



A case study of socio-economic returns from farm forestry and agriculture in south-east Australia during 1993–2007

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ABSTRACT

In Australia, a national policy was launched in 1997 to enhance regional wealth and international competitiveness of forest industries through a sustainable increase in plantations. An element of the policy was the development of a commercial forestry and farm forestry culture. In this context, farm forestry was intended to provide the opportunity to integrate smaller-scale plantations into agricultural landscapes on private land. Against this background, a study was undertaken to analyse the socio-economic returns from farm forestry in a case study in south-east Australia. Financial information during 1993–2007 for livestock grazing and 8 ha of blue gum (*Eucalyptus globulus*) was analysed to compare the profitability of farming and farm forestry. During this period, a full cycle of blue gum (14 years) to produce pulp logs was completed with a forestry company under a tree farming agreement. The blue gum was integrated with the livestock enterprise by planting the trees in belts that were mostly 10 rows or 30 m wide positioned 250–300 m apart and located strategically on productive agricultural land along land-class boundaries. For the blue gum farm forestry, the net present value to the farmer expressed in 1993 dollars was \$1236/ha compared to \$768/ha for livestock grazing during 1993–2007. The farmer reported they had successfully integrated farm forestry as a land-use, and that the farm forestry had provided important environmental benefits and social benefits. The farmer was committed to farm forestry being part of the diversified farming business into the future, with the management of a second crop of blue gum on the farm underway.

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1. Introduction

In Australia, a national policy, Plantations 2020, was launched in 1997 as a strategic partnership between governments (Federal, State and Territory) and the plantation timber growing and processing industries. The underlying strategy was to enhance regional wealth creation and international competitiveness through a sustainable increase in Australia's plantations, based on a national target of trebling the area of commercial tree crops from 1 Mha (as at 1997) to 3 Mha by 2020. A further aim of the policy was to convert the annual \$2 billion trade deficit in wood and wood products into a trade surplus (PVIC, 1997).

Plantations 2020 focussed on overcoming impediments to the expansion of plantation forestry (PA, 2002). A key element of the framework (PVIC, 1997) was to facilitate the development of a commercial forestry and farm forestry culture in each of the 15 national plantation regions that would attract a broad spectrum of investors.

To achieve this, a specific action of Plantations 2020 was to inform farmers of the profitability of plantations as part of an on-farm

production system (PA, 2002). Further impetus for farm forestry was provided in 'Farm Forestry: National Action Statement', which detailed the objectives and actions agreed by the Federal, State and Territory Governments and the forest and wood products industry to develop farm forestry, to complement Plantations 2020 (DAFF, 2005). In the National Action Statement, farm forestry was defined as '... the combination of forestry activity with cropping and or livestock production', and can take many forms including smaller-scaled plantations on farms, timber belts, wind breaks, alleys and wide-spaced plantings (DAFF, 2005).

The strong policy support for farm forestry (independently or jointly owned and managed small-scale commercial plantations) evolved from recognition of its multiple benefits to landowners. These include timber production and farm enterprise diversification without reduced livestock carrying capacity when farm forests are strategically planted (DSE, 2003), biodiversity enhancement (Race and Freudenberger, 2003; Salt et al., 2004), enhancement of landscape amenity (Herbohn and Harrison, 2004), and reduced livestock mortality and increased livestock production from provision of shelter (Race and Freudenberger, 2003).

The nexus between the national policy to expand plantations and farm forestry was that farm forestry provided the opportunity to integrate smaller-scale plantations into agricultural landscapes on

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private land, diversifying income and providing other benefits for farmers and maintaining regional communities while providing wood resources for regional industries (DAFF, 2005).

However, since the launch of Plantations 2020, expansion of planted forests in southern Australia has been dominated by blue gum (*Eucalyptus globulus*) established in industrial plantations on farm land. The primary objective has been the production of pulp logs on short rotations (e.g. 10–12 years) to produce wood fibre for the production of paper. During 1997 to 2009, Australia's plantation estate increased from 1.2 M ha to 2.0 M ha, a net annual increase of about 71 000 ha per annum on average (Gavran and Parsons, 2010).

A recent inventory estimated that the national plantation estate included 155 000 ha of farm forestry plantations. Most of the increase in farm forestry since 2001 was due to the inclusion of plantations established by managed investment schemes on leasehold farm land where a working farm continued to operate (URS Forestry, 2008). Excluding areas planted by managed investment schemes on leased farm land, only 33 000 ha of farm forests had been established since 2001 (URS Forestry, 2008). This continued the trend of slow uptake during the 1990s despite strong promotion of farm forestry as a way of generating a wide range of socio-economic and environmental outcomes at a regional scale (Race, 1999; Schirmer et al., 2000).

A study of financial returns from farm forestry in Australia (Fritsch and Hudson, 2008) had six case studies in which the investment in farm forestry was funded by the landowner, but only one had realised returns from a full rotation. In that case, located in Western Australia, a blue gum plantation harvested for pulp logs produced '... an adequate reward for investor risk on a stand-alone basis' (p. 16), and had a higher net present value than the alternative land-use of beef cattle breeding. This study highlighted that actual results on the economics of farm forestry in Australia remained scarce.

Against this background of government and industry policy to expand planted forests but with most expansion being in the form of industrial plantations, and a poor understanding of the economics of farm forestry, a study was undertaken to analyse the socio-economic returns from a farm forestry case study in the State of Victoria in south-east Australia. Given that the detail of the socio-economic contribution of farm forestry for an individual property is seldom available in the published literature, this study focused on the farming property of the Stewart family operated principally by A. Stewart (a co-author) supported in the management of farm forestry on the property by his brother H. Stewart (the senior author). The benefit of analysing this property as a case study was the access to a comprehensive longitudinal data set of cost, price and yield information for the farming and farm forestry enterprises provided by A. Stewart, and the interactive reflection on the changing perceptions of farm forestry within the family over time. The specific objectives of the study reported in this paper were to:

1. compare the economic returns from farm forestry and agriculture (livestock grazing) during 1993–2007 in a case study; and
2. learn of the social benefits of farm forestry to the farmer (A. Stewart).

2. Methods

2.1. Case study data

As well as providing access to a comprehensive data set, the case study analysis enabled close interaction with an experienced farmer with first-hand knowledge of farm forestry, with the farmer recently completing a complete growing cycle of a farm forestry crop integrated into the livestock grazing enterprise. This provided an opportunity to examine the relative financial performance of farm forestry and agriculture.

A new business plan was implemented in 1992 for the 229 ha farm in southern Victoria (38° 22' S, 143° 54' E), driven by a goal to

sustainably produce forest and livestock products through the integration of commercial trees and habitat trees into the farming system. The agriculture was mixed livestock grazing on perennial pastures, principally to produce sheep meat from prime lambs mainly for the domestic market with wool and sheep skins as co-products. During the period of the case study, the stocking rate on the property was about 18 DSE/ha.¹ This was in the range of the potential carrying capacity for well-maintained and well-fertilised pastures of 18–22 DSE/ha for farms in southern Victoria where the average annual rainfall was 700 mm (Saul, 2006, p. 5), which was similar to the long-term rainfall for the farm (BM, 2010).

In 1993, the farmer entered a joint venture by way of a tree farming agreement with Midway Ltd ('company') to grow 8 ha of blue gum for production of pulp logs. The crop was harvested in 2007 when the trees were 14.2 years of age, and the company exported the chipped pulp logs from its facility at Geelong to a Japanese paper mill.

Negotiation with the company allowed the farmer to configure the blue gum plantation in six belts of trees that were mostly 10 rows or 30 m wide ('timberbelt' plantation) positioned 250–300 m apart and located along land-class boundaries, rather than in block plantings as normally practised in commercial forestry. All timberbelts were established in 1993 on the same land-class – brown and yellow kurosols, characterised by a strong texture contrast between the surface horizons (sandy loam) and the sub-surface horizons (medium clay) (Isbell, 1996) on undulating to steep terrain.

Under the tree farming agreement, the company's contribution was establishment of the plantation (at a deemed value of \$1650/ha in the first year in 1993 dollars), and the farmer's contribution was provision of land fenced to exclude livestock and plantation protection (at a deemed value of \$110/ha/year for the life of the project in 1993 dollars). Interest compounding annually at the 12-month bank term deposit rate² notionally accrued on the deemed value of the contributions by both parties, such that the shares of the harvest revenue were 55.6% to the company and 44.4% to the farmer. The price for the trees was the 'market price of the trees at the time of felling' (i.e. the fair and reasonable market value of the trees, taking into account such factors as the price being paid by the company and other purchasers for trees of similar type). The term of the agreement was the earliest of 15 years or the completion of harvest, and at the end of the agreement ownership of the tree stumps reverted to the farmer.

The timberbelts were established in 1993 using standard forestry practices (cultivation, chemical weed control and application of fertiliser) at a stocking of 1333 seedlings/ha (2.5 m by 3.0 m). There were no silvicultural treatments after the second year. The planting configuration provided 2.9 km of shelter for the grazing enterprise, but it came at a higher cost for fencing to the farmer than a normal plantation layout because the timberbelts had five times the perimeter of a square plantation block of equivalent area.

At three years of age, survival measured on a series of experimental plots was 93%. In 2006, the company conducted an inventory when the trees were 12.8 years old to assist with the planning of the harvesting. The mean stocking measured on eight plots (each 0.04 ha) was 911 trees/ha. Thus, the stocking of the final crop was 68% of the initial stocking, indicating that competition had caused substantial mortality between ages 3 years and 12.8 years. Mean statistics for growth of the plantation at age 12.8 years were tree height of 17.0 m, basal area of 29 m²/ha, and total standing

¹ The dry sheep equivalent ('DSE') is a standard unit frequently used to assess the carrying capacity of a given farm or area of grazing land (McLaren, 1997). The standard DSE unit used in the Department of Primary Industries in Victoria is the amount of feed required by a dry, 50 kg sheep to maintain its weight (DPI, 2009, p. 66).

² Data used for each year was the deposit rate for the month of April which was the average of term deposit rates of the four largest banks in Australia for a deposit of \$10 000 for 12 months. Data from Reserve Bank of Australia at: http://www.rba.gov.au/statistics/tables/index.html#interest_rates.

volume of 190 m³/ha. This growth rate equated to a mean annual increment ('MAI') of 14.8 m³/ha at age 12.8 years, expressed in total standing volume.

Mechanical harvesting of the plantation commenced in November 2007 as planned in the last year of the tree farming agreement. All logs were delivered by road transport to the company's processing facility located 65 km from the farm. The actual harvest for the entire plantation, based on logs weighed on-truck at the mill, was 211 tonnes/ha. The company paid harvest revenue to the farmer based on the weight in tonnes and stumpage rate for each load of pulp logs delivered and weighed at the company's mill, and this revenue data was used in the financial analysis.

2.2. Financial analysis of case study data

The returns from livestock production were analysed by calculating the operating profit for the farm for each year during 1993–2007, using detailed farm business records provided by the farmer and the methodology used in the Farm Monitor Project (DPI, 2008, Appendix C, p. 67). Using this industry standard terminology (Box 1), operating profit was calculated as net farm income (gross income minus enterprise and overhead costs) minus an allowance for the farmer's management and own labour. The latter was estimated using an industry benchmark (DPI, 2008, Appendix C, p. 67) and assuming that 0.4 of a full-time farm operator was required to operate the livestock enterprise.

Operating profit does not include interest, leases, capital expenditure, principal repayments and tax, but was believed to be useful for illustrating the relative performance of the livestock enterprise and farm forestry. It is analogous to 'farm business profit' reported by the Australian Bureau of Agricultural and Resource Economics in national surveys of farm financial performance (Martin et al., 2007, p. 182).

Net farm income for each year during 1993–2007 was also calculated separately for comparison with the longitudinal data on net farm income reported by the Farm Monitor Project (e.g. DPI, 2008).

The net return from farm forestry ('operating profit') was estimated from the revenue received at harvest minus the cost of fencing the timberbelts, the annual rates and the agricultural opportunity cost of pasture loss adjacent to the timberbelts due to tree competition (i.e. the 'edge effect' of the blue gum).

Although fence costs prior to 1993 were treated as sunk costs, in the analysis, the fences constructed for farm forestry and the livestock enterprise during 1993–2007 were not treated as sunk costs because of the large difference in the capital cost per hectare for farm forestry compared with livestock grazing during that period. For the 8 ha of timberbelts, the density of fences (km/ha) was five times that for the livestock grazing enterprise. Depreciation of the capital value of the fences was estimated as an overhead cost (Makeham and Malcolm,

1988; DPI, 2008). This was done by assigning an opening value to the fence at the start of the project in 1993 from the actual capital cost (materials and labour), and a closing value at the end of the project in 2007 estimated using straight-line depreciation over a service life of 50 years. Depreciation of fence costs against the livestock enterprise was treated the same way.

Growth of the trees caused pasture loss around the edges of the timberbelts due mainly to strong competition by tree roots for soil moisture, and the impact increased as the trees matured (i.e. the trees had an 'edge effect'). The opportunity cost to the livestock enterprise of pasture loss caused by the blue gum was taken to be a cost to the farm forestry enterprise. The results for operating profit from the livestock enterprise were used to estimate the agricultural opportunity cost of the edge effect of the blue gum timberbelts, drawing on research on the width of seasonal pasture loss caused by blue gum timberbelts (Albertsen et al., 2000), validated by measurements made by the farmer. For instance, at a tree age of 2 years, the 8 ha of trees 'occupied' 1.0 ha of land outside the fenced timberbelts (an extra 13%), but by age 14 years the trees occupied 2.9 ha (an extra 37%) outside the fenced timberbelts. For each year, the edge effect, as a proportion of the total area of timberbelts, multiplied by the operating profit from farming, was taken as the agricultural opportunity cost (but if the operating profit was negative, the opportunity cost was set to zero).

All costs and revenues during 1993–2007 were used to construct the operating profit for farm forestry for comparison with the operating profit from the livestock enterprise during the same period. These nominal, annual cash flows were discounted using market interest rates to calculate the net present value for each enterprise in 1993 terms. The rate used for each year was the deposit rate for the month of April which was the average of term deposit rates of the four largest banks in Australia for a deposit of \$10 000 for 12 months. This market rate of interest was used as the opportunity cost of capital, ignoring risk differences between the two enterprises. The rates ranged from 3.85% to 8.05% and were: 5.15% (1993–1994), 8.05% (1994–1995), 7.10% (1995–1996), 5.45% (1996–1997), 4.45% (1997–1998), 3.85% (1998–1999), 5.85% (1999–2000), 4.05% (2000–2001), 3.85% (2001–2002), 3.85% (2002–2003), 4.80% (2003–2004), 4.60% (2004–2005), 4.4% (2005–2006) and 5.85% (2006–2007).³

Under the tree farming agreement, the farmer owned the tree stumps after harvesting and decided to manage the coppice⁴ from the stumps to produce a second crop of pulp logs in a 14-year rotation. The forestry cash flows were estimated for 2007–2008 to 2020–2021, informed by emerging experience with this type of crop from Western Australia (Archibald, 2005), and using the same method as in the first rotation for calculating the annual overhead for depreciation of the fence and the opportunity cost to the livestock enterprise of pasture loss caused by the edge effect of the timberbelt. For comparison with the second crop of blue gum, the farmer estimated an annual operating profit for the livestock enterprise for 2007–2008 to 2020–2021, informed by results from the past decade and the domestic and international market outlook for livestock enterprises (e.g. ABARE, 2008).

The results for both enterprises were also expressed as annual equivalent returns, to allow financial comparison of the farm forestry system with the existing agricultural land-use (Cubbage et al., 2007; Polglase et al., 2008). These returns were calculated using a discount rate of 5% for the first (1993–2007) and the second (2007–2021) production periods of the farm forestry project.

Box 1

Glossary of terms related to the business of farming.
Source: DPI (2008, p. 56).

Gross income	Total income including allowances for inventory changes and rations.
Enterprise costs	All operating (or running or variable) costs that can be allocated to a specific enterprise and which vary with the size of the enterprise.
Overhead costs	All fixed costs that cannot easily be allocated to a specific enterprise (e.g. fuel, permanent labour, rates, administration, and depreciation), but excluding owner/operator allowance, interest, leases, capital expenditure, principal repayments and tax.
Net farm income	Gross income minus enterprise and overhead costs.
Operator allowance	Allowance for the owner/operator's own labour.
Operating profit	Net farm income minus operator allowance.

³ These rates were used to calculate the shares of the harvest revenue between the company and the farmer, as described previously. Data from Reserve Bank of Australia: http://www.rba.gov.au/statistics/tables/index.html#interest_rates.

⁴ Coppice is the many stems that normally arise from dormant buds beneath the bark of a blue gum stump following removal of the trunk.

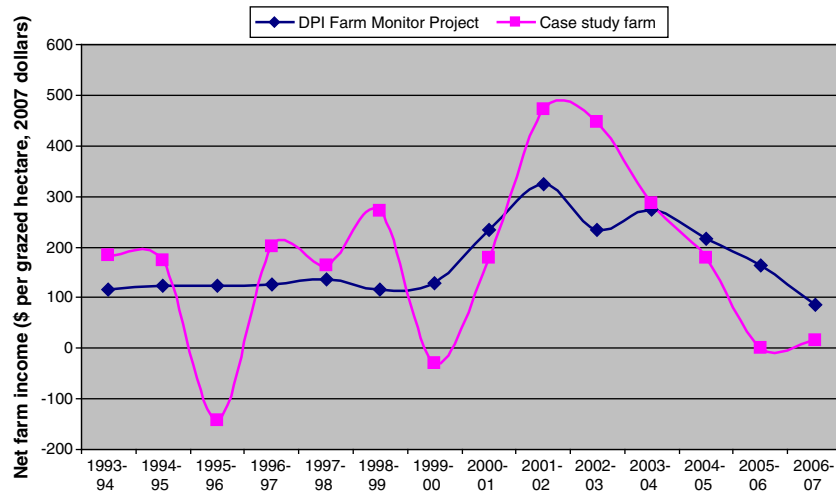


Fig. 1. Net farm income for farms in the Farm Monitor Project in south-west Victoria compared with the case study farm during 1993–2007, expressed in 2007 real dollars (adjusted by relative Consumer Price Index to the 2007 purchasing power of the dollar).

2.3. Interview

Further primary data was obtained from the farmer by the use of a semi-structured, in-depth interview. Such interviews have no fixed wording or ordering of questions, so that the content of the interview is focussed on the issues central to the research questions (Minichiello et al., 1995). The farmer was interviewed by the senior author in 2007 using an interview protocol approved by the Ethics in Human Research Committee, Academic Secretariat, Charles Sturt University, Panorama Avenue, Bathurst, New South Wales, to learn how the farmer's perceptions of farm forestry had changed since commencing farm forestry on the property. Results of the interview presented in this paper were prepared by the first three authors.

3. Results

3.1. Financial returns from the livestock enterprise compared with farm forestry

Net farm income for each year during 1993–2007 was compared with the longitudinal data on net farm income reported by the Farm Monitor Project (DPI, 2008). The annual results for the farm, expressed in 2007 real dollars (i.e. adjusted by relative Consumer Price Index to the 2007 purchasing power of the dollar), were volatile,

influenced mainly by variable seasonal conditions and markets (Fig. 1). Nevertheless, the trend and absolute amount of net farm income for the farm during 1993–2007 were similar to that of farms in south-west Victoria which were participants in the Farm Monitor Project, which collates financial data for large-scale farms (average size of 919 ha in 2006–2007 for 30 farms) mainly engaged in livestock grazing. While the results should not be taken to represent averages nor should be extrapolated to other regions as the farms are not selected at random (DPI, 2008), comparison of the data indicated that the financial performance of the farm was similar to that of the only known industry benchmark for livestock enterprises in the wider region.

The annual operating profit for the livestock enterprise on the farm, expressed in 1993 dollars, ranged from −\$144/ha in 1995–1996 to \$230/ha in 2001–2002 (Table 1).

For the blue gum timberbelts, harvest revenue to the farmer was \$3565/ha (excluding GST), based on a harvest yield of 211 tonnes/ha, a stumpage of \$38.06/tonne and the farmer receiving 44.4% of the proceeds. Taking account of the total farm forestry costs (direct costs and the opportunity cost of pasture loss caused by the blue gum timberbelts), the benefit–cost ratio of the project was 3.3 and the net present value of farm forestry to the farmer expressed in 1993 dollars was \$1236/ha compared to \$768/ha for livestock grazing during 1993–2007 (Table 1).

Table 1

Comparison of returns from farm forestry (blue gum for pulp logs) and farming (livestock grazing) for 1993–2007 (\$/ha in 1993 dollars).

Year	Farm forestry direct costs	Opportunity cost of pasture loss caused by farm forestry	Total farm forestry costs	Farm forestry revenue	Farm forestry operating profit	Farming operating profit
1993–1994	−477	−8	−485	0	−485	70
1994–1995	−5	−8	−13	0	−13	64
1995–1996	−4	0	−4	0	−4	−144
1996–1997	−5	−13	−18	0	−18	77
1997–1998	−5	−10	−14	0	−14	52
1998–1999	−5	−24	−28	0	−28	114
1999–2000	−4	0	−4	0	−4	−63
2000–2001	−5	−14	−19	0	−19	59
2001–2002	−5	−61	−66	0	−66	230
2002–2003	−4	−60	−65	0	−65	211
2003–2004	−4	−35	−40	0	−40	116
2004–2005	−5	−18	−22	0	−22	54
2005–2006	−4	0	−4	0	−4	−40
2006–2007	238	0	238	1780	2019	−32
NPV (\$/ha)	−293	−251	−544	1780	1236	768

Note: These are the nominal cash flows discounted to 1993 terms. The discount rate used for each year was the deposit rate for the month of April which was the average of term deposit rates of the four largest banks in Australia for a deposit of \$10 000 for 12 months. Columns and rows that do not add up are due to rounding.

For the second crop of pulp logs from the blue gum timberbelts, assuming that the production cycle or rotation would be the same as the first rotation (i.e. 14 years from 2007 to 2021), but that the production system would be management of coppice regrowth from the stumps instead of planting new seedlings, the net present value or operating profit was estimated to be \$2541/ha in 2007 dollars at a real discount rate of 5%. The benefit–cost ratio of the project was 2.7.

The farmer estimated that the future returns from the livestock enterprise (mainly production of sheep meat) during 2007–2021 would be an annual operating profit of \$180/ha. Using this assumption, the operating profit of farming during 2007–2021 was estimated to have a net present value of \$1782/ha in 2007 dollars at a real discount rate of 5%.

For farm forestry, the annual equivalent return was \$125/ha in 1993 dollars in the first production period (1993–2007) and \$256/ha in 2007 dollars in the second production period (2007–2021); for farming, the respective annual equivalent returns were \$78/ha and \$180/ha (Table 2).

In both the first rotation of blue gum (using actual cash flows) and the second rotation of blue gum (using estimated cash flows), the net present value for farm forestry was greater than that of livestock grazing over the same period of time (Table 2).

3.2. Perceptions of farm forestry

In 1999, 11% of the property was revegetated with a target of 14% by 2005, which has been achieved. Because of the success of farm forestry, the farmer had since revised the target and aimed to revegetate 20% of the property, then to be reviewed if achieved (“... farm forestry has greatly exceeded our expectations. As I see the property develop, I am more passionate than ever about it”). The strategy would concentrate the farm forestry planting in timberbelts (15–30 m wide) along land-class boundaries and in narrower belts of commercial trees with understorey for biodiversity enhancement along riparian zones – that is, strategically placed on productive agricultural land. Although unable to provide quantitative evidence, the farmer believed that agricultural production of the whole farm had been maintained despite conversion of arable land to farm forestry because of protection of land and livestock by the revegetation (“... I am comfortable overall that we have not compromised agricultural productivity”).

The farmer was satisfied with the tree farming agreement, particularly the willingness of the company to move away from a traditional plantation configuration (i.e. block planting) and establish the trees in timberbelts along property and land-class boundaries.

The farmer explained that the benefits of farm forestry included increased property value, providing greater equity and borrowing capacity for the farming enterprise, and a reduction in the risk of farming. The farmer said that analysis of farm forestry benefits typically only accounted for the direct economic benefits, but from the farmer's perspective, there were important environmental benefits and social benefits. From the farmer's experience in the past decade, these benefits were substantial and unexpected. For example, the

amenity value of farm forestry had improved the family dynamics – both immediate and extended; the emerging eco-tourism business on the farm had created an important social network for the farming family; and the aesthetics and ambience of the property continued to improve (“... the farm is now a far more pleasant work environment”). The latter was expressed by improved landscapes and more biodiversity (measured by regular counts of bird species) as the farm forestry plantings became more diverse and mature.

The farming enterprise was being conducted in a region undergoing socio-economic change, reflected by a large increase in rural property prices in the last 10 years as buyers from urban areas purchased farms. The farmer said that market value of the farm (at least \$10000/ha in 2007 terms, based on an independent valuation) was substantially more than the agricultural value of the land, based on the farmer's analysis using regional economic data from an agricultural consulting group together with the farmer's own experience of farming in the locality. This perspective was borne out by using the farmer's estimate of future operating profit from livestock production to calculate the value of land for farming – at an assumed operating profit of \$180/ha, the value of the land for farming was \$3600/ha at a real discount rate of 5%, using the capital asset price theory (Clark et al., 1993). Nevertheless, the farmer was committed to using the land primarily for agribusiness and said that farm forestry would be an integral component of land-use on the property.

4. Discussion

The timberbelt configuration, which separated the blue gum plantation from the pastures, was the most practical way of integrating timber production and livestock production on the farm. Under this arrangement, different interactions across the boundary between the trees and pasture ('edge-effect') are theoretically possible (Reid, 2009). The most commonly observed edge-effect in Australian grazing systems is a significant reduction in pasture growth along the tree boundary (Reid, 2009), which was the case in this project and was accounted for by estimating the opportunity cost of reduced pasture production as a cost to the farm forestry enterprise. This effect was estimated to be greater in the second rotation of blue gum because of the carry-over effects of the first rotation crop. However, it is possible that timberbelts reduced wind speed and hence the evapotranspiration of pasture at some distance from the timberbelt, resulting in increased pasture production (Abel et al., 1997) and that shelter improved animal production (Reid, 2009). If such benefits occurred, the observed difference in the financial benefit of farm forestry and livestock grazing would have widened.

The longitudinal study demonstrated the potential for farm forestry in a changing landscape. The farmer with more than 15 years experience with farm forestry had dedicated 15% of the agricultural land to strategically placed commercial forestry. The financial returns from blue gum grown for pulp log production in a forestry partnership exceeded those from farming. While this example was not broadly representative of farm forestry in south-east Australia because of the diversity of the latter, it demonstrated that farm forestry can be economically viable. However, stumpage prices and hence returns from farm forestry are dependent on harvesting costs and transport distance to the processing centre. In the case study, harvesting costs were offset to some extent by integrating the operation with harvesting of an industrial-scale plantation in the locality, and the farm forest was located close (65 km) to the processing centre relative to most blue gum plantations in the region.

The farmer who had successfully integrated farm forestry as a land-use was committed to farm forestry being part of the diversified farming business. Also demonstrated was that with well-designed farm forestry, production and amenity can co-exist and social networks can

Table 2

Comparison of returns from farm forestry (blue gum for pulp logs) and farming (livestock grazing) for two production periods.

Enterprise	Actual returns for 1993–2007 (1993 dollars)	Estimated returns for 2007–2021 (2007 dollars)
Farm forestry		
Net present value (\$/ha)	\$1236	\$2541
Annual equivalent return (\$/ha/year)	\$125	\$256
Farming		
Net present value (\$/ha)	\$768	\$1782
Annual equivalent return (\$/ha/year)	\$78	\$180

develop. Thus, farm forestry ‘softens’ forestry in a physical and social sense, which builds the social acceptability for commercial forestry.

While corporate forestry may see farm forestry as an insignificant part of national wood supply, having a farmer as an enthusiastic investor was connecting the industry to the community at a very local and tangible way, and arguably promoted change in behaviour towards more integrated land-use. In this example of a successful joint venture between a farmer and a forestry company, the farmer became the sole owner of the residual forest (i.e. stumps) after the harvest, allowing the farmer to manage a coppice crop, representing a shift in the ownership of the forest investment and decision-making – that is, the farmer was independently engaged in commercial forestry.

Lessons from research on factors influencing farm forestry decisions indicated that financial factors – insufficient income to invest in any new land-use, better returns available from off-property investments – rated much higher than such other factors as time and effort to acquire new knowledge and skills, or bad experiences with farm forestry in the area (Race and Curtis, 2007). The farm forestry partnership with blue gum in this case study provided the farmer an opportunity to participate in forestry because the capital cost of entry was shared.

5. Conclusion

Financial information during 1993–2007 for livestock grazing and a blue gum plantation integrated with the agricultural enterprise was analysed to compare the profitability of farming and farm forestry on a 229 ha property in southern Victoria, Australia. During this period, a full cycle of the blue gum crop, which produced pulp logs destined for production of paper, was completed. Such comparative data were scarce in the literature.

The farming enterprise was being conducted in changing a landscape where the value of farm land had increased markedly during the last 10 years and was substantially more than the agricultural value of the land. The strategy had been to concentrate the farm forestry in timberbelts (10 rows of trees) strategically planted along land-class boundaries.

For the first crop of blue gum, the net present value or operating profit was greater than that of livestock grazing over the same period of time (calculated using actual cash flows), confirming that it was a good business decision to participate in the farm forestry joint venture. The farmer who had successfully integrated farm forestry as a land-use was committed to farm forestry being part of the diversified farming business and was independently managing a second crop of blue gum on the farm. For the second crop of blue gum, the net present value or operating profit was estimated to be greater than that of livestock grazing over the same period of time, indicating that it should be a good business decision to continue with farm forestry.

The research revealed the benefits of integrated land-use in an agricultural landscape. It challenged the widely held perception outside the forestry industry that the place for commercial forestry on farms was the least productive arable land. It suggested that a renewed focus on farm forestry may provide a pathway for new forest resources to be established and supported by rural communities as a strategy to improve the profitability and sustainability of land-use.

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