Bluegum timberbelts for profitable landcare

Peter Eckersley

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Available at: https://researchlibrary.agric.wa.gov.au/journal_agriculture4/vol35/iss4/3
Revegetation with Tasmanian bluegums in wide-spaced timberbelts appears to offer high returns, especially in areas where high winds cause crop and stock losses and where land can be saved from salinity and waterlogging.

In the South Coast and South-West regions, timberbelts will complement existing enterprises and so optimise overall land use. Graziers should be able to maintain their stock numbers while creating an on-farm superannuation package.

The Coffey alley farming project aims to reduce watertables while providing an additional return.

The Coffey plantings

Peter and Jan Coffey were concerned about salinity on their property 'Bloomvale' at Chowerrup near Boyup Brook. Saline groundwater has emerged and it appears that over 30 per cent of the farm might become affected. This prompted them to search for a commercial solution to this significant potential loss of productive land.

On the basis of the Jenkins' experience, the Coffeys decided to design the most profitable timberbelt layout as well as avoiding land from future salinity and waterlogging.

They estimated the profitability of a range of designs using a spreadsheet model. There wasn't time to experiment on a small scale, so they had to use the best estimates they could find about tree growth rates and the interaction of trees and pasture. After consulting hydrogeologist Richard George, they decided that the design should give a dispersed cover of bluegums, with the tree crowns covering at least 10 per cent of the 130 hectares treated. They also chose a high planting density to generate that crown cover as quickly as possible.
The Jenkins' design of three rows, 4 metres between rows, 2 metres within rows and 25 metre bays, was calculated to produce a Net Present Value of $124,700 and 10 per cent return on investment if applied with the same base assumptions.

A critical review

The assumptions used in designing the Coffey's plantings are open to question, especially given the limited experience with the design and use of Tasmanian bluegums in this (600 mm rainfall) environment. It seemed important to review all assumptions critically and to incorporate the value of groundwater control benefits in the analysis, as this is the major factor motivating farmers.

The spreadsheet model now includes an estimate of the area protected by the trees from salinity and waterlogging, and a windbreak effect that responds to the belt spacing (Figure 1). This was made possible with data from the FARMTREE model, based on research in Canterbury, New Zealand.

Canola has been sown in the bays. This has less summer grazing value than cereal or lupin stubble, so there is less to lose if stock decide not to graze around the young trees. However, experience shows that young sheep can be run among bluegums from the first autumn after planting.

As the paddock is on a north-facing slope, Peter first installed wide contour banks that can be driven over by cropping machinery.

Likely profitability

Allowing for the loss of land planted to trees and the estimated competition and shelter effects on pasture and crop, Peter found the project to be profitable (almost 20 per cent real return) for a wide range of assumptions. By contrast, his expected return for a pure bluegum plantation was only 9 per cent.

Table 1 shows some of these assumptions and the rates of return calculated in the sensitivity analysis on their agroforestry project.

Peter expects his project should return 19 per cent (Net Present Value $54,000) even though he assumed a net reduction of up to 20 per cent in pasture yield between the belts. This is clearly important when the trees are taller than half the bay width. It will need to be measured.

The project looks very robust. It should be profitable within the range of yields and prices expected, even if the belts were spaced more widely, although that is less likely to reverse the rise in groundwater.

The bluegums were planted in two-row belts in August 1994 to take advantage of the 'edge effect' which was noticeable on the Jenkins' property. The bays (or alleys) between the belts are almost 40 metres wide, which is convenient for normal farming operations. The belts are oriented mostly north-south to retain maximum sunshine for agriculture. This also provides protection for pastures, crop and sheep from most problem winds.

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Figure 1. Change from normal yield at various distances downwind from a windbreak, measured in tree heights.
Canterbury compete with perennial pastures, and that winds are less harmful at Chowerup, the tree effect was modified. This is conservative compared with effects described elsewhere.

Protection of waterways, encouragement of biodiversity and philosophical reasons are also important in timberbelt planting decisions. A spreadsheet model cannot account for all of these, but it can add a financial dimension to them.

The timberbelt treatment is designed for recharge control and can be viewed as turning off the tap on groundwater accessions. The existing store of groundwater has to drain from the landscape. It is likely the benefits will take a few years to appear and 20 to 40 years to materialise fully. This delay, and the limited proportion of the landscape likely to be saved with this planting, make the groundwater control benefits small relative to the pulp log revenue in this project.

If it is assumed for Chowerup that 15 per cent of the paddock will be covered by trees (crown cover) and a total of 11 hectares ultimately saved from salination, less than one tenth of the net benefit calculated by the model is from groundwater control.

If bluegum timberbelts are to be planted by more farmers in the 550-700 mm rainfall zone, projections will need to stand up under conservative assumptions. Table 2 shows that, even within much more conservative assumptions, two-row timberbelts are profitable. The project still looks very robust.

The most likely result is a return of 13 per cent. This translates into an average of $26 per hectare per year over the whole of the paddock, which is an increase of almost a quarter over the agricultural gross margin. However, the cash flow pattern is very different.

**Cash flow**

While we have shown the robust profitability of the timberbelt project, it does involve a period of negative cash flow. Figure 2 shows the cash flow effect of the project, with cumulative deficits compounded at 7 per cent for both the initial base case and the conservative scenario. Both scenarios show that the project breaks even within 10 years and should be profitable enough to finance the continued tree cover to maintain a reasonable water balance.

A significant financing requirement is inherent in any form of forestry, but widely spaced timberbelts are likely to be within the reach of many farmers for at least part of their farms, especially where the shelter benefits are greatest.

Hazards such as saline groundwater and drought remain factors to consider, but these can be minimised through careful site selection. Proper site evaluation and establishment are absolute priorities. There is a good case to be made that trees in narrow belts (two to three rows) reduce the risk of drought deaths. It will be important to confirm the assumptions about groundwater hydrology.

Narrow belts of trees provide shade and shelter for stock as well as timber which can be harvested as required.
The spreadsheet model was used to calculate profitability under conditions likely on the south coast. A suitable example is a 100-hectare block carrying beef cattle which produce an above average annual gross margin of $200 per hectare. Being a flat, exposed site in the 700 mm and above rainfall zone (south of Mt. Barker), the windbreak value is higher (climate more like Canterbury NZ).

Electric fencing is erected at a cost of $700 per kilometre. As it is needed on each belt for only three years, to allow the trees to grow beyond the reach of cattle, the net cost is assumed at only $400 per kilometre.

This analysis assumes the conventional bluegum spacing of 4 metres between rows and 2 metres between trees in the rows. Pulpwood yield for centre rows (plantation equivalent) is assumed to be 250 cubic metres per hectare.

With these assumptions, the model suggests that for an investment of less than $10,000 a farmer could protect 100 hectares and earn a return of at least 16 per cent.

Another key assumption is the 'edge effect' of pasture on bluegum growth. Measurements of the Jenkins' seven-year-old bluegums in the near future will show how close is the visual estimate of 50 per cent. The edge effect could extend into the second and third rows of trees in a belt.

South Coast potential
The long-term average annual rainfall at 'Bloomvale' (35 km south east of Boyup Brook) is not much over 600 mm. There is a reasonable amount of remnant vegetation adjoining the project paddock, and the undulating landscape appears less prone to wind erosion, chilling and dessication than the south coastal plain. All these factors suggest that the potential for bluegum timberbelts may be even greater on the South Coast.

Beef and milk producers will choose trees for their wood value as well as shelter value. Wide spacing of timberbelts will ensure a minimum of shading so that palatability of pastures is maintained. There is the possibility that the growing season is extended, providing a marketing advantage.

Harvesting of 10-year-old bluegums underway in September 1994 at Yornup near Bridgetown. These trees are in plantation, but could return more if planted in belts.
Conclusion

Integrated farm forestry is now seen as highly desirable in the South-West and South Coast regions, and perhaps as far inland as Kojonup. If the pioneer commercial plantings prove as successful as predicted, we may be able to profitably address the looming problem of rising groundwater, soil erosion and nutrient loss in the high rainfall areas.

Figure 3 shows how return on capital invested can be maximised by planting narrower timberbelts 250 metres apart rather than planting wider rows closer together.

If there is no shortage of funds, the highest total return, equivalent to more than $18 per hectare per year overall, is obtained by planting 8 or 10 row belts 100 metres apart (see Table 3). This would require an investment of at least $30,000 (Table 4).

Four-row belts 100 metres apart on a farm where the grazing gross margin is $100 per hectare would add $21/ha/year to the paddock gross margin and return 13 per cent on investment.

These wider belts are likely to have less impact on groundwater, as the trees are less dispersed than in narrower belts.

The cost of fencing to some extent negates the benefits from the edge effect on trees in outside rows. Other analyses using FARMTREE have shown that producers with above average grazing margins, such as dairy farmers, will find narrower widely spaced timberbelts most profitable. These will provide the maximum shelter benefit and take less land out of pasture production.

The Jenkins' alley farming experiment with mixed bluegums and pasture is one of the oldest in Western Australia.

Figure 3. Effects of timberbelt spacing and width on returns on capital.
Further reading


Peter Eckersley can be contacted on (097) 255 255

Table 1. Profitability of Chowerup timberbelt project under a range of assumptions

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>Change from base case</th>
<th>Net present value NPV</th>
<th>Internal rate of return IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Base case</strong></td>
<td></td>
<td>$55,000</td>
<td>19%</td>
</tr>
<tr>
<td><strong>Factor varied</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grazing gross margin</td>
<td>up by 10%</td>
<td>$53,000</td>
<td>18%</td>
</tr>
<tr>
<td>Max. shelter benefit</td>
<td>up to 50%</td>
<td>$64,000</td>
<td>21%</td>
</tr>
<tr>
<td>Distance between belts</td>
<td>up to 50 m</td>
<td>$40,000</td>
<td>22%</td>
</tr>
<tr>
<td>Wood yield</td>
<td>down by 20% to 0.16 cu m/tree</td>
<td>$36,000</td>
<td>16%</td>
</tr>
<tr>
<td>Stumpage</td>
<td>down to $15</td>
<td>$31,000</td>
<td>15%</td>
</tr>
<tr>
<td>Max. competition effect</td>
<td>up to 70%</td>
<td>$48,000</td>
<td>17%</td>
</tr>
<tr>
<td>Block plantation</td>
<td>yield 220 cu m/ha</td>
<td>$44,000</td>
<td>9%</td>
</tr>
</tbody>
</table>

**Base assumptions for Table 1:**

- 2-row belts, 2 m between rows, 1.5 m within rows, 36 m wide bays
- 0.13 cu m per tree in centre row at Year 10 (i.e. yield in a plantation situation)
- 50% yield advantage of outside row (i.e. 0.2 cu m/tree)
- 90% tree survival to harvest
- $20/cu m stumpage for pulpwood at year 10, and year 18.
- 1 m edge row canopy overhang (to calculate "area planted" and, by deduction, pasture area between belts)
- $1110/ha grazing gross margin (net of per head, fertiliser and livestock capital costs)
- 60% maximum competition effect (potential decrease in stocking rate)
- 40% maximum shelter benefit (potential increase in stocking rate)
- 7% discount rate to calculate Net Present Value (NPV)

Table 2. Profitability of Boyup Brook timberbelt under revised and conservative assumptions

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>Change from base case</th>
<th>Average annual benefit over paddock#</th>
<th>Internal rate of return IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conservative base case</strong></td>
<td></td>
<td>$26</td>
<td>13%</td>
</tr>
<tr>
<td><strong>Factor varied</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grazing gross margin</td>
<td>up to $150/ha/yr</td>
<td>$19</td>
<td>11%</td>
</tr>
<tr>
<td>Advantage of outside row</td>
<td>down to $70/ha/yr</td>
<td>$33</td>
<td>15%</td>
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<tr>
<td>Distance between belts</td>
<td>down to 30%</td>
<td>$24</td>
<td>13%</td>
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<tr>
<td>Wood yield</td>
<td>up to 50 m</td>
<td>$23</td>
<td>15%</td>
</tr>
<tr>
<td>Stumpage</td>
<td>up to 100 m</td>
<td>$18</td>
<td>19%</td>
</tr>
<tr>
<td>Wood yield</td>
<td>down by 10% to $18</td>
<td>$20</td>
<td>12%</td>
</tr>
<tr>
<td>Block plantation</td>
<td>yield 0.146 cu m/tree overall</td>
<td>$20</td>
<td>12%</td>
</tr>
</tbody>
</table>

# 'Average annual benefit over paddock' means the equivalent annual value of the project divided by paddock area.

**Base assumptions for Table 2:**

The conservative assumptions for the Base case are the same as for Table 1 except:

- 0.12 cu m per tree for a plantation at this site
- 35% yield advantage of outside row with 34 m effective bay width (i.e. 0.162 cu m/tree)
- 80% tree survival to first harvest, 70% tree survival to second harvest
- $20/cu m stumpage at years 10 and 18.
- 2 m edge row canopy overhang (to calculate "area planted" and, by deduction, area of pasture between belts)

Table 3. Capital needed for a 100 hectare South Coast timberbelt project with a range of belt and bay widths

<table>
<thead>
<tr>
<th>Bay width (m)</th>
<th>50</th>
<th>100</th>
<th>150</th>
<th>200</th>
<th>250</th>
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</thead>
<tbody>
<tr>
<td>Rows/belt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$36,000</td>
<td>$20,000</td>
<td>$13,000</td>
<td>$10,000</td>
<td>$8,000</td>
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<tr>
<td>6</td>
<td>$48,000</td>
<td>$27,000</td>
<td>$19,000</td>
<td>$15,000</td>
<td>$12,000</td>
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<tr>
<td>8</td>
<td>$57,000</td>
<td>$34,000</td>
<td>$24,000</td>
<td>$19,000</td>
<td>$16,000</td>
</tr>
<tr>
<td>10</td>
<td>$65,000</td>
<td>$40,000</td>
<td>$29,000</td>
<td>$23,000</td>
<td>$19,000</td>
</tr>
</tbody>
</table>