some hardwoods and in so doing leave tunnels packed with fine powdery frass *(DPIF 1988).*
In this case, the Spotted Gum sapwood is susceptible to borer attack and, as it was the major species cut, a marketing decision was made to CCA treat all timber to H4 standard**.** The H rating is the residual level of Copper Chromium Arsenic (CCA) wood preservative left in the timber after treatment. All treated timber was stamped H4 in accordance with the Act.
Hazard Level 4 (H4) treatment is used when the timber is likely to be subject to a severe decay hazard, such as being in contact with the ground, continually damp or if the sapwood is susceptible to lyctid borer attack. The treatment is designed to reduce the likelihood of attack by insects, including termites, and decay (*Mathews 2001).*

Marketing and Value Adding

The pre-milling survey produced a number of retail orders amounting to almost half the final sale and a wholesaler potentially willing to purchase the remainder depending on the success of the operation and current demand when available.

A proportion of this sale required 1,430 lineal metres of 100 x 25mm boards to be 'dressed all round'. This was sold as green off saw, dressed (machined) and then CCA treated as requested by the purchaser, and the drying was their responsibility. Unless specifically requested by the buyer, under The Timber Utilisation and Marketing Act (1987), dressed timber should be dried and then dressed. However in this case,

treating the dressed product ensured the integrity of the treatment of the heartwood normally reduced or lost by dressing.

Costs and Returns

The costs and returns of the mobile milling component of this trial are given below for the 30 m^3. Essentially, this included purchase of the sawlogs at the log dump to ensure the landowner did not carry the cost of milling, processing and marketing**.**

Costs	
Sawlogs at dump (cut, snig and stumpage)	$ 2933
Landscape blocks at dump (cut, snig and stumpage)	$ 125
Milling 30.44 m3 @$115/$m^3$	$ 3500
Treatment to H4 @$68 m^3	$ 952
Cartage to treatment works	$ 315
Cartage for delivery	$ 147
Dressing @$0.25/lin metre	$ 350
Total	**$ 8322**

Returns

Dressed timber 1,430 lin m @ $2.20 /lin m^3	$3,146
Larger section timber (Retail) @ $800/$m^3$	$ 646
Large section timber (wholesale) 2.2 m3@ $765/$m^3$	$1,685
Smaller section timber (retail) 1.73 m^3 @ $670	$1,157
Smaller section timber Whole sale $510-665/$m^3$	$1,175
Larger section landscape timber @ $368/$m^3$	$ 737
Small section landscape timber @ $300/$m^3$	$ 645
Total	**$ 9,191**

DISCUSSION

Value Adding Trial

Most private native forest owners in Queensland have traditionally sold trees to established timber processors on a 'standing in the paddock' basis. Landowners who 'value add' by cutting, snigging or processing their own product are the exception rather than the rule. In some instances landowners have long standing agreements with sawmillers to harvest on a rotational basis, while others harvest on an *add-hock* basis usually when finance is tight or some other capital acquisition is planned.

Value adding is frequently cited as a panacea to the poor returns often received by the grower. The aim of this trial is not to advocate value adding, but to test one form of the process from stand management to harvest to sales, examining the systems used and completing a cost analysis of the results.

Property Management

Past Management

Cattle have always been the main enterprise of the property, closely aligned with this has been timber production. It is the firm belief of Mark and Owen that maintaining tree cover improves and maintains grass production over a longer period of the year than a bare paddock. Having timber as a second enterprise allows a safety net when cattle prices drop.

"Trees got me out of trouble on a number of occasions, 1964 was a bad recession, cattle were bad, building was slow but the price didn't really go down for timber only the quantities. Supplying the one mill for many years gave us steady sales through out that recession and things would have been a lot tougher without it." (Mark Thompson)

This property followed the pattern of most property selection in the early part of the last century. Properties were selected and progressively cleared for pasture and beef or dairy production. Little was known of the potential hazard of extensive landclearing and given the abundance of timber at the time, meagre value was placed on retaining timber. The early appreciation by Mark Thompson of the advantages of tree cover for improved grass and timber production resulted in most of the property being progressively managed for grazing and timber production over the last 60 years.

The forest is maintained at around 140 stems per hectare (> 10 cm DBH) by periodic silvicultural treatment (thinning), harvesting and fire. This allows sufficient light and moisture to allow a grassy understorey to be maintained under the forest canopy. Important to this strategy of multiple use is maintaining the highly productive areas with more fertile soils for pasture production alone. The forest is control burned on a 2 - 3 year cycle, depending on seasonal conditions, and the fire intensity is regulated by timing to manage regeneration of the timber species as well as Acacia regeneration and regrowth is kept to manageable levels. Occasionally the Acacia requires treating with herbicide when numbers get too prolific and impact on grazing values.

The forest has gradually been encouraged to regenerate back into the areas that were cleared in the past and these areas now support significant stands of high quality Spotted Gum. Anecdotal evidence by the Thomsons (observed growth from sapling to harvest) suggests the trees at this spacing (8 - 9 m, approx.140 / ha for trees > 10 cm DBH) have an annual diameter growth increment of at least 1 cm which is consistent with well-managed Spotted Gum forest *(Henry 1960, Taylor and Nester 1998).*

Salinity and Erosion

One of the main drainage lines of the property commences in the adjacent old dairy farm (now part of the property) which was totally cleared in the 1920s. The creek was originally
a permanent water line with deep holes. In the 1940s, due to the nature of the sodic soils with its highly soluble clays, the banks started eroding and by 1960 after cyclonic flooding the creek completely collapsed leaving a deep canyon. What water holes remained turned increasingly saline and scalding appeared on the low lying areas. An early decision to allow natural regeneration over large areas of the farm saw the forest gradually re-establish causing the salt scalding to gradually disappear. The creek erosion still remains a problem that can only be ameliorated by expensive engineering works, however the erosion is slowed by maintaining tree and wattle cover. Any further gully erosion is allowed to regenerate to a heavy Acacia cover.
This is a graphic demonstration of the potential for severe erosion problems to develop with these soil types and the amelioration benefits of forest regrowth to salinity problems.

Forest management

The area logged had a relatively low stocking of large trees with patches of open country and only 21 trees per ha over 40 cm dbh. Part of the reason for this is the complete clearing in the past and gradual regeneration of forest back into these areas. This was also evident in the number of stems per ha between 10 and 20 cm (70). The number of trees harvested per ha was also low (8-9), mostly in the upper size range. Some trees were removed in the 40cm dbhrange due to defect or being in decline. Generally Owen prefers trees to be at least 50 cm dbh before harvesting but trees 60cm+ dbh were left if they were healthy and free of defect, particularly if they could produce a girder (greater than 45 cm diameter at 10 metres above ground level) at a future harvest.

Poles were left to harvest later in the year (winter) as these have to be debarked at harvest. Spotted Gum and most other eucalypt species in this area become easier to bark from about May to September, and consequently this is the preferred time of year for poles to be harvested.

Following the harvest tree heads were pushed together and burnt, providing a seedbed for regeneration and aiding grass reestablishment. This also allows for safer and easier access to the area for mustering in the future. Regeneration in these forests is predominantly through lignotubers that persist at ground level for many years until a gap in the overstory allows it to progress into the 'advanced growth' stage.

Transverse drains were established on any snig tracks that required draining to avoid any soil erosion problems. This is essential where repeated use of snig tracks forms a

rut exposing the subsoil which is often very prone to erosion due to the high levels of sodium. Experience has demonstrated that redirecting water at regular intervals, dependent on slope and soil type, onto undisturbed areas reduces erosion significantly.

Forest Growth Potential

Regrowth forests such as this have the potential to be highly productive forests and with good management can take on many of the growth habits of a plantation. Productivity can be greatly enhanced with well-managed selective treatment. Treatment generally involves 'selective' thinning where trees are retained on the basis of growth and product potential (healthy crowns and long straight boles) and are spaced to maximise growth. Trees with little growth potential are generally either cut for sale or thinned to waste.

Forests that have been previously harvested, particularly to a minimum DBH regime, often leave a stand of trees that are defective and/or suppressed and identification and removal of these trees is critical to maintaining productivity. A suppressed tree can usually be identified by a misshapen or declining crown, often from having grown under a more dominant tree. Suppressed trees generally have unsatisfactory growth rates and short boles and in turn can dominate and suppress further regeneration significantly reducing the productivity of the stand. Intervention by treatment is essential to bring the forest back to potential productive capacity.

Forests Stands Suitable for Treatment

On this property only the higher quality areas for timber production are intensely managed. This is usually soil related and is indicated by the quality of the standing forest and forest type, ie, a predominance of Spotted Gum. Some areas are best suited to grazing and are consequently maintained with much lower tree cover. The areas managed for timber production are all regrowth forests and without management would develop high stocking levels resulting in very slow individual growth rates. Some criteria need to be formulated for this and the Thomsons have developed those listed below. Past work has demonstrated that not all forest are productive and like other enterprises, investment in future growth needs to be targeted at those areas which will return the best profit.
Generally forests in need of treatment are made up of one of the following:

- Stands that require removal of suppressed and defective trees to release ‘advanced growth’ (20cm+ dbh) aiming to produce a rapid increase into merchantable size class by freeing them from immediate or overstory competition.

- Stands which are overstocked with ‘advanced growth’.

- Stands which require removal of suppressed and defective trees to activate the regeneration process or to speed regeneration into the ‘advanced growth’ stage.

- Stands that have heavy regeneration, particularly a stand with defective or suppressed trees as overstory.

Stand Assessment

When making management decisions for any stand of timber, assessing the stand condition is the first step of the process and usually includes gathering information such as:

- Stocking rates by diameter class, indicating harvest potential and timing.
- Product range and volume.
- Numbers of defective trees.

In this trial the information gleaned from the 10 m strip method of stand assessment was relatively detailed. Information like this is invaluable to the decision making process providing reliable data on harvestable volume, product and species range, stocking rates and size classes for organising markets prior to harvest.

Information on stocking rates and numbers of defective trees aids the decision making process on management issues such as the need or value of treatment, regeneration levels or best product range to aim for.

MOBILE MILLING

Mill Selection

It is estimated there are over 350 portable mills in Queensland, not counting bandsaws, twin bladers or sleeper cutting mills. Of these 40-50 are serious/commercial operators in their own right (*Goodman 1999).* Most of the saws in operation are 150, 200 or 250 mm cut with a swivel head saw blade, allowing for the corresponding depth of cut in a vertical or horizontal position. Variations occur in the combination and type of adjustments available between models and brands of saw. The Lewis® mill, being 10 years old, only had 5 mm adjustment increments, whereas the new models now have 1 mm adjustments. One of the big advantages of the Lewis® saw was its ability to adjust one end only. This allows for a quick and easy alignment with the taper of the log or a change in direction in the saw cut, to cut around decayed pipe or other defects. While most of the mobile saw brands seem to have a function or a component advantage, overall performance is similar. The major variable in saw performance lies in the skill and knowledge of the operator and a skilled operator is essential to meet the rigours of quality, visually stress-graded timber suitable for sale.

Issues Effecting Sawn Wood Quality

The size and quality of the logs have a direct impact on the recovery rates, size and quality of the end sawn timber product. With the average log volume nearing one cubic metre, this trial should be considered to be at the top end of the quality scale for this type of operation. Much of the regrowth forest available currently has a predominance of small size logs. The average log size in this sale reflects the past high quality forest management which maximised growth on selected, well spaced trees.

Large section sawn timber commands a price 25-35% higher than small section timber, and rises in 10-20% increments for lengths over 6 metres. For example 250 x 50mm timber sold for around $800/m³, where as 75 x 38 batten material sold for $510/m³. Most mobile mills can not handle logs over 6 metres in length due to the strength of the rails needing to support the saw and motor and the excess 'chatter' or vibration that starts to develop as the saw moves through the log. This and other limitations place the mobile mill at a disadvantage to a bench saw in regard to consistency of sawn product.

Other limitations may be:

- Log movement (bowing or bending) as the tensions in the log change with sawing.
- The timber is unable to be easily re-sawn if size variations occur in the board due to this movement.
- Limited options in sawing technique compared to bench saw.
- When sawing >200 mm wide boards the saw is flipped over to saw from the opposite side, this may cause a step at the junction of the two saw cuts, that can vary in depth along the board, and from board to board depending on the developing tensions. This can severely down grade the product or require dressing before sale.

Figure 5. A variable depth sawn groove was often left on boards >200 mm in width

The pre-sawing market survey results showed a preference for large section timber as the optimum product in both value and demand, in particular 250 x 50, 250 x 38 and 100 x 100 mm. Achieving a 250 mm cut with the Lewis® mobile mill (200mm) required back sawing from both directions. This produces a board more inclined to bow rather than spring, bow is easier to straighten than spring as it occurs on the narrow axis.

Figure 6. Cutting a 250 mm board required making a 200 mm cut from one side, flipping the saw over and cutting the edge board off the outside of the log and finally making the final 50 mm cut to complete the 250 mm board.

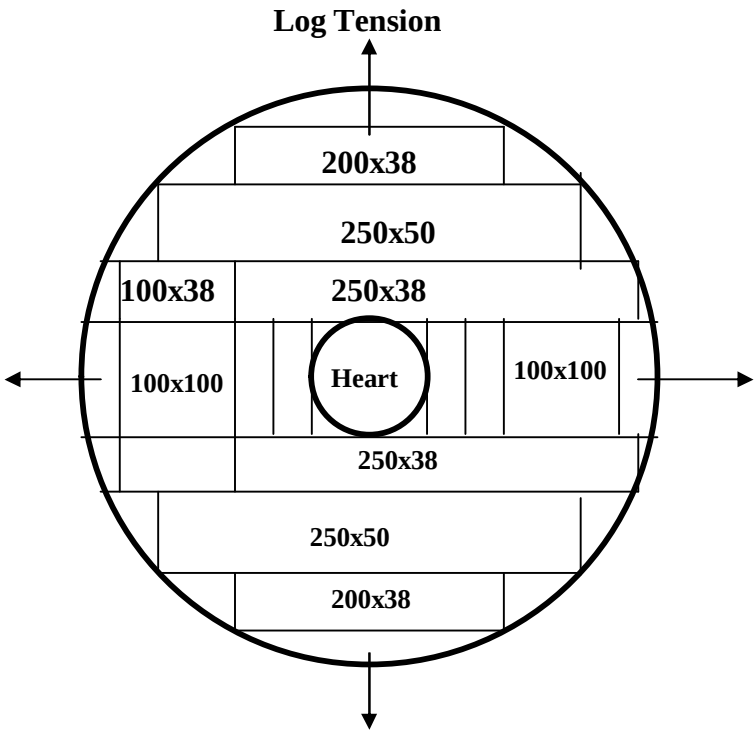


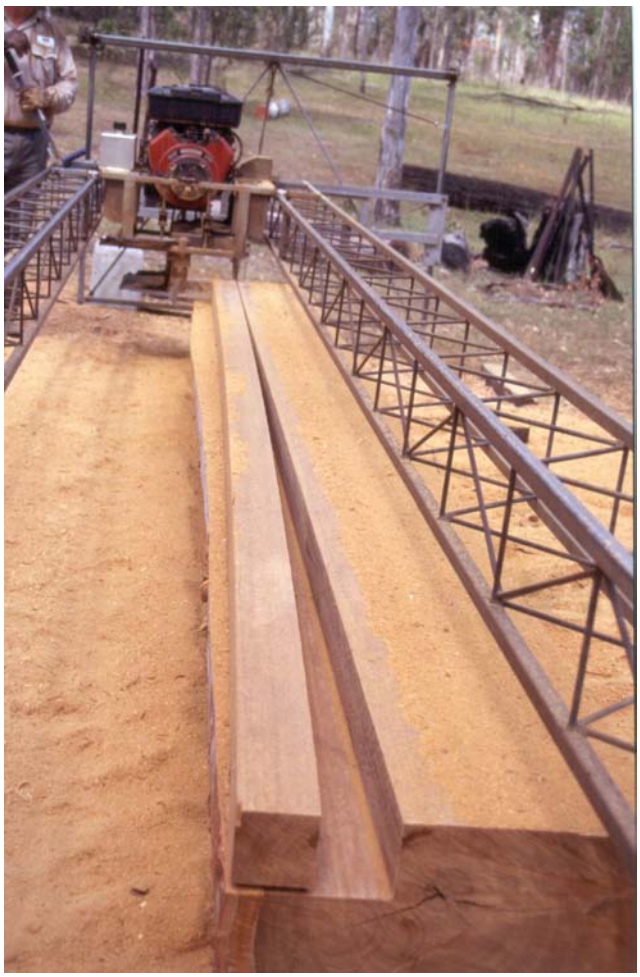
Figure 7. Shows a simplified cutting pattern, which varied with log size, pipe and other defects, but the aim was for large section timber.

Progressive milling of a Spotted Gum Log

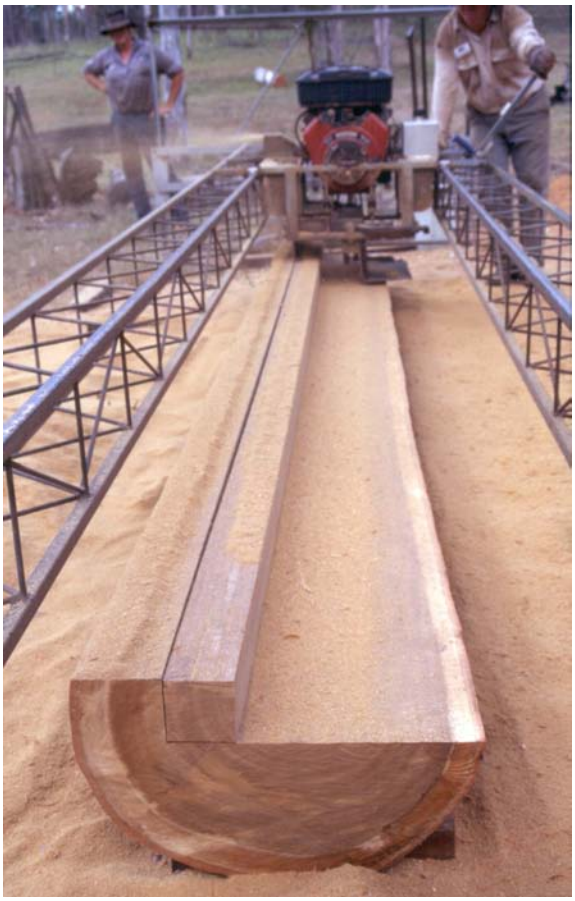
1. First boards cut were usually 15 mm palings

2. Once the cut section of log was wide enough a step tread was cut

3. The Final cut for a 250x 50 mm Step tread



4. Log Tension causing the 100x100 mm to pull away from the cut



5. The tension left in the log below the pipe is less and the 100 x 100 mm is straight

6. As the log is reduced, it often started to bow up in the centre necessitating skimming

7. The remaining flitch can become unstable and difficult to cut.

8. The flitch can be placed on top of the next log and sawn further.

MARKETING

Sawlog and Landscape Blocks

Quality and Value

This part of the study was carried out independently by the Thomsons and followed a successful pattern to previous sales where logs were cut and offered 'at ramp' to more than one mill. Logs directed to the mobile mill were costed at the same price as paid by the successful mill.

The positive effect of past silvicultural management is clearly evident in the quality and size class of the harvested timber. In this sale, this has had a significant influence on the price offered for the product as the average volume of saw log was over a cubic metre. Larger logs in both diameter and length allow a higher recovery and a higher value sawn product to be cut from the log. As discussed earlier, large section timber and long lengths are worth considerably more than small section timber. Larger logs also give a superior sawn recovery rate, particularly the percentage of this higher value product, consequently a mill is able to pay more. The high price offered at the log dump is a result of these and other factors including:

1. Proximity to the sawmill; A short haulage distance, such as is the case in this study, allows the mill to pay more to the landowner than a long haul distance.

2. Continuity of supply; The Thompsons have a significant timber resource and the serious decline in the private native forest resource and the impact of the Regional Forest Agreement has resulted in most mills looking to secure local long term supply outlets. Resource security was identified as the most important concern for small to medium mills *(FORTECH 1996)*.

3. Due to the closure of the largest hardwood mill in SEQ as a result of the RFA, and even with the present serious down turn in the building industry, the remaining mills are quite busy and prepared to pay well for quality products.

4. Log size, species and defect. In this case past management, manipulation of species, spacing and tree quality as well as site factors site has resulted in a high quality product.

Log Sorting and Sale

Once felled, the resulting log was measured and classified into a log class and stacked accordingly at the log dump. In this case this was a simple combination of girder, saw log or landscape block. There was no complicated formula for A, B or C class saw logs, they were either acceptable as a saw log or they were a landscape block This negates an argument at the dump with the buyer on log classification and subsequent valuation. Log classification requires a level of skill and knowledge of allowable defect etc only gained through experience, resulting in better returns. The price received will always be a reflection of the quality of the logs offered. Selling at the dump compared to selling a standing block takes the uncertainty and variables from the purchaser. Purchasers know exactly what they are buying, requiring little

organisation, time or risks involved in the harvesting process and the subsequent costs entailed, and these savings can be included in the offer to the grower.

Girders were sold direct to the Main Road purchase officer (subject to his inspection to ensure the girders meet the required specifications). Girders are worth approximately double the price of saw logs per cubic metre and saw logs twice that of landscape blocks.

Sawn Wood

Pre-harvest Market Survey

One of the most important processes in this operation was the pre-harvest marketing survey. The survey gave information on the state of the market, size class preferences and price range from a broad range of merchants in a variety of locations. It also gave initial contact with potential buyers, their attitude to one off sales, species preference and the prices they would be willing to pay in this instance.
Most of the timber sold was sold to merchants or individuals contacted during this survey. Most merchants inquired about ongoing sales, as continuity of supply and trust is a big factor in this process. This survey also emphasised the depressed state of the industry at the time of the trial.

Many of the marketing problems encountered by private forest owners can lead to loss of potential income if all potential products are not given adequate consideration and markets are not carefully sourced. *(Hanson 1998).*

Sale of Sawn Timber

Retail vs Wholesale

The options for sales varied widely, and are best summarised as either retail or wholesale. Retail sales produced a greater return but required a lot more organisation and tallying to achieve specific orders. Cutting certain sizes and lengths from specific logs to order was a factor in this, often resulting in cutting lesser value products from logs in order to attain a particular size order. Large size pieces such as 100 x 100 and 150 x 150 mm had to be cut from certain sections of the log to ensure a straight product. For example cutting a piece of 250 x 38 mm ($800 m3) meant that the remaining timber on that cut had to be cut at 38mm, usually 75 x 38 ($510/m³). Although this is often the case in conventional milling it is exacerbated due to the limitations of mobile mills.

Sorting, stacking and strapping bundles for orders also takes time, space and organisation. Ensuring all pieces are in the order and restacking with the long lengths on the bottom etc suitable for transportation, treatment or dressing was part of this process.
A large area adjacent to the mill was required for the 13-14 m^3 of timber to be sorted. The timber was stacked on

Figure 8. Part of the sawn timber stack

runners, allowing for strapping and then loading for transportation.

The wholesale selling process was a less complicated system. The merchant agreed to buy the range of timber produced at agreed prices, so the logs could be cut into the best combination of product available from the log and then stacked in its size class. The stacks could then than be tallied and tagged.

Pricing the product

Pricing the product was generally dictated by the initial marketing survey, although this gave a surprising variation in prices merchants were buying and selling at. This indicats that comprehensive market sampling is likely to pay off. The final retail price was between the price quoted by the local mills and those quoted by the merchants in the sale area. The wholesale price was negotiated after sawing with the best offer accepted for the remaining product. The merchant stated this was the price they normally paid for stock landed in their yard.

Visual Stress Grading and Quality Assurance

Being a builder, the project officer had a good knowledge of the standards of timber routinely supplied in the market place and what was acceptable and what was not. Applying the specifications required for visually stress grading the timber to the Australian Standard 2082, backed this industry standard. (See Appendix 2 for summary).

Due to the quality of the logs, the main area of concern in assessing this sawn timber was:

- Size accuracy; generally the sawn product had to be within + or - 3 mm (width and thickness) for timber <200mm and + 9 mm to - 3 mm for >200 mm. This was a problem initially, probably due to the mobile millers not previously being checked on sizing, as they usually cut landscape grade material. The quality improved markedly after the first day of sawing. If the log started to spring during milling the resulting board would be thin at both ends and thick in the middle. This is a very common problem with mobile mills and had to be constantly checked and often resulted in needless downgrade. The logs had to be straightened by skimming 5mm or more off the middle to ensure accurate and true sizing.
- No heart (standard to any milling operation).
- Degree of spring or bow; this was also a problem initially, particularly with any quarter sawn boards. Back sawing produced a better quality product.

Handling and Delivery

General handling is a time consuming issue to consider. The logs were easily snug to the mill and then rolled into place with a couple of cant hooks. But cutting 30 m^3 of timber at around 50% recovery means at least 13 m^3 of scrap timber and 2 m^3 of sawdust is produced that constantly needs shifting away from the mill. In this case the machinery was available and the forks on the front of the tractor were very useful for this. The scrap wood was heaped and burnt and the saw dust spread out around the work area after milling was complete. The sawn product also required transport, some

for dressing and all for CCA treatment and then final delivery. Some of these costs had to be absorbed as the price the merchant offered was at the gate.

GST

Calculating the GST is as usual a complex system. GST must be paid for each step of the way, the timber in the round, cutting, snigging, the processing, treatment and transportation. This can be claimed back if the timber is then sold on via another merchant as GST is only paid for the final product not an accumulation on each process.

Continuity of Supply vs One Off

Being a one-off disadvantaged this trial. Once a system for the whole process was established the process would run more smoothly, however merchants were more inclined to purchase if there was a continuity of supply. Any one-off sale, be it log, pole or sawn timber is at this disadvantage. The implications for this to landholders are that reliable supply of known product is likely to produce a better price. For larger landholders regular smaller sales may be a better option than 'one off' larger sales. Landholders with smaller amounts of resource may be advantaged by developing a co-operative approach to marketing.

COMPARISON OF RETURNS

The returns from this trial can be considered as three scenarios in comparison the the traditional sale of logs to a sawmiller:

1. The timber was bought at the ramp from the landowner by a third person and a miller was employed to mill the timber. The product is then sold by the third person. This is what effectively occurred in this study.
2. The landowner employs a miller to saw the logs and then sell the sawn product himself.
3. The landowner mills and sell his own timber using a mobile or 'small-scale' mill as is practiced in many European countries.

Scenario One:

Buying the timber from a landholder and employing a miller, either a mobile or static miller, is barely cost effective when marketing and general organisation such as the initial stand inspection and price negotiations etc with the owner were taken into account. This equation may improve with a block further from a mill where the haulage is higher and the price of the logs at the dump was lower. The price paid in this trial at the dump ($105) would be considered high by industry standards.

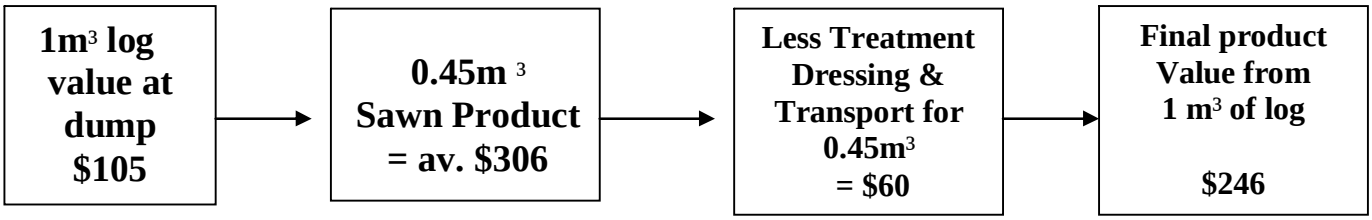
Scenario Two:

The landholder employing a miller to mill the timber and then selling it. In this study, the milling (at $115 /$m^3$) cost $3,500 resulting in returns of $4,116 to the landholder instead of the $2,933 for the logs at the dump.

Scenario Three:

The landholder mills and markets their own timber. For the Thompsons to consider this option is a very different scenario. Due to their significant area of resource, the aquired skills of Owen in forest management and available machinery, purchasing a mobile mill for $14,000 - $17,000 may be a feasible option. Cutting and snigging adds at least 20% to its standing value or around $22 /m³.

With 'A' grade sawn recovery rate from the operation at 45% producing from 1m3 saw log, .45m3 of sawn timber for sale at an average price of $680/m3. This equals $306 per cubic per metre of round timber; less $68/m3 for treatment, $25/m3 for dressing a proportion of the timber, and $40/m3 for transport a total of $133 per cubic metre or $60 per .45 m3. This equals a return of $246 per cubic metre of round wood compared to $105/m3 for stumpage, cut and snig, achieved for this sale.



The mill and associated work was easily handled by two people and in this trial averaged 4m ³ of round wood a day, producing 1.68 m³ of sawn product averaging $680 per m³. Cutting and snigging 30m³ of timber took approximately 8 hours.

Skills required for each method

In reality the above scenario requires a significant portfolio of skills, as does any primary production venture.
To produce a product from a mobile mill is a reasonably simple task, but to produce a consistently marketable product and then sell it requires a good knowledge of the milling techniques for eucalypts, stress grading specifications and marketing techniques. As with most new ventures there are accredited courses available including:

- Portable Sawmilling Accreditation, training and manual APS004
- Wood Properties and Uses
- Visual Stress Grading
- Chainsaw level 2 &3 accreditation

Risks

There are inherent risks associated with any value adding process. Meeting product specifications can mean considerable downgrade resulting in drastically lower returns. Incorporating a saw bench in the operation to resize or resaw inconsistent timber would assist with both product quality and recovery rates. When considering further value adding such as drying or dressing, 10% downgrade would be expected but any

where between 10 to 30% of the green off saw volume can be down graded because of knots, gum veins, gum pockets, heart associated defects, spring, bow or end splits.
Other risks associated with this process are, outlaying and carrying the extra expense of processing, whether it be the purchase of the mill, treatment, cartage, dressing or drying and the extra time involved in each level of this process before a sale can be achieved and money received. Demand can also change rapidly in this industry, with the building industry going through periods of sudden decline or growth. These risks are off set by considerably higher returns.

Best Product Return

With any marketing exercise, the more products you produce and sell the more complex the process becomes. Concentrating on one product such as flooring will certainly simplify the milling process but will require considerable extra time, extra processing, tight quality control and grading. There can be significant downgrade during the drying and dressing process. The green off saw product has to be treated if containing Lyctid susceptible sapwood ($68m³ + transport), stripped out, preferably stored for 1-2 months and then kiln dried. This will cost between $130-$200/m³. Once dried, it is put through a four-sider and then sorted and any defects such as end splits etc docked to wast. If tongue and groove it is then end-matched. This process costs 50-80 c / lineal metre or $200-$350/m³. The end product is then sorted into select, standard or cover-grade flooring, the percentage mix dependent on the original log quality. Current retail prices vary but an average price (less 20% for wholesale) for these products are cover grade $1.88/lm ($750/m³), Standard $3.00/lm ($1,120m³), Select $4.00/lm ($1600/m³).

CONCLUSION

SFM of Regrowth Forests

One of the most important aspects of managing any agricultural crop is the marketing and sale of the product. The better the return the greater the incentive and capacity to maximise productivity and ensure sustainability. The better the returns from the sustainable management of our native forests the more forests will be retained as a viable alternative to other agricultural pursuits that usually require the clearing of the forests.
Value adding is not a process that can be suddenly taken up and improved returns expected. It is an important management decision that requires careful planning, research and education. The simplest and in the end most effective value adding is to ensure that the timber stand is in a healthy, vigorous state with optimum stocking and few defective trees. This was the first result from this trial, as a quality well managed stand produced a superior product worth 20% more standing than an average stand. This had a positive effect on the whole process with a good recovery rate, a good proportion of large section timber and small percentage of down grade.

The results of this trial show that in this case it would not be cost effective to buy logs, employ a mobile miller and sell the timber and make a reasonable return in the process. Owning the timber and employing a miller may produce a higher return than a conventional sale, depending on the quality of the logs, the skill and experience of the miller and marketing skills of the owner. Owning and milling the timber would return a higher profit but is also dependent on gaining the necessary skills and

knowledge required for a complex and dangerous operation. The timber and milling industry has one of the highest levels of industrial accidents of all industries.

This value-adding scenario in this trial was for a one off operation. For a viable long term operation justifying the outlay of $13,000 - $17,000 for a mill would require a significant resource capable of sustainably producing at least 200m³ of sawlog per year. At growth rates of 1-2 m³ / ha / year achievable in a well managed spotted gum forest, returns (including wages for landowner and off sider) of $50,000 per year per 100-200 ha of well-managed forest is possible. This would be a 50-60 day operation allowing for other farm enterprises to be undertaken for the remainder of the year. This compares with $16,000 if timber is sold at the dump (cut and snig by owner, 7 day operation) or $11600 for standing timber sale.

The results of this trial demonstrate mobile mills have the capacity to produce a product meeting industry and regulatory specifications. However due to inherent limitations in moving the mill across the log and the subsequent spring or bow that may occur, constant checking of timber sizes to ensure accuracy needs to occur.
The marketing survey clearly indicated the advantage of continuity of supply and the need of a consistent quality product. The survey also emphasised the value and marketability of large section timbers over smaller sizes.

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APPENDIX 1

Log Volume and Recovery Rates

	Log no	Log Volume	Sawn Volume	Recovery Rate	Sawn Landscape	Recovery Rate	Total Recovery Rate
1	53 - spg	.316	.110	35%	-	-	35%
2	43 - spg	1.034	.4175	40.3%	.097	9.38%	49.7%
3	85 - spg	2.009	.858	42.7%	.132	6.6%	49.3%
4	70 - gbx	1.77	.531	30%	.223	12.5%	42.5%
4	108 - frg	2.364	1.225	51.8%	.145	6.1%	57.9%
5	114 - spg block	.323	-	-	.150	46.4%	46.4%
6	118 - frg block	.662	-	-	.175	27%	27%
7	119 - frg block	.349	-	-	.132	37.8%	37.8%
8	121 - gri	.340	.02	5.8%	.1856	54.4% (sleepers)	59.2%
9	122 - frg	.289	.1125	38.9%	.03	10.3%	49.2%
10	128 - spg	.981	.497	50.6%	.096	9.7%	60.3%
11	129 - spg block	.317	-	-	.0244	50.3%	50.3%
12	130 - spg	.193	-	-	.093	48.2%	48.2%
13	132 - spg	.784	.3155	40.2%	.068	8.6%	48.8%
14	133 - spg	.382	.154	40.3%	.058	15%	55.3%
15	134 - spg	.499	.169	33.9%	.06	12.2%	46.1%
16	135 - frg	.499	.14	28%	.063	12.6%	40.6%
17	136 spg block	.244	-	-	.1328	54.6%	54.6%
18	137 -spg	1.039	.433	41.7%	.099	9.5%	51.2%
19	165 - spg	1.226	.48	34.9%	.075	6%	40.9%
20	167 - frg	1.086	.462	18.4%	.077	7.1%	25.2%
21	171 - spg	1.914	.807	42%	.2	10.4%	52.4%

22	**180 - gbx**	**.867**	**.4032**	**46.5%**	**.015**	**1.7%**	**48.2%**
23	**182 - frg**	**.231**	**.057**	**24.6%**	**.072**	**31.1%**	**55.7%**
24	**183 - gbx**	**.942**	**.352**	**36%**	**.024**	**2.5%**	**38.5%**
25	**201 - gri**	**1.684**	**.673**	**39.9%**	**.368**	**21.8%**	**61.7%**
26	**202 - gri**	**Dud**					**-**
27	**204 - gri**	**.589**	**..235**	**40%**	**.071**	**12%**	**52%**
28	**205 - gri**	**.340**	**-**	**-**	**.165**	**48.5%**	**48.5%**
29	**206 - gri**	**.377**	**.118**	**31.2%**	**.054**	**14.3%**	**45.5%**
30	**207 - gbx**	**1.405**	**.569**	**40.5%**	**.137**	**9.7%**	**50.2%**
31	**239 - spg**	**.707**	**.271**	**38.3%**	**.04**	**5.6%**	**43.9%**
32	**240 - spg**	**.885**	**.382**	**43.1%**	**.034**	**3.84%**	**46.9%**
33	**241 - spg**	**.741**	**.221**	**29.9%**	**-**	**-**	**29.9%**
34	**242 - spg**	**.625**	**.288**	**46.7%**	**.018**	**2.8%**	**49.5%**
35	**243 - spg**	**.54**	**.245**	**45%**	**.009**	**1.6%**	**46.6%**
36	**276 - gri**	**.589**	**.225**	**38.2%**	**.034**	**5.8%**	**44%**
37	**285 - frg**	**1.265**	**.528**	**41.7%**	**.037**	**2.9%**	**44.6%**
	Total	**30.441**	**12.82**	**44.61%**	**3.393**	**11.15%**	**55.7%**

spg - Spotted Gum
frg - Forest Red Gum
gbx - Grey Box
gri - Grey Ironbark

Total Sawn	**30.441 m^3**
Total Saw Log	**27.94 (av 1.03m^3)**
Total Sawn timber	**12.82 m^3**
'A' Grade Sawn recovery	**44.61%**
Total Block	**2.5 m^3**
Total landscape sawn from block and saw log	**3.393 m^3**
Landscape recovery	**11.15%**
Overall recovery	**55.7%**
Total Sawlog harvest	**190.242 m^3**
Total Block harvest	**43.013 m^3**

APPENDIX 2

Queensland Forest Industries Training Council

VISUALLY STRESS-GRADED HARDWOOD

(GRADE SPECIFICATIONS SUMMARY)

Introduction

These specifications set out the requirements for visually stress grading seasoned or unseasoned, sawn, dressed or sized hardwood that is intended for structural purposes. To comply with the standard, the complete specification for any grade consists of the general provisions given in AS 2082, Section 1, together with the relevant grade description given in section 2.
While the main factor in AS 2082 is strength, consideration has been given to the necessity for a surface that provides a firm backing for the attachment of cladding, lining, etc.
Four structural grades apply. From these are derived stud and lintel grades (straighter material) and appearance grades (fewer visual blemishes), that have more stringent limitations. Limits for permissible imperfections in the four structural grades are shown in Table 3.

Grading

The basis for grading structural timber is the effect on the strength of each piece of the worst permissible imperfection. Each piece is to be graded on all surfaces.
Unless the purchaser orders otherwise, species may be supplied mixed, but if there is a mixture and the timber is not branded in the manner provided in AS 2082, the stress grade applicable to the species of the lowest strength present, will apply to whole parcel. If the species present cannot be identified, the strength group rating will be that given for mixed hardwoods in Table 3 of AS 2082.

Lyctus Susceptible Sapwood

AS 2082 refers to wane, want and sapwood susceptible to Lyctid attack. Although the standard makes provision for sapwood that is Lyctid susceptible, in Queensland the Timber Utilisation and Marketing Act requires all Lyctid susceptible sapwood to be treated.

Combination of Imperfections

- Two or more imperfections occurring within twice the surface width are permitted provided the cumulative effect does not exceed the equivalent of a single imperfection of maximum size.
- Maximum imperfections should not be closer than three times the surface width.

Equivalent Imperfections

- When imperfections not described in the specifications are encountered, they are to be considered to the equivalent strength-reducing effect of allowable imperfections
- Imperfections close to an arris may be assessed as for want and wane.

Size and Tolerances - Unseasoned Timber

- Up to 6 metres long and up to 200 mm in width or thickness ± 3 mm.
- Up to 6m long and over 200mm in width or thickness + 9 mm, - 3 mm
- Over 6 m long tolerance may be increased by 1/3
- Sized or gauged timber: + 2 mm, - 0 mm.
- Length not less ordered dimension
- (w =width, T = thickness, L = length)

Strength Groups and Stress Grades

Table 1. Unseasoned - (Seasoned)

Strength Group	Stress Grade			
	No I Structural	No 2 Structural	No 3 structural	No 4 Structural
S1 (SD1)	F 27 (F 43)	F 22 (F34)	F 17 (F 27)	F 14 (F 22)
S2 (SD2)	F 22 (F 34)	F17 (F27)	F 14 (F 22)	F 11 (F 17)
S3 (SD3)	F 17 (F 27)	F 14 (F22)	F 11 (F 17)	F 8 (F 14)
S4 (SD4)	F 14 (F 22)	F 11 (F 17)	F 8 (F 14)	F 7 (F 11)
S5 (SD5)	F 11 (F 17)	F 8 (F 14)	F 7 (F 11)	F 5 (F 8)
S6 (SD6)	F 8 (F 14)	F 7 (F 11)	F 5 (F 8)	F 4 (F7)

Table 2. Strength Group by Species

Species	Strength Group	
	Unseasoned	Seasoned
Blackbutt	S2	(SD2)
Grey Box	S2	(SD2)
Grey Gum	S1	(SD2)
Forest Red Gum	S3	(SD4)
Spotted Gum	S2	(SD2)
Grey Ironbark	S1	(SD1)
Broad leaved red Ironbark	S1	(SD1)
Narrow leaved Red Ironbark	S2	(SD3
White Mahogany (Yellow Stringy)	S2	(SD3)
Gympie Messmate	S2	(SD3)
Tallowwood	S2	(SD2)
Unidentified Qld Eucalypt	S3	-

Table 3. Degrade Specifications

Type of Imperfection	Grade and Maximum Permissible Limit			
	Structural Grade No. 1	**Structural Grade No. 2**	**Structural Grade No. 3**	**Structural Grade No. 4**
(a) Knots	1/7 of W or T	1/4 of W or T	1/3 of W or T	3/8 of W or T
(b) Borer Holes 1. ≤ 3mm 2. > 3 mm	12 / 100 x100 mm As for knots	20 / 100 x 100mm As for knots	Unlimited	Unlimited
(c) Tight Gum Veins	Aggregate L < L Individual L 1/2 of L Not one surface to another	Unlimited	Unlimited	Unlimited
(d) Loose Gum veins and Shakes. < 3 mm, not one face to another 1. aggregate length 2. intersecting an end from one face to another	1. 1/10 of L 2. Not permitted	1. 1/6 of L 2. Not permitted	1. 1/4 of L 2. As for end splits	1. 1/3 of L 2. As for end splits
(e) Pockets of Gum Veins, Latex, Resin, overgrowth of injury 1. individual length 2. individual width - 1 face only - 1 face to another - intersecting an end	1. Lesser of 3W, 3T or 300 mm 2. 1/4W,1/4T or 12 mm - 1/8W or 1/8 T or 6 mm - As for end splits	1. Lesser of 3W, 3T or 300mm 2. 1/3 W,T or 20 mm - 1/4 W,T or 12 mm - As for end splits	1. Lesser of 3W, 3T or 300mm 2. 1/2 W,T or 25 mm - 1/3 W,T or 20 mm - As for end splits	1. Lesser of 3W, 3T or 300mm 2. 1/2 W,T or 30 mm - 1/3 W,T or 25 mm - As for end splits
(f) Bow, Spring and Twist	See Table 5 and 6			
(g) Cupping	1mm / 50 mm W	1mm / 50 mm W	1mm / 50 mm W	1mm / 50 mm W
(h) Surface Checking **1.** On the surface up to 75 mm W **2.** On the surface >75 mm W **Internal Checking**	1. Individually, 2 mm w 2. Individually, 3 mm w 1/4 of T	1. Unlimited 2. Unlimited 1/3 of T	1. Unlimited 2. Unlimited 1/2 of T	1. Unlimited 2. Unlimited 2/3 of T
(i) Sloping Grain	1 in 15	1 in 10	1 in 8	1 in 6
(j) Primary Rot	Surface only and slight	Surface only and slight	Surface only and slight	Surface only and effect < (e) or (i)
(k) Termite Galleries	Not Permitted	Surface only and slight	Surface only and slight	Surface only and effect < (e) or (i)
(l) Wane or Want Individual or aggregate, fraction or cross section	1/10 cross section 1/3 T	1/5 cross section 1/3 T	1/4 cross section 1/3 T	1/4 cross section 1/3 T
(m) Heart and Heart Shakes **1.** < 175 mm timber 2. ≥ 175 mm timber	1. Not permitted 2. Permitted within 1/3 W or T	1. Not permitted 2. Permitted within 1/3 W or T	1. Not permitted 2. Permitted within 1/3 W or T	1. Not permitted 2. Permitted within 1/3 W or T
(n) Included Bark Strands 1. Intersecting an end 2. Within 600 mm of end 3. Not within 600 mm of end: - Within middle 1/2 of D > 300 mm apart - Outside middle 1/2 of D	1. Not permitted 2. Not permitted - 150 mm long - 300mm long, > 300mm apart	1. 75 mm long 2. 150 mm long 3. - 300 mm long - 600mm long >300mm apart	1. 150 mm long 2. 300 mm long 3. - 600 mm long - unlimited if tight	1. 200 mm long 2. 400 mm long 3. - 800 mm long - unlimited if tight
(o) End Splits	Not Permitted	Aggregate L ≤ than W or 100 mm	Aggregate L < than 1½or 150 mm	Aggregate L < than 1½W or 150 mm

Table 4. Special Gradings

<table>
<tr><td colspan="4">Lintel Grades: as for the appropriate structural grade, except that the bow is not to exceed -</td><td rowspan="2">Stud Grades : as for the appropriate structural grade, except
1. Spring is not to exceed 6mm in length of 2.4m, 8mm in 2.7m, and 10 mm in 3.0 m
2. Twist not to exceed 8 mm/ 100 mm of W</td></tr>
<tr><td>Length (m)</td><td>Bow (mm)</td><td>Length (m)</td><td>Bow (mm)</td></tr>
<tr><td>2.4</td><td>6</td><td>3.6</td><td>14</td><td rowspan="4">Appearance Grade : as for the appropriate structural grade, except that loose, unsound and defective knots, knot holes, borer holes larger than 3mm, loose gum veins, shakes gumpockets, resin and latex pockets, overgrowths of injuries, primary rot, termite galleries, lyctid susceptible sapwood, want, wane, included bark, and checks > 1 mm W are not permitted. Bow, spring and twist is maximum 75% of structural grades.</td></tr>
<tr><td>2.7</td><td>8</td><td>3.9</td><td>16</td></tr>
<tr><td>3.0</td><td>10</td><td>4.2</td><td>18</td></tr>
<tr><td>3.3</td><td>12</td><td>4.5 and ></td><td>20</td></tr>
</table>

Table 5. Maximum Permissible Twist

Length (L) in m	Thickness (T) in mm	Width (W) in mm										
		50	**75**	**100**	**125**	**150**	**175**	**200**	**225**	**250**	**275**	**300**
1.8	38	8	12	16	20	24	28	32	36	40	44	48
	50	6	9	12	15	18	21	24	27	30	33	36
	75	4	6	8	10	12	14	16	18	20	22	24
	100	3	5	6	8	9	11	12	14	15	17	18
2.4	38	11	16	21	26	32	37	42	47	53	58	63
	50	8	12	16	20	24	28	32	36	40	44	48
	75	6	8	11	14	17	19	22	25	28	30	33
	100	4	6	8	10	12	14	16	18	20	22	24
3.0	38	13	20	26	33	39	46	52	59	65	72	78
	50	10	15	20	25	30	35	40	45	50	55	60
	75	7	10	13	16	20	23	26	29	33	36	39
	100	5	8	10	13	15	18	20	23	25	28	30
3.6	38	16	23	31	39	47	54	62	70	78	85	93
	50	12	18	24	30	36	42	48	54	60	66	72
	75	8	12	16	20	24	28	32	36	40	44	48
	100	6	9	12	15	18	21	24	27	30	33	36
4.2	38	18	27	36	45	54	63	72	81	90	99	108
	50	14	21	28	35	42	49	56	63	70	77	84
	75	9	14	18	23	27	32	36	41	45	50	54
	100	7	11	14	18	21	25	28	32	35	39	42
5.4	38	24	35	47	59	71	82	94	106	118	129	141
	50	18	27	36	45	54	63	72	81	90	99	108
	75	12	18	24	30	36	42	48	54	60	66	72
	100	9	14	18	23	27	32	36	41	45	50	54
6.0	38	27	40	53	66	80	93	106	119	133	146	159
	50	20	30	40	50	60	70	80	90	100	110	120
	75	14	20	27	34	41	47	54	61	68	74	81
	100	10	15	20	25	30	35	40	45	50	55	60
6.6	38	29	44	58	73	87	102	116	131	145	160	174
	50	22	33	44	55	66	77	88	99	110	121	132
	75	15	22	29	36	44	51	58	65	73	80	87
	100	11	17	22	28	33	39	44	50	55	61	66
7.2	38	32	47	63	79	95	110	126	142	158	173	189
	50	24	36	48	60	72	84	96	108	120	132	144
	75	16	24	32	40	48	56	64	72	80	88	96
	100	12	18	24	30	36	42	48	54	60	66	72