

Forestry Integrated into Agriculture

A landholders' guide
to plantation and
farming economics in
North West Victoria



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economics in North West Victoria

Written by Farm Tree Systems &
Geddes Management

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Background/introduction

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The Federal Government aims to treble the Australian plantation estate between the years 1997 and 2020. The Victorian Government, through the Private Forestry Council Victoria, has developed a strategy that aims to facilitate this marked increase in plantation development on private land.

The publication is intended to provide you with an appreciation of some of the opportunities for low rainfall farm forestry in the NorthWest region of Victoria (see box). It outlines the costs and benefits for three farm forestry enterprise options and should be most useful for landholders contemplating how to 'make their farm trees pay' – more than is the case for most 'landcare-style' plantings.

The three case studies (illustrate with figure(s)) outlined in this publication are:

- A woodlot in the Wimmera
- A paddock perimeter timberbelt (productive shelterbelt) in the Wimmera
- Timberbelts or alley farming in the North Central

You should be able to gain enough of an insight from reading this publication to decide whether the notion of integrating productive trees into your farming system is worth investigating further or decide, for whatever reason, that it is not for you.



The diverse NW region includes the North Central, Wimmera and the Mallee. The region ranges in average annual rainfall from 350–700 mm and embraces grazing, mixed farming, continuous cropping, viticulture and horticulture. Forestry has historically been largely restricted to the higher rainfall zones in the south of the region plus limited wood production on the riverine plains.

The basis for evaluating farm forestry options

Estimating the value of agriculture displaced by a farm forestry design is fundamental to working out how to best integrate trees with agriculture. So the overview of each of the designs in this publication first involves using agricultural gross margins (GMs) to quantify the agricultural opportunity cost from the area occupied by the trees. This cost is then added to the establishment and management costs and compared with any returns from plant and wood products and the value of expected agricultural productivity gains from shelter.

Note that agricultural gross margins are the total returns less direct costs and do not include the landholders own time, depreciation on infrastructure or paddock maintenance costs. Seeing that GMs have been used to estimate the value of agriculture displaced by trees, the viability of the forestry is calculated the same way. On-farm labour input into farm forestry operations such as site preparation, establishment and management is also not costed. The number of days input from on-farm labour is estimated, providing the opportunity to reflect on the returns relative to the effort.

The project analysis summaries include a description of the 'property' and farming system, the forestry enterprise and include estimates of the total project:

- Establishment and management costs
- Agricultural opportunity costs
- Farm labour inputs
- Wood and plant returns
- Shelter benefits
- Costs and benefits
- Reduction in groundwater recharge as a paddock-scale percentage

plus total costs and benefits per hectare.

Costs and returns for the examples are presented in current day dollar values. All you will need to do initially is to make a 'mental adjustment' for the waiting time for returns and decide if it is appealing enough to pursue further. Cash flows

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The next step

are adjusted to take into account the waiting time in the study *Comparative economic analyses of forestry & agriculture in the North West Region of Victoria*. This study should be useful if you decide farm forestry is worth a closer look and you want to refine designs by considering the relative merits of variations on the initial design.

The next step

If you decide to proceed, the examples provided in this brief publication are not intended to be off-the-shelf prescriptions. You are strongly encouraged to modify these and other designs to match your circumstances. For example, consider factors such as:

- Your target product specifications and how long you want to wait until final harvest – you can grow large diameter sawlogs quicker if the trees are spaced further apart
- The level of management input that matches the time you have available or what you can afford to pay a contractor to do – you may decide that you don't have the time to prune and thin

yourself or the money to pay contractors but you are happier to wait longer until the trees are ready to harvest

- The size of the planting and cash flow implications – just about everyone has peak acceptable levels of debt, so the size of the planting and the inherent management inputs can be limiting factors for different designs, regardless of the relative economic merit

and other factors such as market risk, biodiversity value, shelter and visual impact to tailor-make your designs, especially as your experience grows.

If you subsequently take the next step towards establishing a plantation on your property, further information may be obtained from DSE's Private Forestry website (www.dse.vic.gov.au/forestry/private) or by calling the Customer Service Centre on 13 61 86. General advice to landholders and investors considering plantation development can be obtained from your local DSE/DPI office.

A woodlot in the Wimmera

A 2100 hectare mixed farming property with 450 mm average rainfall 20 km from Horsham has a well-drained paddock with 1–2 metres of sand over clay. The paddock is currently only grazed and supporting 3 DSEs per ha. The cropping paddocks with heavier textured soils carry approximately 2 DSEs per ha on the crop stubble.

The occurrence of approximately 25-metre tall yellow gum (*Eucalyptus leucoxylon*) indicates good conditions for tree growing. Sugar gum (*Eucalyptus cladocalyx*) should be well suited to the site and could be grown on 12–15 year rotations – clear felled for firewood then allowed to grow on to produce a second crop in another 12–15 years.

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A woodlot in the Wimmera

The pressure on roadsides from local firewood collection partly reflects the demand for firewood in Horsham. Prices are believed to be approximately \$70/m³ (stack¹ volume) delivered to Horsham.

Surplus employed farm labour could be gainfully deployed onto tree management and harvesting at certain times of the year.

A sugar gum woodlot measuring 400 by 300 metres has a planted area of 12 ha of a 40 ha paddock. With paddocks on three sides and a roadside on the fourth side, unripped tree roots can be expected to compete with surrounding pastures for approximately 30 metres. The area directly occupied by the trees will effectively displace an additional 3.3 ha of agriculture. Based on the sandy site's inherently lower productivity of 3 DSEs/ha (one-third of the regional grazing average of 9 DSEs/ha with a corresponding gross margin of \$168/ha), the average annual value of agriculture displaced from the 15.3 ha is \$813. The approximate total opportunity cost for the 36-year project is \$29,300.

The out-of-pocket costs are assumed to be \$5000. This estimate is based on 'machinery hire' for site preparation, seedling costs, fencing materials, planting and pre and post-planting weed control materials and the trees costing \$0.40 per seedling at 4 by 3 metre spacing. Farm labour inputs totalling 10 days includes erection of 400 metres of sheep ringlock fencing (material assumptions based on \$2000 per km).

Assuming that operator and farm labour is used to manually fell the trees, mechanically crosscut, split, load and deliver the wood and allowing 2.25 hours/m³, \$15/m³ for operating costs and \$3/m³ for tip truck costs (\$0.15/m³/km over 20km), the harvesting and delivery direct costs total \$18/m³. The labour input of 0.25 days/m³ totals 13.5 days per ha or 162 days for the first cut for the 12 ha woodlot. An average annual labour input of 1.1 days/ha/yr is approximately six times the 0.2 days/ha/yr for grazing inputs based on allocating 50% of the time for three people to manage sheep on a 2100 ha property.

Assuming an average of 4% gains in agricultural productivity the value of the shelter from the very small sheltered area of 3.5 ha peaks at only \$27 per annum. The sheltered area assumptions are based on a zero porosity block providing protection of 7.2 H where H is the height of the trees. H equals 12m in the 12th year and the shelter benefits begin in the 3rd year and are in direct relation to the height of the trees. The shelter is foregone when the trees are harvested at Yrs 12 and 24 and increases as the coppice regrows. In practice, the harvesting would be spread out over a number of years and some shelter would be maintained.



Based on harvesting 48m³/ha of solid firewood every 12 years for three rotations and a price of \$70/m³ of stacked wood (\$87.50/m³ for solid wood using a conversion factor of 1 m³ or stacked wood = 0.8 m³ of solid wood) delivered to the customer, the gross margin to the grower is \$69.50 per m³. This equates to \$3300/ha, \$40,000 for the total project at each harvest or \$120,100 for the total project.

The total revenue of approximately \$120,700 exceeds the total project costs of approximately \$34,000. The woodlot gross margin works out to \$200/ha/yr *plus* the \$55/ha/yr from grazing that is incorporated as a cost. Note the additional labour required as set out above.

1 A pile of stacked wood with a volume of 1 m³ contains about 0.8 m³ of solid wood – the rest is air in the gaps between the wood.

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A woodlot in the Wimmera

The summary is set out in the table below.

Costs and returns

Total establishment and management costs	\$5,000
Total agricultural opportunity costs	\$29,300
Total on-farm labour inputs (days)	496
Average on-farm labour inputs per year (days)	14
Total wood and plant returns	\$120,100
Total shelter benefits	\$600
Total costs	\$34,000
Total benefits	\$120,700
Costs \$/ha	\$2,900
Benefits \$/ha	\$10,100
Paddock-scale % reduction in groundwater recharge	39%



If this is of interest and you wish to look further into aspects such as how the value of future revenues are diminished by the waiting time, read the report *Comparative Economic Analyses of Forestry & Agriculture in the NW Region of Victoria*. It is available at www.dse.vic.gov.au/forestry/private

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A paddock perimeter timberbelt in the Wimmera

A paddock perimeter timberbelt in the Wimmera

A highly productive continuous cropping property with 450 mm average rainfall near Kaniva has uniform non-cracking clays. Almost all of the buloke (*Casuarina luehmannii*), grey box (*Eucalyptus microcarpa*) and occasional yellow gum (*E leucoxylon*) has been cleared in years gone by.

Sugar gum (*Eucalyptus cladocalyx*) is growing well around the homestead and the species should be well suited as the tall timber-producing component of a timberbelt design. Legume crops in particular will benefit from protection, especially when flowering.

Firewood prices are approximately \$70/m³ stack volume (\$87.50/m³ solid wood volume) delivered to Horsham and \$120–130 per air-dried tonne (or \$108–117/m³ solid wood volume at 900kg/m³ at 20% moisture content) at Adelaide woodyards.

There is little time required for establishment and management. Farm family labour is available for harvesting and marketing outside seeding and harvesting seasons.

A narrow unfenced belt 1000 metres long comprising two closely-spaced rows (2 metres apart) of alternating sugar gum and buloke will displace as little cropping country as possible, whilst providing and maintaining shelter over the years. The sugar gum will provide the fast

early growth, mature height of approximately 18 metres and firewood when periodically harvested; the buloke will provide permanent low to medium-height shelter, filling-in the gaps left as the sugar gums mature.

The belt will be 2 metres from the fence and deep ripped every three years approximately 3 metres each side of the planting lines to minimise competition with crops.

The area of this unfenced narrow belt is 0.6 ha and the tree roots displace an additional 0.1 ha of crop up to the rip line. The cropping rotation comprises canola, wheat, lentils, barley, faba beans and chickpeas with an average gross margin of \$355/ha. The average opportunity cost equates to \$213 of cropping gross margin per year or \$4,900 for the 20-year project.

The out-of-pocket costs are assumed to be \$800. This estimate is based on 'machinery hire' for site preparation, seedling costs, planting and pre and post-planting weed control materials and the trees costing \$0.40 per seedling² at 3 by 2 metre spacing. Farm labour inputs total 15 days for the establishment, periodic ripping and firewood harvesting.

The sugar gums are likely to be much more productive than the bulokes. Calculating a yield based on 70% of 4 m³/ha/yr over the 20 years, 48 m³/ha of solid firewood should be harvestable.

Working on a 60-km haulage distance at \$0.15/km and \$15/m³ for operating costs, the out-of-pocket expenses for harvesting are \$24/m³.

At a price of \$70/m³ of stacked¹ wood (\$87.50/m³ for solid wood using a conversion factor of 1 m³ or stacked¹ wood = 0.8 m³ of solid wood) delivered to the customer, the gross margin to the grower is \$64 per m³ or \$2,400 for the total project.

Assuming an average of 6% gains in agricultural productivity from a sheltered area of 19 ha, the total project shelter benefits only amount to \$5000. The sheltered area assumptions are based on a 70% porosity belt providing protection of 11 H where the mature H is the mature height of the shelterbelt. H is assumed to equal 18 m at in the 18th year and the shelter benefits begin in the 3rd year. The shelter benefits are assumed to be proportional to the height of the trees.



² Buloke seedlings may be more expensive than this if you don't seek out a nursery willing to grow buloke in cell trays.

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A paddock perimeter timberbelt in the Wimmera

The total benefits of approximately \$7,400 exceed the total project costs of approximately \$6,000. The timberbelt's gross margin computes to \$117/ha/yr plus the \$355/ha/yr cropping gross margin that is incorporated as a cost.

The reduction in groundwater recharge is insignificant with this design.

The summary is set out in the table below.

Costs and returns

Total establishment and management costs	\$800
Total agricultural opportunity costs	\$5,000
Total on-farm labour inputs (days)	15
Average on-farm labour inputs per year	1
Total wood and plant returns	\$2,400
Total shelter benefits	\$5,000
Total costs	\$6,000
Total benefits	\$7,400
Costs \$/ha	\$9,700
Benefits \$/ha	\$12,300
Paddock-scale % reduction in groundwater recharge	1%

To see how the value of future revenues are diminished by the waiting time and the relative merit of design variation such as changing the belt composition and width, read the publication *Comparative Economic Analyses of Forestry & Agriculture in the NW Region of Victoria*



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Timberbelts in the North Central

Timberbelts in the North Central

A 500-hectare mixed farming property with 450 mm average rainfall north of Bendigo is producing prime lamb, grains and wool. One of the partners is generating some off-farm income.

Well-managed pastures in the district support an average of 5 DSEs – equivalent to a gross margin of approximately \$70/ha. The cost of leasing land is approximately \$25/ha (excluding rates).

The undulating grazing land is well suited to growing sugar gum (*Eucalyptus cladocalyx*), ironbark (*E. tricarpa*), eumong (*Acacia stenophylla*) and willow wattle (*A. salicina*) and could be grown in timberbelts in a 26–30 year wide-spaced high-pruned regime principally for hardwood sawlog.

It is planned to use operator labour for site preparation and spraying, but use contractors for tree establishment, management and harvesting.

A 26–30-year wide-spaced high pruned regime, principally for hardwood sawlog will provide very little if any returns from firewood and will require the greatest management inputs in the form of pruning and thinning. Demand for high quality pruned sawlogs is expected to be strong.

Twelve-row timberbelts with an edge row of wattles on each side to reduce competition with agriculture and ten internal rows of sugar gum and/or ironbark are located on the northern and western boundaries of

a 600 by 800 metre paddock. The planted area is 6.5 ha in the 48 ha paddock.

To continue grazing pastures during tree establishment and early growth requires fencing. Assuming that conventional permanent sheep and lamb ringlock fencing is erected by a contractor on the inside of the timberbelts, the fence will cost approximately \$4600 for 1300 metres based on \$3500/km.

An alternative to fencing the belt is to either forgo the grazing income during the establishment years or to crop or cut the area for hay until stock can be reintroduced.

Unripped wattle roots can be expected to reduce pasture production for approximately 10–20 metres from the timberbelts on both sides. If this competition equates to 8 metres of bare ground (zero pasture or crop production), this area occupied by the tree roots will effectively displace an additional 2.2 ha of grazing. Based on the regional grazing average of 5 DSEs/ha (gross margin of \$70/ha), the average annual value of agriculture displaced from the 8.7 ha is \$550. The approximate total opportunity cost for the 28-year project amounts to \$15,400.

Note that ripping the tree roots may be feasible – to the benefit of agricultural production but at the expense of wood production.

Landholder site preparation (cultivation and strip spraying) is assumed to cost \$55/ha for glyphosate and machinery. A directed spray of glyphosate in the second year is assumed to cost \$21/ha.



A planting spacing of 4 by 2.5 metres (1000 trees per hectare) will more than adequately provide for selection of 100 final crop trees per hectare. Assuming a seedling cost of \$0.45, the 6500 seedlings will cost approximately \$2900 to purchase and \$780 for a contractor to plant.

Trees are not going to be guarded or fertilised.

Contract form and high pruning from Years 3–8 and non-commercial thinning in Years 4 & 6 is expected to cost approximately \$4000.

The total out-of-pocket establishment and management costs are assumed to be \$15,500 and landholder labour inputs total 3 days.

It is a reasonably conservative to assume an average of 4% gains in agricultural productivity in the sheltered area. The wide but porous timberbelts are assumed to shelter an area of 20 ha and average \$43 per annum productivity gains over the

Timberbelts in the North Central

life of the project (totalling \$1200). The sheltered area assumptions are based on a 40% porosity block providing protection of 10 H (H = height of trees) where the mature H equals 20 m at in the 18th year and the shelter benefits begin in the 3rd year and are in direct relation to the height of the trees.

Coppice regrowth from the cut stumps is to be controlled by periodically crash grazing.



Estimates of wood revenue of approximately \$33,600 are partly based on producing 0.54 m³ per 40-cm diameter tree of sawlog from 83 final crop eucalypts per hectare and 0.3 m³ of sawlog from 17 final crop acacias per hectare. The eucalypt sawlog is assumed to comprise 75% A-grade sawlog at \$80/m³ and 25% B-grade sawlog at \$40/m³. The Acacia sawlog is assumed to have an average stumpage of \$100/m³. The remaining returns are from firewood taken from the heads of the 100 trees. Based on \$90/m³ stack volume equating to \$113/m³ solid


wood volume and assuming it is contract harvested and transported for \$55/m³ stack volume (\$69/m³ solid volume) leaving a stumpage of \$44/m³ solid volume.

Even though the cost of labour has been included for the timberbelts, but excluded from the agricultural opportunity cost based on gross margins, the total project benefits of \$34,800 still exceed the total project costs of approximately \$30,900. The woodlot gross margin works out to \$22/ha/yr plus the \$70/ha/yr from grazing that is incorporated as a cost. Note the minimal additional labour required as set out above.

The summary is set out in the table below.

Costs and returns

Total establishment and management costs	\$15,465
Total agricultural opportunity costs	\$15,445
Total on-farm labour inputs (days)	3
Average on-farm labour inputs per year	0.1
Total wood and plant returns	\$33,624
Total shelter benefits	\$1,197
Total costs	\$30,911
Total benefits	\$34,821
Costs \$/ha	\$4,763
Benefits \$/ha	\$5,366
Paddock-scale % reduction in groundwater recharge	18%



Find more information about the Department and Private Forestry
on the Internet at www.dse.vic.gov.au

Customer Service Centre Phone: 136 186

