GROWING TREES AT "TANTARABOO"

Trees For Sustainability and Profit in the South Gippsland Hills

Frank & Sharon Hirst's property, Kelly & Currans Rd, Ranceby

Blue Gum (Southern and Sydney), Mountain Ash and Shining Gum wide-spaced agroforestry and woodlots in high-rainfall hill country. Poplars (established as poles) for tunnel erosion control. Bushland and riparian zone "re-creation".

BASIC INFORMATION

1. The Property – General

Location: The property is situated in the western lobe of the Strzelecki Ranges of South Gippsland in Southern Victoria. National Grid Reference: 8021-40395E 57524N.

Geology: This area comprises a huge block of deep Mesozoic sandstones and mudstones, which was uplifted, with faulting and warping, in the Lower Cretaceous geological period. It has since been weathering and eroding, forming steep-sided, dome-shaped hills. The property is steep (up to 40^0) and ranges in altitude between 110 and 250m ASL.

Soils: A deep, grey, gradational **clay loam** covers the property. Formed from the weathered sandstone, it is known locally as "Blue Gum Country" – a reference to the dominant tree species at white settlement: *Eucalyptus globulus*.

Climate: The climate is **cool temperate** with reliable rainfall averaging 1100mm per annum. Monthly averages vary from 50mm in summer to 120mm in winter. Temperatures are quite variable but the extremes are moderated by the property's proximity to the coast (50km). Genuine **frosts** in winter are almost as rare as days over the "century" (38^0 C) in summer. The worst **winds** are sou-westers in winter and spring, although the topography shelters much of the farm.

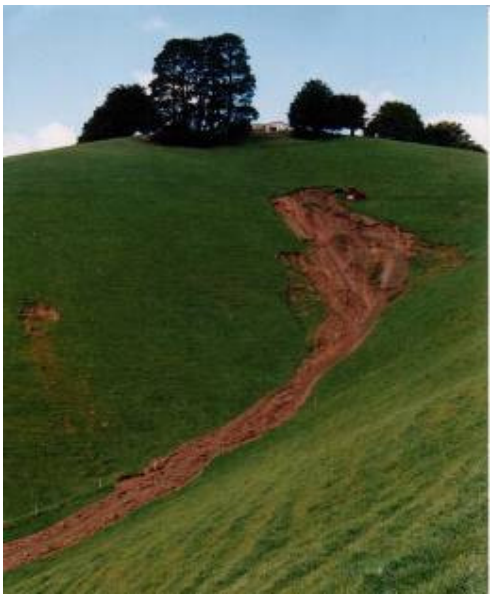
Farm Production: Agricultural production is pasture-based as the country is too steep for regular cultivation. The major enterprise is **prime lamb** production using first-cross (Merino x Border Leister) ewes and terminal sires. **Wool** is produced largely as a lamb by-product but this is currently declining with the change-over to a Dorper flock beginning in 2008. Dorpers are a South African sheep bred solely for meat production. They grow little wool which is shed annually. Sheep are preferable to cattle here as they cause less land degradation and are less likely to fall off the cliffs. Some young **beef cattle** are grown out each year to provide seasonal pasture and internal parasite control.

The Importance of Trees: Trees are vitally important, we believe, to the sustainable management of this property. At white settlement these hills were literally held together by forests in a stable ecosystem. The rapid removal of the forests by settlers has left the steep hills vulnerable to erosion. In just 100 years since then, huge volumes of soil have been lost to tunnel and stream-side erosion, while land slips have disfigured the landscape and caused problems for farmers.

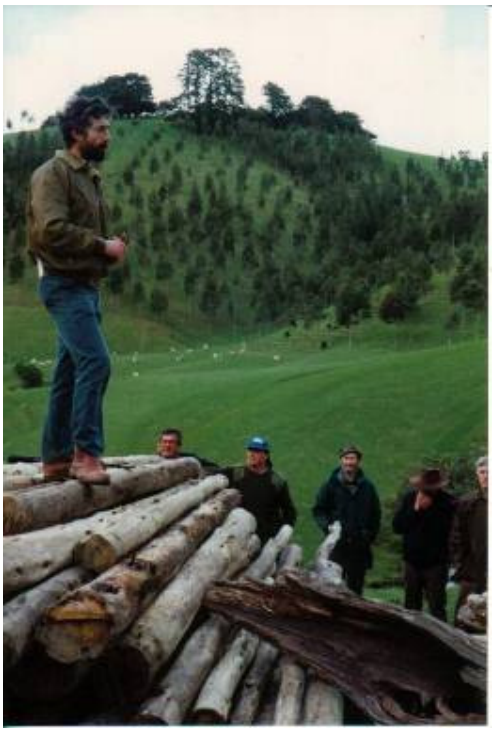
We have little doubt that without the replacement of trees in this landscape, at least strategically, agricultural production is not sustainable.

2. The Property - Treed Areas

Agroforestry	14.5 ha
Replanted natural forest	5 ha
Open pasture	37.5 ha
TOTAL FARM AREA	**57 ha**



A landslip in 1989 has become part of a productive agroforestry system by 1996.



3. Whole Farm Plan

Frank purchased the property in 1981 in a run-down state: covered in **thistles** and **ragwort** with little functional fencing. The tree cover was restricted to **isolated remnant trees** plus the obligatory few pines and cypresses around the house

Tree planting began in a small way soon after, with **aesthetic**, **erosion control** and minor **windbreak plantings** (this steep country largely shelters itself and requires little in the way of windbreaks).

A Whole Farm Plan was developed in 1988 with the objective of **guiding property development towards truly sustainable land use**: land use which is profitable while providing wildlife habitat, and a pleasant living and working environment. The Plan was re-done with an **updated photo** in 1992 and is kept up to date with farm developments. It is always on display and explained when visitors arrive, and is used each year to demonstrate the concepts and practicalities of the discipline to landholders in **Whole Farm Planning courses**.

Land Use Zones

Using Whole Farm Planning principles the property is divided on the Plan into **land classes** (or Zones) based on **land capability for agriculture and tree growing**. The zones are illustrated on the Farm Trees Plan which follows these notes. As the geology and soils are common to the whole property, land use zones are determined by slope with an overlay for aspect.

- *Zone 1 (27% of property).* This zone comprises land which is **"tractorable" with slopes up to 15^0**, and is suitable for **intensive grazing**. It occurs both as hilltops and lower slopes, and has deeper soils and thus better growth potential than the steeper zones. Where possible it is fenced into separate paddocks, but many areas are too small for this to be practical.

- *Zone 2 (63% of property).* The majority of the farm is in this zone with **slopes between 15^0 and 35^0**. It is suitable only for **extensive grazing** and **commercial tree growing** (where harvesting access can be provided). Grazing management in this zone (especially with the potentially more damaging cattle) needs to be varied throughout the year depending on **aspect**.

- *Zone 3 (10% of property).* These areas **slope steeply (greater than 35^0)** and are **unsuitable for sustainable agriculture or forestry**. Most stream banks are also in this category. About two thirds of this zone has now been retired from grazing, while further small areas are protected by agroforestry or poplar trees. It is suitable for **habitat and aesthetic plantings, providing soil and stream protection**. The threatened Gippsland Giant Earthworm (*Megascolides australis*) occurs in good numbers on the property, mainly in this zone.

All treed areas have been actively managed for their intended use since planting, while many of the remnant trees have been protected. We are quite clear about management objectives for all trees: this will be expanded on in later sections.

TREE GROWING INFORMATION

4. Agroforestry Plantings

Two paddocks have been established: 9.5ha in 1990 (Agroforest 1) and 5ha in 1992 (Agroforest 2).

(a). Commercial Tree Growing Objectives

These objectives relate basically to Zone 2 land, since Zone 1 is to remain as clear pasture and Zone 3 is not to be harvested.

a) To provide a **deep root system to hold our steep soils in place** and allow land use to approach sustainability. The last century has clearly shown that the current system of open pasture is not appropriate, especially with cattle.

b) To provide a **superannuation-type investment** which could become a regular income stream from the property.

c) To **improve the farm environment** for people, stock and wildlife, making it a pleasant place to live and work.

d) To **demonstrate** to local landholders that livestock and commercial trees can be integrated and that **agroforestry** is a sensible and economic use of land in the Strzeleckis.

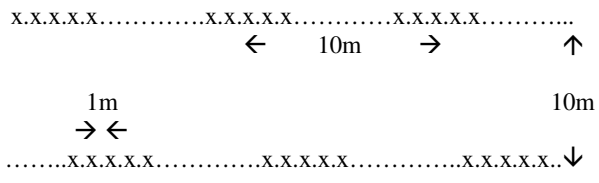
(b) .Design

Working with the above objectives and given that

- we wanted to **retain** gr**a**zing as long as possible
- the operation was necessarily fairly **small scale**
- **no pulp market** is handy and
- **commercial thinning** would be difficult anyway

we decided to aim for a **direct sawlog** and **peeler regime**, involving early **thinning to waste** and **rigorous pruning** to ensure top quality.

The actual design of the Agroforest 1 stemming from these inputs was to plant trees at approximately **final spacing** of 10m x 10m but to have a number of trees to choose from at each point. This spacing allows Eucalypts unrestricted growth up to a DBH of around 70cm, and is important in ensuring the highest quality timber especially in *E globulus*. Since the best establishment required deep ripping, the trees for each point were placed close together along the rip lines thus:



Smaller sections (almost a third of the paddock in total) were planted in **standard forestry spacing** of 4 x 2.5m (1000SPH) in six-row belts. These were to give comparisons with the wide-spaced design and were strategically placed so as to provide **maximum shelter** to the paddock and the other trees.

To maximise the benefits from this system it was important that the pasture in the paddock not be left rank for too long ie that **grazing** be **re-introduced** as soon as possible. Discounting individual tree protection as too expensive, this meant that the fastest-growing and least-palatable species would be most desirable. Fortunately, the three Eucalypt species available commercially at the time (*E. regnans, nitens* and *globulus,* Mountain Ash, Shining Gum and Southern Blue Gum respectively) all fit these criteria. One third of the paddock was planted to each of these species in each design, with each species also placed in the most appropriate area of the paddock. For example, the Mountain Ash were restricted to the lower and southerly slopes.

The Agroforestry 1 paddock: ripped, sprayed and planted in October 1990, and (below) as it looked 13 years later, thinned and high pruned.

(c). <u>Establishment</u>

Establishment practices for Agroforest 1 were as follows:-

June '90	**Ripping** to 45 cm with 4WD tractor largely on or near the contour and in a N-S direction. Tractor wheel run back over rip line. In theory this would have been better done earlier, but in practice with such good soils it made no difference.
July	**Weed spraying** done by contractor on crawler. Strips 2m wide sprayed with 5L/ha glyphosate (36% A.I.) and 14L/ha simazine (50%A.I.). Un-tractorable areas were spot sprayed with a similar mixture using a Forestry Spot Gun.

late August - September	**Planting** of most of the trees using **Hamilton Tree Planters** (ripped areas) and **tree planting spades** (unripped).
	Pest control included: • **Mesh guards** on some vulnerable areas • **Blood and bone** – successful for a few vital weeks • **Egg-powder spray** – successful for longer • **Spirited harassment of rabbits and wombats** for 4 months.
October	**Fertilising** with 100g NPKS 16-8-9-11 in a spade slit above each tree.
November	Planting of last **replacement trees.**

This procedure led to the following **results at 12 months** calculated from measuring ¼ of all trees (every forth row):-

Species	**Survival (%)**	**Average height (m)**	**Best tree height (m)**
E. globulus	95	2.54	4.2
E. regnans	93	2.28	3.6
E. nitens	97	1.70	2.8

A similar procedure was used in Agroforest 2 with the following differences:-

Difference	**Reason**
Ripping -D4 dozer -straight down hill	Too steep (to 35^0) for contour ripping. This led to no tunnel erosion in spite of dire predictions.
Mainly *E. globulus* used	Steep with harsher northerly aspect.
Only 2 trees (2m apart) per spot	Confident of good growth so less selection needed.

5. Fire Protection

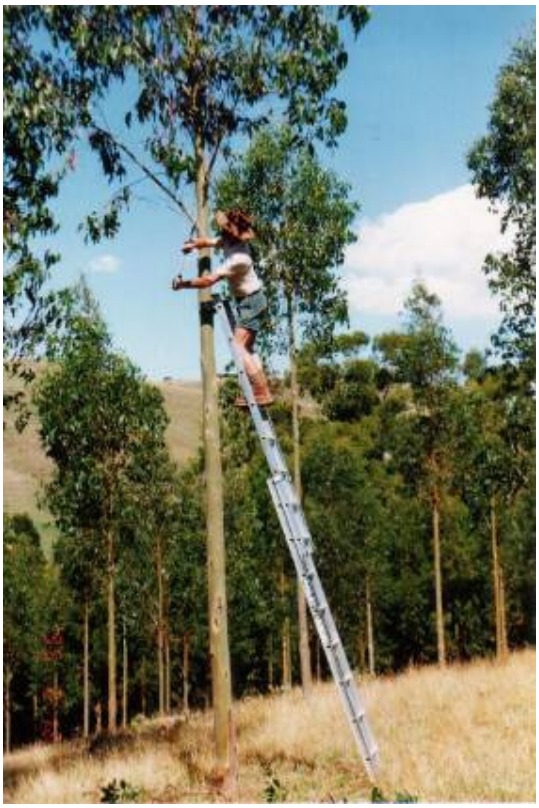
For a number of reasons our agroforests (especially while they're young) are at **negligible risk** from fire:

- The district seldom gets dry enough for the pasture to be **fully cured** and therefore carry a fire - rainfall averaging 50mm even in the summer months sees to this.
- Even if a season did get dry enough for fire conditions to exist, our relatively high stocking rate of livestock would ensure that what **dry feed** remains would be unlikely to carry a fire.
- With pruning and thinning done early in the agroforest's life (well before canopy closure) there is never a continuous carpet of **slash** to add significantly to any residual dry pasture.
- Lift pruning of the trees means that even if a low intensity fire did enter the agroforest it could not **crown** up 7m smooth trunks.
- The paddocks don't have public access which could make them more vulnerable to fire-lighting.

Because of these factors **no fire insurance is carried** at this stage but the situation is reviewed regularly.

Now that the trees are well grown and canopy closure is almost complete, pasture growth is severely limited but there is still some ground fuel now in the form of bark and leaves. This fuel would be very unlikely to carry a fire and if it did that fire would not damage the maturing trees.

Fire fighting access is excellent with every tree easily accessible with a 100m hose-lay. Two short sections of **track** have been added to existing cut tracks to achieve this in Agroforest 1, while the smaller but steeper Agroforest 2 block is accessible from its perimeter.



Third lift pruning to 7m on 4½YO Mountain Ash. Frank modified the basic extension ladder to cover all off-the-ground pruning.

6. Silviculture

For the first six years after establishment silvicultural input in the wide-spaced trees is quite intense but one of the advantages of the direct sawlog regime is that there is little more to do after that.

As an example, silviculture in the **Bluegum** of Agroforest 1 went as follows:-

Tree Age	Operation
6-8 months	**Form pruning** to remove double leaders caused by nursery topping, rabbits and magpies.
16 months	**Thinning** from 5 trees per group down to 3. Done with brush cutter, stumps painted with glyphosate to prevent re-shooting. **Form pruning** required because of magpies removing leaders.
2½ years	**Thinning** to 2 trees per group with chainsaw – firewood from culls. **First-lift pruning** to a trunk diameter of 9 cm. Average lift 1.5 m. **Form pruning** using manual high pruner on double leaders and large branches too high for loppers.
3½-4 years	**Second lift pruning** from ground and specially adapted pruning extension ladder (closed) to 9 cm trunk diameter on one selected tree per group. Average pruned height 4 m. **Form pruning** as necessary to 6 m.
4-5 years	**Final thinning** producing fencing materials for CCA treatment and firewood.
5-6 years	**Third lift pruning** to 7 m from extended pruning ladder. Some smaller trees required a fourth visit a year or two later in order to achieve this pruned height.

Silviculture on the other timber species has followed the same basic sequence, with the timing being much the same for **Shining Gum** and **Mountain Ash**. Four other species, grown in small numbers, are pruned in essentially the same manner although the time scale is stretched by progressively slower

growth in **Sydney Blue gum** (*E. saligna*), **Blackwood** (*Acacia melanoxylon*), **Pine** (*Pinus radiata*) and **Douglas Fir** (*Pseudotsuga menziesii*). Douglas fir have taken up to 15 years to be fully pruned.

7. Harvesting and Products

Until 2002 harvesting had only taken the form of **thinnings** and all of this was achieved using very simple farm equipment. Trees were felled with a chainsaw and the bark removed with the aid of a hand tool specially fashioned from a small cultivator tine. On the steeper areas (largely in Agroforest 2) the freshly peeled logs were slid down the hill then all the logs were left to dry in the paddock for up to a year. This was meant to provide relatively **slow drying** in the shade and thus reduce end-splitting – its success was questionable.

The logs were then assembled at landings, using a four-wheeled motor bike as a **skidder**, cut to length and transported with a Land Rover and trailer. Twenty cubic metres of 4-8YO Eucalypt thinnings have been **CCA-treated** for **farm fencing materials**, while 2m^3 have been **sawn** as 150 x 50mm (6x2") boards and treated for use in **sheep yard construction**. Another 5m^3 is in storage awaiting sawing.

CCA-treated fencing materials grading from 60mm SED posts to stays and large strainers, stacked ready for sale or use on the farm.

As well as supplying all our own **firewood** since 1994 we have **sold** about 25 tonne of firewood from thinnings to locals who have come to cut and collect. A similar amount derived from the heads of harvested trees has been sold more recently through wood yards.

An interesting and unusual product was cut from the tops of cull trees in 1997 for a special order. These were sticks around 1.5 m long with SED's of 4.5-6 cm which became the **"trunks" of pot-plant model trees**, used in decorating the lobbies of hotels and the like!

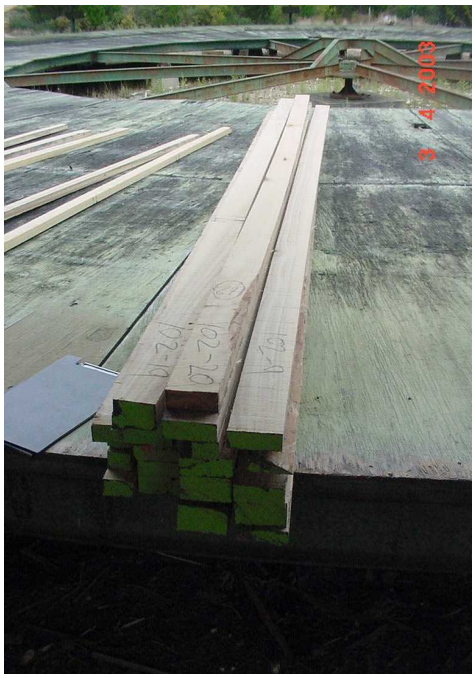
In autumn 2002, as part of a trial by Gary Waugh of the CRC for Wood Innovations looking at **sawmilling plantation-grown Blue Gum**, eight trees were harvested for sawing at Creswick. Seven were 12 ½ years old while the other was from Agroforest 2 and thus only 10 ½.

The trial results have been extremely encouraging for this wide-spaced regime. Unusually for fast-grown Blue Gum the sawn timber has been highly stable and of good density (700kg/m^3 kiln dried). It has also dried well and the combination of open growth and on-time pruning has led to a very **high proportion of select grade** (66% in the butt logs) in the lumber produced. This compares with just 2% in similar-sized but older, unpruned and late-thinned trees from SE South Australia which were put through the same processing (see graph below).

The price implications of this difference are huge with two prominent hardwood mills (Goulds and Black Forest Timbers) indicating that **stumpages of $100/m^3** are not out of the question for this material, while the other logs are little better than pulp and may struggle to fetch 1/5th of this price.

Phil Blackwell, Creswick and Frank with the largest tree harvested for the sawing trial – 52.5 cm DBHOB.

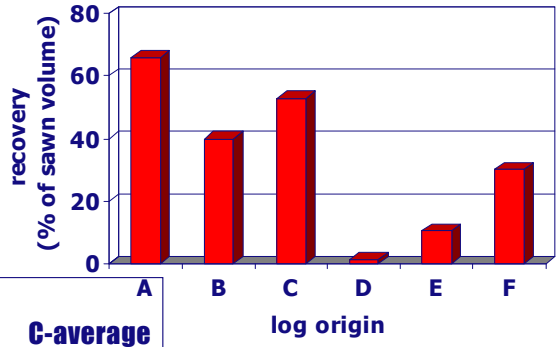
The green-sawn output from a 3.7m log shows the straight, clear timber.



BELOW
A slide from Gary Waugh's presentation entitled ***The Potential of planted E. globulus in Sustaining the Hardwood Sawmilling Industry.*** *The graph not only shows our timber to be far superior to unmanaged* E. globulus*, but that it has almost twice the clear timber of 62 year-old E. regnans, a current mainstay of the industry.*

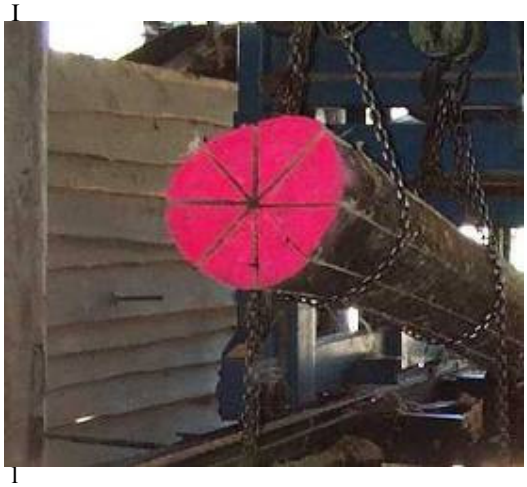
Planted *E. globulus* resource quality

Select appearance product recovery



12-year-old clearwood regime
A-butt log B-top log C-average
D- 14-year-old, thinned at 10, no pruning
E- 8-year-old, pruned and thinned at year 4
F- 62-year-old, *E. regnans* regrowth

Two more sawing trials have since been undertaken and have generally confirmed the high quality of the timber grown – especially the Blue Gums**.**



In 2004 20 Blue Gum trees were harvested, then sawn in Yarram at two different mills. At the Radial Timber Australia mill logs were sawn into wedges (above left) then backsawn into decking material. After careful drying and dressing some of this material is now showcased as a new deck at our home.

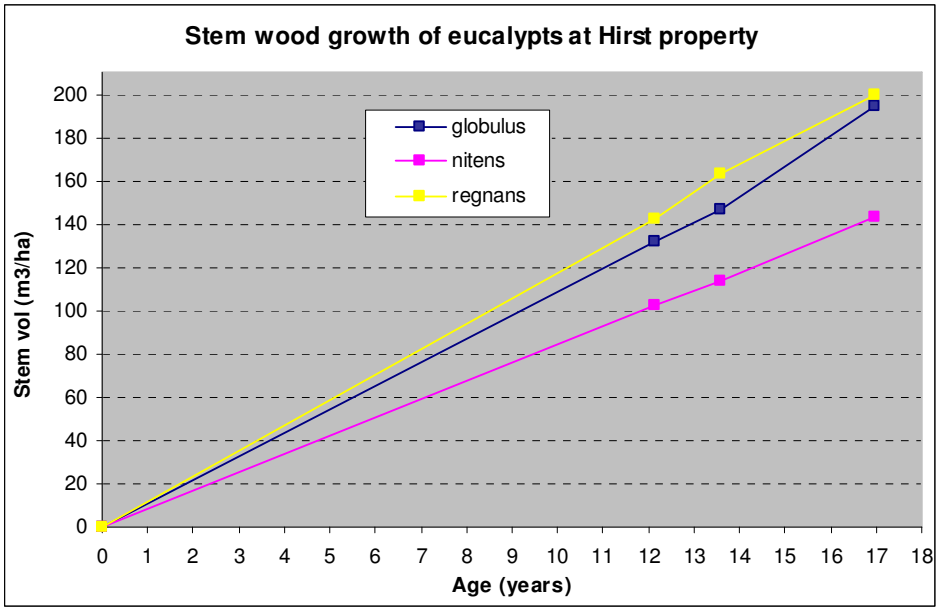
There were doubts as to how the Hewsaw at the nearby McDonnell mill would handle the hardwood as these massive "sausage-machine" mills are generally used for softwoods. With appropriate set-up it handled the logs perfectly.

The 2005 trial utilised two truckloads of logs (one of Blue Gums and the other of Shining Gum) which were sawn at Neville Smith Timbers at Heyfield. This was the first full-scale trial and utilised hand falling (the trees were too large for mechanical harvesting) a forwarder (seen loading Blue Gum logs below left) and a commercial log truck. Access was via the neighbouring property to the north as nothing larger than a 5-tonne tray can access through our property.

With this trial we took the opportunity to harvest two sections ($^1/_3$ hectare each) of trees (one of each species) which contained trees which hadn't performed well, indicating that the sites were marginal for the species. A number of the Shining Gum harvested had struggled to overcome a fungal disease and some had dead tops. These problems were reflected in poor timber quality caused by the fungus.

The heads of these trees were then dragged under nearby trees and the cleared areas replanted in Spring 2005 with *Corymbia maculata* (Spotted Gum) seedlings in triangular groups of three at 10 x 10m spacing between the stumps (seen below right at two years of age).

8. Current growth



Tree growth was measured in October '02, April '04 and August '07. These measurements indicate that the Blue Gum and Mountain Ash (*E. globulus* and *regnans*) trees are currently producing an average of **11.6m^3 of timber /ha/year**. Whilst this is a low figure for this sort of country by forestry standards, it needs to be remembered that this is largely high quality timber and there is no current expense in obtaining it because the trees are already wide-spaced. Of this timber 7.3m^3 is being grown on the valuable butt log and would command a price on the stump of around $100/m^3. If the remaining timber is valued at an average of $20m^3 as pulp, poles and firewood, then **these species are currently gaining about $815/ha/annum** in value. As its size increases so too does the value /m^3 of the butt log, perhaps up to $150/m^3.

9. Markets

Markets at this stage have, of course, been very limited and are mainly mentioned in the section above.

Of the post material about 4m^3 has been used in the construction of boundary fences and new subdivision, especially for further tree planting in the Wilderness Gully and along the creek. About half this amount has been **sold to other farmers**. The remaining post material will be sold or **used on the farm** progressively in the coming years.

After drying for two years the heads of the harvested trees were cut to "foot" blocks and 20 tonne was sold in the paddock to a **local firewood retailer** in autumn 2007. A year later Frank cut and delivered another 9T to a wood yard at Clyde for $90/T.

Commercial markets for clear-fall products will be sought as the time gets nearer, but the job should be much easier now that the quality of the logs has been authenticated by the recent sawing trials.

There are **sawmills within economic haulage distance**, notably Drouin West Timbers in Morwell which specialises in plantation eucalypts. Given the current rate of improvement in sawing and drying technologies it is quite feasible that at least some of the **timber conversion** will be **done on-farm**, thereby avoiding the necessity for bulk log haulage from steeper parts of the agroforestry paddocks .

OTHER INFORMATION

10. Progress Towards Objectives

Tree growing management objectives were described in section 4(a) above as they directly affected the design, establishment and management of the agroforestry stands.

Progress to date is certainly better than we had expected. **Tree growth** has been excellent, with diameter still increasing by well over a centimetre/year, while the **form** (especially in Agroforest 1 where there were 5 trees to choose from) is almost impeccable. With the encouraging information from the sawing trials, the ideal rotation length may now be little more than 20 years.

In the major aim of **soil stability**, it seems very unlikely that any further slips will occur in the Agroforestry paddocks. An encouraging sign was that when a long crack opened up in Agroforest 2 when the trees were just four years old, it did not progress into a slip as most do.

The **integration of grazing** has been a complete success with the introduction of livestock as early as five months after planting. Since the trees were less than two years old there have been no restrictions on grazing with any stock, and what little damage there has been along the way has been removed by thinning.

Shining Gum at 14 months in the original groups of five. Pasture is already rehabilitated by grazing sheep, having been closed for just five months.

The same trees after another 14 months now shelter contented bullocks. The trees have been reduced to two per group and first lift pruning is complete.

The **environment** within and around the treed paddocks is certainly improved. It is more pleasant to work in, provides more shelter for stock and has seen a big increase in bird-life. The **Wilderness Gully** (very steep area of 4hectares replanted to native species) has been a great success in turning a weed-infested wasteland into a much-visited asset.

The plantings have had substantial exposure as **demonstrations** to potential tree-growers with field day and tour attendances now totalling over 700 people. Indications from the sawing trials are that the venture will provide a good **superannuation investment** sooner than expected.

11. Tree Growing Work and Funding

We have done the vast majority of the tree growing work ourselves. There was some help with planting from friends and family and some **paid student labour**. Paid work-experience **forestry students** helped out with silviculture in the first five years, but supervision became more difficult in later years and the work harder on bigger trees.

Most of the plantings have had some **Government support** vis Agroforest 1 (plants and weed control, NAP 158), main track planting (plants and fencing $, Land Protection Incentive Scheme, CF&L), Wilderness Gully extension (plants and fencing $, Strzelecki Steep Slopes Project, GAV) and riparian planting (plants and fencing $, Hills to Ocean, Landcare). We have funded all other tree-related work.

12. Multiple Use of Trees

It's clear from much of the preceding discussion that tree establishment and management on Tantaraboo is undertaken with multiple uses in mind. The main agroforestry plantings are designed to provide **erosion stability** while allowing **farming** and growing valuable **timber**. The Wilderness plantings provide for **wildlife**, **erosion control** and **passive recreation**, while the riparian planting targets erosion control and **water quality.** A three-row native windbreak provides **shelter for stock** and further **increases biodiversity**.

Some other aspects of tree planting, not yet mentioned also provide for **multiple use**:-

- More than **300 poplar poles**, planted primarily for **tunnel erosion control**, are also managed for timber.

- The steep bank above the main track has been planted to **dry the track**, **avoid slippage**, **improve aesthetics** and **provide timber** from pruned Blackwood and Yellow Stringybark (*E. muelleriana*).

- Two demonstration **Timberbelts** (Radiata Pine and Douglas Fir) are designed to **grow quality timber** whilst **providing shelter**.

There is considerable emphasis in the Trees Plan on **improving farm amenity**. Many of the early plantings, along the road and near the house, were designed with amenity and beauty as major considerations. This led to the use of many non-indigenous natives noted for their **colour, form and bird-attracting ability.**

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