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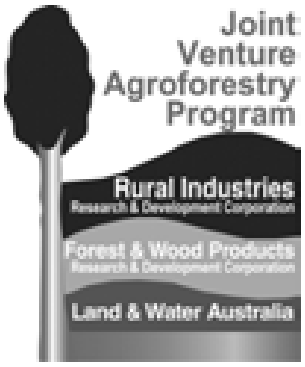

Quantifying the Value of Farm Forestry

A national level analysis

by Anthony Hassall

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Foreword

This report uses a desktop review to identify the economic, social and environmental value of farm forestry at the national level. The report estimates farm forestry's direct contribution to the economy and its role in natural resource management, and identifies the social impacts in regional Australia. This report is of one of four commissioned by the Joint Venture Agroforestry Program (JVAP) to improve understanding of the role and value of farm forestry, and improve the delivery of current farm forestry research knowledge.

The project uses existing literature and forestry databases to 1) overview the farm forestry sector and area across Australia; 2) estimate its contribution to GDP; 3) identify the economic, social and environmental values provided by farm forestry; 4) identify the data gaps which prevent further detailed analysis of the value of farm forestry; and 5) report the implications for key stakeholders.

The report uses recent estimates of the area of farm forestry plantations to value the economic and environmental contribution of farm forestry. Private native forestry and agroforestry (e.g. woody fodder) are acknowledged as being part of the sector, but have not been included in most valuation estimates. Relative to the whole forestry and forest products sector (worth $18B to the Australian economy), farm forestry is estimated to provide 2% or $362 million GVP per annum. It is estimated that the farm forestry and wood products sector provides 1,778 to 2,144 jobs, excluding direct on-farm employment. On-farm benefits can include complementary effects of integrated farm forestry on the agricultural enterprises, such as fodder production and improving lambing rates via tree shelter.

Environmental values are estimated to be approximately $25 million per annum nationally, taking into account only farm forestry woodlots (159,000 ha). Social values include aesthetic, intrinsic values and economic contributions that enable farmers to stay on the land. The contribution of farm forestry to economic and environmental values may increase in importance in the future, in part driven by carbon markets. An understanding of the potential aggregate role farm forestry can play at a landscape and also a national scale will be critical to future government policy and climate adaptation strategies.

The key recommendations from this study involve improving the information available to enable a clear definition and quantification of the benefits associated with farm forestry to assist policy development in this area, and to assist decisions to adopt farm forestry. It is important to note that the value estimates in this report are almost exclusively based on studies completed on the broader forestry sector. Understanding the degree to which these values are applicable to the farm forestry sector and drive decisions will enable targeting of future strategies. Also, adopting farm forestry as part of an enterprise mix is underpinned by a diverse range of drivers that vary farm by farm.

It is apparent that the current state of knowledge is not sufficient to enable development of informed policy and lags behind the information available regarding other significant farm enterprises.

This project was funded by the Natural Heritage Trust through the Joint Venture Agroforestry Program (JVAP), which is supported by three R&D Corporations - Rural Industries Research and Development Corporation (RIRDC), Land & Water Australia (L&WA), and Forest and Wood Products Australia (FWPA). The R&D Corporations are funded principally by the Australian Government.

This report is an addition to RIRDC's diverse range of over 1,800 research publications. It forms part of our Agroforestry and Farm Forestry R&D program, which aims to integrate sustainable and productive agroforestry within Australian farming systems. The JVAP, under this program, is managed by RIRDC.

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Peter O'Brien
Managing Director

Acknowledgments

Hassall & Associates would like to acknowledge to contributions made by Jacki Schirmer and Maree Candish to the development of this report.

Abbreviations

ABS	Australian Bureau of Statistics
ABARE	Australian Bureau of Agriculture and Resource Economics
BRS	Bureau of Rural Science
CRC	Cooperative Research Centre
DPI	Department of Primary Industries
GDP	gross domestic product
GVP	gross value of production
MIS	managed investment scheme
NFI	National Forest Inventory (managed by BRS)
NRM	natural resource management
PFDC	Private Forestry Development Committee
PNF	private native forestry

Contents

Executive Summary

What the report is about
This report quantifies the economic benefits of farm forestry at the national scale through its contribution to the economy; identifies the value of farm forestry's role in natural resource management and estimates its economic value to Australia; and discusses the social value of farm forestry in regional Australia.

Who is the report targeted at
The aim of this report is to increase the understanding by growers, industry, prospective investors and policy makers of the benefits of farm forestry.

Background
Although the development of farm forestry has received support from the Australian government, State and private investors for over a decade, there have been few efforts to value the sector's achievements, role and value at a national scale. There is also a need to improve coordination and understanding of farm forestry.

This report presents an overview of the farm forestry sector and resources across Australia as a basis for identifying the economic, social and environmental values of farm forestry. Each of these three values is addressed, with the results of the analysis summarised to highlight the identified values and the information gaps identified during this process. The implications of these findings for key stakeholders are then reported and a brief set of recommendations provided.

Aim
The main aims of the project were to:

- review the existing data and resources to identify the economic, environmental and social values of farm forestry;
- estimate these values;
- identify information gaps where there is insufficient information to value the benefits of farm forestry; and
- suggest needs for future research.

Methods used
This study is based on a desktop review of existing data resources that examine the value of farm forestry in economic, social and environmental terms. This has been supplemented by telephone interviews with selected experts on key impacts. The study sourced information on both use values, i.e. those values associated with products based on farm forestry outputs, and non-use values such as effects on amenity and environmental outcomes.

The economic value of farm forestry is estimated based on:

- recent estimates of farm forestry planting trends and growth rates;
- the extent and current mill harvest of private native forestry;
- consideration of the range of farm forestry products and services, associated prices and farm forestry's share of forest products trade;
- the economic contribution of farm forestry in terms of gross value of production (GVP), employment generation, down-stream processing and supporting services and regional multipliers; and
- the impact of farm forestry on property values.

The short and long term financial costs and benefits of integrating farm forestry with other farming enterprises are also described. The key measure of economic value used in this study is the gross value of commodities produced. This is the value placed on recorded production at the wholesale prices realised in the market place. The economic value of farm forestry in this report has been estimated by

first identifying the proportion of plantations that are classed as farm forestry. This proportion was then applied to the value of whole-of-industry forest and wood sector.

Similarly, employment generated by farm forestry has been estimated based on employment data extracted from existing research on the wider forest and wood products sector. The processing and services sector has been addressed through an assessment of the proportion of GVP and employment generated by processing and services components of farm forestry output.

The literature reviewed included studies on the social and economic impact of both forestry and farm forestry and perception and attitudinal studies. Many of these focus on the potential social impediments to farm forestry adoption. These studies are synthesised so as to consider the impacts of farm forestry on farm managers and their families, and broader impacts on the community and national scale.

The environmental values of farm forestry have been based on estimated values for ecosystem services developed by other studies and applied to areas of farm forestry over which they are likely to be relevant. Values have been sourced for carbon sequestration, water quality and nutrient flows, salinity control, biodiversity improvements, and soil condition and erosion. There are very few studies that explicitly focus on the environmental values derived from farm forestry

Private native forestry and agroforestry (e.g. woody fodder) are acknowledged as being part of the sector, but are not included in most valuation estimates in this report.

Results/key findings

Economic Values

The economic value of farm forestry is estimated as follows:

- The GVP is some $362 million p.a., or around 2% of the value of the broader forest and wood products sector.
- Between 1,778 and 2,144 jobs are generated by farm forestry, based on a ratio of employment estimates in the forest and wood products industry.
- The processing and services sector is likely to contribute a significant proportion of the farm forestry GVP, at $271 million, or around 75% of value, and some 1,102 to 1,822 jobs. This does not take into account the age or management of farm forestry plantings compared with the main industry sector.
- The greatest value of farm forestry is likely to be concentrated in areas where farm forestry constitutes a higher proportion of the plantation forestry sector, or areas where timber mills are reliant on private native forest resources, for example in the northern rivers region of NSW.
- Rural property values have risen significantly in the recent past driven by many factors. In some areas there has been a relatively high level of transfer of agricultural land to plantation forestry. It is likely that the transfer of whole (non-farm forestry) properties is likely to have had a much greater impact on rural values than any within-farm changes to include farm forestry.
- The literature indicates that farm forestry provides a significant number of associated on-farm values, but these were difficult to estimate due to a lack of accurate data and the site specific nature of these values.

It is important to recognise that these values can be concentrated in certain regions.

Social Values

The social values of farm forestry will vary depending on the nature and purpose of the farm forestry plantation established (e.g. type of tree, effect on the landscape, conservation, commercial), magnitude of changes in land use patterns across a region, availability of off-farm employment from timber processing, and shifts in population demographics.

The literature identified a range of farm forestry social values:

- Lifestyle and amenity values of forested land, associated with aesthetic appeal, wind protection and habitat improvements via tree cover are key social values of farm forestry.

- These amenity values have been shown to have a positive influence on rural property prices to the extent that landholders "believed that planting trees or managing native forest could increase the value of their property".
- Farm forestry provides farmers and their families with the option to harvest timber during periods of low income (e.g. drought), as well as reduce the impact of wind through increased tree cover and providing shelter for livestock. As a result of assisting in drought proofing the farm, the risk that the property will need to be sold outside the family is reduced and this increases the opportunity for effective intergenerational transfer.
- Farm forestry has the potential to affect population and social values where it assists in the profitability of a farm business.
- Where economic benefits from farm forestry are realised, the added flexibility may play a role in maintaining rural populations and reducing community fragmentation and isolation.

Environmental Values

The environmental values of farm forestry are important to private landholders and the wider community. They include:

- Carbon sequestration services to businesses that are either required to, or seek to voluntarily offset their emissions as part of their corporate responsibility. The value of carbon sequestration services provided by farm forestry could be valued at up to $14.7 million per year.
- Improvements in riparian zone vegetation, biodiversity and associated water quality improvements in waterways, which may be valued at around $4.78 million each year.
- The benefits of salinity control, estimated to be worth $25 per hectare, may generate up to $1.99 million in farm forestry environmental value annually.
- Improvements in biodiversity may be worth up to $3.51 million per year, assuming a value for biodiversity ecosystem services of $22 per hectare of farm forestry.
- Improvements in soil condition and reduced rates of soil erosion are estimated to be up to $1.59 million per year.

These figures suggest that the environmental value provided by farm forestry across Australia may be worth around $25 million per year, or approximately $288 million over a 20-year period[1]. While the specific per hectare values and the areas to which these values are relevant are difficult to define with accuracy, these estimates provide an indication of the magnitude of environmental values.

Implications

The estimates of farm forestry value provided here indicate that the farm forestry industry makes an important contribution at an on-farm, regional and national scale. These values are based on data sets not specific to the farm forestry sector and may not fully reflect the true underlying values for this reason. Environmental and social benefits vary greatly with circumstance and location and information on impacts is not available in aggregated form. The importance of farm forestry in terms of social and environmental benefits may be significantly understated or overstated, and many reports are based on case study type information that does not assist discussions at a landscape, regional or national level.

The coming decade is likely to see a number of significant changes that will affect the farm forestry sector. The three significant changes are effects on the economy arising from the introduction of a value placed on carbon, the increasing value placed on natural resource management and environmental services, and finally, the relative importance of these versus the demands of outputs from farming systems. Competition for resources has been highlighted recently by proposed legislation in South Australia that seeks to account for the water use associated with forestry plantations.

Rapid change will place an importance on the ability to articulate the role of farm forestry in the landscape using information on the economic, environmental and social consequences. Articulation of

[1] Net Present Value over 20 years using a 7% discount rate.

benefits is likely to lead to an emphasis on appropriate planning and management of forestry in general to maximise benefits across a landscape.

Data Gaps and Research

Areas where further work is needed to gain a better picture of the economic value of farm forestry include:

- whether and when the impacts of farm forestry differ to those of larger scale plantation forestry, identifying the demand for employment at the farm level for management of farm forestry;
- further understanding of the proportion of GVP and employment within the private forestry/managed investment scheme sector that is attributable to farm forestry;
- more detailed data sets on the productive capacity and harvest from the farm forestry estate, (current estimates based on the planted area are a limiting factor in analysis); and
- the intent of the farm forestry plantation, productivity from farm forestry plantations and multipliers for farm forestry production, employment and incomes.

There have been a range of studies that have aimed to identify the socio-economic impact of the forestry sector with little indication of the impact of farm forestry as part of this change. The key information needs to make a more in-depth assessment of the value of farm forestry at the national scale include:

- how farm forestry has specifically impacted those communities where it is present, and in particular, those areas where it is increasing in size;
- the nature, scale and impact of farm forestry incomes for farm foresters; and
- the impact of farm forestry on farm viability and sustainability, and the impact of these outcomes on farming families.

There is still little data on the actual on-farm and regional environmental values that can be attributed to farm forestry. Information needs in relation to farm forestry include:

- the extent of farm forestry plantations planted with the intention of reducing salinity impacts;
- the extent of farm forestry areas that meet the criteria of the carbon credit system;
- the impact of those plantings on adjoining agricultural enterprises in terms of cropping capability and yields, grazing productivity and long term sustainability;
- the area of agricultural land use which has either been brought back into production, or which has had its productive capacity improved or maintained; and
- the value of any improvement in agricultural productive capacity.

Implications for Stakeholders

For farm forestry growers, the key implications lie in the on-farm production values that farm forestry provides, the improved social well being and improvements in their on-farm sustainability and environmental outcomes. Currently, there is a lack of solid data to fully estimate most of these values.

There is no data to clearly establish the productivity - at present or into the future - of the estimated 159,000 hectares of plantation farm forestry across Australia, including the intent and nature of farm forestry plantings.

In illustrating the values of farm forestry to the community, it will be important to demonstrate the economic values in terms of value and employment, the social values to regional communities and the ability of farm forestry to deliver expected environmental services. In this context there are still a number of large gaps in the information available to provide more accurate estimates of these values – particularly in the case of environmental services.

There is a need to improve the data available to assess the value of farm forestry, in particular, identifying the sources of wood resources. It is apparent from the estimates of value and location-specific studies that well-managed farm forestry can add value to the broader forestry and wood products sector and to regional economies. There is still a need to develop a system that can estimate these values in a more structured way.

Finally, more consideration is needed of the trade-offs faced in the potential expansion of farm forestry, especially for environmental values. For example, the impacts of farm forestry on catchment water cycles will vary among and within catchments.

Recommendations

The recommendations from this study are:

- Develop a clear definition of farm forestry for data collection and analysis. This will assist with understanding the nature and value of benefits provided. This is particularly important for JVAP and future strategy development this area.
- Define the farm forestry estate in terms of the scale, age and nature of plantings. This underlies the ability to gauge the current and future contributions of farm forestry to the economy, social implications for local communities and environmental impacts.
- Improve understanding of the degree to which the values in this report are applicable to the farm forestry, recognising that the estimates of value here are almost exclusively based on studies completed on the broader forestry sector.
- Note that farm forestry has economic, social and environmental benefits that are distinctly different to other types of forestry. Policy should be developed that is specific to farm forestry.

It should be remembered that though the list of financial, social and environmental benefits associated with farm forestry are extensive, decisions to adopt farm forestry as part of a mix of enterprises is underpinned by a diverse range of drivers and these vary farm by farm. Understanding the degree to which these values are applicable to the farm forestry sector and also drive decisions will enable targeting of future strategies.

The first step in achieving these recommendations is a detailed understanding of the farm forestry estate and its future direction given the significant changes in the economic, environment and social context which will become apparent over the coming decade.

Introduction

The purpose of the project is to quantify the economic, social and environmental value of farm forestry at the national level. This is intended to increase grower, industry, investor and policy maker understanding of the benefits of farm forestry.

There are three broad areas under which the benefits of farm forestry can be classified: economic, social and environmental. The aim of the project is to identify the benefits of farm forestry across each of the areas and, to the extent permitted by available data sources, value those benefits. A significant part of this project was to review the existing data sources and collect and collate these existing resources into a single location.

The economic value of farm forestry is recognised through:

- an analysis of farm forestry planting trends;
- the extent and current mill harvest of private native forestry;
- the range of farm forestry products and services and associated prices, and farm forestry's share of forest products trade;
- the economic contribution of farm forestry in terms of gross value of production (GVP), employment generation, down-stream processing and supporting services and regional multipliers; and
- the impact of farm forestry on property values.

Information on the impacts of farm forestry on the environment and social benefits is not readily available in aggregated form. The types of impacts and their magnitude vary greatly with circumstance and location.

Definition

For the purpose of this project, farm forestry is regarded as trees planted for commercial production, private native forests actively managed for production, and agroforestry[2] used as part of the farm enterprise. Farm forestry products and services include tree-based products, both wood and non-wood, carbon, bioenergy and ecosystem services.

Structure of the report

The objective is achieved through the collection and collation of data resources on both the farm forestry sector and the broader forest and wood products sector. This data includes:

- planting trends (extent or area);
- private native forest extent and mill harvest;
- production, prices and trade data for tree based products;
- economic contribution of farm forestry in terms of GVP, employment, processing and services, regional multipliers and property values;
- social impacts and benefits;
- the short and long term impacts of integrating farm forestry with other farming enterprises; and
- the value of ecosystem services provided to the broader community.

Understanding that the data resources to undertake this task would be patchy, an important objective was to identify where there is insufficient information to value the benefits of farm forestry and suggest information gaps to address in the future.

[2] Defined here as shelterbelts, and woody perennials such as saltbush and tagasaste.

The analysis is set out in the following chapters:

- Description of farm forestry resources across Australia;
- Production and trade of farm forestry products;
- Description of the economic value of farm forestry;
- Description of the social value of farm forestry;
- Description of the environmental value of farm forestry;
- Results of the analysis to quantify the value of farm forestry;
- Implications of the research to relevant stakeholders; and
- Recommendations.

Methodology

Overview of valuation

Farm forests provide goods and services that are traded in markets, as well as goods and services that are outside the market system. Combined, all the values that can be obtained from a resource are often referred to as total economic and social value (Figure 1). For the purposes of this report, the total value of farm forestry is assumed to be captured through three related value sets: economic values, social values and environmental values.

Total value can also be disaggregated into use values and non-use values. Use values are those that are associated with the direct use or consumption of a good, service or resource. Examples include the value associated with the harvest of forest resources and transformation to forest products. Non-use values comprise option, quasi-option, vicarious use, bequest and existence values and, for example, would be associated with net positive environmental outcomes for farm forestry compared with any prior land use. The methods adopted for this study are to source information on both use and non-use values to estimate the economic, social and environmental values of farm forestry.

Values associated with social benefits and environmental benefits are most often not traded in a market (non-use values). Indirect use values or ecosystem function values are from ecosystem services and functions provided by a resource. The concept attempts to capture indirect ecosystem values due to the interconnectedness of ecosystems (Young 1992).

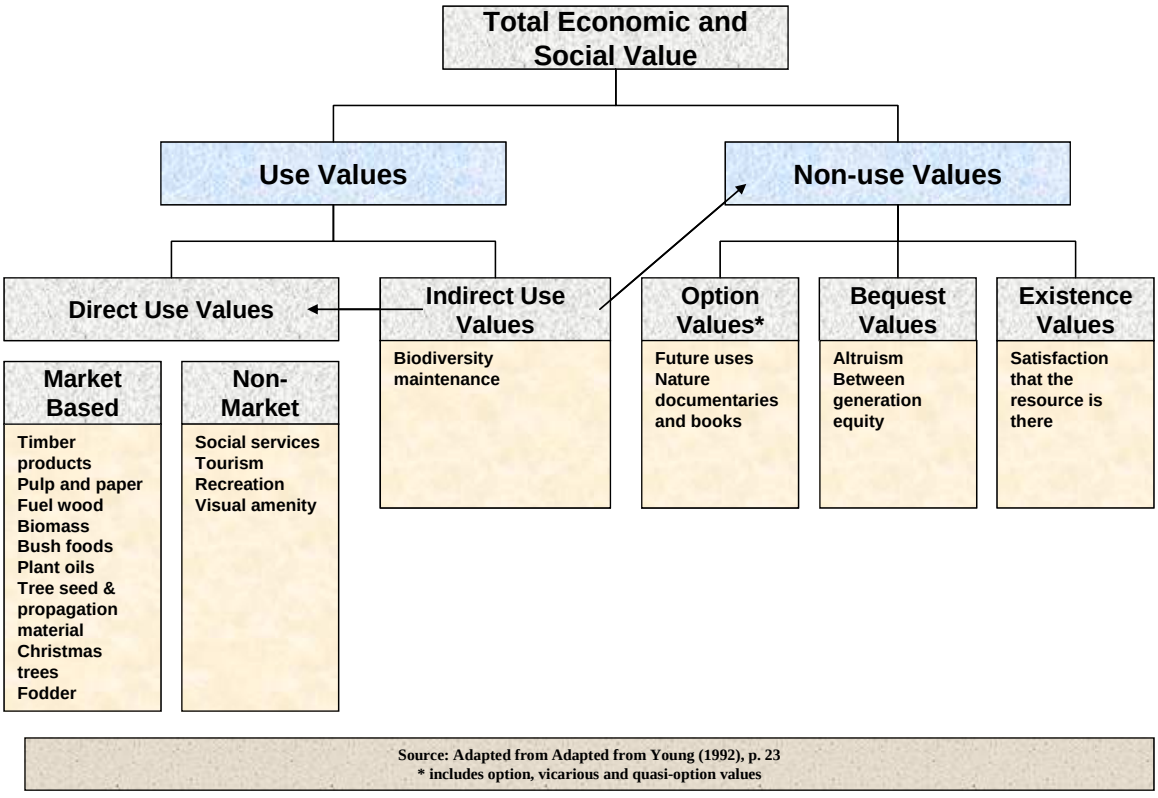

Figure 1: Values of Farm Forestry – Use and Non-Use Values

Review of data resources

This study is based on a desktop review of literature and existing data resources that assess the value of farm forestry in terms of economic, social and environmental benefits.

The values of farm forestry in this report are predominantly based on allocating farm forestry as a proportion of the forest industry – using the area of land as planted farm forestry as a proportion of the total Australian plantation area for the forest industry. The data collated by URS (2007) provides an important set of estimates of the area of farm forestry across Australia and a limited estimate of farm forestry wood production. These estimates are important as many of the estimates of forestry value in the literature are reported on a per hectare basis in terms of GVP, regional economic multipliers and ecosystems services. The estimates and literature review have been supplemented by some telephone interviews with experts on key impacts.

Estimating the economic values of farm forestry

The measure of economic value used in this study is the gross value of commodities produced. This measure is the value placed on recorded production at the wholesale prices realised in the market place (ABS 2007). The economic value of farm forestry has been estimated here based on the value of the forest and wood sector and estimated proportion that the farm forestry resource might provide from the area planted. URS (2007) estimate the areas of farm forestry plantation and private native forest and, in some cases, quantity of output by region and by state across Australia.

The GVP of farm forestry has been estimated using per hectare production values reported on a per unit basis (i.e. dollars per 1,000 hectares) for the broader forest and wood products sector. These values have been assigned to the estimates of farm forestry area (URS, 2007).

Employment generated by farm forestry has been estimated based on employment data extracted from existing research on the broader forest and wood products industry. These studies contained a number of estimates of the persons employed on an area of plantation or level of investment basis. Employment estimates on an area basis are adopted as the means for estimating the level of farm forestry employment generation, due to the availability of data for the areas of farm forestry on a state basis. Estimates of employment generated by private native forestry activities have been made using the output (production) levels reported by URS (2007) and estimates of employment per 1,000 cubic metres of output.

The value of the processing and services sector associated with farm forestry has been estimated based on the contribution of this sector to overall forestry value and employment.

The impact of farm forestry on property values was analysed through a review of previous studies and via discussions with real estate agents by Hassall & Associates in two key forestry areas – south west Western Australia and north east Victoria.

The on-farm values of farm forestry described are:

- shelter for crops and livestock;
- fodder production;
- increased lambing and survival rates;
- reduced supplementary feed and labour from using saltbush fodder;
- improved soil condition;
- water needs;
- improved on-farm water quality and water availability; and
- reduced farm management costs.

On-farm economic values are given where available but except for fodder and salinity, economic estimates at a regional or national level are not provided. Fodder is used as an estimate for on-farm value as it is significant and quantifiable.

Estimating the social values of farm forestry

The social values of farm forestry include impacts of farm forestry on farm managers and their families, the community and at the national scale. The sources for this information can be classed into two groups. Firstly, socio-economic studies of the impacts of farm forestry on and off-farm and secondly, studies that examine the perception of farmers towards farm forestry, and potential social impediments to farm forestry adoption.

This section of the report demonstrates the complex system of values associated with farm forestry and the factors that affect their realisation.

Estimating the environmental values of farm forestry

The environmental values of farm forestry are described and an attempt has been made to value these using estimated values developed by other studies and applying them to farm forestry. Environmental services valuation techniques are applied across each of the farm forestry areas.

Values have been sourced for the following ecosystem services: carbon sequestration, water quality and nutrient flows, salinity control, biodiversity improvements and soil condition and erosion, mainly from URS (2003) estimates. More detail on carbon sequestration and credit values has been added to assist understanding of this emerging aspect of farm forestry.

A difficulty in determining the value of ecosystem services provided by farm forestry and other associated environmental values is the extent to which the estimated per hectare values are applicable to farm forestry plantations or areas of private native forestry. Nevertheless, the results of the analysis have been aggregated to provide some indication of the value of farm forestry at the national scale.

Farm forestry resources in Australia

This chapter provides information on farm forestry areas, planting rates and harvesting across Australia as a basis for estimates of the value of farm forestry later in the report. The different types of farm forestry are defined first, followed by a summary of farm forestry resources at the national scale with some state-based comparisons.

Definitions

For the purposes of this project, farm forestry is regarded as:

- trees planted on farms for commercial production (where the landholder has made the decision about the land use for forestry, i.e. either self or through leasing to others for these purposes);
- private native forests actively managed for production; and
- landholders using agroforestry (shelterbelts, and woody perennials such as saltbush and tagasaste) as part of their farm enterprise.

For economic estimates, only the area of planted forests (the conventional definition of farm forestry) is used to calculate values. Information on private native forests and woody perennials are not included in estimates of the economic value of farm forestry as there is little data available. The environmental and social values of these types of farm forestry are considered.

Farm forestry plantations

Farm forestry plantations include forest species on private land for commercial production for wood and non-wood purposes. It should be recognised that the forestry plantation is operated as only one of a number of enterprises on the property.

The broad definition of farm forestry plantations includes agroforestry plantings in shelter belts where it is specifically intended to harvest wood or other forest products for commercial use (e.g. alley belts of mallee eucalypts in Western Australia). It is noted that different agencies that collect data use different definitions relating to the sector. The majority of farm forestry plantations are commercial forestry species, which are harvested and then fed into the broader forest and wood products processing sector.

Private native forests

Private native forests are defined as areas of native vegetation that are actively managed for a sustainable harvest of forest and wood products. Some data on the extent of, and harvest from, private native forests has been identified on a statewide basis by URS (2007). There is very little information available on private native forests, but where possible areas have been broken up by total area, area potentially available for sustainable production and areas from which native forest logs are currently harvested.

Woody fodder crops

For this study, woody fodder crops have been valued separately to the broader forestry and wood products sector. In URS (2007) information on fodder crops in the wheat–sheep zone has been collected by the Florasearch project (funded by JVAP and the Cooperative Research Centre [CRC] for Plant-Based Management of Dryland Salinity). Plantings of woody perennial fodder crops were identified on a statewide basis. The data reported in this document has been provided by URS (2007) and includes tagasaste *(Chamaecytisus palmensis)* in the drier regions, *Leucaena leucocephala* in tropical areas, and some plantations of *Acacia saligna* and *Rhagodia preissii* in Western Australia.

Farm forestry area

This section of the report provides an overview of the area of existing farm forestry in Australia and some state level analysis. The key information source is URS (2007). URS (2007) sourced data from the National Forest Inventory (private native forests) and the National Plantation Inventory (BRS) and updated this through consultation with regional Private Forestry Development Committees and State Governments. The data collected includes areas of farm forestry plantations, private native forestry and fodder crop plantations (Table 1).

The National Plantation Inventory (BRS) covers forestry plantations used for commercial forestry production, but not those less than 1,000 hectares in size. Consequently, estimates exclude mallee plantations and also plantings purely for non-market environmental services (e.g. salinity control, riparian management and shelterbelts).

However, the URS estimates span the range of commercial planted woody perennials on-farm, including mallee and woody fodder. Forests planted by managed investment schemes (MIS) have also been included where they are on land leased from an existing farming operation. Whole properties or land purchased by MIS companies for private forestry are not included. Plantations established as part of a joint venture (e.g. between government agencies and plantation owners) are included.

Table 1: Estimated Farm Forestry Plantation Areas by Region and Forest Category

Species	Farm forestry plantations (ha)	Gross area of PNF[(b)] (ha)	Fodder crops (ha)
Central and North Queensland	1,375	-	130,000
South East Queensland	3,384[a]	-	20,000
Queensland	4,759	10,213,000	150,000
North Coast	7,632[a]	-	-
Northern and Central Tablelands	2,760	-	-
Murray Valley	9,011	-	-
Southern Tablelands	7,641	-	-
South East New South Wales	906	-	-
New South Wales	27,950	8,523,000	35,000
North West Victoria	4,500	-	-
Central and Western Victoria	1,330	-	-
+ leasehold MIS plantations on farms	14,000		
Gippsland	5,607	-	-
Victoria	25,437	1,298,000	2,000 - 5,000
South East South Australia	671	-	-
+ leasehold MIS plantations on farms	12,000	-	-
Mt Lofty Ranges and Kangaroo Island	1,845	-	-
South Australia	14,516	822,000	8,600
South West Western Australia	38,680	-	-
+ leasehold MIS plantations on farms	27,000	-	-
Western Australia	65,680	1,639,000	200,000-300,000
Farm forestry plantations	14,805	-	-
+ leasehold MIS plantations on farms	6,200	-	-
Tasmania	21,005	922,000	-
Northern Territory	44	15,511,000	2,000
Total	159,391	38,106,000	400,000 - 500,000

(a) Includes joint venture forestry.
(b) Total area of private native forest (private land) of which a proportion is available for harvesting and a lower proportion is actively managed for timber production.
(c) PNF – private native forest.
Source: URS 2007. NB: Some figures were revised slightly in the 2008 published URS report.

URS (2008) found there are approximately 159,000 hectares of farm forestry, 38.1 million hectares of private native forest and between 400,000 and 500,000 hectares of fodder crops. Importantly, only a small proportion of the total area of private native forest is actively managed for the production of forest products.

The data reported by URS (2007) provides a breakdown by species where possible, however this cannot fully identify the likely use of that plantation. Further, no information is available on the number of properties that have each form of farm forestry.

Farm forestry plantations account for 9.2% of plantation forestry nationally. The proportions vary significantly among the states and territories, from 2.1% in Queensland to 17.4% in Western Australia. The actual areas of farm forestry vary to an even greater degree. A comparison of the area of farm forestry and total plantation forestry areas is provided in Table 2 and Figure 2.

Table 2: Comparison of Farm Forestry Plantation with Total Plantation Area by State

State	Farm forestry plantations (ha)	Total plantation area (ha)	Proportion Farm Forestry (%)
Queensland	4,759	225,637	2.1
New South Wales	27,950	341,123	8.4
Victoria	25,437	384,599	6.6
South Australia	14,516	166,962	8.6
Western Australia	65,680	377,598	17.4
Tasmania	21,005	227,200	9.5
Northern Territory	44	16,329	2.6
Total	**159,391**	**1,729,948**	**9.2**

Source: URS (2007).

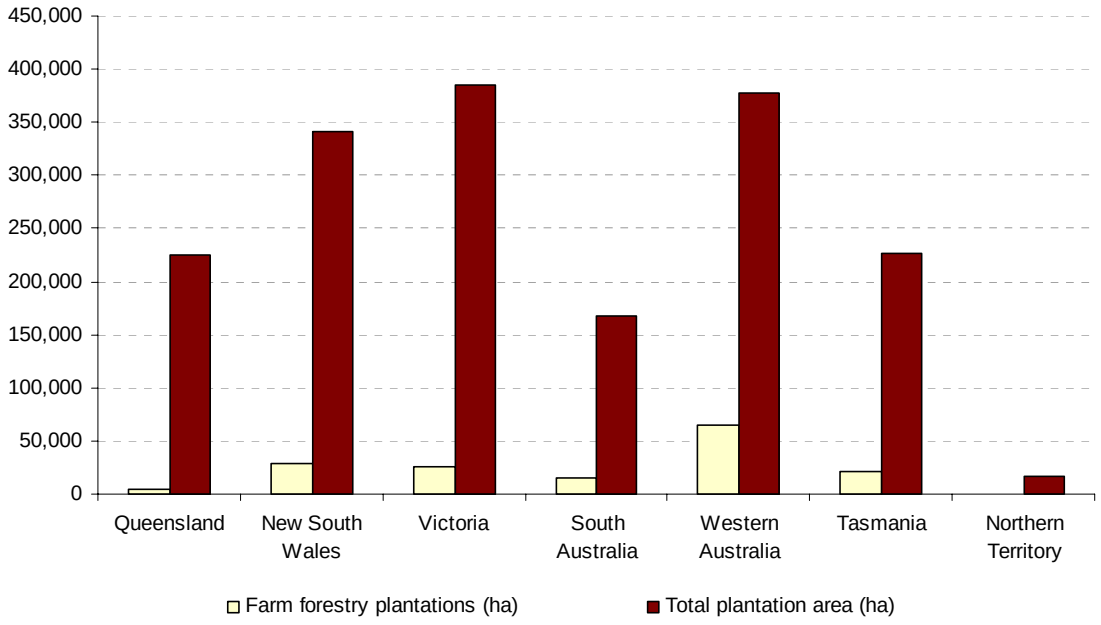

Figure 2: Proportion of Farm Forestry Area by Type of Plantation (URS 2007)

Figure 3 shows the proportion contributed by each State to total farm forestry area. The largest area, by far, is located in Western Australia (41%), while less than 1% of the total farm forestry plantation area is located in the Northern Territory.

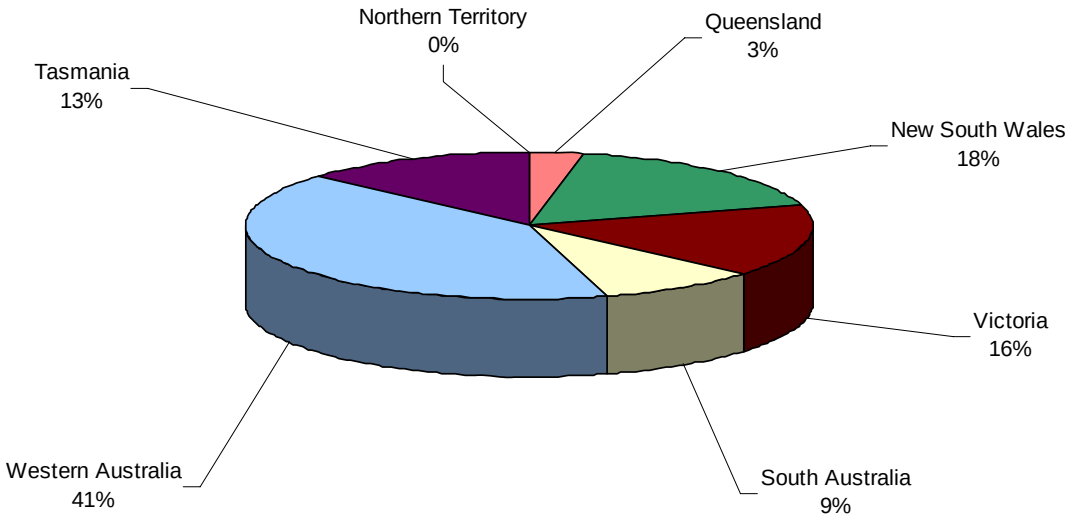

Figure 3: Proportion of Farm Forestry Area by Type of Plantation (URS 2007)

Figure 4 provides a summary of the type of farm forestry plantations across Australia (URS 2007). The largest sector is the MIS forests, which account for over a third of all farm forestry plantations. *Pinus* species, predominantly *P. radiata*, account for a further 26% of plantations. URS (2007) report that a significant proportion of the MIS plantations are *Eucalyptus globulus*, which will contribute to the production of wood chips.

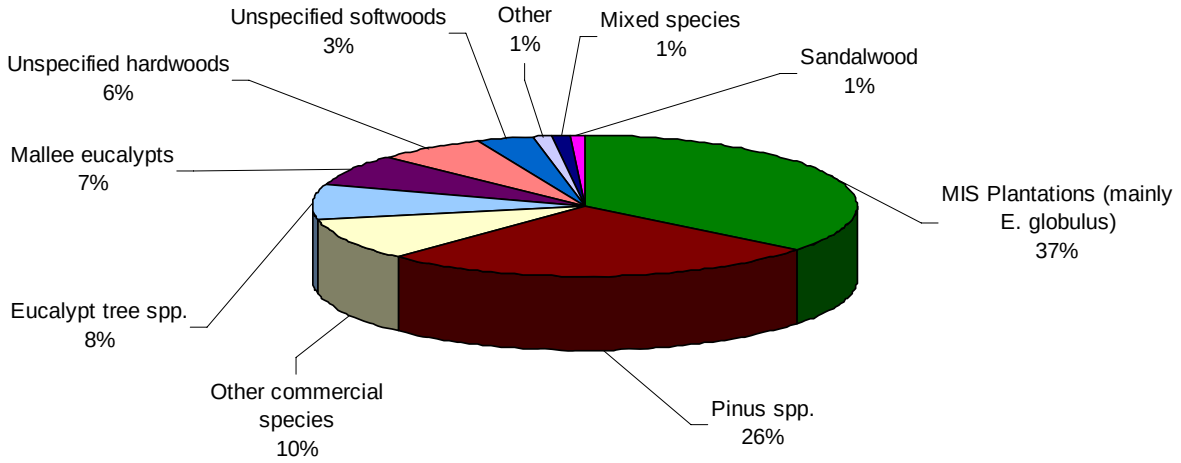

Figure 4: Proportion of Farm Forestry Area by Type of Plantation (URS 2007)

In 2001 the number of landholders engaged in farm forestry was estimated at 13,400 (Reid and Stephens, 2007) based on small grower plantations, according to the National Farm Forestry Inventory (NFFI). At this time, the farm forestry plantation estate was 67,000 hectares (excluding MIS and joint ventures). As indicated in Table 1, the area of farm forestry is now estimated at around 159,000 hectares and includes more than the small grower plantations as defined by the NFFI. As such the estimate of 13,400 landholders should be regarded as conservative.

An earlier report by ABARE (1994) based on a survey of 2,000 broadacre and dairy farmers across Australia indicated that 35% had tree belts and corridors, 14% had tree blocks, 6% had alley belts and 6% had widely spaced plantings, indicating that overall 61% of farmers surveyed had planted trees. Similarly, Mylek, Schirmer and Field (2007) conducted a survey of landholders in the southern tablelands of NSW and identified the following characteristics:

- 76% of landholders had planted trees or shrubs on their properties;
- Most landholders had planted the trees for aesthetics, environmental and shade/shelter reasons, while less than 10% planted for timber production;
- 43% considered farming to be their main occupation while 42% indicated that farming was not their main occupation; and
- Other land uses on their property included sheep and cattle grazing and non-commercial or residential uses.

The survey by Mylek et al. (2007) found a high proportion of landholders with farm forests who are not farmers and that many who plant trees do so for on-farm or social reasons rather than commercial timber production. The work of both ABARE (1994) and Mylek et al. (2007) suggest that trees have been planted on-farm by a high proportion of farmers and other landholders, but the proportion of these trees intended for commercial timber production is low.

Estimated rate of plantation forestry expansion

Plantation sector expansion

BRS (2007) provides estimates of plantation areas and expansion rates based on the National Plantation Inventory. These estimates are for the entire plantation forestry sector, including plantations owned by Governments, MISs, timber companies, superannuation funds, farm foresters and other private owners.

The estimated plantation area by state is provided in Table 3. The area of broadleaved and coniferous plantations established from 2000 to 2006 is provided in Table 4 and Table 5. The average annual rate of growth has been calculated over this period. The area of broadleaf plantations has expanded significantly in Western Australia, Victoria and Tasmania, contributing to a national broadleaf expansion of 66% over the period 2000 to 2006.

Coniferous forests have shown slower growth in area over the past six years, with most expansion occurring in NSW, Queensland and South Australia. The area of coniferous forest declined in the ACT. However, this was the result of damage from fire rather than as a result of changed planting and harvesting rates. Coniferous forests are estimated to have expanded at a much slower rate of 5% over the same period.

Table 3: Estimated Plantation Area (hectares) by State in 2000

State	Broadleaf	Coniferous
New South Wales	44,630	270,670
Aust. Capital Territory	190	14,590
Victoria	101,450	215,110
Queensland	9,440	178,620
South Australia	20,700	113,870
Western Australia	214,990	98,440
Tasmania	109,570	75,630
Northern Territory	1,650	5,240
Australia	502,620	972,170

Source: BRS (2007)

Table 4: Broadleaf Plantation Establishment Area (hectares) by State

State	2000	2001	2002	2003	2004	2005	Average
New South Wales	78	2,401	1,830	1,770	2,024	3,308	1,902
Aust. Capital Territory	0	0	0	0	0	0	0
Victoria	36,974	25,449	12,093	8,029	11,858	10,266	17,445
Queensland	3,867	8,798	8,234	4,853	4,618	8,860	6,538
South Australia	14,323	6,355	4,448	589	3,888	5,860	5,911
Western Australia	59,845	18,139	12,754	5,403	7,829	21,589	20,927
Tasmania	9,933	12,310	9,656	9,485	11,585	10,000	10,495
Northern Territory	1,190	738	165	1,250	4,461	5,668	2,245
Australia	126,211	74,190	49,180	31,379	46,263	65,551	65,462

Source: BRS (2007).

Table 5: Coniferous Plantation Establishment by State

State	2000	2001	2002	2003	2004	2005	Average
New South Wales	2,165	1,490	1,378	2,717	4,444	4,053	2,708
Aust. Capital Territory	0	0	0	0	0	0	0
Victoria	687	1,022	407	462	485	641	617
Queensland	11	642	292	611	852	812	537
South Australia	781	988	1,082	563	106	186	618
Western Australia	4,926	3,442	1,495	5,192	1,149	785	2,832
Tasmania	2,712	2,643	544	1,396	287	0	1,264
Northern Territory	0	0	0	0	0	0	0
Australia	11,282	10,227	5,198	10,941	7,323	6,477	8,575

Source: BRS (2007).

These trends are clearly identified in Figure 5. A trend line has been inserted for both broadleaf and coniferous plantations. Broadleaf plantations show a general downward trend until 2003 and a limited recovery since then. The level of expansion of softwood plantations has been low and relatively static over the same period.

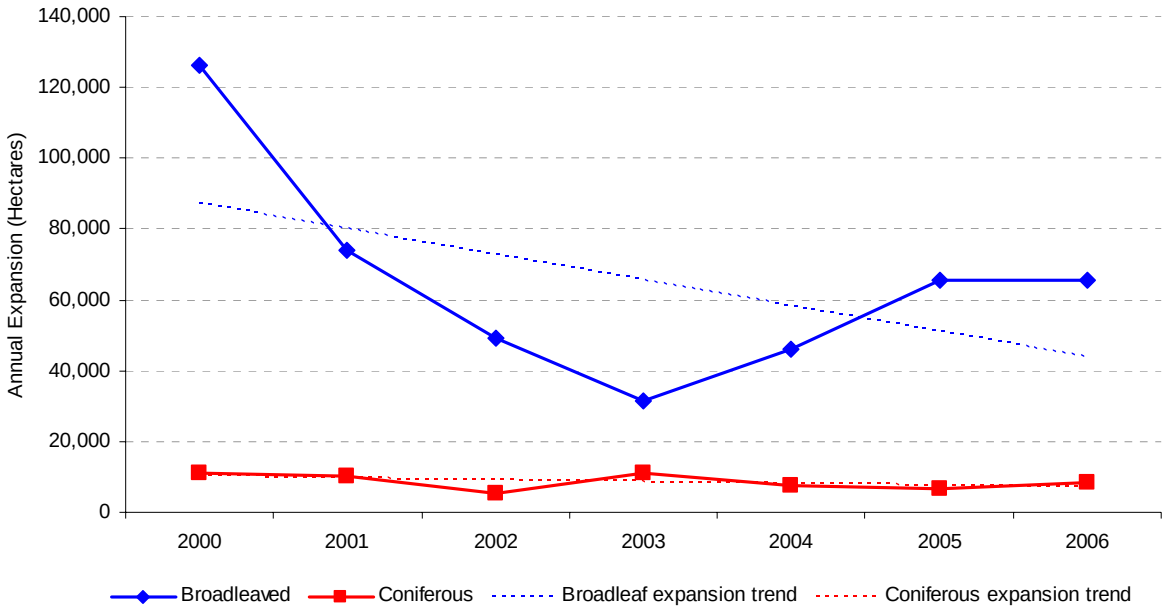

Figure 5: Trend in the Rate of Plantation Forestry Expansion (BRS 2007)

Estimated farm forestry expansion

The data reported by BRS (2007) shows overall growth in plantation forestry. The only way to estimate expansion of farm forestry is to use the trends seen in the broader forest and wood products sector as a guide.

BRS (2006) reports a breakdown of plantation ownership in Australia into five key categories. The proportion of plantation ownership by each of these groups is shown in Figure 6. It shows that 13% of plantation forests are privately owned. Assuming that the large majority of these are farm forestry plantations, up to 13% of the expansion in plantation forestry reported in Table 4 and Table 5 could be attributed to farm forestry.

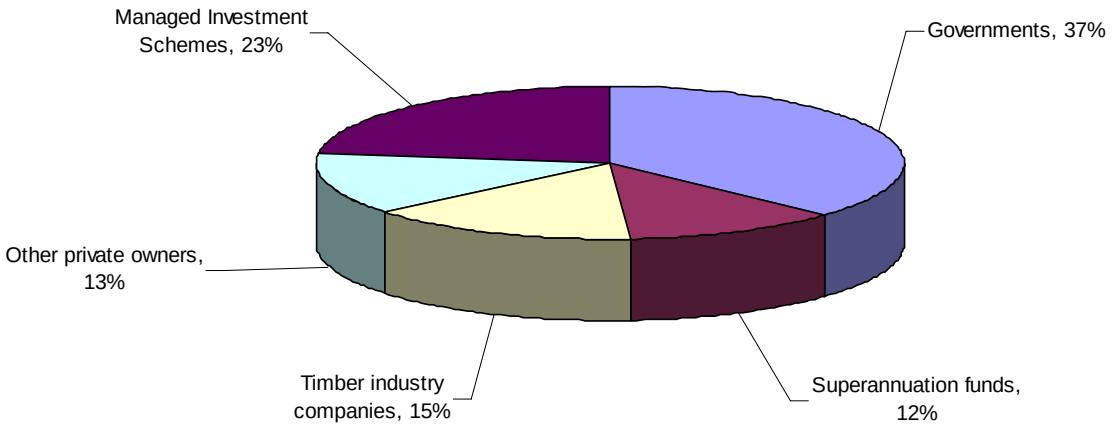

Figure 6: Ownership of Plantations in Australia as Proportion of Total Plantation Area (BRS 2006)

Private native forestry

As shown in Table 1 there is an estimated 35.1 million hectares of private native forest in gross terms across Australia, of which not all will be actively managed for production. Estimates of the actively managed areas of private native forestry in each state and the estimated level of production from the areas are provided in Table 6 (URS 2007). Note that these are significantly smaller areas than those identified for the gross area of private native forest.

Table 6: Area and Resource Harvested from Private Native Forests

State	Area (ha)	Estimated Production (m^3) p.a.
Queensland		280,000
New South Wales	669,000	586,000
Victoria	1,058,000	77,000
South Australia	822,000	-
Western Australia	303,000	14,589*
Tasmania	922,000[#]	967,000
Northern Territory	-	-

* Also a further 23,135 tonnes of pulpwood. [#] Includes pulpwood
Source: URS (2007).

Victoria shows the highest level of area of private native forest, followed closely by Tasmania and South Australia. For Tasmania, the area of gross private native forestry is the same as the area reportedly actively managed, indicating a very high utilisation rate of the area of private native forest available in this state compared to other states. Estimates of the area of private native forest in Queensland and the Northern Territory are not available, nor are estimates of output for South Australia and the Northern Territory.

A survey of 76 mills in northern NSW completed by Northern Rivers Private Forestry (2005) showed that 66% of the mills in the region were totally reliant on the private native forest resource, while a further 18% of mills sourced more than 50% of their timber from private native forestry. It was also reported that the private native forest resource provides around 260,000 cubic metres of logs per year.

Discussions with sawmills and Timber Queensland, who operate in south east Queensland, have identified that:

- 40 to 45 of the 150 sawmills across Queensland utilise private native forestry timber to some extent;
- Of the 7 mills surveyed in south east Queensland, an average of 42% of their business was based on the use of private native forest resources, though this ranged between 20% and 60%; actual timber use ranged from 1,500 to 250,000 cubic metres of timber per year, and often varied within each sawmill from year to year; and
- A range of approaches are used to obtain private native forest resources including advertising, directly approaching landholders, sourcing from contractors harvesting timber and owning land with the existing resource.

Timber Communities Australia in Western Australia was also contacted, along with two sawmills in the south west of the state. It was reported that:

- Private native forestry contributed a relatively small proportion of timber to the industry in the region, of between 2% and 3%;
- Private native timber use by sawmills was generally low, but variable; and
- Reliance on private native forestry resources has declined in recent years due to changes in Government regulation.

The Victorian Association of Forest Industries reported that private native forestry in Victoria was also limited and undertaken only by relatively small mills; some mills have closed in recent years due to reduced access to public native forest resource. Hardwood is primarily sourced from crown lands, with a small amount also grown in plantations.

These findings demonstrate that private native forestry has value, not just in terms of market value, but also in terms of the sustainability of the mills that rely on the resource for their viability.

Summary

The farm forestry sector consists of a number of different types of plantation species and forest resources. Planted farm forestry includes farm forest plantations, agroforestry and woody fodder crops, while private native forestry refers to the areas of privately owned native forest which is actively managed for the production of forest products.

The farm forestry plantation sector is present in all states and territories of Australia and is estimated to cover a total of 159,000 ha. Western Australia shows both the highest area of farm forestry and the highest proportion of farm forestry relative to total plantation forestry, largely as blue gum pulp plantations. The Northern Territory shows the lowest level of farm forestry, only 44 hectares. Overall, while the gross area of private native forest is high, the area managed actively for timber production is much smaller (refer Table 6).

MIS plantations account for 63% of the farm forestry area and are predominantly plantations of *Eucalyptus globulus* and *Pinus radiata* (BRS 2006).

There is little data available on the specific intended use of farm forestry plantations or what has been harvested from plantations. The types of farm forestry reported by URS (2007) provide some indication of the potential use and therefore value of the plantation.

Plantation establishment rates peaked around the year 2000, but growth has continued since then. Estimated average annual hardwood establishment for farm forestry is over 5,500 hectares for the period 2001 to 2005, based on a ratio of 13% of total forestry plantations.

Production and trade

Forestry sector production

A diverse range of products is sourced from private native and plantation forests. This section of the report aims to identify the volume and value of production, and the extent to which farm forestry contributes to production and trade in forest and wood products. Table 7 provides data on the production of sawnwood and wood-based panel for the 2000/01 and 2005/06 periods. Both sectors showed growth in output in this period, though the sawnwood sector grew more than twice that of the wood-based panels sector. Paper and paperboard production has also increased over this period, with total output growing by 21% to 3,221 kilotonnes. A breakdown of production statistics is provided in Table 8.

Table 7: Sawnwood and Wood-based Panels Production – '000m^3

	2000-01	2005-06	Change 2001 to 2006
Sawnwood			
Broadleaved	1,287	1,188	-8%
Coniferous	2,634	3,596	37%
Total	3,921	4,784	22%
Wood based panels			
Plywood	157	145	-8%
Particleboard	904	1,002	11%
Medium density fibreboard	712	798	12%
Total	1,774	1,944	10%

Source: ABARE (2007).

Table 8: Paper and Paperboard Production - kilo tonnes

	2000-01	2005-06	Change 2001 to 2006
Newsprint	465	415	-11%
Printing and writing	554	663	20%
Household and sanitary	204	217	6%
Packaging and industrial	1,449	1,926	33%
Total	2,672	3,221	21%

Source: ABARE (2007).

A breakdown of the output of broadleaved and coniferous forests by state is provided in Table 9. Output from coniferous forests in 2005/05 was close to 3.6 million cubic metres, three times that of the 1.2 million cubic metres from the broadleaf sector. While production from coniferous forest grew over the period, broadleaf production shows a decline in output. The decline in broadleaf production is largely the result of a decline in native forest harvest from public lands across most states (Schirmer 2007, personal communication).

Table 9: Broadleaved and Coniferous Forestry Production by State – '000m^3

	Broadleaved		Coniferous	
	2000-01	**2005-06**	**2000-01**	**2005-06**
New South Wales	400.4	490.4	594.2	968.3
Aust. Capital Territory	0.0	0.0	44.3	50.4
Victoria	370.5	311.1	771.3	826.3
Queensland	142.8	137.2	494.8	757.2
South Australia	0.0	0.0	389.4	493.9
Western Australia	214.2	97.6	166.0	286.9
Tasmania	158.7	151.4	174.1	212.9
Northern Territory	0.0	0.0	0.0	0.0
Australia	1,286.5	1,187.6	2,634.1	3,596.0

Source: ABARE (2007).

Forestry sector value

The Australian forest and forest products sector was valued at $18.3 billion in 2004/05 (ABARE (2007). Turnover in the various forest product industries is provided in Table 10. The paper and paper product industry is the largest of these, with a turnover in excess of $8 billion in 2004/05. Each of the industries showed significant growth over the five-year period.

Table 10: Value of Turnover in Forest Product Industries ($millions)

Industry	**1999-00**	**2000-01**	**2004-05**
Log sawmilling and timber dressing			
Log sawmilling	881	694	1,325
Wood chipping	517	243	677
Timber re-sawing and dressing	1,287	1,633	1,898
Total	2,685	2,569	3,900
Other wood product manufacturing			
Plywood and veneer	262	158	360
Fabricated wood	977	1,158	1449
Wooden structural component	3,241	2,624	3,526
Wood products	682	617	1,004
Total	5,161	4,557	6,339
Paper and paper products			
Pulp, paper and paperboard	2,277	2,663	1,843
Solid paperboard containers	551	714	188
Corrugated paperboard containers	na	2,629	3,411
Paper bag and sack	1,899	261	343
Paper products	1,054	1,686	2,245
Total	5,780	7,951	8,030
Total Forest Product Industries Value	**13,626**	**15,077**	**18,269**

Source: ABARE (2007).

Figure 7 provides an indication of the trends in the value of forest industries including log sawmilling and timber dressing, paper and paper products, and other manufactured wood products over the past six years. There has been a general positive trend over the period.

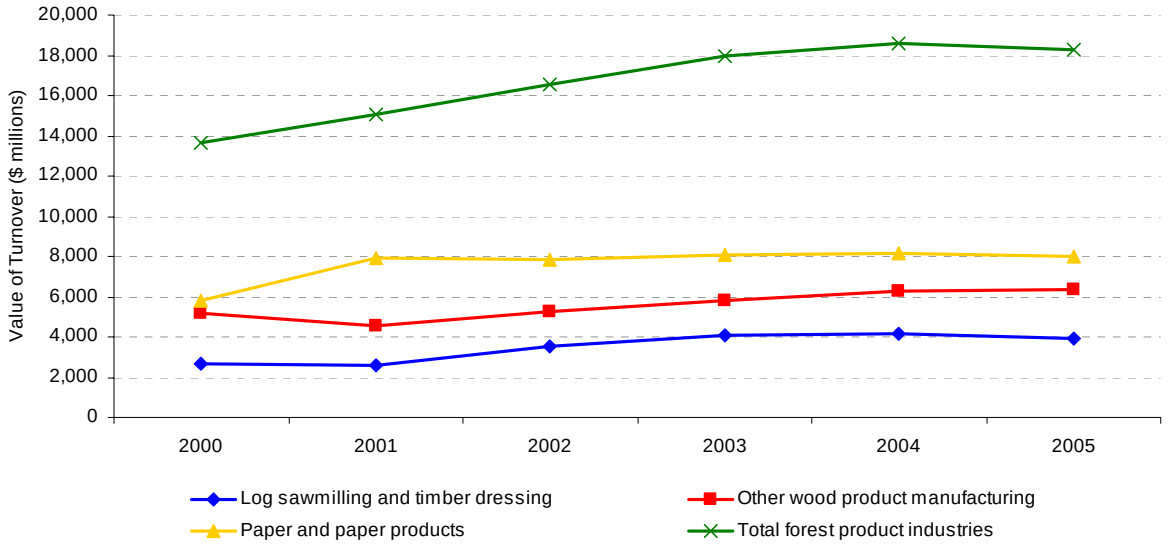

Figure 7: Value of Turnover in Forest Industries (ABARE 2007)

Estimated farm forestry production

Output from Australia's forest and wood products sector in 2005-06 included 3.60 million cubic metres of coniferous and 1.19 million cubic metres of broadleaf production. In terms of further processing, 3,221 kilo tonnes of paper and paperboard products, 4.78 million tonnes of sawnwood and 1.94 million cubic meters of wood-based panels were produced.

Using the proportion of total plantation area attributed to farm forestry (9.2%), a broad estimate of the current contribution production of farm forestry is made of:

- 440,000 tonnes of sawnwood;
- 179,000 cubic metres of wood based panels; and
- 269 kilo tonnes of paper and paperboard products.

These estimates provide a broad indication of the contribution of farm forestry to production in the forest and wood products sector. Further information has been sourced to provide some detail on plantations, output and future productivity as summarised below.

BRS (2007) provide some indication of the contribution of farm forestry to the log supply based on data provided by plantation owners and managers. The specific regions for which farm forestry is identified and the status of these plantations is provided in Table 11. The information collected from plantation owners and managers includes log supply forward estimates and estimated current and future farm forestry contributions.

Table 11: Farm Forestry Plantations and Log Supply

Region	Farm Forestry Supply
Western Australia	Some farm foresters managing blue gum plantations for sawlog production. Potential supply is very small.
Mt Lofty Ranges and Kangaroo Island	90% of the hardwood plantations are blue gum established by investment schemes for pulpwood production. Remaining 10% is farm forestry for sawlog production. Comprises a range of hardwood species and most is less than ten years old.
North Queensland	Farm forestry native hardwoods established in the 1990's. Hardwood plantations are currently too young to produce commercial timber. About 60% of the hardwood plantations in North Queensland are managed for pulpwood production (plantations established 2001-2005), with the balance managed for sawlogs.
Murray Valley	70% of hardwood plantations in the region are managed for sawlog production and many have been thinned and pruned. The remaining 30% are managed for pulpwood production; some of which will reach harvest age over the next few years. These include a small amount of farm forestry plantations developed by the Farm Forestry North East project.
Central Victoria	Estimated that 98% of hardwood plantations in region are managed for pulpwood production. Remaining 2% are farm forests comprising a wide range of species. Because of the small current area, diversity of species and variability in growth rates, the forecast hardwood sawlog supply from these plantations should be considered low.
East Gippsland – Bombala	Regional hardwood plantations include shining gum (*Eucalyptus nitens*), blue gum for woodchip production and a few farm forests (estimated 800 hectares). Farm forestry resource is composed of recently established eucalypts and no sawlog production is expected for several years.

Source: BRS (2007).

Kelly (2007) also reports private native forestry resources on a state by state basis, and indicated that:

- NSW private native forests currently provide around 500,000 cubic metres per year, and that the sustainability of this resource was unknown and its harvest likely to decline over the next 10 to 20 years;
- private forests in Tasmania supply around 300,000 cubic metres of sawlogs per year, and this resource is expected to decline in the future;
- the current harvest of 250,000 cubic metres of sawlogs from private native forests in Queensland is expected to decline; and
- Western Australian private forests are very small and future resources are unknown.

The estimated value of farm forestry is dealt with further in the economic section of this report.

Forestry exports and imports

Australia's forest products exports totalled $2.1 billion for the 2005/06 financial year. Imports were around twice this value at $4.0 billion. Trade in forest products has increased over the past six years, with exports rising by 33% and imports by 6%.

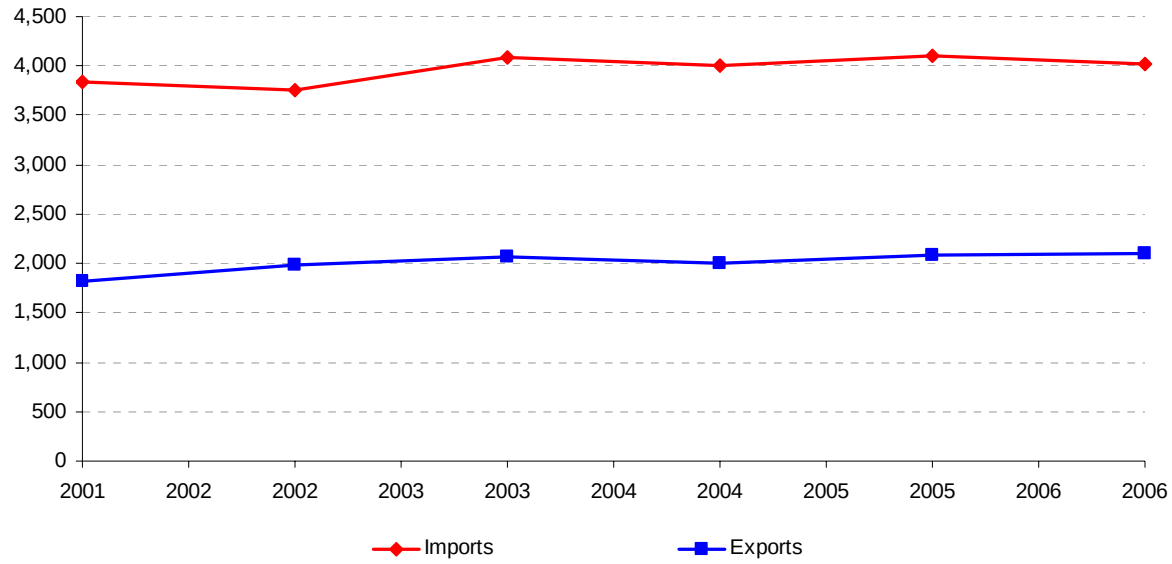

Figure 8: Australian Imports and Exports of Forestry Products 2000 to 2006 (ABARE 2006)
Note – based on financial years.

Growth in exports has primarily been fuelled by large increases in sawnwood, paper and cardboard, wastepaper and medium density fibreboard exports. Woodchip exports grew 30% over the five years to 2006 and are Australia's largest forest product export, accounting for 30% of forest product export value.

Estimated farm forestry contribution to export trade

Farm forestry accounts for approximately 9.2% of the area of forestry across Australia (based on percent plantations only) and the total value of forest industry exports was $2,109 million in 2005/06. Therefore it is estimated that the contribution of farm forestry to forestry and wood product exports is $194 million per year. This estimate assumes that farm forests are of similar age distribution, management and worth to industrial plantations.

Economic Value of Farm Forestry

The economic value of farm forestry is broadly associated with the production and sale of farm forestry goods and services for the full length of the farm forestry supply chain. The supply chain (Figure 9) starts upstream with the suppliers of inputs into farm forestry and flows downstream to those marketing forestry products.

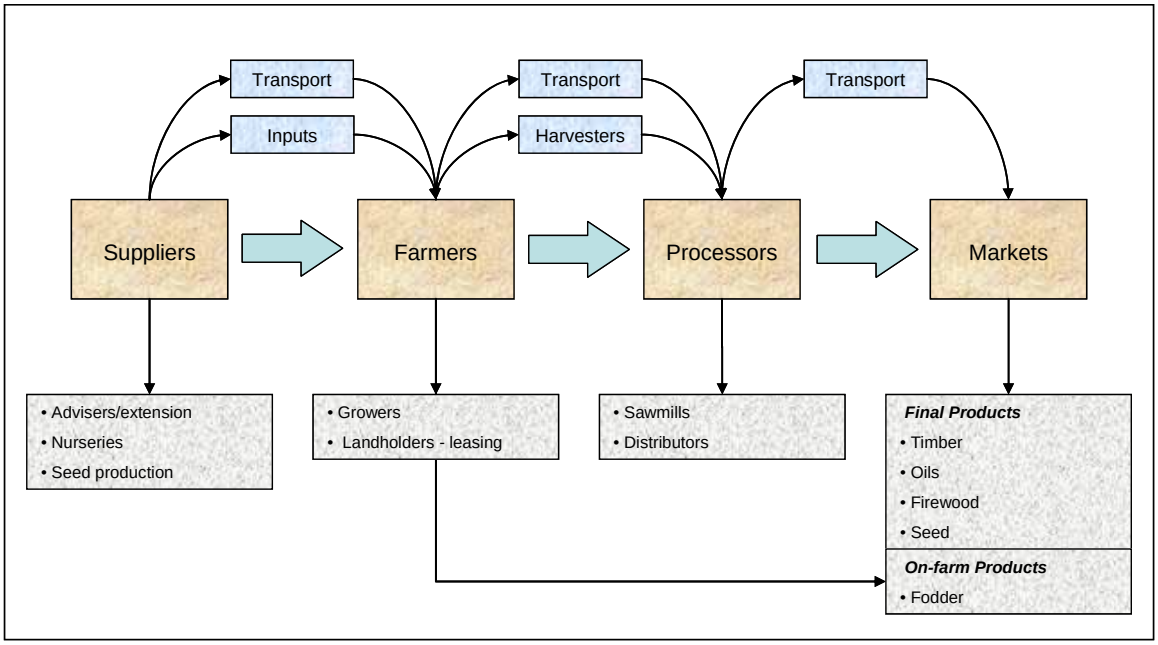

Figure 9: Supply Chain for Farm Forestry Industry

Importantly, the economic value of farm forestry goes beyond the value of the final products and includes the value of goods and services purchased and utilised in the production of forest products, and wages and salaries paid to employees.

Activities that contribute to economic activity and employment associated with farm forestry are identified by Tonts *et al.* (2001) and include:

- contract planting;
- site inspection and preparation;
- fire management;
- tree nurseries;
- chemical spraying; and
- harvesting and haulage operations.

A review of the literature suggests that these benefits are likely to surface in larger regional centres rather than in smaller regional communities (Tonts *et. al*. 2001). A summary of the area of farm forestry by state is provided in Table 2. These areas are used as the basis for much of the assessment of the value of farm forestry undertaken in this section.

In assessing the economic values of farm forestry the approach adopted has been to provide a range of potential values using lower and upper range estimates, to accommodate the different estimates in the literature and the uncertainty governing these estimates. These uncertainties arise because estimates of value and employment are not specific to farm forestry but rather, come from the broader forest and wood products sector. Further, a range of values is provided in the literature, and the lower and upper estimates have been used to provide a range within which the true value is likely to fit.

Gross value of production

This section provides an overview of the forest and wood products sector in order to identify the value, and changes in value, of the forest and wood products sector and give context to the subsequent valuation of the farm forestry sector. The estimated GVP of the farm forestry sector is provided, based on the per hectare values provided by a number of studies of forestry production applied to the estimated area of farm forestry resources on a plantation type by state basis.

The forest and wood products sector

The GVP for the national wood and wood products and paper sector has grown over the seven years to 2004 by 62%, with the wood and paper industries individually growing by 66% and 57% respectively. Figure 10 highlights the increase in the value of the sector to the Australian economy.

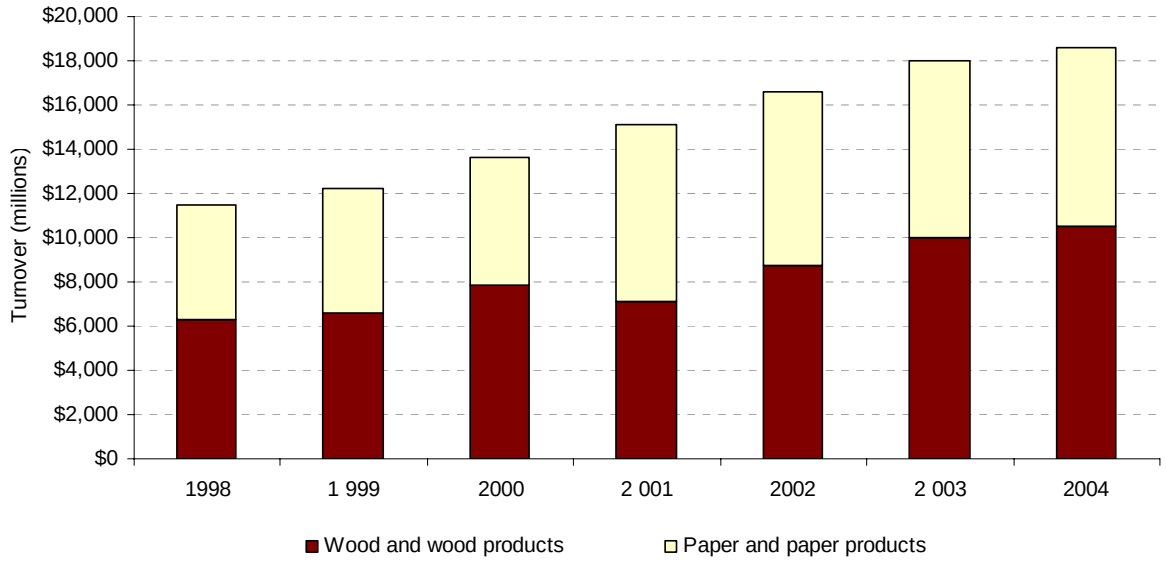

Figure 10: Australian Turnover in Wood and Paper Products (ABARE 2006)

An index of prices received for a range of wood products is provided in Figure 11. Using 1990 as the base year, all product prices show a clear positive trend for the past 25 years. However, it has only been in the past decade or so that the prices of the products have differed in growth in price, with structural hardwood, in particular, increasing in value more than other products.

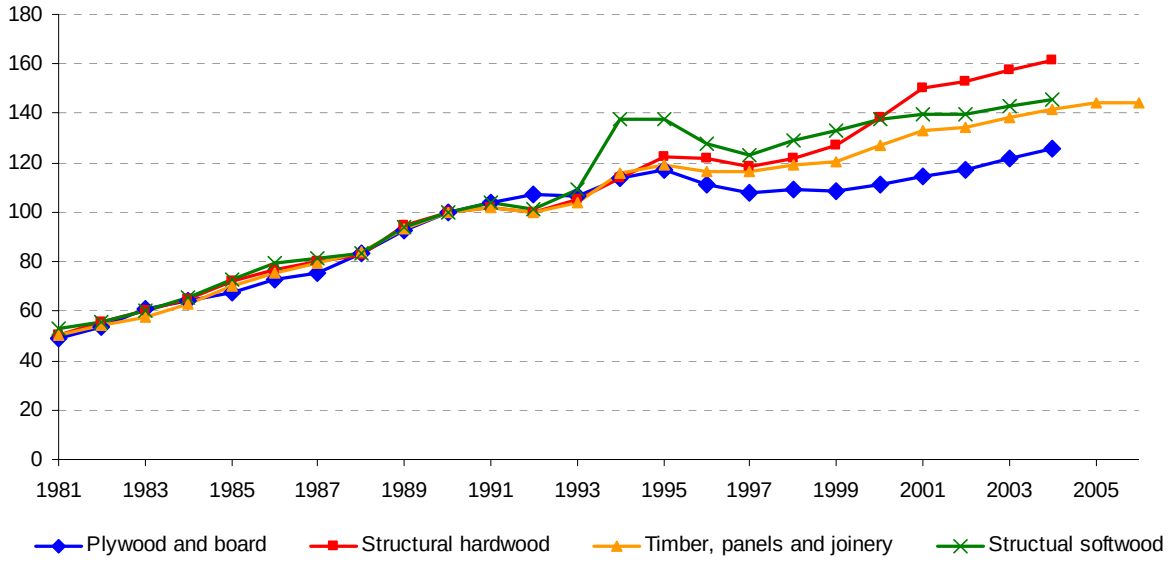

Figure 11: Index of prices received for forest products (ABARE 2006)

Value of forestry production

Table 12 provides a summary of values provided by URS (2003) and Schirmer *et al.* (2005b). These have been estimated using the gross value of forestry production along the supply chain and the estimated area of the forest resource. While these values are not farm forestry specific, we can use these values to imply the value of farm forestry plantations and managed private native forests. These estimates have been used in the next section to estimate the GVP of farm forestry.

Table 12: Estimates of the Unit Value of Forestry Production by Forestry Type

Region and Forest Type	***Value***	***Comments***
Central Victoria		
Softwood plantations	$4,900/ha	Value of production from components of Central Victorian forest industries (sawmilling, woodchip export and log export).
Hardwood plantations	$227/ha	
Native forests	$967/ha	
Firewood	$60/m^3	
South West Slopes		
Plantation softwood	$4,939/ha	Value of production from components of South West Slopes (NSW) forest industries (sawmilling, woodchip export and log export).
Native forest	$127/ha	
Plantation softwood	$5,334/ha	Mature softwood plantations of the South West Slopes of NSW.

Sources: URS (2003) and Schirmer et al. (2005b)

Estimated GVP of farm forestry

Table 14 has been produced using average unit values of forestry sector production (Table 12) and applying these over the areas of farm forestry shown in Table 13.

Table 13: Areas of Farm Forestry by State by Type

	Eucalyptus and Hardwoods	Softwood and radiata	Mixed and other	Mallee eucalypts	MIS plantations	Total
Queensland	3,060	388	1,311			4,759
New South Wales	8,703	18,907	340			27,950
Victoria	5,596	4,678	15,163			25,437
Tasmania	9,363	5,442			6,200	21,005
Northern Territory			44			44
South Australia	1,456	845	12,215			14,516
Western Australia	1,021	24,085		13,574	27,000	65,680
Total	29,199	54,345	29,073	13,574	33,200	159,391

Source: URS (2007).

A breakdown of the estimates of farm forestry GVP on a state-by-state and national basis is provided in Table 14. At the national scale, the gross value of the forest and wood products sector was estimated to be $18,627 million for the 2003/04 financial year. It is estimated that the annual GVP of farm forestry is $362 million per year, based on the areas of farm forestry and their estimated value of production. Using these estimates, farm forestry is estimated to contribute around 2% of the GVP of the broader forestry and wood products sector.

Table 14: Estimated Farm Forestry GVP by State by Plantation Type ($ millions)

	Eucalyptus and hardwoods	Softwood and radiata	Mixed and other	Mallee eucalypts	MIS plantations	Total
Queensland	0.54	1.96	3.43	0.00	0.00	5.93
New South Wales	1.54	95.62	0.89	0.00	0.00	98.05
Victoria	0.99	23.66	39.68	0.00	0.00	64.33
Tasmania	1.66	27.52	0.00	0.00	1.10	30.27
Northern Territory	0.00	0.00	0.12	0.00	0.00	0.12
South Australia	0.26	4.27	31.97	0.00	0.00	36.50
Western Australia	0.18	121.81	0.00	0.00	4.77	126.76
Total	5.16	274.84	76.09	0.00	5.87	361.96

Employment

The forest and wood products industry

The ABS's Census of Population and Housing (ABS 2001) figures provide an indication of the level of employment in both the forestry and logging sector, and the wood and paper products sector (Figure 12). Figure 12 highlights that a high proportion of employment is generated by processing of the raw forest resources into goods, rather than the production of the forest products themselves. Further, the proportion of employment in the wood and paper products sector varies from state to state. Employment in the combined forestry and logging and the wood and paper products sectors across Australia is highest in NSW, where 30% of employment is generated. Victoria and Western Australia also account for a high proportion of the sector's employment (Figure 13).

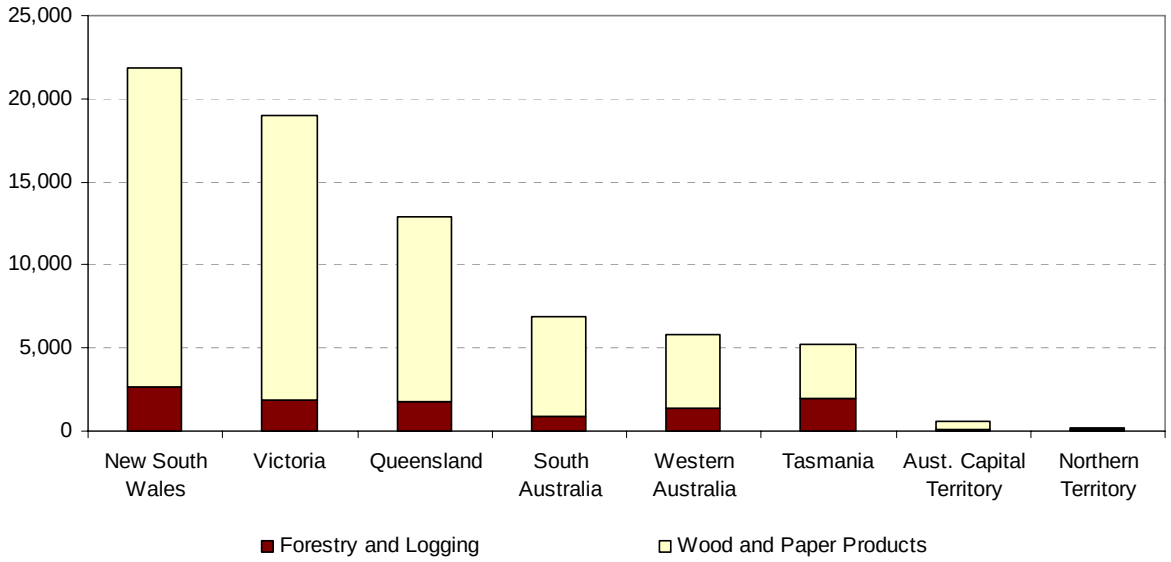

Figure 12: Persons Employed in the Forestry and Logging and Wood and Paper Products Sectors by State (ABS 2001)

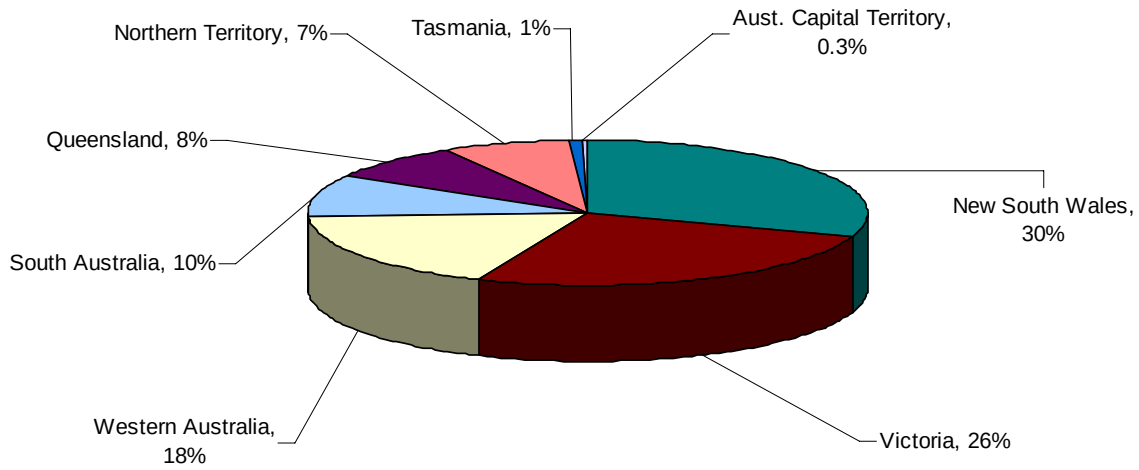

Figure 13: Proportion of Total Employment in Forestry, Logging, Wood and Paper Products Sectors by State (ABS 2001)

Several reports provide some indication of the level of employment generated by the forest industry (combined plantation and private native forestry) on either a per hectare or per cubic metre of output basis.

Schirmer et al. (2005a) estimated that between 8.3 and 15.7 direct and indirect jobs are created in the South West Slopes of NSW for every $1 million invested in the softwood plantation sector. Further, between 0.8 and 1.3 more employment positions are created in the region as a flow-on from the forestry sector. Employment generation per 100 hectares was estimated to have fallen over time, due to efficiencies in the sector, but stood at 1.53 jobs per 100 hectares in 2003/04.

A similar study was completed for the Great Southern region of Western Australia (Schirmer 2005b), where over 90% of plantations are blue gums which were planted after 1980. It was reported that in this region 17.15 direct and indirect jobs are created for every $1 million invested in the plantation sector and that this led to flow-on employment of 0.65 persons per $1 million spent. However, Schirmer (2005b) has identified that because much of this plantation area is still not mature, these estimates of employment generation are likely to be somewhat lower than can be expected in the future as more timber is harvested and processed. On an area basis, employment generation varied with the age and life cycle of the plantations, with plantation establishment rates and forest maturity (harvesting and processing) increasing the level of employment. The levels of employment varied between 0.22 and 0.52 persons per 100 hectares over the period from the early 1990s to 2003/04.

Note that the definition for direct and indirect employment used by Schirmer *et al.* (2005) indicates that direct employment includes:

- employees of plantation management;
- companies/agencies;
- processors;
- employees working for contracting businesses; and
- employees servicing the plantation sector.

Indirect employment is identified as flow-on employment that includes employment generated from the expenditure of employees in the plantation sector and from the purchase of inputs by plantation based businesses.

Other studies, including those by CIE (2005), MBAC Consulting (2005) and Hayter (2003) also provide indicative employment impacts for forestry. CIE (2005) completed a study on the operations of Willmott Forests, which plant and manage softwood plantations in southern NSW. The study identified 2.5 jobs per 1,000 hectares of plantation, compared to 1.8 jobs per 1,000 hectares of agricultural land. It should be understood, however, that Willmott is a single operator managing a large area of mature and new plantations. MBAC Consulting (2005) completed two studies, the first on the NSW timber industry and the second on the plantation processing sector. Cameron Consulting (2005) also reports employment figures per 1,000 hectares of plantation. Estimates for plantation hardwood and softwood range between 0.6 and 9.6 persons and 5.4 and 51.3 persons per 1,000 hectares, respectively.

Estimated employment by farm forestry sector

Employment in the farm forestry sector is generated both on-farm and in downstream processing activities. While the above figures provide a basis for understanding the structure of employment within the broader forestry sector across Australia, they provide little insight into the level of employment generated specifically in relation to farm forestry. While these estimates are not farm forestry specific, they provide a basis for estimating the level of employment generated by farm forestry based on the size of the farm forestry estate and/or estimated level of output.

As there is no data available on the investment levels in farm forestry, estimates of employment have been made on the basis of employment generated per 100 hectares of forestry, as provided by Schirmer *et al.* (2005a, b). Those figures have been adopted to estimate the employment generated by

farm forestry in the hardwood and softwood sectors. As most of the MIS plantations in URS (2007) are hardwood-based, the estimates for hardwood employment generation are used to generate employment estimates for MIS plantations classified as farm forestry.

The estimates provided in Table 13 were used to estimate the total level of employment generated by farm forestry. Employment generated by the hardwood farm forestry sector is estimated to be in the range of 124 to 292 persons, while softwood farm forestry employment is estimated to employ between 831 and 924 persons. The MIS farm forestry is estimated to employ between 73 and 173 persons, over 80% of which is estimated to be employed in Western Australia.

As indicated in Figure 5, the ABS Census of Population and Housing (2001) estimates the level of employment to be 72,500 in the combined forestry and logging and wood and paper products sectors. Using the above estimates of employment generated by farm forestry (including private native forestry), with a lower bound estimate of 1,778 and an upper bound estimate of 2,144, the farm forestry sector is estimated to contribute between 2.5% and 3% of the forestry sector's national employment.

Cameron (2005) further noted that softwood plantations generate higher levels of employment on a per hectare basis due to the faster rate of tree growth leading to higher volumes of timber being harvested over time.

Processing and Services

The processing and services sector is a significant contributor to the national value of forestry. The ABS Census of Population and Housing (2001) indicates that the majority (85%) of employment in the forest and wood sector is attributed to wood and paper products, while only 15% is associated with the forestry and logging part of the sector (Figure 14). Estimates provided by Gippsland Private Forestry (2005) for the Gippsland region of Victoria, though different, also indicated that the processing sector contributed a higher level of the employment (62%) of the forestry industry. It was also estimated that 75% of the gross value of the industry was attributed to the processing of forest and wood products (Gippsland Private Forestry 2005).

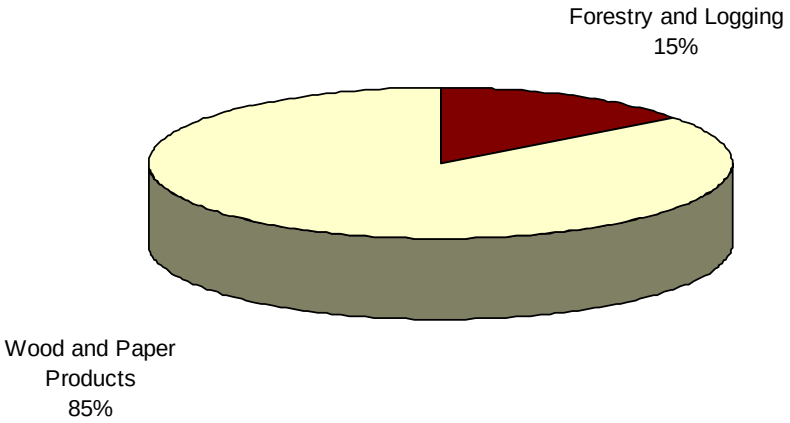

Figure 14: Proportion of forest and wood products employment in processing and services (ABS 2001)

The value generated by the processing and services sector is estimated using GVP and employment, as provided in previous sections of the report. Using the estimates provided by the ABS (2001) and Gippsland Private Forestry (2005) we can determine that the GVP attributable to the processing and service sector of farm forestry is $271 million (i.e. 75% of the industry value of $361 million) and employment in the processing and services sector to be between 1,102 and 1,822 persons (i.e. between 62% and 85% of industry employment).

Firewood

Firewood as an output from the forestry sector is not included in the above GVP estimates. However firewood provides value both on-farm to landholders able to utilise private native forests or plantation timber for firewood, and off-farm for wood that is collected and harvested for sale as a commercial forest product.

Firewood is relatively undemanding to produce in terms of tree form and quality specifications compared to other forest products (e.g. construction timbers). However, due to the returns from firewood (Table 15) it is unlikely that a purpose-grown firewood plantation could generate sufficient income to be profitable. For this reason, most firewood timber is currently sourced from existing forests, including private native forests.

A plantation, on the other hand, can yield higher value wood products, with firewood being a joint product from timber that cannot be sold for higher value uses. Therefore, it is likely that multi-purpose plantations, which produce higher value products as well as firewood, will generally be more attractive to investors (NRE 2002).

Table 15: Average Commercial Firewood Consumer Costs (2005)

Location	Cost range
Hobart (Tasmania)	$80/t to $120/t
Launceston (Tasmania)	$80/t to $120/t
Campbell Town (Tasmania)	$45/t
Perth (WA)	$130/t to $170/t
Sydney (NSW)	$350/t
Melbourne (Victoria)	$230/t to $250/t
Melbourne (Victoria)	$140/t
Adelaide (SA)	$150/t to $200/t
Canberra (ACT)	$120/t to $195/t

Source: Todd (2005).

It is also possible for firewood to be a source of income during the time taken to produce a mature stand of hardwood, as thinnings from a sawlog plantation could be sold as firewood to enhance the viability of the plantation.

Regional impacts

Farm forestry plantations and private native forests are located across all states and territories of Australia. It is important to recognise not just the national scale but also the regional distribution of these forests and the diverse range of regional impacts associated with the farm forestry sector. As these impacts can differ significantly across regions, there is no general means by which to ascertain the national level impact. The approach adopted here is to utilise a set of estimates of the GVP, employment and incomes generated by farm forestry and impute them at the state and national scale.

However, farm forestry provides employment, incomes and value to regional economies as both direct and indirect effects. The direct economic impact of farm forestry captures the value of production and employment generated directly by the production, harvesting and processing of forest and wood products from farm forestry. The indirect economic impact is how this production and value flow through and affects other sectors of the economy. For example, indirect employment measures the employment created in other sectors that provide inputs to the farm forestry sector or are generated in industries in which employees of the farm forestry sector spend their incomes and hence generate further demand for goods and services.

The indirect impact of the farm forestry sector measures the regional impact because it provides an indication of the economic activity generated beyond the sector.

In terms of the distribution and importance of farm forestry across Australia, the scale, age and form of farm forestry plantations will have a strong influence on the regional impact. Further, there are regions that are highly dependent on private native forest resources to sustain the forestry sector and associated benefits, and these should also be taken into consideration.

Where farm forestry forms a larger proportion of the region's forest and wood products sector, that sector is likely to have a higher reliance on it, and farm forestry resources will have a greater regional impact. In terms of distribution, Western Australia shows the greatest extent of farm forestry at 41% of the national farm forestry plantation area, and also the highest proportion of farm forestry relative to the rest of the forestry plantation sector (17%). Comparatively, in both Queensland and the Northern Territory, farm forestry accounts for less than 3% of the total plantation area and hence the forest and wood products sector in these states are less reliant on farm forestry resources, and farm forestry would have a smaller regional impact.

Private native forestry is also an important component of the available resource. A survey of 76 mills in northern NSW, completed by Northern Rivers Private Forestry (2005), showed that 66% of mills in the region were totally reliant on the private native forest resource, while a further 18% of mills sourced more than 50% of their timber from private native forestry. Therefore, in regions like the northern rivers, private native forests have a strong regional impact on the forest and wood products sector.

A number of estimates of the regional economic impact of forestry have been identified in the literature. Estimates of employment on a unit basis are provided by MBAC Consulting (2006) and Schirmer *et al.* (2005). MBAC Consulting (2006) estimated that every 1,150m^3 of logs processed in East Gippsland generates close to one full time job. Schirmer *et al.* (2005a) indicated that for every $1 million spent by the plantation sector 17.15 jobs are created directly and indirectly[3]. Additionally, Schirmer *et al.* (2005) estimated that for every direct job created in the forestry sector, 0.65 indirect jobs were also created.

As indicated by the employment estimates above, the farm forestry sector is likely to directly contribute 1,102 and 1,822 jobs to the national economy.

Property values

There are two components to the impact of farm forestry on land values: the value of an individual farm with farm forestry, and the impact of farm forestry on property values across a region - including farms without forestry plantations.

Rural land prices – background trends

Property values have been rising for agricultural land generally. Attribution to the presence of farm forestry needs to be extracted from this general rise in prices that may be associated with the non-forested portion of a farm.

[3] Figure based on modelling in the Great Southern region of Western Australia.

Distinguishing the effect of plantation forestry on land values

Work completed by Schirmer (2005), on the blue gum plantation sector in the Great Southern region of Western Australia, assessed:

- changes in average rural land prices;
- proportion of land sales involving transfer of land from the agricultural sector to the plantation sector; and
- the differential in prices paid for plantation and non-plantation land.

The study identified that the high demand for land from the plantation forestry sector had influenced the change in the value of agricultural lands and that higher prices were paid for land to be used for plantation forestry. Although URS (2007) has identified some 27,000 hectares of MIS plantations in the south west Western Australia region that they classed as farm forestry, Schirmer (2005) has indicated that there are many factors that have influenced changes in land values in the region and that forestry development is only one of a number of factors contributing to land value increases.

Discussions undertaken by Hassall & Associates with a number of real estate agents in two regions with significant blue gum estates have highlighted the following:

- it is difficult to differentiate the impact of farm forestry from other forms of private forestry, especially where land is leased or being sold to plantation companies;
- around Albany, Western Australia, land values have increased from $500 per acre in 1990 up to $4,000 per acre at present (an increase of 700%);
- in most cases land has been sold to the forestry company or a significant portion of the farm has been leased, and virtually no farm managers manage their own plantations (i.e. not related to farm forestry) and only a proportion of this change in value is attributable to forestry demand;
- land values in south west Western Australia are seen be driven by demand from private timber companies; and
- a similar situation was reported in Victoria, where private timber companies were seen to be having the most significant impact on property prices.

Effect of amenity value of trees on land values

Walker (cited in Field *et al.* 2006) found a correlation between tree cover on a rural property and land values. Specifically, a tree cover of between 5% and 50% on a property can result in a 25% increase in the sale price compared to the same property cleared. The price increase was associated with the lifestyle values or amenity values of aesthetic appeal, wind protection and habitat improvements, and measured using a contingent valuation technique.

The primary considerations for the land value of farm forestry are:

- The broader plantation sector has had an upward influence on property prices, but this is part of a larger trend and the role of farm forestry in these increases is likely to be small; and
- The impacts of plantation demand for land affect non-plantation land irrespective of farm forestry.

It is not possible to provide a generalised independent assessment of the impact of farm forestry on property prices, due to the significant number of factors which impact on land values. However, the above discussion has identified that:

- trees on properties have the potential to positively influence property prices due to amenity values and protection they offer;
- at present, it is difficult to separate the increase in property values associated with farm forestry from the range of other factors, and in particular, expansion of the broader forestry sector; and
- property prices are unlikely to reflect the productive capacity of the property, either agriculturally or from forestry related activities, due to the influence of location (proximity to major centres), off-farm incomes and lifestyle choice factors.

On-farm values

There is a range of on-farm values provided by farm forestry, ranging from direct production benefits such as reduced financial costs and increased feed production, to improvements in natural resource quality, which improve the sustainability of the farm via improved productive and environmental capacity. In the long term improved natural resource condition may potentially reduce other costs such as labour, earthworks to remediate erosion and loss of yield of agricultural land. The key on-farm values of farm forestry and agroforestry include:

- shelter for crops and livestock;
- increased lambing and survival rates;
- fodder production;
- reduced supplementary feed and labour from using saltbush fodder;
- improved soil condition;
- water needs;
- improved water quality and water availability;
- wood harvested from pruned shelter belts;
- on-farm timber use including posts, poles firewood and fencing; and
- pest management.

These on-farm values are discussed in the following sections.

Shade and shelter for crops and livestock

Farm forestry has been reported to reduce physical damage to fruit and cereal crops by reducing wind speed. This can lead to improvements in productivity. In some cases it may create a microclimate that provides better growing conditions (Victorian Department of Primary Industries, 2001). ABARE (1994) reported that the impact of shelterbelts on crop yields was negligible (less than 1%) for a range of planting techniques. However, the reported impacts have varied over time with other research reported by ABARE (1994) suggesting that, depending on crop and location, the impact of trees could increase yield by 25-50%. In the National Windbreak Program (2003) a simulation of expected impacts on crop yields was undertaken across the cropping belts in the eastern states and Western Australia, based on empirical data. The results identified the potential for an increase in cropping yields of up to 20% in some areas. The highest gains were expected to result in areas where crop season rainfall was lower and the value of the trees was generated through protection of moisture for the crop during grain fill.

Farm forestry may also provide protection for livestock. The Victorian Department of Primary Industries (DPI) (DPI, 2001) estimated that up to 10% of newborn lambs in Australia die from wind and cold. Wool production can be increased by up to 31% and liveweights increased by 6 kg when shelter is provided to sheep. Heat stress has also been shown to reduce fertility and wool growth in sheep; these effects can be reduced through improved access to shade.

Shelterbelts in New Zealand have been shown to increase the butterfat content of milk by 5%. In contrast, areas deprived of shelter can lead to an 11% reduction in the milk butterfat content. Beef production can also be improved by increased weight gain and reduced weight loss over severe winters.

Work completed by ABARE (1994) indicated that the shelter effects of wind breaks reduced cattle hay requirements by 25%, increased sheep carrying capacity by 15% and reduced the time taken for lambs to reach market weight (ABARE, 1994).

Increase in carrying capacity

ABARE (1994) reported research findings for the impact of farm forestry on the adjacent agricultural enterprises. It was reported that carrying capacity increased by:

- 2.3% where tree blocks had been planted;
- 0.5% for alley belt farming;
- 2.9% for tree belts and corridors; and
- there was no positive impact from widely spaced tree plantings.

It was suggested that this benefit was primarily derived from the shelter provided to these paddocks. ABARE (1994) indicated that due to the reliance of these estimates on on-farm observations and the small scale of the changes, these results are not considered to be rigorous and therefore do not lend themselves to regional or national assessment of the quantitative value of this increase in carrying capacity.

In addition to marginal impacts of plantation forestry on surrounding grazing land, the planting of woody fodder species, such as old man saltbush in saline regions, can significantly improve the productive capacity of saline and non-saline low rainfall grazing land. The value of these benefits is addressed in the fodder production section.

Increased lambing and survival rates

As above, the Victorian DPI (2001) reported that farm forestry could improve lamb survival rates by reducing exposure to wind and cold. It is suggested that up to 10% of lambs born in Australia die from exposure to wind and cold. Further, up to 1 million sheep die in Australia die each year as a result of cold stress.

It is difficult to quantify the value provided by farm shelter belts at the national level as effects will vary depending on climatic factors, the nature of farm forestry and the extent of protection provided by the trees. Further, there is no national data available to indicate the type and planting configuration of farm forestry on farming properties, or the distribution of shelterbelts across different climatic regions.

On-farm sustainability

Sustainability issues such as erosion and salinity cost the agricultural sector millions of dollars in foregone profit each year. Kingwell *et al.* (2003) reported that salinity alone costs agricultural producers an estimated $29 million per year. The present value of this annual decline in profit would amount to $387 million over the period 2000 to 2020. In terms of erosion, estimates in the 2003 State of the Environment report suggest that the value of nutrients lost from wind erosion in South Australia alone total $6.2 million per annum for agricultural land. The extrapolation of similar figures across the other states is expected to show values similar to those seen for the cost of salinity.

Importantly, farm forestry has the potential to be used to alleviate both salinity and erosion on-farm. Kingwell *et al.* (2003) reported that an estimated 724,000 hectares of trees had been planted on broadacre agricultural properties across Australia to reduce salinity. The largest areas have been planted in Western Australia with close to 500,000 hectares planted for salinity management (environmental and commercial plantings). Though not all of these plantations are captured through farm forestry data collection, there is a clear indication of the role that farm forestry can play in reducing the impact of salinity and erosion, and the value placed on this role. Other benefits are reduced nutrient loss via erosion, and improved water quality.

Fodder production and supplementary feed

It is estimated that there are 400,000 – 500,000 hectares of woody fodder species grown solely for fodder production across Australia (Table 16). Up to half consists of old man saltbush, most of which is grown in the saline parts of Western Australia's agricultural zone (URS 2007). These areas are in addition to the areas of farm forestry and farm woodlots used to estimate the production of wood and forest products.

Saltbush is also recommended for farming on non-saline lands in the low rainfall mixed farming regions of southern Australia, where it provides supplementary feed to bridge the annual autumn feed gap. Research shows it can be used to increase both farm income and farm resilience to drought (de Koning and Milthorpe 2008, Toovey and Revell 2007).

The value of a fodder crop is largely influenced by the value that crop provides to grazing livestock enterprises, both as grazing energy that is provided by the fodder crop to the livestock and the values of those livestock in livestock markets. O'Connell et al. (2005) found that saltbush stands provide value through reduced supplementary feeding costs (in terms of reduced supplementary feeding and associated labour costs) and can also increase the number of livestock supported and the associated returns.

Table 16: Farm Forestry Fodder Production by Species

Fodder species	Estimated Area (ha)	Location
Tagasaste	105,000	There are an estimated 100,000 ha in the northern agricultural region (from Geraldton south to approximately 100-200 km from Perth).
		Approximately 2,000 ha are recorded in South Australia with approximately 1,300 ha known in mid-upper SE and additional, likely smaller areas around Murray Mallee and Eyre Peninsula.
		Approximately 2,000-5,000 ha are estimated to be planted in Victoria.
Old Man Saltbush	140,000-240,000	There are an estimated 35,000 ha scattered throughout the wheat–sheep belt of NSW. Another 6,600 ha is estimated in SA, mainly in Murray Mallee, Eyre Peninsula and mid to northern agricultural districts.
		There is 100,000-200,000 ha estimated to be scattered throughout saline parts of the WA agricultural zone (300-450mm rainfall).
Leucaena sp.	150,000	Nearly all crops are located in Queensland. There is an estimated 127,500 ha in Central Queensland, 15,000 ha in Southern Queensland and 3,750 ha in Northern Queensland.
		There are also small areas of *Leucaena* plantations in the NT and northern WA with approximately 1,900 ha throughout each.
Acacia saligna	5,000	All *Acacia saligna* crops are located within the agricultural zone of WA with approximately half in the northern sand plain of the agricultural zone.
Rhagodia preissii	240	Most plantations are concentrated around Geraldton in the WA agricultural zone.
Total Area	400,000 - 500,000	

Source: URS (2007).

Estimates of the value of saltland pastures, including saltbush, provided by O'Connell *et al.* (2005) indicate that farm profit can be increased by $4,000 per farm when up to 50 hectares is planted, though there is a diminishing marginal value beyond that size. The majority of this benefit was derived through a reduction in supplementary feeding. This suggests that these pastures have a value of approximately $80 per hectare. While the development of a saltbush pasture system increased pasture establishment costs, this was more than offset by the reduction in supplementary feeding costs and increase in income from sales of sheep and wool production. A report on the outcomes of the Sustainable Grazing on Saline Lands Project (LWW, 2005) found that saltland re-habilitated with saltbushes could improve the farm profit level. It was estimated that saltbush could generate an improvement in profit of approximately $61 per hectare over the case where saltbush pastures were not developed.

Using these estimates, multiplied by the estimated area of woody fodder species grown (Table 14), the value of fodder production across Australia lies in the range of $24 million to $40 million. The lower bound has been estimated using 400,000 hectares and $61 per hectare and the upper bound has been estimated using 500,000 hectares and $81 per hectare.

Other on-farm values

There are other on-farm benefits attributed to farm forestry which have not been quantified but contribute to the value of farm forestry, including:

- returns to farm foresters from wood harvested from pruned shelter belts;
- on-farm use of forest resources for posts, poles, firewood and fencing; and
- potential to assist in the control of pest animals and weeds (e.g. serrated tussock, Campbell 2001).

The value of carbon sequestration services provided by farm forestry is addressed under the environmental section of this report.

Summary

A summary of the economic value of farm forestry at the national level is provided in Table 17. The estimates indicate a GVP of farm forestry woodlots of approximately $362 million, or around 2% of the GVP of the broader forestry and wood products sector. A significant proportion of this value is assumed to be generated by the processing and services sector, based on estimates by the Gippsland Private Forestry (2005). ABARE (2006) reports that employment in the forestry and wood products sector was estimated at 72,500 persons, of which we estimate between 1,778 and 2,144 jobs are generated by farm forestry.

Identifying the impact of farm forestry on property values is difficult due to the broad range of other factors that can impact on property prices. However, it can be stated that farm forestry can have a positive impact on property values where there are benefits delivered through shelter to agricultural enterprises and perceived improvements in amenity value. These have been estimated to raise property values by between 5% and 50%.

An important part of the analysis is to identify where further research is needed in order to gain a better picture of the economic value of farm forestry. Key areas for further research include:

- identifying the demand for employment in farm forestry management at the farm level;
- further understanding of the proportion of GVP and employment within the private native forestry and MIS sectors attributable to farm forestry;
- more detailed data sets on the productive capacity and harvest of products from the farm forestry estate – currently, estimates based on the planted area are a limiting factor in analysis;
- knowledge of where harvested farm forestry resources are sold and their contribution to the processing and marketing sector; and

- the degree to which farm forests have been used to reduce the impact of salinity and erosion, primarily through the area to which these impacts are applicable.

Table 17 Summary of the Economic Value of Farm Forestry*

Economic Value	Lower Estimate	Description
Gross Value of Production	$362 million	Based on the estimated proportion that farm forestry plantations contribute to the forest and wood products sector.
Employment	Lower: 1,778 Upper: 2,144	Upper and lower bound estimates based on employment multipliers from the forestry sector in Victoria.
Processing and Services	GVP: $271 million Employment: 1,102 to 1,822 positions	GVP – assuming 75% of GVP in the forestry sector is attributed to processing and services. Employment – assuming 62% of employment is generated by the processing and services in the forestry sector.
Regional Impacts	1,102 and 1,822 jobs	Key regional impacts include employment and income generated and flow on economic value in related sectors.
Property Values	5% to 50% increase in value	Difficult to directly attribute value changes to farm forestry. Some positive impact from shelter and amenity values.
Firewood	$45 to $350 per tonne	Value of firewood is determined by demand and supply factors at the regional level. This explains the wide variation in value.

- in addition to tree-based farm forestry, the estimated value of on-farm fodder is $24 to 40 million

Social values of farm forestry

Introduction

This chapter presents the social values associated with farm forestry, both in terms of the on-farm impacts that farm forestry has on farm managers and their families, and the broader impact at the community and national scale. Whilst the focus of this report is the national value of farm forestry, it must be recognised that most social values are found at the individual and community level. As such, this section of the report focuses on regional values and draws on studies examining values associated with specific regions.

Literature on social economic impact studies, and studies into the perceptions of farmers towards farm forestry and potential impediments to the adoption of farm forestry indicate the following social values relevant to farm forestry:

- Intrinsic values;
- Lifestyle and amenity values;
- Intergenerational values;
- Drought proofing in support of intergenerational values;
- Potential reduction of the loss in farm families and loss of social values; and
- Potential effects on farm management and regional employment structures.

The studies showed that the social and environmental values associated with farm forestry are closely tied to the economic aspects of farm forestry. The following sections outline these values and the factors that affect their realisation.

Intrinsic values

Planted farm forestry

A range of studies of landholders have found that aesthetic and environmental values and personal interest in trees are common motivations for planting trees on farm, including when planting for commercial farm forestry (Wilson *et al*. 1995, Harrison *et al*. 1996, Emtage and Specht 1998, Emtage *et al*. 2001, Herbohn *et al*. 2003).

Private native forestry

A recent study of landholders' perceptions, values and uses of native forests on their land in the Southern Tablelands of NSW (May *et al*. 2006), found that the most important uses of native forest by the majority of landholders were intrinsic, that is enjoying native forest for its aesthetic and environmental benefits. The study involved 700 postal surveys of which 52% responded, and of these 37% had native forest on their property. The preliminary results showed that 74% of these landholders found aesthetic purposes of their native forests to be most important and 73% found habitat providing for native plants and animals most important. Commercial timber production was found to be the least important use, with 95% of respondents indicating they never used their native forests for commercial timber production and 81% indicating that commercial timber production in their native forest was not important (May *et al*. 2006).

It was found that 70% of respondents believed that the commercial and intrinsic values of their native forest could be managed together for the production of multiple outcomes, including commercial products and conservation outcomes (May *et al*. 2006).

Intrinsic values were found to be significant and likely to affect whether landholders adopt private native forestry. Sixty two percent had the view that: "my forest should be left to grow as nature intended" and 57% had the view that: "I intend to preserve my native forest from timber harvesting" (ibid, p. 7). Further, the preliminary results showed that female respondents were more likely to hold intrinsic values for their native forest, with females more likely than males to agree that their native

forest should be left to grow as nature intended and to preserve their native forest from timber harvesting (ibid). The result for landholders in the Southern Tablelands with native forest on their properties - that their forests were valued for primarily intrinsic purposes - was found to be consistent with numerous other landholder surveys conducted in Australia and internationally (ibid, p10):

> "Similar studies of landholder values and attitudes in Australia have shown the attitudes of landholders towards existing native vegetation on their properties is not utilitarian and only a minority of landholders' focus has been on timber production. They have shown what this study has shown, that landholders hold amenity and recreational value in high regard (Lambert and Elix 2000)." (May *et al*. 2006, p. 10)

What is not known from these studies is whether the social values held by landholders is affected by the degree to which commercial uses affect intrinsic and aesthetic values i.e. how forest is seen to be managed. For example, did commercial timber activities of a neighbouring landholder affect the intrinsic and aesthetic values of other landholders with native forest on their properties? Further, it is not clear whether the aesthetic or intrinsic values held by the broader community for native forests, will be affected by farm forestry activities which are managed to produce both commercial and conservation outcomes. As cleared lands are established with trees, landscape change occurs and with those changes, potentially the aesthetic and social values of the broader community.

Lifestyle and amenity values

Lifestyle and amenity values of forested land associated with aesthetic appeal and the wind protection and habitat improvements of tree cover have been shown to have a positive influence on rural property prices. A study conducted at ANU by Walker (cited in Field *et al*. 2006) found a correlation between tree cover on a rural property and land values. Specifically, a 5-50% tree cover on a property can result in a 25% increase in the sales price, as compared to the same property cleared. The price increase was associated with the lifestyle values or amenity values of aesthetic appeal, wind protection and habitat improvements, and measured using a contingent valuation technique.

This finding supports the results from two quantitative studies investigating the perceptions of landholders in the Southern Tablelands towards the values associated with farm forestry, finding that landholders "believed that planting trees or managing native forest could increase the value of their property" (Field *et al*. 2006, p. 11).

Drought-proofing in support of intergenerational values

There is anecdotal evidence that suggests some farmers are using farm forestry as 'insurance' against downturns in commodity prices or land values, or as an alternative source of income during drought. Whilst these benefits refer to economic values, there are also social values associated with this practice, including risk-management and planning for succession within the family. This method of drought-proofing is therefore considered to have intergenerational value. Farm forestry provides farmers (and their children) with the flexibility to harvest timber during periods of low income, as well as reduce the impact of wind during drought, as increased tree cover can allow soils to remain more moist, boosting pasture growth, and providing shelter for livestock (ABC, 2006). Together these benefits may reduce the risk that the property will need to be sold outside the family.

Link between economic benefits and social values

There has been a general trend across Australia for the population of regional cities to rise while the population of most small towns has fallen (Schirmer, 2005b). Between 1986 and 2001, the number of farming families decreased by 22% across Australia. Factors that have contributed include changes in agricultural markets, introduction of new technologies, and farm families selling their farms to landholders who are expanding their enterprises (BRS 2005, citing ABS 2003). Whereas 20 years ago many farmers employed a full-time farm worker, this is now uncommon. Many farmers currently manage considerably larger areas of land with considerably less labour than 20 years ago. Farm

amalgamation and decreasing labour requirements per unit of output have been common trends across Australia (Schirmer *et al*. 2005).

The population and demographic changes occurring in rural and farming areas have contributed to the decline in numbers of farmers and farm managers, an increase in the average age of the population and a decline in social capital. A number of social values are affected by these changes. There are a number of economic benefits associated with farm forestry (see the economic values section of this report), which have the potential to assist farmers to retain their properties and continue to reside in the region.

URS Forestry (2003), in its study of the socio-economic impacts of forest industries in Central Victoria, reported that where farm forestry assists in the profitability of a farm business there is a reduced need for farm consolidation, which may slow the loss of farmers and rural population decline. The improved profitability may also be linked with an improved level of drought resilience. Where farm forestry is able to assist with general profitability and improve drought resilience, there may be less financial strain on farm resources.

Maintaining socio-cultural preferences for farmers managing the land

One socio-cultural preference or value identified by Schirmer (2007) was for the management of traditional farming land by the landholder farmer, including when they undertake farm forestry activities. In Schirmer's (2007) study of conflicts associated with forestry, including small-scale farm forestry and large-scale plantations, farm forestry undertaken by farmers was consistently associated with positive perceptions (p11). Schirmer reported that three studies (Mutch and Hutchinson 1979; Tonts *et al.* 2001; Schirmer 2002) had found that community conflict occurred mostly where whole farms had been purchased and planted in contrast to situations where only part of a farm was planted.

Negative social perceptions were associated with large-scale plantations by the government or business. Further, for the three critics of plantation forestry in the sample, the reason they gave for supporting the decision of farmers to undertake farm forestry was that if it meant the farmer could stay on the land, as a result of the financial assistance provided by farm forestry, this was preferred to farmers leaving the land (ibid).

Schirmer (2007) also found that less social conflict was associated with the establishment of small-scale farm forest plantations than large-scale plantations by non-farmers (p1). Through analysis of interviewees in the cases of conflict surrounding forestry studies, Schirmer found support for the belief commonly cited in literature that small-scale farm forestry is less commonly associated with conflict than large-scale afforestation (ibid). Specifically, those interviewed "agreed that small-scale afforestation was encouraged by most of those who criticised large-scale afforestation, and as a result tended to be less associated with conflict over afforestation" (p. 9). In both case study regions, Schirmer found that concerns regarding social impacts of afforestation were "exclusively associated with large-scale afforestation".

Many of the social concerns relating to a change from broad scale farming to farm forestry relate to the shift from annual income and service provisions to periodic income and service provision coinciding with harvesting.

Schirmer (2007) found that small-scale afforestation, undertaken on land owned by farmers, was consistently associated with positive perceptions. This was the case even where the plantation established by a farmer was as large as those typically planted by a non-farmer, or in Western Australia where companies established share-farming arrangements with farmers and established plantations on all or part of the property. There were three explanations for the preference for farmer-controlled afforestation:

a) it generally involves integration of farm forestry activities with traditional agricultural activities, which was believed to be less disruptive to rural social and economic relations;

b) large-scale afforestation by non-farmers was believed to contribute to depopulation of the countryside and a shift to de-personalised, factory-like use of land; and
c) it is viewed as a means for farmers to stay on the land through financial assistance and a decision made by a farmer.

Maintaining and increasing population-supporting infrastructure and services

The availability of off-farm employment is also a factor in reducing farmers leaving the land. Off-farm employment has allowed farmers to retain their farms while earning additional income to remain financially viable.

Rural populations in the south west slopes of NSW were found to remain more stable between 1996 and 2001 in areas where off-farm income is more readily available, allowing farming families to remain on their properties while earning additional income via off-farm employment (Schirmer, 2005b). The plantation sector is one source of off-farm employment in Australia, amongst others. Towns with large-scale plantation processing facilities have tended to experience population growth or a stable population, while those with local economies more heavily dependent on agriculture and smaller timber processing industries tended to experience population decline (ibid).

A number of reports, like those completed in the Oberon region (RIRDC 2001), have indicated that the presence of the forestry sector can help reduce the risk of decline in service provision by providing regional communities with employment, incomes and demand for services.

The economic benefits provided by forestry to a region and the ability of farmers and farm foresters to benefit, are dependent on the way the forestry sector is established and distributed, and the employment and timber processing facilities within the region. Further, any assessment of the regional employment impact needs to consider:
comparative employment levels between existing land uses such as agriculture and forestry;
the establishment and location of processing activities; and
the implications for incumbent service providers to farms and agricultural industries, should there be a substantial land use shift such as shearers, fencing contractors and stock agents, as farmers are the primary market for these services (BRS 2005).

Madden *et al.* (2000, cited in Tonts *et al.* 2001), in a study of the effects of farm forestry in rural Victoria, found little evidence "that farm plantation forestry would have a major impact on the provision of essential services".

It is difficult to draw conclusions based on direct causality. Shirmer *et al.* (2005b) when assessing the socio-economic impacts of the south western slopes, found that:

> [m]embership of community groups, and the number of community groups, was greater in areas experiencing higher population growth. However, in LGAs where many people are employed in manufacturing, focus group attendees reported that it was sometimes difficult to maintain memberships in some community groups, particularly sporting groups, as shift workers employed in processing facilities can find it difficult to attend meetings or games on a regular basis. Additionally, in areas with ageing populations there is sometimes a trend of declining membership of sports groups such as football groups, while membership of other groups such as golf or bowling clubs is steady or rising (p. vii).

Summary

The social values of farm forestry will vary depending on the nature and purpose of the farm forestry plantation established (e.g. type of tree, effect on the landscape, conservation, commercial), magnitude of changes in land use patterns, availability of off-farm employment from timber processing and shifts in population demographics.

Qualitative research in the literature provides an indication of the types of social impacts that are associated with the forestry sector. A number of social values of farm forestry were identified:

- intrinsic values;
- lifestyle and amenity values;
- intergenerational values;
- drought-proofing reducing stress on landholders through diversity of income;
- potential population and social values, such as allowing existing landholders to maintain farming, with the opportunity to stay on the land with flow-on benefits to maintain rural communities; and
- potential effects on regional employment structures.

The relative social value of farm forestry depends on the proximity and scale of agriculture and forestry industry regional centres.

Some of the key information needs required to make a more in-depth assessment of the social value of farm forestry at the national scale include:

- how farm forestry has specifically impacted those communities where it is present, and in particular, those areas where it is increasing in size;
- to identify the social value of farm forestry outside of, or in relation to the broader forest and wood products sector;
- the nature, scale and impact of farm forestry incomes to farm foresters;
- the impact of farm forestry on farm viability, sustainability and the impact of these outcomes on farming families; and
- assessment of the social aspects of shifting from annual income and service provisions associated with most agriculture enterprises to periodic income and service provision coinciding with farm forestry.

Environmental value of farm forestry

There is a broad range of environmental values and services that farm forestry provides. The environmental value accrues at both the individual property level and in aggregate, across Australia. Our approach has been to provide an overview of some of the environmental outcomes reported in the literature. Estimates from a number of studies that aim to quantify these values have been used to impute a potential impact at the national scale.

Environmental services

Environmental degradation resulting from agriculture is posing a growing problem across southern Australia. In 1999, 36% of farmers reported some form of significant land degradation on their farms, amounting to an estimated area of 410 million hectares on broadacre farmland (NLWRA, 2007). Currently sodicity and acidity are the most extensive forms of degradation affecting 23% and 4.5% of agricultural land respectively (ibid). Many of the environmental effects of farm forestry affect the wider landscape and generate public benefits. For example, salinisation doesn't just affect farmland but has significant off-site impacts on public and private lands. Short and McConnell (2000) estimated the cost of high water tables and associated salinity to agriculture, rural towns, transport infrastructure and vegetation on public lands was $664 million annually in Western Australia.

The range of potential ecosystem services or environmental services associated with farm forestry includes:

- carbon sequestration;
- capturing nutrients and improving water quality and riparian restoration;
- assisting in salinity control;
- improved biodiversity;
- improved soil condition and reduced erosion;
- reduced nitrification, sedimentation and overland flow; and
- wind protection.

The measurement of these services is difficult. They are highly contextual, depending on climate, the condition of the surrounding landscape, the location of the forestry within the landscape, surrounding vegetation complexes, the nature of the species grown and harvested and the nature of surrounding land uses (Maher and Thackway 2007).

The value of environmental services also varies significantly depending on the nature, age, size and configuration of the plantation and intended use. The values provided in Table have been sourced from URS (2003) and are based on 'benefit transfer' estimates from a range of other studies. In all cases where benefit transfer is used it should be recognised that the values are provided to give an order of magnitude of the environmental benefits. The high degree of variation in farm forestry from property to property, and region to region, is not captured using this approach. However, this is a widely accepted method by which to estimate the value provided by environmental services (URS 2003).

Each estimate identifies the value of that type of ecosystem service provided by farm forestry on an annual per hectare basis, which represents the cost savings from reducing the various forms of natural resource degradation. In some cases, the public (broader community) and private (farm scale) benefits have been separately identified. Where they are not, the value represents both the public and private benefits.

Table 18: Estimated Environmental Value of Farm Forestry

Environmental Value	Measure
Carbon sequestration – mitigating greenhouse gas emissions	$100 per ha/year
Reduced nitrification, sedimentation and over land flow/run-off	$30 per ha/year
Assisting in salinity control	$10 per ha/year (private) $15 per ha/year (public)
Biodiversity	$22 per ha/year
Improved soil condition/reduced erosion	$7 per ha/year (private) $3 per ha/year (public)

Source: URS (2003).

We used the estimates in Table 18 and the areas of farm forestry in Table 1 to estimate the value of environmental services provided by farm forestry at the national scale (see summary at end of chapter).

Carbon sequestration

Carbon sequestration refers to the process of carbon being captured from the atmosphere and stored. Trees sequester carbon as part of their growth cycle, and forests represent a carbon sink (i.e. absorb carbon) whilst they are actively growing and absorbing carbon from the atmosphere. Carbon sequestration is important to businesses that are either required by law or voluntarily opt to offset their emissions.

The estimated carbon sequestration value of farm trees varies considerably depending on species and environmental factors such as rainfall, as shown in Table 19. The annual credit value is the per hectare value of carbon credits associated with the tonnes of carbon commodity sequestered per year. This value can be realised by selling the carbon rights of the trees to another party.

Table 19 Estimated Carbon Sequestration Values of Farm Trees

	Rainfall Zone	Average Seq. Rate (tonnes C/ha/yr)	Annual Credit Value
Maritime pine block planting	400-600	3.4 t/ha	$119
Tasmanian bluegum block planting	>600	2.5 t/ha	$88
Oil mallee in alleys	250-400	3.0 t/ha	$105
Trees in alley plantings	400-600	2.2 t/ha	$77
Trees in windbreaks	400-600	4.3 t/ha	$150
Wide-spaced trees	250-400	0.4 t/ha	$15
Average		2.6 t/ha	$92

Note: These estimates are based on a carbon price of $35 per tonne, as a credit farmers may receive for planting trees. This value would need to be realised by selling the carbon rights of the trees to another party.
Source: URS Forestry (2003).

Entities liable to purchase carbon offsets under statutory requirements will pay higher prices than those executing voluntary compliance. Currently, typical prices for emission offsets purchased by these entities range between $10 and $15 per tonne of carbon (Willis 2006). The planned implementation of the Commonwealth Government emissions trading scheme in 2011 will make it mandatory for more businesses to purchase offsets for their emissions, which should have a positive impact on the value of carbon offsets (Department of Prime Minister and Cabinet, 2007).

Other entities or businesses may enter carbon markets to voluntarily offset their emissions. Examples may include airlines, developers and other businesses that undertake to voluntarily offset the emissions associated with their activities, such as burning fossil fuels and land clearing. These businesses are generally less willing to pay, as they are not required by law to offset their emissions. Accordingly, these businesses typically pay between $0.50 and $7.00 per unit of carbon commodity (Willis 2006).

NSW Greenhouse Abatement Certificates trade between $5 and $35, depending on demand and supply, and each certificate represents one tonne of carbon dioxide equivalent (Candish, personal communication; Fowler, 2004). With 159,400 ha of farm forestry plantations in Australia and based on minimum and maximum annual credit values ($5 and $35 per abatement certificate), and assuming an average sequestration rate of 2.6 tonnes per hectare (Table 14), the annual carbon sequestration value of existing commercial farm forestry woodlots in Australia might range between $2.1 million and $14.5 million. This does not include woody fodder, shelterbelts and environmental plantings.

This is an indicative value only as there are significant caveats associated with this estimate. First, the type and carbon sequestration value of different farm forestry plantations is unknown. Secondly, the carbon sequestration value of farm trees in Australia can only be recognised if the forest sink is Kyoto-consistent (Australian Greenhouse Office, 2006). To be Kyoto-consistent the forest sink needs to:

- be comprised of trees with a potential height of at least 2m and canopy cover of at least 20%;
- cover an area greater than 0.2 ha and a width of at least 10m;
- be established on land that was clear of forest on 31 December 1989, and have been established after this date; and
- be established by direct human induced methods (e.g. planting, direct seeding, or the promotion of natural seed sources).

Further requirements may also need to be satisfied, depending on the scheme that the farmer is entering. These requirements cover issues such as permanence and tree species. For example, the Victorian Government's CarbonTender scheme requires that carbon sinks only be planted with native plants that are endemic to the area. The NSW Greenhouse Gas Abatement Scheme (which allows forest managers to create greenhouse abatement certificates) has a requirement that the forest manager be able to demonstrate that carbon traded (as distinct from total forest carbon) will be sequestered by the forest for at least 100 years.

Nutrients and water quality

Farm forestry affects nutrient flow and water quality by:

- improving the quality of riparian zones; and
- absorbing excess water-borne nutrient and sediment loads.

URS (2003) estimated values provided by farm forestry associated with riparian restoration and improved water quality, and reduced nitrification, sedimentation and overland flows (Table). These benefits were allocated a value of $30 per hectare per year. They represent the value of improving the quality of riparian zones and using trees to act as a buffer to absorb nutrients and sediment which would otherwise end up in waterways and lead to degraded water quality. That is, there are indirect costs on-farm and to downstream communities from erosion and excess nutrient (e.g. eutrophication). Benefits of improving water quality and reducing nutrient loss are: improved water quality for farm watering points, dams and streams, decreased sediment build-up in low-lying areas and dams, and retained topsoil for pasture and crops.

Using the 159,400 ha estimate of farm forestry area, this implies that farm forestry provides $4.78 million in environmental value associated with the protection of water quality and improved riparian zones.

Groundwater and surface flow

Groundwater is defined as that part of the subsurface water that is in the zone of saturation, including underground streams. Groundwater underlies the soil surface almost everywhere. Ground water is stored in, and moves slowly through moderately to highly permeable rocks called aquifers.

There is a range of impacts associated with changes to groundwater flows. These include:

- changes in recharge of fresh groundwater or water flow downstream;
- impacts on salinity levels;
- change in nitrification, sedimentation and overland flow/run-off; and
- effects on nutrients.

Forestry does affect water flows and infiltration. The quantity and quality of streamflow depends on rainfall, climate, soils, geology and land cover. In general, mature plantations use more water than mature native vegetation, pasture or crops (BRS, 2006). Water use in plants is related to leaf area index (LAI) which is a function of species, soil and water availability – trees have greater leaf area than pastures, so trees use more water than pasture. When agricultural land is replanted, water yield reductions may commence around canopy closure (year 5) and peak around years 10 – 20.

Targeted plantations can help control erosion, reduce salinity and improve water quality. However, the impacts are likely to be localised if on-farm forestry is located in catchments in low rainfall areas, is dispersed and uses species targeted at low water use. Where overland flow is important for agriculture and urban water supply, water inception by plantations can be a concern. This can be a negative or positive outcome depending on the circumstances and characteristics of the groundwater system. Some plantations in some catchments can reduce flows. Plantation area must be balanced against the role that trees can play in biodiversity, carbon, reducing salinity, improving water quality and allowing a return to productive land.

The effect of plantations on water yield can potentially be minimised by:

- dispersing plantations across the landscape
- phasing plantings to give a spread of ages;
- maintaining plantations at lower stockings through thinning; and
- choosing species well adapted to the site and, if feasible, species that use less water.

BRS (2006) highlight that further research is needed to reduce the uncertainties that surround the estimation of the impact of plantations on water and stream flow. Specific research needs include:

- monitoring of stream flow over the long term at catchment and regional scales for different groundwater flow systems;
- comparative studies of groundwater use;
- water use across different plantation management practices and different species in different climate and soil types; and
- catchment models to assess potential impacts of plantations on water use and stream flow.

Assisting in salinity control

The cost of salinity at a national level is reflected in land lost to agricultural production on-farm, saline streams and water points, and damage to urban infrastructure and vegetation in low-lying saline areas. The value derived from salinity control benefits both the private landholder and the community. These benefits are the reduced impact of salinity on farm production, the environment and contributing to more sustainable resource use. URS (2003) reported a value of $10 per hectare per year from farm forestry when used to control for salinity on-farm, with a further $15 per hectare per year accrued as a public benefit from reduced salinity impacts off-farm.

Not all farm forestry is undertaken with the intention of assisting in salinity control or located in areas with a material salinity issue. To estimate an indicative benefit we assume that 50% of current woodlots provide some benefit in the control of salinity. This yields a value of approximately $1.99 million per year for both public and private benefits nationally. Salinity is likely to be a growing problem in the future and farm forestry has the potential to play a role in combating salinity, particularly in areas with localised aquifers.

Improving biodiversity

There are a number of factors to take into consideration when determining the biodiversity value of farm forestry. Some of these factors are:

- plantations and farm forests, especially when near remnant native forest, can increase native species biodiversity relative to agriculture (Kavanagh *et al*. 2005; Loyn *et al*. in press).
- some species of bird and mammal rely on the presence of older trees which are large enough to provide habitat – these are generally absent from farm forestry plantations or are disadvantaged if larger trees are selectively harvested;
- the value of biodiversity provided by farm forestry will depend on the surrounding land use (for example agricultural grazing or native vegetation) and position in the land use mosaic;
- the value of the vegetation complex will be affected by its positioning in the landscape (for example, whether it is located close to or around a water source and/or whether it connects previously isolated communities);
- the shape of the forestry stand and the proportion of edge will affect its core refuge values;
- the forested area may provide a refuge for pest species; and
- the plant species (native/exotic) and management will affect the relative biodiversity value.

URS (2003) reports that the biodiversity value of farm forestry is $22 per hectare per year. Based on this figure, we estimate the biodiversity value of farm forestry to be $3.51 million.

Improved soil condition and reduced erosion

Farm forestry is able to assist in improving soil condition by providing shelter and windbreaks that reduce soil loss through erosion, and also assists in reducing water related soil erosion.

URS (2003) estimated that the value of farm forestry for improved soil condition and reduced erosion is estimated at $7 per hectare at the private level, and a further $3 at the public level. This equates to a total value of $10 per hectare for improved soil condition/reduced erosion. There are many factors that will change the value at various locations across Australia and it is important to recognise that this is a very broad estimate (ibid). Not all areas of farm forestry would have been planted with the intention of protecting soils for erosion, and the quality, and hence value of soils can vary significantly.

However, in general terms, taking the area of farm forestry as 159,400 hectares across Australia, and using an estimated value of $10 per hectare to capture both private and public benefits, farm forestry is estimated to provide a value of $1.59 million at the national scale through improving soil condition and reducing soil erosion.

Summary

Farm forestry provides a set of environmental, or ecosystem services which are of value to both private landholders and the wider community. While the estimates of these values are very preliminary and do not capture the variation from region to region, farm forestry does provide a significant level of environmental value. These are summarised in Table 20.

Table 20: Summary of national Environmental Value of Farm Forestry

Environmental Value	Estimated Values	Description
Carbon Sequestration	Up to $14.7 million	Based on an equivalent annual value of carbon credit that may be attached to farm forestry plantations across Australia.
Nutrients and Water Quality	$4.78 million	Based on an annual value of improved riparian zone and associated water quality improvement of $30 per hectare.
Salinity Control	$1.99 million	Assuming a per hectare value of $25 and up to 50% of farm forestry estate providing assistance.
Biodiversity	$3.51 million	Assuming an annual value of $22 per ha applied over the entire national farm forestry estate.
Soil condition/Erosion	$1.59 million	Based on the combined public and private benefits of improved soil condition and erosion control.

These figures suggest that the environmental benefit of farm forestry across Australia may be valued at over $25 million per year. This equates to approximately $288 million over a 20-year period[4].

There is a need for further information to value ecosystem services provided by farm forestry, particularly to specify the areas of the farm forestry estate to which each environmental service is relevant. The information required includes:

- the area and location of farm forestry plantations that have been planted with the intention of reducing salinity impacts;
- the extent to which the farm forestry estate is situated in locations where there are direct benefits of nutrient control and associated water quality; and
- the extent and nature of farm forestry areas that meet the criteria of the carbon credit system.

[4] Based on a discount rate of 7% p.a. as per NSW Treasury Guidelines.

Key Findings

This section summarises the economic, social and environmental values of the farm forestry sector. While is has been possible to identify a diverse range of qualitative values derived from farm forestry, the quantification of these values is challenging. An important outcome of this project is the identification of information gaps and research needs which need to be addressed to gain a better understanding of the value of farm forestry.

Summary of economic values

The economic value of farm forestry is captured through the GVP, employment, processing and services, regional impacts, property and on-farm values of the industry. Our estimates are that:

- The annual GVP of farm forestry plantations is $362 million, or around 2% of the value of the broader forest and wood products sector. This estimate does not include private native forest, woody fodder and some agroforestry plantings.
- Between 1,778 and 2,144 employment positions are generated by farm forestry based on employment estimates in the forest and wood products sector.
- The processing and services sector contributes a significant proportion of the farm forestry GVP at $271 million, or around 75% of value, while some 1,102 to 1,822 of the employment positions generated can be attributed to the processing and services of forest and wood products derived from farm forestry.
- The regional impacts of farm forestry are likely to be concentrated in areas where farm forestry constitutes a higher proportion of the plantation forestry sector, or areas where timber mills are reliant on private native forest resources, as shown by the example of the Northern Rivers region.
- There is potential for farm forestry to increase land values by between 5% and 50% through shelter and amenity benefits. However many factors have impacted rural land prices, making the farm forestry component difficult to distinguish without further data.
- Firewood values range significantly depending on the demand and supply conditions in regional markets. Firewood prices can range between $45 and $350 per tonne.
- Farm forestry provides a significant number of direct on-farm values identified in the literature. Their value is difficult to estimate quantitatively due to a lack of data for a large number of variables such as farm forestry plantation type, regional climatic influence and actual locations of plantings within farming systems. However, there is evidence that farm forestry can affect farm viability in addition to the income derived from farm forestry production by:
    - Providing fodder production;
    - Improving shelter for crops and livestock;
    - Improved lambing survival rates;
    - Decreasing costs for feed and labour through using saltbush or other woody fodder species;
    - Reducing farm management costs (e.g. erosion control); and
    - Improving soil condition and water quality.

Summary of social values

The social aspects of farm forestry are associated with intrinsic and aesthetic values, and intergenerational, risk management, family and community benefits derived from income diversification and contributions to the wider rural community. The extent of values and impacts will depend on the nature and purpose of the farm forestry plantation established (e.g. type of tree, effect on the landscape, conservation, commercial). It is important to note that wider community social benefits are interlinked with changes at a regional level. That is, the regional context of change, particularly land use change, may affect how farm forestry is viewed.

The review of literature identified a range of farm forestry social values. These were:

- Intrinsic values of planted farm forestry.
- Lifestyle and amenity values of forested land are associated with aesthetic appeal, wind protection and habitat improvements from tree cover. These have been shown to have a positive influence on rural property prices to the extent that landholders "believed that planting trees or managing native forest could increase the value of their property" (Field *et al.* 2006, p. 11).
- Income diversification and flexibility. Farm forestry provides farmers and their families with the option to harvest timber during periods of low income (e.g. drought) and can increase the opportunity for effective intergenerational transfer.
- Farm forestry has the potential to assist in the profitability of a farm business, slow farm consolidation and through employment generating activities, slow rural population decline.
- Where economic benefits from farm forestry generate additional income and reduce population decline, social values may be derived by reducing community fragmentation and isolation and maintaining community participation.

Summary of environmental values

Farm forestry provides a set of environmental, or ecosystem, services which are of value to both private landholders and the wider community. The environmental values include:

- Carbon sequestration services which arise through the provision of carbon sinks. The value of carbon sequestration services provided by farm forestry is estimated to be worth up to $14.7 million per year. This value is imputed by assuming the current stock of farm forestry is equivalent to forests that could be credited under any trading or offset scheme.
- Improvements in riparian zone vegetation, biodiversity and associated water quality improvements in waterways may be valued at up to $14.5 million each year.
- The benefits of salinity control, estimated to be worth $25 per hectare, may generate up to $1.99 million in farm forestry environmental value annually.
- Improvements in biodiversity associated with farm forestry may be worth up to $3.5 million per year - assuming a value of $22 per hectare of farm forestry biodiversity.
- Improvements in soil condition and reduced rates of soil erosion may yield further value, estimated to be up to $1.59 million per year.

These figures suggest that the environmental value provided by farm forestry across Australia may be worth around $25 million per year. This equates to approximately $288 million over a 20-year period. While the specific per hectare values and the areas to which these values are relevant are difficult to define with accuracy, these estimates provide an indication of the national environmental value of farm forestry and highlight the large number and scale of environmental values relevant to farm forestry and agroforestry.

Implications

The farm forestry industry makes an important contribution at the on-farm, regional and national scale. The values used in this report are based on data sets not specific to the farm forestry sector and therefore can only provide an indication of the value of farm forestry.

Many of the benefits of farm forestry are currently not easily quantified and aggregated. This has the potential to undervalue the importance of this enterprise in the farming system and hinder adoption. This issue - and the location-specific nature of benefits - make policy development and information provision difficult to generalise across regions and individual farm circumstances.

Provided below is a discussion of the future potential of farm forestry, a summary of data gaps in valuing farm forestry and the implications of the results of this project for farm forestry stakeholders.

What future?

The coming decade is likely to see a number of significant changes that will affect the farm forestry sector. Three significant changes are the effects on the economy arising from the introduction of a value placed on carbon, the increasing value placed on NRM and environmental services and finally the relative importance of these versus the demands of outputs from farming systems. Competition for resources has been highlighted recently by proposed legislation in South Australia that seeks to account for water use associated with forestry plantations.

Rapid change will mean increasing importance will be placed on the ability to articulate the role of farm forestry in the landscape using information on the economic, environmental and social consequences. Articulation of benefits is likely to lead to an emphasis on appropriate planning and management of forestry in general to maximise benefits across a landscape.

As the upfront investment of farm forestry is high, appropriate information regarding location and also future demand for the product is critical. The uncertainty associated with long lag times, places additional importance on the non-financial benefits when considering whether to adopt farm forestry within a farming system.

Information and research needs

The following gaps, if filled, would provide a more comprehensive understanding of the nature and value of farm forestry over time.

Economic

Significant amounts of data and reporting are available for the forest, wood and paper products sector at the state and national scale. While some of this data is disaggregated by product and plantation or timber type, there is no attribution to farm forestry plantations. As a result, it is difficult to determine with real certainty the contribution of farm forestry to the GVP and employment outcomes of the broader forestry sector. Some work has been completed by regional forestry groups to identify the socio-economic value of forestry in particular regions, however none to date has set out to specifically identify the value of farm forestry.

The lack of substantiated and current research to quantify the value of farm forestry should be seen as a setback in being able to demonstrate the value of landholders to Australia in undertaking farm forestry.

Areas where further work is needed include:

identifying the demand for employment at the farm level for management of farm forestry;
further understanding of the proportion of GVP and employment within the private forestry/MIS sector that is associated with plantations on leased farm land;
further understanding of the value of integrated farm forestry with respect to other agricultural enterprises on-farm;
the intended purpose of farm forestry plantations;
more detailed data sets on the productive capacity and harvest from the farm forestry estate – current estimates based on the planted area are a limiting factor in analysis; and
knowledge of where harvested farm forestry resources are processed and prices received, and role within the processing sector.

In addition, there is a need to consider the difference in private native forestry and plantation farm forestry in terms of data availability and the estimation of value and impact. Accounting for these differences, particularly in terms of national value (i.e. the case of mill reliance on private native forestry), is an important part of demonstrating the value of farm forestry.

Social

Most of the studies have been on the socio-economic impact of the whole forestry sector, in most cases with little detail available on the social impact of farm forestry. Many studies of social impacts examine the implications associated with the plantation sector, not the role of farm forestry. Case studies focus on those regions where the broader forestry sector is growing most quickly and provide little indication of the impact of farm forestry as part of this change.

Many of the social concerns relating to a change from broad scale farming to farm forestry relate to the shift from annual income and service provisions to periodic income and service provision coinciding with harvesting.

Some of the key information needs to make a more in-depth assessment of the social value of farm forestry at the national scale are:

- how farm forestry has impacted those communities where it is present, and in particular, those areas where it is increasing in size;
- the nature, scale and impact of farm forestry incomes to farm foresters; and
- the impact of farm forestry on farm viability, sustainability and the impact of these outcomes on farming families.

Finally, social data including collated data on socio-demographic derived from the ABS are out-dated and should be targeted to provide insight into the impact of forestry in rural areas, including the role of farm forestry in the context of land use change.

Environmental

Relative to economic and social values, the environmental values of farm forestry have been given a lot of attention in the literature. However, there is still a great deal of uncertainty as to the actual on-farm values and across sector values that can be attributed to farm forestry. Much of the work is based on specific case studies, where the benefit under examination is apparent.

While these case studies identify reductions in salinity, improved biodiversity and reduced erosion as a result of an increase in trees on the farm, there is no firm basis or framework by which to estimate the national value provided by these benefits. This is despite a level of certainty among researchers and farm foresters alike that these benefits exist, and increased community desire for ecosystem services.

The environmental values used in this study are estimated using a benefit transfer approach. The results of this desktop study can only be indicative and provide a guide to which environmental benefits may be the most significant.
In summary, information needs include:

- the area and location of farm forestry plantations which have been planted with the intention of reducing salinity impacts;
- the extent to which the farm forestry estate is situated in locations where there are direct benefits for nutrient control and associated water quality;
- the extent and nature of farm forestry areas which meet the criteria of the carbon credit system; and
- the quantification and valuation of environmental services to facilitate better adoption, and enable participation in the trading environment for environmental stewardship payments.

Implications for stakeholders

Farm forestry growers

For farm forest growers, the key impacts lie in the on-farm production values, improvements in on-farm sustainability and environmental outcomes and potential social wellbeing. Examples include:

- shelter for crops and livestock;
- fodder production;
- increased lambing and survival rates;
- reduced supplementary feed and labour from using saltbush fodder;
- improved soil condition;
- water needs;
- improved water quality and water availability; and
- reduced farm management costs.

Currently, there is a lack of data to fully estimate these values. While a number of case studies provide anecdotal evidence, and other research reports (i.e. Victorian DPI and ABARE) suggest there are quantifiable benefits provided by farm forestry, these have not been illustrated extensively or conclusively. Key to this is better data on the nature and harvest intent of the various forms of farm forestry in Australia.

As noted above, many of the benefits of farm forestry are not currently quantified and aggregated. As a result, farm forestry will be undervalued as a potential enterprise in the farming system. This is likely to hinder adoption by landholders who may stand to benefit, and provide benefit to the broader community, through the integration of forestry on their land.

Industry

The contribution of farm forestry to the broader forest and wood products sector varies significantly from region to region. In some regions, such as northern NSW and southeast Queensland, utilisation of private native forestry is high. Some mill operations are sourcing over 60% of their timber resource from private native forests and a shift in the availability of this resource would have significant impacts on their operations. Comparatively, reliance on private native forestry has declined in Western Australia in recent years with a swing toward the use of plantation hardwood resources. This is also the case for southeast Queensland, where dependence on private native forest is higher, though variable, compared to Victoria and Western Australia.

But there is no data to clearly establish the productivity at present, or into the future, of the estimated 159,000 hectares of plantation farm forestry across Australia. Some regions currently use the farm forestry resource as part of industrial supply, e.g. blue gum pulp regions and sawlogs in the Green Triangle. More farm forestry resource will come on-stream over the next 40 years and can supplement industrial supply (pulp and sawlog); hardwood sawlog supply will depend on adequate pruning and management of stands (Parsons *et al.* 2007)

The key to conveying the value of farm forestry to industry, in particular plantation farm forestry, will be the identification of the location, scale and nature of farm forestry plantations over time. Future value will be maximised if farm forestry plantations are located within areas that are, or will be, within reasonable transport distances from mill operations. This will improve the value of these resources to mills.

A key difficulty in valuing farm forestry is the lack of understanding of the intent of private native forestry management and the nature of farm forestry plantings. Further, there does not appear to be any plan in place to begin collecting this information in the near future. As suggested earlier, this is a key information need and one that would be able to provide a positive outcome for both farm forest growers and industry by:

- facilitating an understanding within the forest and wood products sector of the resources available, and hence sustainability of their operations;
- further assisting mills in planning their operations and provide certainty in investment;
- identifying key areas where plantation farm forestry and private native forest resources are, or will be available in the future; and
- demonstrating the contribution that farm forestry makes to the broader forest and wood products sector.

For the broader forest and wood products sector, the greatest proportion of socio-economic value is derived through the contribution to the processing and services sector. This is expected to be the same for farm forestry, whose commercial products feed into the supply chain of the broader sector.

Prospective investors and policy makers

The communication of key benefits of farm forestry to policy makers is important. The extensive lists of benefits provided by forestry, in particular farm forestry, provided in the literature are helpful and now generally accepted. However, providing a comprehensive and justifiable set of values for the key benefits should now be the focus of JVAP in demonstrating the value of farm forestry to policy makers. The regional employment impacts, social and environmental benefits that can be provided by farm forestry are important benefits that should be made explicit when considering the role of farm forestry.

Policy makers will be interested in the direct financial values generated by farm forestry. At present, there is not a substantial data set that identifies these values for farm forestry specifically. It is important to note that farm forestry has economic, social and environmental benefits that are distinctly different from other types of forestry. For this reason, policy should be developed that is specific to farm forestry. The first step in achieving this appropriate level of targeting is a detailed understanding of the farm forestry estate and its future direction.

The most significant values provided by farm forestry, of most relevance to policy makers are:

- The GVP of farm forestry and employment generated in regional economies.
- The contribution of farm forestry to the broader forest and wood products sector. Importantly, the products harvested from farm forestry feed into the processing and services sector of the forest and wood products sector supply chain, where it is estimated up to 75% of GVP value is generated.
- The lifestyle and amenity values of forested land, associated with aesthetic (visual) appeal, wind protection and habitat improvements of tree cover are important social benefits to landholders with farm forestry.
- Farm forestry has also been shown to provide farming families with an alternative income source via the option to harvest timber during periods of low income (e.g. drought).
- The carbon sequestration services that can be provided by farm forestry is likely to increase over future years, in particular as the national carbon trading scheme is developed and introduced. This has the potential to increase the economic value of farm forestry to growers.

- On-farm environmental sustainability benefits in relation to soil condition and water quality are important to both landholders and policy makers. Demonstrating the ability of farm forestry to contribute to positive resource sustainability outcomes could assist with on-ground uptake by landholders and support from governments.

Researchers and research funders

There are a number of large gaps in the information available to provide accurate estimates of economic, social and environmental values – particularly in the case of environmental services. The NPI data reported by BRS does not include mallee or many of the small farm forestry and environmental plantings that have been established to provide environmental services such as reducing salinity impacts, improving riparian zone management and water quality.

There is a clear need to improve the underlying resources available in the assessment of the value of farm forestry – this might be achieved by encouraging more detail from collectors of information on the forestry sector (i.e. ABARE and ABS) to identify whether wood sources have been sourced from farm forestry – extensive data which would need to be collected from mills and farm forestry growers. Further work similar to that completed by the Northern Rivers Private Forestry PFDC (2005) in surveying mills, as well as farm foresters would also be helpful.

The focus of ongoing research should be to systematically identify the steps that need to be taken to be able to better quantify these values and develop a plan to achieve those goals.

Finally, more consideration will need to be given to the trade-offs faced in the potential expansion of farm forestry. This is especially the case for environmental values of farm forestry. While it may be desirable to encourage the expansion of farm forestry and plantation forestry more generally, the assessed values of this change need to be considered in light of all the impacts of this change. For example, the impacts of farm forestry on catchment water cycles, which will vary in impact across each catchment.

Recommendations

The following recommendations focus on the need to identify the nature of the farm forestry sector more clearly, obtain a better understanding of the underlying farm forestry estate and prioritise areas for further research.

The recommendations from this study are:

- Develop a clear definition of farm forestry for data collection and analysis. This will assist with understanding of the nature and value of benefits provided. This is particularly important for JVAP and future strategy development this area.
- Define the farm forestry estate in terms of the scale, age and nature of plantings. This underlies the ability to gauge the current and future contributions of farm forestry to the economy, social implications for local communities and environmental impacts.
- Improve understanding of the degree to which the values in this report are applicable to the farm forestry, recognising the estimates of value here are almost exclusively based on the studies completed on the broader forestry sector.
- Note that farm forestry has economic, social and environmental benefits that are distinctly different to other types of forestry. Policy should be developed that is specific to farm forestry.

It should be remembered that though the list of financial, social and environmental benefits associated with farm forestry are extensive, decisions to adopt farm forestry as part of a mix of enterprises is underpinned by a diverse range of drivers and these vary farm by farm. Understanding the degree to which these values are applicable to the farm forestry sector and also drive decisions will enable targeting of future strategies.

The first step in achieving these recommendations is a detailed understanding of the farm forestry estate and its future direction given the significant changes in economic, environment and social context which will become apparent over the coming decade.

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