TREE CROPS FOR PROFIT AND LAND IMPROVEMENT

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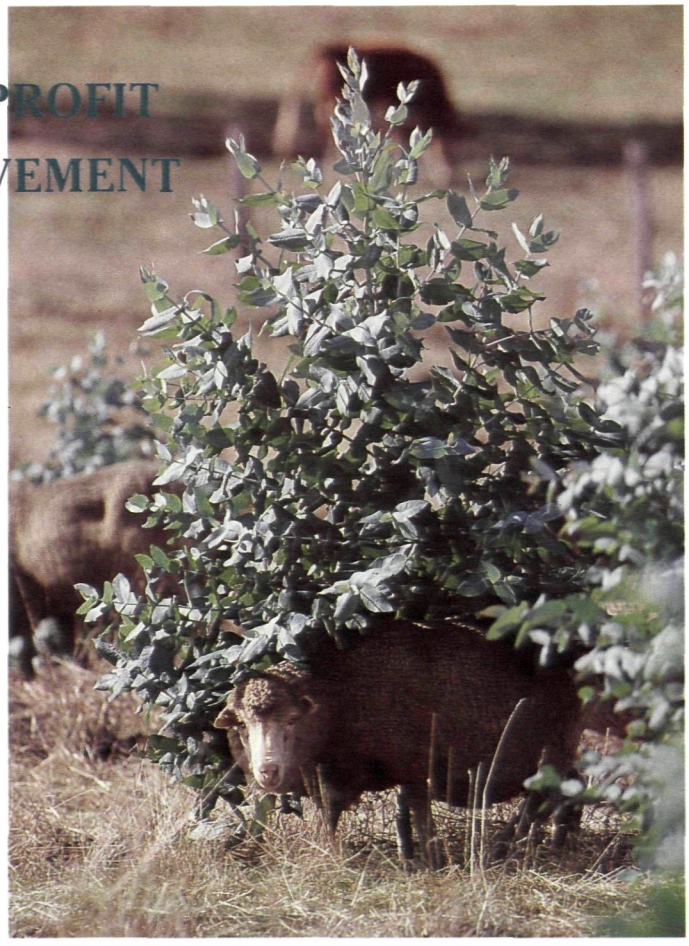


Young Merino sheep grazing in bluegums in the first summer after planting.

Western Australian agriculture is deficient in good perennial species.

The traditional segregation of agriculture and forestry has diverted attention from commercial wood producing trees as a potential perennial crop.

Recently, scientists have made rapid progress in developing tree cropping systems suitable for extensive use in the wetter (more than 600 mm average annual rainfall) areas of the lower south-west.

There is potential for a major industry based on fast-growing eucalypts for pulpwood. The foundations for this industry developed from work on agroforestry, forestry sharefarming and salinity control.

Agroforestry

The promise of agroforestry is that a mixture of tree crops with conventional agriculture could be more productive than either alone. This yield gain would be the result of:

- The robust perennial tree being able to capture water, nutrients and sunlight that would go unused by annual plants.
- Trees providing shelter benefit to pasture, crops and stock.

Recent research has shown the size of the yield gain from agroforestry. Moore (1989) found that in the south-west mixed pine/grazing systems gave a gain of 40 per cent (that is, 80 per cent of what could be expected from a pure pine crop plus 60 per cent of what could be expected from pure grazing).

Bird (1988), using assumptions of pasture and stock performance appropriate to southern Australia, showed that up to a fifth of a flat, treeless farm could be planted to tree belts without loss of agricultural income.

Plantings of tree belts and small blocks of trees could be fitted readily into traditional farming systems. They could be arranged to augment remnant native vegetation, the main source of shelter on farms today.

Sharefarming idea

In the early 1980s, the Department of Conservation and Land Management (CALM) explored ways in which pine plantation forestry could be made attractive to farmers. The major factors discouraging farmer interest were the risk and uneven distribution of costs and returns over the long wood production rotation. The idea of 'forestry sharefarming' was developed.

Under a sharefarming contract, the State (or private investors) and the farmer agree to share the establishment and management costs of a plantation on the farmer's land, and to share the harvest revenue. The farmer can choose to take part of the expected future revenue as an annual land rent or annuity. This reduces the farmer's risk and provides annual cash flow.

The sharefarming idea is highly flexible, and a wide range of cost and revenue sharing regimes have been developed.

Tree water-use, salinity and bluegums

In the mid 1970s, the State Government recognized that the increase in salinity of the Wellington Dam had to be stopped, and that reforestation of farm land on the catchment would be part of the solution.

Reforestation species were selected initially on their expected water-use potential. However, subsequent studies showed the differences between water-use of various species were not large enough to be important (Schofield *et al.* 1989). Interest turned to the economic potential of species.

Several fast-growing eucalypt species were found to give commercially promising yields of pulpwood over short production rotations. Amongst these, *Eucalyptus globulus*, the Tasmanian bluegum, was a recognized producer of premium pulp enjoying strong demand on world markets.

The potential for a managed, economic tree crop for salinity control in farm land in high rainfall areas emerged.

Development of a pulpwood cropping industry

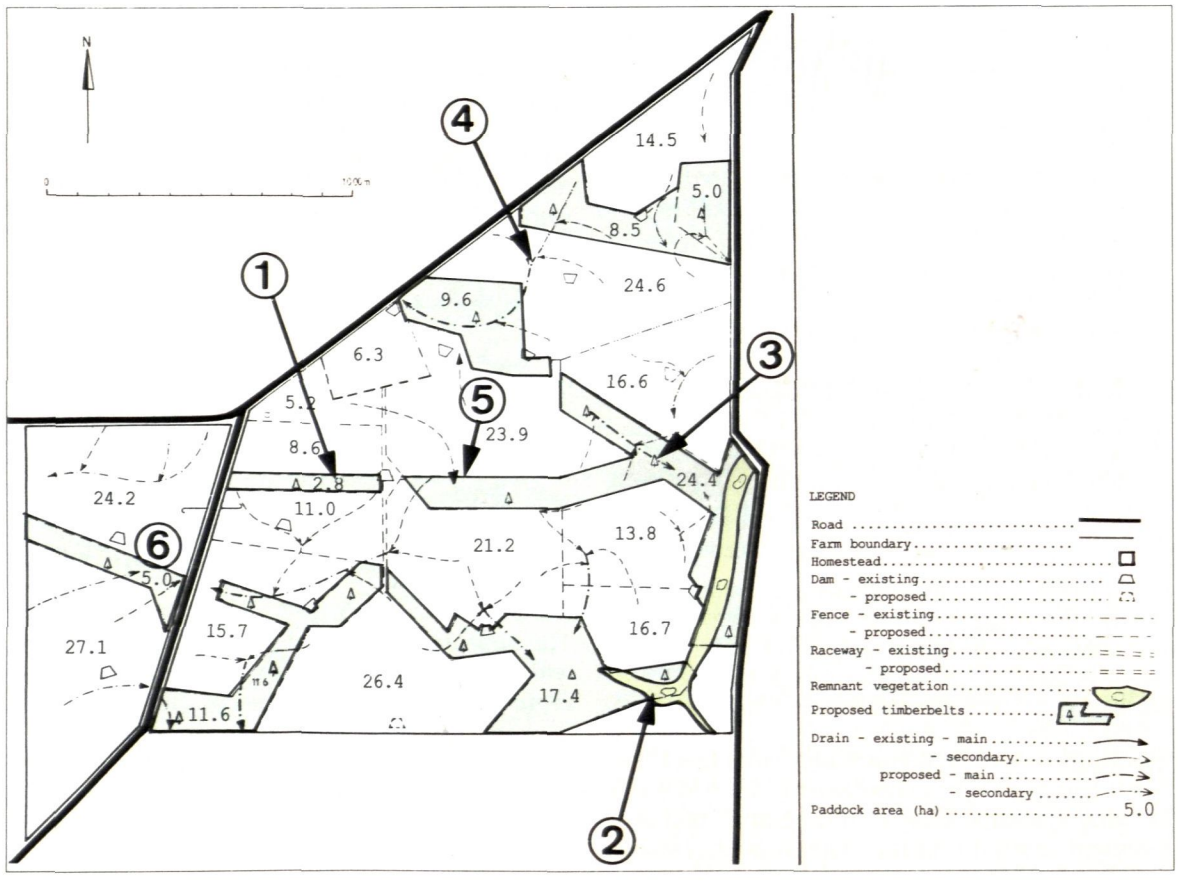
Detailed development and planning of the production and marketing aspects of a pulpwood industry started in 1987. The aim was to build an industry large enough to gain economies of scale and to provide competitive economic returns from wood production.

The sharefarming technique and the benefits of agroforestry and land care could be developed to provide additional incentive to farmers to adopt pulpwood crops more quickly.

CALM recognized that the traditional forestry plantation — a large single block planting — would not be very effective in providing landcare benefits and would not be very attractive to many farmers (Bartle 1989).

For this reason CALM, the Department of Agriculture and the Water Authority of Western Australia designed a project to develop the integration of pulpwood crops into agricultural systems in the lower south-west. This project, which started in 1988, was supported by the Commonwealth National Afforestation Program. The timberbelt sharefarming idea

Figure 1. A farm plan incorporating timberbelts in the Yate Flat Creek sub-catchment of the Denmark River catchment .(Prepared by Rudi Ferdowsian, Department of Agriculture, Albany.)



1 *trees in belt formation to gain shelter benefit*

2 *remnant vegetation protected by inclusion in belt*

3 *timberbelts mainly located on deep valley soils to maximise use of groundwater and produce more wood*

4 *timberbelts integrated with surface drainage*

5 *maximum use made of existing fences*

6 *timberbelts and drainage were jointly planned with the adjoining property to the west*

was developed to incorporate agroforestry and sharefarming principles. Some 950 ha of timberbelts were planted on 64 properties in 1990.

CALM will fund 800 ha of timberbelt sharefarming in 1991. A new CALM section called the Vegetation and Tree Planting Advisory Service has been established to manage the timberbelt scheme. CALM also hopes to attract other investors into the scheme. The Vegetation and Tree Planting Advisory Service also can act as manager for investors.

What is timberbelt sharefarming?

A timberbelt is a stand of trees at least five rows wide of any size or shape. Ideally, it is laid out as an integral part of the farm plan, and designed to give best wood production yields and other benefits (Figure 1). These other benefits may include:

- shade and shelter;
- control of wind and water erosion;
- control of rising groundwater, waterlogging and salinity;
- protection of remnant vegetation;
- improved farm landscape and land values; and
- diversification of farm business.

The wood production rotation is about 10 years, and a new crop will coppice (shoot) from the stump after harvest.

Timberbelt sharefarming is a commercial operation attractive to both farmers and investors. The sharing of costs, responsibilities and returns between farmer and investor is flexible. The joint venture involves only the first harvest. Subsequent coppice crops belong to the farmer.

In timberbelt sharefarming the farmer receives no annuity (yearly income). Instead, the farmer gains the on-going benefit of a tree crop specifically designed to complement the farming operation. The design may include some rehabilitation planting on degraded land.

The investor usually undertakes the technical evaluation, planning and legal work, and meets the cost of the major contract operations (such as ripping, weed control and planting) and seedlings. Some farmers may require financing of other costly items such as fencing materials.

Bluegum coppice shoots pruned to retain two stems for the next crop.

One-year-old timberbelt planting near Albany.

The farmer's minimum role is day-to-day management of the plantings. During establishment this will include tractor work, fencing, rabbit control, and insect monitoring and control. During the growth of the crop the investor will have only a small administrative role. The farmer will monitor the crop and manage grazing, fire control and fertilizer application as necessary.

A specialist CALM adviser who lives in the district carries out evaluation, planning, negotiation and administration of the sharefarming project with the interested farmer. A legal agreement is signed. The same adviser supervises and controls the quality of establishment operations.

Financial arrangements

All operations and inputs necessary to grow the crop are given a realistic market price for that locality to streamline negotiation and record- keeping (Table 1). All cost settings are reviewed annually. The farmer can undertake any operation to the agreed standard at the market price. A management plan detailing the agreed costs and responsibilities is finalised before operations begin.

Fixed costs are itemised for each contract so that plantings of small areas will carry a full cost share. For example, in Table 1, the cost of $250/ha for evaluation/legal costs incurred by the investor is a fixed cost of $3000 for each separate contract expressed as a cost per hectare for the expected average planting area of 12 ha. It will therefore be less attractive to plant smaller areas, but no minimum area is set.

Table 1. Cost distribution of timberbelt sharefarming - standard prices for the Darkan district

Operation	Farmer input Cost/ha $	Farmer input Compounded with 7% interest	Investor input Cost/ha $	Investor input Compounded with 7% interest
Year 0-1				
evaluation/legal			250	
ripping			137	
herbicide			71	
seedlings			218	
planting			98	
fertilization			55	
fencing	40		100	
rent/preparation	80			
	120	236	929	1,827
Year 1-2				
rent/annual costs	62	114	20	37
Year 2-3				
rent/annual costs	62		20	
fertilizer	100	278		34
Year 3-4				
rent/annual costs	62	100	20	32
Year 4-5				
rent/annual costs	62		20	
fertilizer	100	243		30
Year 5-6				
rent/annual costs	62	87	20	28
Year 6-7				
rent/annual costs	62		20	
fertilizer	100	212		26
Year 7-8				
rent/annual costs	62	76	20	24
Year 8-9				
rent/annual costs	62	71	20	23
Year 9-10				
rent/annual costs	62	66	20	21
Total costs		1,483		2,082

The land rent/annual cost item contributed by the farmer consists of $42/ha, being the estimated lost grazing value (that is, six dry sheep equivalents (DSE) per hectare at $7/DSE) averaged over the full term of the contract, plus $20/ha running costs (firebreaks, fence repair).

Planning for harvest starts in year 7 and harvest will usually be completed by year 10. The harvest revenue is the value of the standing crop, that is the price per cubic metre of the standing tree (stumpage) multiplied by total harvestable volume. The stumpage is established before harvest and the harvest volume recorded.

The revenue is divided between the farmer and the investor in the same proportions as their contribution to total costs. Costs include interest at a real rate of 7 per cent compounded to the time of harvest. For the total costs shown in Table 1 (that is, investor — $2082 and farmer — $1483) the revenue share ratio is 58.4 : 41.6. The investor will organize the harvest but it is possible that the farmer could gain additional revenue by contracting to do some harvest operations.

The effects of yield and price on financial returns (sensitivity analysis) are shown in Table 2. The analysis uses the cost share presented in Table 1. Returns are expressed as real dollar revenue at year 10 and as internal rate of return at year 20 to include the benefit of the first coppice crop. For example, for an expected yield of 250 cubic metres and a stumpage of $25, a total revenue in year 10 is $2,600.

Long term market prospects

Prices for and investment in wood production have historically been held back by the big stocks of wood available in the world's native forests. However, these stocks have contracted while demand has continued to grow. The era of cheap wood products is coming to an end. Wood prices are increasing to a level where tree crops can compete for agricultural land.

Eucalypt fibre is now well established as a component of high quality printing papers. This section of the fibre market has the greatest short-fall in supply. Groome (1987) estimated that the pulpwood supply deficit in

Japan alone would be 5.5 million tonnes per year by 1997. Australia is well placed to compete on Asian markets to supply pulpwood.

Market analysis predicts that real prices of eucalypt fibre should be maintained for about 20 years. Prices paid for stumpages could range from $25 to $35 per cubic metre, depending on transport costs.

W.A. Chip and Pulp is the only exporter of pulpwood from Western Australia. The growth in farm-based pulpwood production could open the opportunity for one or more new export operations.

Choice of species

Eucalyptus globulus (Tasmanian bluegum) is the major species grown in timberbelts because of its established reputation as a pulpwood species. It is very adaptable to local conditions and is resistant to grazing and grasshopper attack.

In the 600 to 900 mm rainfall zone *Eucalyptus globulus* will grow to more than 25 m high and 25 cm in diameter in 8 to 10 years in planting densities of 800 to 1000 trees (stems) per hectare. Total volume growth is small in the first few years, but accelerates rapidly before levelling out (Figure 2) to produce 200 to 300 cubic metres over 10 years. Trees can be harvested when they are between 7 and 12 years old.

Several other species that show promise for pulpwood production are being developed to extend the range of sites on which trees can be planted and to diversify the crop. They include *Eucalyptus camaldulensis* (Red river gum) for salt tolerance, *E. botryoides* for waterlogging tolerance and nitrogen-fixing *Acacia* species for infertile soils.

Plantings to date consist of 90 per cent Tasmanian bluegum and the balance is a mixture of some 10 other species. Timberbelt planting of pine *(Pinus radiata)* will also be developed during 1991.

Fire control and grazing

Timberbelts must conform with fire control regulations of local shires. Farmers will gain clearance for all timberbelt fire control arrangements from their local Fire Control Officer.

Bluegums are unpalatable to stock. With careful management the tree planted area can be grazed during the first summer after planting. Grazing can be part of the farmer's fire control strategy. It also provides extra income from the tree planted area and reduces pasture competition for the tree crop.

With careful management timberbelts should present no additional fire risk to the farm. No insurance cover is planned to be included in the current timberbelt sharefarming scheme being operated by CALM.

Table 2. Effects of yield and price from timberbelt sharefarming on the farmer's return

(a) Gross revenue in $/ha at year 10 in 1990 dollar value

Yield cub. m/ha	Price$/cub. m $15	$20	$25	$30	$35
150	936	1,248	1,560	1,871	2,184
200	1,248	1,664	2,080	2,496	2,912
250	1,560	2,080	2,600	3,118	3,639
300	1,871	2,496	3,118	3,743	4,366

Note: Farmer net revenue can be determined by deducting farmer costs given in Table 1.

(b)Per cent internal rate of return† at year 20

Yield cub. m/ha	Price $/cub. m $15	$20	$25	$30	$35
150	5.0	8.8	11.8	14.3	16.4
200	8.8	12.7	15.7	18.3	20.5
250	11.8	15.7	18.9	21.5	23.8
300	14.3	18.3	21.5	24.3	26.6

Notes: Includes all farmer costs and revenue over two 10-year rotations.
† Internal rate of return is the highest real interest rate that could be paid on total costs to still break even with revenue.

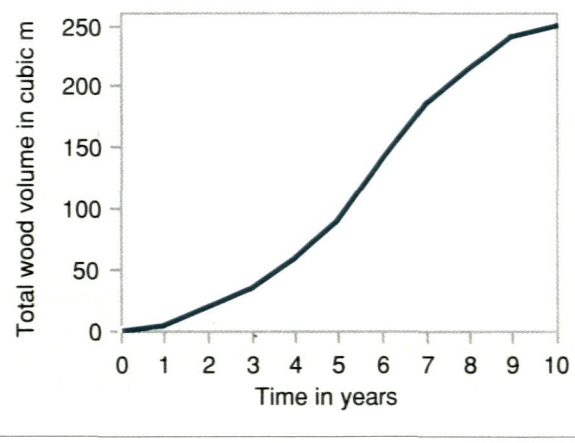


Figure 2. Growth in wood volume over time

Legal agreement

The interests of both parties to a timberbelt contract are secured by a legal instrument called 'a deed of grant of profit a prendre'. This is an agreement by which the farmer grants to the investor the right to share in the growing and harvest of the tree crop. It specifies the general terms and conditions of agreement and has an attached schedule for the particular detail of costs and responsibilities as agreed in each situation.

The agreement is registered on the title of the land, but does not require a caveat. Existing mortgagee(s) must agree to the registration of the agreement. Once in place, the agreement is independent of the landowner and land transfer is not hindered. The agreement ends after the first harvest at about year 10.

Areas for timberbelt sharefarming in 1991

Planting in 1991 will extend mainly from Darkan to Albany, within the 600 to 900 mm rainfall isohyets (Figure 3). The rainfall limits are a guide only, and site selection will depend on soil characteristics. Deep freely draining soils are preferred. CALM advisers will be based at Darkan, Boyup Brook, Mt Barker and Albany.

Technical developments

There is good potential to increase the viability of the tree crop industry by further research and development. This will include the introduction of better species, genetic gain from tree breeding, improvement of tree crop management techniques, and better integration of tree cropping with agriculture.

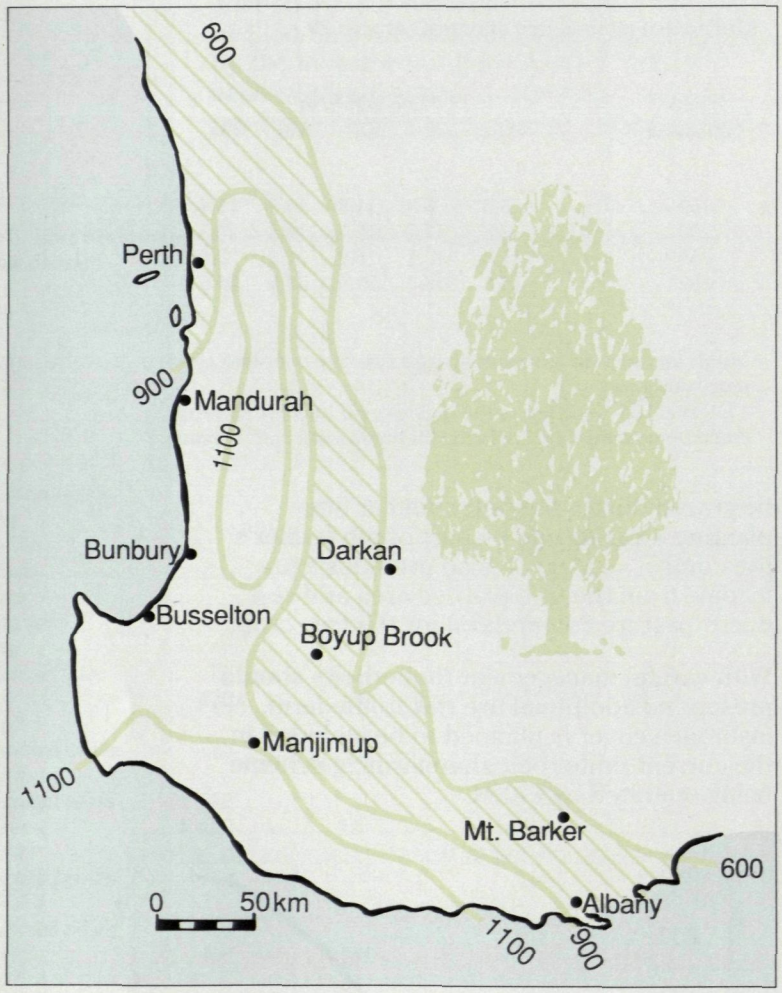


Figure 3. Main timberbelt planting area for 1991.

A timberbelt planting designed to provide shelter and protection for remnant vegetation. Note severe decline in remnant vegetation (top left) common in the Albany district.

A timberbelt planting designed to combat saline groundwater seepage and waterlogging, and to protect remnant vegetation near Mt Barker.

The future

Carefully designed eucalypt timberbelt plantings will form an important component of a new generation of sustainable agriculture in areas with rainfall greater than 600 mm. Farmers will have better control of groundwater systems, land and water degradation will be greatly reduced, and farm productivity will increase.

Some 20 per cent of farmland will be under tree crops and this will support a major pulpwood industry.

Acknowledgements

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