

# October 2023

# **Private Forestry Guidance Materials**

An introduction to the business of small-scale forestry for farm forestry, private native forestry and Indigenous-managed forest lands





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# Introduction

# Background

To meet Australia's, and the world's, increasing demand for wood fibre requires a policy approach that maximises the role of small-scale, privately owned forests.

There are barriers to participation of private landholders and Indigenous groups in commercial forestry. One of the most significant obstacles is limited knowledge about how plantations and native forests can be managed as a legitimate and profitable land use that contributes meaningfully to Australia's future wood fibre needs.

Forest & Wood Products Australia (FWPA), with funding from the Australian Government Department of Agriculture, Fisheries and Forestry (DAFF), engaged Greenwood Strategy Solutions Pty Ltd to undertake a comprehensive project to collect, collate, analyse and make available the large volume of trials and publications related to the topic and to prepare detailed guidance materials that will help break down these knowledge barriers.

The guidance materials are intended to provide an introduction to the business of commercial forestry for Indigenous landowners and land managers and small scale owners of plantations and native forests.

# Purpose

This document provides a generic overview to the business of small-scale private forestry in Australia. It is supported by a suite of more specific documents that address each of the three types of forest management as well as providing detail on topics of particular interest.

It is intended to inform people and organisations interested in developing private forestry as an enterprise. It aims to provide sufficient detail to assist individuals and businesses to make well-considered decisions about forestry as a serious and viable land-use option that can provide commercial, social and environmental outcomes. This is one of several Guidance Materials publications prepared as part of the Australian Government's commitment to delivering the National Forest Industries Plan.

The Private Forestry Guidance Materials are not intended to provide operational instruction about how to grow forests or manage them as a business. Rather they are an introduction to the range of considerations that landowners and businesses should take into account when managing forests for commercial outcomes. Audiences that could benefit from this guidance document include:

- landowners
- advisers
- regulators
- non-government organisations
- timber processors and manufacturers.

# Structure of the guidance materials

There are four guidance documents in this series, covering the following topics:

- An introduction to the business of small-scale farm forestry, private native forestry and Indigenous managed forest lands.
- 2. Farm forestry
- 3. Indigenous owned and managed forests.
- 4. Private native forestry.

References to relevant publications are provided within the guidance documents and can be accessed via the FWPA online database of relevant publications. The database includes actual publications and links to a vast catalogue of material that has been produced by government departments, programs and regional plantation groups over many years.

The Guidance Materials also include a series of information sheets and case studies that provide more detail on specific topics of interest.

# **Professional advice**

Forestry is a specialist discipline and wood product markets are quite different to markets for other commodities. Many land owners utilise the advice of professional agronomists when looking to get the most out of their cropping or grazing activities. Forestry is no different. It is strongly recommended that private forestry practitioners seek the advice of professional forestry service providers to understand how commercial forestry can best be integrated into their specific agricultural enterprise and obtain detailed site-specific guidance on how to go about this.

# Private native forestry in context

# Commercial forestry and timber production in Australia

## Overview

Australia is the seventh most-forested country in the world, with 134 million hectares of forests, equivalent to 17% of the national land area<sup>1</sup>. These forests provide a wide range of benefits, including carbon sequestration, watershed protection, habitat for native fauna and flora, tourism and recreation, cultural activity, and valuable timber and non-timber products. Production forests – plantations and native forests managed for commercial timber – account for less than 1.5% of Australia's land mass.

## **Economic contribution**

Australia's forests are economically important Despite the small physical footprint, Australia's production forests and wood products sector generated \$23.1 billion in revenue and contributed \$7.2 billion to Australian gross domestic product (GDP) in 2020<sup>2</sup>. That represents about 0.4% of GDP and about one-fifth of all agricultural contribution to GDP. The total export value of forest and wood products peaked at nearly \$4 billion in 2019<sup>3</sup>. Australia also imports up to \$6 billion in timber products annually. Imported sawn timber represents about 20% of total sawn timber consumption in Australia<sup>4</sup>.

## The timber production challenge

Australia is experiencing a gap between available supply and market demand for sawn timber, which is forecast to exceed 2.6 million m<sup>3</sup> every year by 2050<sup>5</sup>. This forecast takes into consideration factors including stable domestic sawlog production, an estimated population of 40 million by 2050, housing demand of 259,000 new dwellings each year and no significant change in the types of houses being built. For Australia to meet its future demand for housing, there is a need to quickly increase the amount of land dedicated to the production of softwood timber by more than 400,000 hectares. The timeframe between establishing a plantation and producing highquality structural wood is generally more than 30 years. Therefore, there is also a need to consider what actions can be taken to assist in bridging the gap. These may include:

- Improving productivity, or the amount of wood grown on each hectare, by improving genetics and influencing site productivity factors such as nutrition, pest and disease management and silviculture.
- 2. Increasing the recovery of sawn timber from logs by addressing issues related to log quality and processing/manufacturing technology.
- 3. Improving the proportion of logs that are processed for sawn timber through changes in specification and introduction of new timber processing technology.
- 4. Using silvicultural interventions to increase the proportion of sawlog volume produced from each hectare. For example, changes in silvicultural practice and rotation length may work to generate an increase in the proportion of structural sawlog compared to pulp and lower grade logs produced from the current estate over a relatively short period of time.
- Shifting house construction systems from solid wood frames and trusses to engineered panels and beams that require different kinds of logs to produce woodchips, strands or small section laminated sawn timber.

<sup>&</sup>lt;sup>1</sup> Australian Government (2019) Australia's Voluntary National Contribution to the United Nations Global Forest Goals <u>https://www.un.org/esa/forests/wp-content/uploads/2020/01/VNC-Australia-April2019.pdf</u> (accessed 25/05/2022)

<sup>&</sup>lt;sup>2</sup> Australian Industry and Skills Committee <u>https://nationalindustryinsights.aisc.net.au/industries/forest-and-wood-products#:~:text=The%20Forest%20and%20Wood%20</u> <u>Products%20industry%20generated%20%2423.1%20billion%20in,the%202019%E2%80%9320%20financial%20year</u>. (accessed 25/05/2022)

<sup>&</sup>lt;sup>3</sup> ABARES (2022) <u>https://www.awe.gov.au/abares/research-topics/forests/forest-economics/forest-wood-products-statistics</u> (accessed 25/05/2022)

<sup>&</sup>lt;sup>4</sup> Industry Edge (2022) Sawnwood imports and consumption hit new records in March, Wood Market Edge online <u>https://fwpa.com.au/sawnwood-imports-and-consumption-hit-new-records-in-march/</u>

<sup>&</sup>lt;sup>5</sup> Woods & Houghton (2022) Future market dynamics and potential impacts on Australian timber imports

## Forest and wood products

#### Overview

Timber harvested from Australia's forests is used to manufacture a wide range of products. These include cellulose products, newsprint, tissues, fine papers, packaging, structural timber, frames and trusses, flooring, fittings such as windows, door frames and staircases, and manufactured wood products such as chipboard, medium density fibreboard and, increasingly, engineered wood products such as cross-laminated timber. There are also emerging timber products such as wood pellets for bioenergy production and biochar for use in agriculture. Production forests fall into two broad categories:

- Plantations, established for the specific purpose of producing timber products for export and domestic manufacturing. There are two main types:
  - Softwood (conifer) plantations, which are typically focused on the production of sawlogs for use in construction.

- Hardwood (eucalyptus and acacia) plantations, which are typically focused on production of woodchips for export to Asian markets.
- Native, or natural forests, of which a very small proportion is available for multiple-use purposes, including timber harvesting to produce high-quality, durable solid wood products.

#### Production forestry trends

Australia is home to about 1.8 million hectares of planted forests, which produce between 25 and 30 million m<sup>3</sup> of harvested logs each year.

Softwood plantation areas and harvest levels have remained relatively stable over an extended period (see Figure 1 and Figure 2).



Hardwood plantation area and log production trends



14 -og production (million m<sup>3</sup>) 12 10 8 6 4 2 2003-04 2014-15 2010-11 2016-17 2019-20 2001-02 2002-03 2004-05 2005-06 2006-07 2007-08 2008-09 2009-10 2011-12 2012-13 2013-14 2015-16 2017-18 2018-1 Year

Figure 4: Hardwood plantation log harvest 2001/02 to 2019/20 (ABARES, 2021)

Establishment of hardwood plantations peaked in the mid-2000s and then declined quickly over the subsequent decade to current levels (see Figure 3). Hardwood plantation harvest peaked in 2019 (see Figure 4).

Native forest harvesting produces about 3.5 million m<sup>3</sup> of logs each year and has declined significantly in recent decades. This is primarily due to state government decisions that seek to balance multiple policy objectives, including conservation and timber production, from public forests (see Figure 5 and Figure 6).

2009-10

2011-12 2012-13 2013-14 2014-15

2010-11



#### Native forest log production trends

2015-16



Figure 7: Integration of forestry in agricultural setting (Source: Greenwood Strategy, 2023)

# Types of commercial forestry

#### **Plantation forestry**

#### What is a plantation?

Plantations, or planted forests, are forests that are established with specific management objectives in mind. Typically, a primary objective is commercial production of timber. Other objectives can include environmental services, particularly carbon sequestration. Plantations incorporated into agricultural settings will often be managed for a range of objectives including timber production, carbon, watershed protection, prevention of erosion, and other on-farm benefits such as shelter and productivity improvement.

Industrial plantations are usually planted at large scale

(many thousands of hectares) and managed under

uniform and intensive silvicultural regimes involving site preparation, weed and pest control, use of fertilisers and routine interventions such as pruning and thinning. However, plantations can take many forms. In some instances, they might be relatively small and established on parts of a farm with lower productivity. Alternatively, they can take the form of shelterbelts and strip plantings between paddocks or along roadsides. In other cases, they might form part of an overall plan to diversify landuse and income streams for a private farm.

#### Who owns Australia's plantations?

Australian plantation ownership is distributed among several distinct groups, including state governments, institutional investors, timber processing companies, other large private owners, Indigenous owners and small-scale private owners. More than 75% of Australia's plantations are privately owned (see Figure 8).



Figure 8: Plantation ownership by category in 2018 (Source, ABARES 2021)

	Area (hectares)					
State	Hardwood	Softwood	Unknown	Total		
New South Wales	3,100	5,300	600	9,000		
Queensland	400	0	3,400	3,800		
South Australia	0	1,000	100	1,100		
Tasmania	37,500	8,200		45,600		
Victoria	2,100	5,200	3,400	10,700		
Western Australia	400	0	2,800	3,200		
Total	43,400	19,700	10,300	73,400		

**Table 1:** Verified farm forestry plantation area in Australia.

 Note: Validated data were not available for the Australian Capital Territory or the Northern Territory.

#### Plantations as an agricultural land use

Although minor in area, small-scale private plantations in agricultural settings make an important contribution to Australia's overall timber production capability, especially in key regions where mature timber markets are located. The most recent verified estimate of farm forestry area in Australia is 73,400 hectares, about 4% of Australia's plantation estate (see Table 1).

There is no comprehensive system for collecting farm forestry data and therefore this is most likely an underestimate. Previous reports have identified up to 155,000 hectares of farm forestry in Australia<sup>7</sup>. Recent work identified about 9,000 hectares of small, privately owned softwood plantations in central west New South Wales alone<sup>8</sup>, nearly twice the area reported for New South Wales above. It is possible that the actual area of plantations as an agricultural land use is closer to 10% of total plantation area.

### **Native forestry**

#### Native forest area

Australia has 132 million hectares of native forests of which about 31 million hectares are privately owned and potentially available for commercial harvesting<sup>9</sup>. The largest areas are in the Northern Territory, Queensland and New South Wales, and most are not managed for timber production.

# *Timber production from private native forests*

The area of private native forest managed for timber production is not known with any certainty. Private native forest timber harvesting is strongly concentrated in Tasmania, northern New South Wales and southern Queensland with much smaller levels in Western Australia and Victoria. As harvest levels from public native forests have decreased over the past two decades, timber production from private native forests has become more important for the hardwood timber processing sector. However, there is very little contemporary data available regarding harvest volumes.

<sup>7</sup> URS Forestry (2008) Farm Forestry Area and Resources in Australia. RIRDC Publication No. 08/104

- <sup>8</sup> Greenwood Strategy (2022) Development of a Spatial Database. Report prepared for the Central West NSW Forestry Hub
- <sup>9</sup> ABARES (2018) Australia's State of the Forests Report 2018



Figure 9: Native forest spotted gum logs, south east Queensland.

#### Forestry as agriculture

It has long been recognised that trees integrated with agricultural systems can offer a wide range of benefits for farms, including supporting sustainable landscapes. For individual farm enterprises, trees can provide a profitable alternative income stream through generation of forest products while improving farm productivity and providing ecosystem services. Forest products include logs for commercial sale or on farm use and nontimber products such as honey. Productivity benefits include shade and shelter for stock and crops, erosion prevention, improved water quality and management of salinity. More recently, the role of trees in capturing carbon has emerged as a potential benefit, either to offset farming emissions or to generate carbon units for participation in Australia's Emissions Reduction Fund. In many cases, trees integrated into agriculture can provide multiple benefits at any point in time.

At a landscape scale, small-scale private forestry generates regional employment and economic activity. It also offers environmental and ecosystem benefits for biodiversity, water quality and yield, soil health, and carbon accumulation and storage.



Figure 10: Tiwi Islander forestry employees on Melville Island.

#### Indigenous owned and managed forests

Indigenous landowners and managers have responsibility for the stewardship of a wide range of forest types throughout Australia under various ownership and management structures. This includes one of Australia's largest commercial plantation estates, the Indigenous owned and managed Tiwi Plantations Corporation in the Northern Territory. It also includes Indigenous community involvement in the management of National Parks, State forests and other Crown land and leases through southern Australia. Importantly, it includes management of traditional lands in northern Australia for a range of outcomes including commercial timber production, food and cultural values. For more information on forest management by Indigenous corporations and communities, refer to the accompanying document *Private Forest Guidance Materials: Indigenous Owned and Managed Forests.* 

# Sustainable forest management

# Definition

Traditionally, sustainable forest management referred to maintenance of the productive capacity of forests, or sustained yield. However, the concept has evolved with expanding recognition of the roles that forests play for communities, the environment and the economy. Now, sustainable forest management, in the broadest sense, means management of forests to sustain the full range of environmental, social and economic benefits. However, there are widely differing views about what factors are important in the three sustainability categories and which of those should carry more weight. There are also different expectations about what sustainability means for natural forests compared to plantations, and for forests where people have a strong cultural connection.

# Australia's sustainable forest management framework

Australia's sustainability framework for forests is well established. It includes national and state level policies, regional forest agreements, a framework for criteria and indicators to measure sustainability and independent third-party forest management and chain of custody certification.

Framework element	Specific actions	What does it mean
National policy	National Forest Policy Statement (1992)	Promotes the conservation and sustainable management of forests
	National Forest Industries Plan: Growing a better Australia – a billion trees for jobs and growth (2018)	Promotes the expansion of forestry and forest indus- tries with the right trees in the right place at the right time.
	Regional Forestry Hubs	Eleven Regional Forestry Hubs in strategic locations funded by the Australian Government to support the 'Growing a better Australia' policy.
	National Institute for Forest Products Innovation	Establishment of research centres in partnership with states and industry to drive smarter use of forest resources.
	Regional Forest Agreements	20-year agreements between the federal and state government to support regional approaches to balanc- ing conservation and timber production needs from native forests.
	Australia's Sustainable Forest Management Framework of Criteria and Indicators (2008)	An internationally recognised framework for monitor- ing, measuring and reporting on Australia's sustain- able forest management.
State and Territory frameworks	Policy, legislation, regulation	Each state and territory has policies, legislation and regulation (such as Codes of Practice) in place to ensure sustainable forest management practices.
Certification	Independent, standards-based verification of sustainable management of forests and supply chains	Independent, third-party certification of sustainable forest management and timber manufacturing to internationally recognised standards, which applies to the majority of Australia's production forests.

Table 2: Australia's sustainable forest management framework.

# Measuring sustainability

There are many accepted approaches to the measurement of forest management sustainability. Some apply at a national or state scale; others are suitable at an enterprise or farm scale. Some examples of commonly used and accepted frameworks are discussed below.

# Montreal Process criteria and indicators

Australian governments have adopted the *Montreal Process Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests* (the Montreal Process). The Montreal Process emerged as an initiative of the 1992 Earth Summit in Rio de Janeiro, focused on sustainable management of forests. Sustainable forest management aims to maintain a wide range of forest values into the future. The Montreal Process provides a framework for categorising and measuring these values in an agreed and consistent format. In Australia, the criteria and indicators form the basis of five-yearly State of the Forests reporting that is undertaken at the national level.

# Forests and the circular economy

The core concepts of the circular economy include<sup>10</sup>:

- 1. Designing waste and pollution out of systems of manufacture and production that would be otherwise lost during disposal and recycling.
- Making the most of both consumable and durable components of products through processes like composting and anaerobic digestion (consumables) and maintaining product life spans (durables) through repairing, repurposing and upgrading.

Forests and wood products have a critical role to play in moving towards a circular economy. The core principles align well with the goals of sustainable forest management and products manufactured from wood and wood fibre are very well suited to both biodegradation and repair and repurposing. Importantly, forests are a renewable source of raw materials, particularly for the construction sector, and especially when compared to alternatives such as steel, concrete and bricks.

# Triple bottom line accounting

Triple bottom line accounting seeks to quantify and balance the financial, social and environmental costs and benefits of an enterprise or activity. By measuring the social and environmental and economic impacts (both positive and negative), triple bottom line accounting aims to drive sustainable behaviour.

# Natural capital accounting

Natural capital accounting is based on the concept that every part of the natural environment has a capital value that contributes to the overall value of an enterprise or activity. It is particularly suitable for application to land management scenarios, where soils, water, pastures, livestock, crops, trees and native flora and fauna all have an important role in contributing to the sustainable operation of a primary industry enterprise. This approach accounting to measure, record and manage the natural capital balances across a land management unit in both physical (e.g. soil health) and monetary (revenue and profit) terms. Natural capital accounting is increasingly being seen as a useful tool for agricultural production, including forestry.

# Sustainability at the farm scale

Increasingly, individual farm owners are expected to demonstrate their sustainability credentials so that they can maintain access to markets for the food and fibre they produce. Companies that control supply chains for agricultural commodities, such as large grocery chains, have an expectation that the goods they sell are sourced from sustainably and responsibly managed enterprises in order to meet customer requirements. There are many ways that farming enterprises can demonstrate their sustainability credentials. Incorporation of sustainable forest management is one important tool available to landowners to achieve this.

<sup>10</sup> United Nations Economic Commission for Europe (UNECE) <u>https://unece.org/forests/circularity</u>

### Carbon sequestration by forests

As forests grow they accumulate and store carbon. When forests are harvested, the products that are manufactured (e.g. building timber, furniture, packaging and paper) continue to store that carbon for years, decades and even centuries. Commercial management of forests is one of the most effective tools available to assist in tackling climate change. Appropriate silvicultural management increases forest productivity allowing the accumulation of more carbon in growing trees that will later be stored for the long term in manufactured wood products.

## Carbon markets

Some active forest management strategies are eligible to participate in Australia's Emissions Reduction Fund (ERF), which can provide additional revenue to the forest owner. For eligible forestry activities, forestry practitioners can register a carbon forestry project with the ERF and generate Australian Carbon Credit Units (ACCUs). ACCUs can be retained by the owner to offset their own emissions from other on-farm activities, can be sold through reverse auctions run by the Clean Energy Regulator, or can be sold into the secondary market.

## Carbon market eligibility

There are strict rules that determine whether commercial forests are eligible to participate in the ERF. For plantation forests, these rules include geographic zone limits (depending on the size of the proposed plantation), annual rainfall limits (depending on the location of the plantation), and assessing whether the establishment of plantations will have a negative impact on the surrounding agricultural landscape. Practitioners of commercial native forest management are not able to participate in the ERF, although there are other native vegetation management strategies that are eligible. Australia's Clean Energy Regulator publishes detailed methodologies that explain whether particular types of forest management are eligible and under what conditions.

# Policy, regulation and planning for forestry activities

In Australia, responsibility for land management belongs to the states and territories, and each has a unique approach to the way private forestry is regulated. It is important to understand and comply with the requirements for your location and circumstances.

In some jurisdictions, the requirements for commercial forest management on private land are clearly documented so that landholders can quickly and easily determine how to go about incorporating forestry into their enterprise. In other jurisdictions, the regulatory framework is less well articulated and sometimes not specific to forestry as a land use. There are also differences in what level of government (state or local) is responsible for approving and regulating forestry activities. Australia's State of the Forests Report (2018, Indicator 7.1a) provides a schedule of key legislation relating to the conservation and sustainable management of Australia's forests, for each state and territory<sup>11</sup>. The regulatory framework applying to plantations and native forest management in each State is presented in detail in the accompanying Guidance Materials relevant to each forestry type (Private Forestry Guidance Materials: Farm Forestry and Private

Forestry Guidance Materials: Private Native Forestry). Local government planning schemes should also be consulted for relevant local overlays. The longevity of a forestry project means that there are likely to be multiple changes to policy and regulation during the crop cycle. Advice from forestry professionals, authorities and other experts should always be sought.

#### **Forest Industry Hubs**

Eleven Regional Forestry Hubs have been established as part of the Australian Government's *National Forest Industries Plan – Growing a Better Australia – A Billion Trees for Jobs and Growth.* This policy framework is intended to support industry in its establishment of new forestry plantations to meet Australia's future needs for wood and fibre.

The Hubs are in regions where existing concentrations of timber resources are combined with significant processing and manufacturing operations and export facilities. The Hubs provide strategic planning, technical assessments and analyses to support growth of the forest industry in their regions



Figure 11: Regional Forestry Hub locations. (Source: ABARES, 2022)

<sup>11</sup> https://www.agriculture.gov.au/sites/default/files/abares/forestsaustralia/documents/sofr\_2018/web%20accessible%20pdfs/SOFR\_2018\_Criterion7\_web.pdf accessed on 01/07/22.

# The science of growing forests

It is useful for any practitioner of private forestry to understand the basic scientific principles that underpin how forests grow and behave. This section introduces the principles of silviculture and addresses the basic science behind tree growth and measurement.

# What is silviculture?

Silviculture is the art and science of forest management. It is about managing the establishment (or regeneration), growth, structure and health of forests to achieve defined objectives. Silviculture for planted forests is very different to natural forests. Trees in commercial plantations are usually the same age, species and size. By contrast, natural forests often include trees that are a mix of ages and species, as well as growth habits and sizes. Another key difference is that plantations typically involve much greater levels of intervention, from site preparation through to final harvest, than natural forests. However, the basic principles of silviculture apply to both. To put it most simply, trees in a forest setting compete for the available resources (nutrients, light and water) that support growth. Stands can be manipulated through silvicultural interventions such as thinning and pruning to maximise production of the desired characteristics and to achieve the forest owner's objectives.

# Types of silvicultural regimes and strategies

There is no one-size-fits-all approach to designing a silvicultural regime. As well as considerable differences between plantation and native forest silviculture, there are a large variety of silvicultural regimes that are applied to different types and species of plantations, and different types of native forests. The design of a silvicultural regime needs to reflect the management objectives of the forest owner, the biological needs of the target species (plantations) or forest type (native forests) along with site-specific attributes (soil nutrition, past land-use, rainfall and topography) and market requirements for the timber that is grown (e.g. logs for structural timber manufacture or woodchips for paper, panels and packaging). It may also be adjusted to reflect the financial resources available to the landowner.

# Silvicultural requirements for different types of forestry

In general terms, plantations are simpler than natural forests. A plantation stand is typically a single species, planted at the same time in regular rows for the express purpose of growing timber products for available markets over a predetermined length of time (rotation). Native forest stands usually incorporate one or more tree species in a complex matrix of maturity and inter-tree dominance, with a diverse understorey. Commercial management of native forests involves selection of silvicultural regimes that can maintain or enhance forest health, biodiversity and productivity.

## **Plantation silviculture**

Plantation silviculture encompasses the range of activities from identification and preparation of the site to be planted through to clearfell at the end of the plantation rotation.

A farm's natural environment will dictate to a large degree whether a commercial farm forestry venture is possible, what species to plant and what management is required to optimise productivity and returns.

There are a range of site-specific factors to consider, including:

- soil type, structure and nutrient status
- topography
- distribution and location of land productivity categories
- climate (seasonality, rainfall and temperature)
- water availability
- previous land use
- degraded areas.

Climate and soil conditions are particularly important to understand as this will strongly influence what species can be grown, and where they will grow best and most profitably. Most commercial plantation species grow best on sites with low to moderate slopes, deep soils and sheltered aspects, but can be commercially viable on less optimal sites with the application of more intensive management interventions. It is common for farm forestry plantations, for example, to be situated in areas of the property that are less suitable for other farm uses. This can be an effective design consideration for maximising available land use. However, it is important to recognise that some of the issues that affect crops and pastures may also be limiting for tree growth. For example, low-lying areas that are swampy, subject to regular inundation, frost prone or have shallow or problematic (saline or highly acidic) soils are unlikely to support good tree growth, regardless of management intervention. Similarly, areas that are excessively rocky, steep or isolated by water features might grow healthy trees but will have limited accessibility when it comes time to harvest. Site conditions also influence the management requirements of commercial forest operations. Previous land use can be particularly important to understand as it strongly influences nutrient availability, soil condition and weed competition as well as site establishment requirements.

For more detail about plantation silviculture, refer to the accompanying document Private Forestry Guidance Materials: Farm Forestry.

#### Native forest silviculture

Native forests respond to disturbance in different ways depending on the characteristics of the tree species, the history of management and other environmental and biological factors. In natural forests, the science of silviculture aims to mimic natural disturbance and response dynamics to ensure that harvesting results in healthy, regenerating ecosystems, maintaining the wider range of forest values while allowing for production of timber.

One of the most basic principles of silviculture is that forest trees compete to varying degrees for site resources, including nutrients (soil), water and light. When disturbance occurs and trees are removed or damaged, it provides the opportunity for surrounding trees to respond (grow) and take up those resources. For some forest types that regenerate at a landscape scale, following intense disturbance more-dominant trees in dense, even-aged stands (e.g. mountain ash and silvertop ash - E. sieberi) will outcompete less-dominant trees, which subsequently die - a process known as self-thinning. In other forest types (e.g. mixed hardwood forests in northern New South Wales), a range of species with varying degrees of competitiveness can co-exist until a relatively low-intensity disturbance provides an opportunity to respond, if the remaining trees are healthy enough to do so. This is often the challenge in degraded eucalypt forests where the remnant stand is made up of older, unhealthy trees that are not capable of responding to a growth stimulus. By contrast, cypress regeneration can remain dormant for many decades and still retain viability to generate a growth response to disturbance. The design and selection of the most appropriate silvicultural regime should be guided by:

- The growth and regeneration requirements of the species and forest types present in the stand.
- The current condition of the stand.
- The management objectives of the forest owner.
- The regulatory framework in place for the specific state or territory.
- The condition of the land, forest and water.
- The size of the native forest under management.

For more detail about native forest silviculture, refer to the accompanying document *Private Forestry Guidance Materials: Private Native Forestry.* 

Tree component	Description
Biomass	The total quantity of biological material in the tree above ground
Biological volume	The total volume of stem-wood (less branches and leaves) from the ground surface to the tip of the tree.
Gross merchantable volume	The total volume of stem wood from the stump to the small end diameter (measured over bark or under bark)
Net merchantable volume	Volume of stem wood loaded onto a truck (as either log or woodchip) for delivery to a customer, after log defects have been physically removed.

**Table 3:** Explaining the steps from biomass to merchantable volume.

# Forest growth, yield and productivity

### **Biological and commercial volume**

When focusing on commercial forestry, it is important to understand how trees grow and how harvested trees are converted to logs for timber products manufacturing. Not every part of a tree will end up being turned into a log and sold to a customer. This is the difference between biological and commercial (or merchantable) volume. Marketable logs will typically make up between 70% and 80% of the biomass volume of a mature tree (Jenkin, 2013). The remaining biomass will usually remain on site in the form of harvesting residues, including branches, leaves and unusable log lengths. Figure 11 describes the relationship between biomass and merchantable volume. When foresters measure and estimate growth, yield and productivity for commercial plantations, it is usually expressed in terms of the quantity of log products that will be sold from the plantation.

Table 2 describes the steps from biomass to merchantable volume.



**Figure 12:** A depiction of the aboveground standing biomass components of a tree. (Based on Sylva Systems, 2022)

### Log characteristics

The commercially acceptable form of a log (log dimensions) and the price paid for it is usually dictated by a specification schedule provided by the log purchaser. Log specifications include log length, maximum and minimum diameter, straightness and acceptable levels of log damage and defect. They may also include species, age and whether or not bark is allowed. These factors will be variable for different end uses. The log dimensions required by available markets will determine how the commercial volume is determined. For example, a sawmill processing structural grade softwood timber will generally require plantation pine logs that are more than 25 years old, with a small end diameter range between 15 cm and 50 cm, and which are quite straight with very few dead knots. There will be variations and subsets of log requirements based on species, location and processing facility. A woodchip processor will be able to process smaller diameter and less straight logs of specific species but will insist on the logs being bark free. Pole manufacturers have very strict rules about durable native forest species and the relationship between log length and the diameter of the log at the largest end.

#### **Measurement units**

Wood products are measured and sold using several different units in Australia. The most common units are volume (measured in cubic metres – m3) and green metric tonnes (gmt), which is the weight of the log after it is harvested. Woodchips are measured and sold in bone dry metric tonnes (bdmt) and so a conversion is required between logs harvested and woodchips sold.

### Understanding tree growth

To understand how trees grow it is important to understand the concept of increment and how that is measured and expressed. There are two important metrics, both of which are usually measured as m<sup>3</sup>/ha/ year:

- Current Annual Increment (CAI): the amount of growth that a tree exhibits in a specific growing year.
- Mean Annual Increment (MAI): the average annual growth of the plantation at a specific age.

MAI can only be accurately measured when a stand is harvested. Commercial plantation stands are almost always a single species and planted at a known date whereas native forest stands often comprise multiple species with different growth characteristics and trees of multiple ages that can often only be estimated. Estimating CAI and MAI is much easier for plantations than it is for native forests, even after harvesting.

### Estimating growth, yield and productivity

The most accurate system for estimating growth, yield and productivity is to physically measure the forest (termed a forest inventory) and then apply yield models (to estimate the available log products at the time of measurement) and growth models (statistical models that estimate future growth and future log products).

A key factor in the reliability of a forest inventory is how well the species or forest type and silvicultural regime has been studied. For example, reliable estimates can be made for long-rotation radiata pine plantations grown for sawlog in southern Australia and short-rotation Tasmanian blue gum and shining gum plantations producing pulpwood. However, estimates for native forests and untested plantation species or silvicultural regimes are typically much less reliable.

Yield is usually expressed as volume (m<sup>3</sup>/ha) of commercial log products to be harvested at certain points in time and is presented in yield tables. Yield tables are used as an input to financial analysis, to compare the potential productivity with other sites and to analyse actual production.

Element	Acronym	Description	Units
Area statements		Area statements for a specific stand of trees	
Title areas		Legal description of a section of land	Hectares (ha)
Gross area		Total area developed as a plantation	Hectares (ha)
Net planted area	NPA	Area actually planted to trees	Hectares (ha)
Diameter at breast height	DBH	Diameter at breast height = 1.3m (breast height above the ground	Millimetres (mm) or centimetres (cm)
Diameter at breast height over bark	DBHUB	Diameter at breast height under bark	Millimetres (mm) or centimetres (cm)
Basal area	ВА	<ul> <li>Basal area is the cross-sectional area of a tree stem at: 1.3m height</li> <li>BA assumes a circular stem (which in realisty may not be the case. BA is estimated based on DBH.</li> </ul>	Square metres (m <sup>2</sup> ), usually square metres per hectare (m <sup>2</sup> /ha).
Basal area under bark	BAUB	Basal area under bark	Square metres (m <sup>2</sup> ), usually square metres per hectare (m <sup>2</sup> /ha).
Basal area over bark	BAOB	Basal area over bark	Square metres (m <sup>2</sup> ), usually square metres per hectare (m <sup>2</sup> /ha).
Predominant height		A number of techniques are used to estimate predominant height; e.g. height of largest DBHOB tree in each row of a 4 row permanent sample plot (PSP) used for growth assessment.	Usually in metres (m).
Growth rates / increments		Measures of forest growth and productivity	
Mean annual increment	MAI	<ul> <li>Mean annual increment is the total volumne at a point in time divided by age (number of years) at that time.</li> <li>It is an estimated average annual volume growth at that age.</li> </ul>	Expressed as cubic metres per hectare per year (m³/ha/y)
Current annual increment	CAI	Current annual increment is actual increment for each year calculated as difference in volume between year n and year n+1	Expressed as cubic metres per hectare per year (m³/ha/y)

**Table 4:** Forest description – terms, concepts and measurements.

#### Forest area

Forest area is a key input to estimating log yields. There are three measures of area used in forestry: net area, gross area and title area. Net area is the area comprising commercial trees which will be available for harvest, excluding factors such as failed areas, environmental exclusions and infrastructure. Gross area includes the net area, roads, firebreaks, failed areas, dams and waterways as well as physical features which cannot be planted (e.g. rocks, natural vegetation and steep areas). Title area is the legal description of a section of land.

The yield of a forest is calculated by multiplying the net planted area by the applicable volume estimate. Plantation productivity and volume estimates vary

# **Forestry as a business**

according to site conditions. To improve the accuracy of yield predictions, net planted area can be split into smaller plantation stands of similar site quality and attributed to a specific productivity class.

# Forest description

A range of specific terms, concepts and measurements are used to describe a forest and are useful to understand. Table 3 provides a summary.

This section provides a guide to the questions you should be asking and who you should be talking to when you are looking to undertake a commercial forestry operation. Every forest is different, rules for harvesting vary between state and local government authorities, and markets in your region may have different requirements to other regions. It is strongly recommended that throughout the life of your forestry operations, particularly when planning for harvest, you seek expert advice from an experienced forestry professional.

# Planning for small-scale forestry

Like any business activity, effective planning is essential for delivering good forestry and financial outcomes for your enterprise. The potentially long timeframes involved emphasise the importance of planning. Good planning enables you to clearly articulate your objectives for the forestry venture and to understand how it will work with other on-farm activities. There are two important levels of planning of consider. The first is the forest management plan, which outlines the long-term intent of the forest owner. The second is operational planning, which provides detail about how specific activities will be undertaken at a point in time. In Australia, operational plans are often a legal requirement and must be completed and approved before any significant activities, such as harvesting, burning or road construction can occur. This section provides a high level overview of the planning process. For more detail regarding planning for different types of forestry, refer to the accompanying documents Private Forestry Guidance Materials: Farm Forestry and Private Forestry Guidance Materials: Private Native Forestry.

# Forest management planning

The general requirements for forest management planning are consistent for all types of forestry. While there is no fixed format for a forest management plan, a good plan will typically incorporate the following elements:

- 1. Definition of the forest owner's objectives for management of the forest.
- 2. A detailed description of the forest and its condition.
- 3. Identification and documentation of management options and approaches noting where there is flexibility to align with both markets and other farming activities.
- 4. Scheduling of forest management activities.
- 5. A process for evaluation, review and refinement.

Depending on the scale and complexity of the proposed forestry enterprise, growers will have varying degrees of comfort about their ability to develop a fit-for-purpose forest management plan. However, if there is any doubt, or if there is a third party requirement for a plan that meets particular requirements (e.g. certification) then it is sensible to consider engaging the services of an experienced forestry professional to assist.

# **Operational planning**

Forestry operational plans document how activities are to be done on the ground. They are an important tool for instructing contractors and other parties about the standards, conditions and specifications (or prescriptions) for all activity within the operational area. Some operational plans are legally required, for example harvesting and burning plans. Their format and content may also be subject to specific requirements by regulatory bodies. The level of detail, accuracy and quality of communication within these plans will influence operational success.

In most states and territories, formal or informal codes of practice are in place that provide direction or guidance about how private forest operations are to be planned and undertaken. It is important that private forest practitioners understand any obligations that must be met in their relevant jurisdiction. Table 4 presents a summary of some of the typical items addressed in a code of practice.

Topic / activity	Issues addressed
Design and planning	Operational harvesting plans
Licensing and control	Relevant legal, policy and forest certification requirements
Safety	Workplace Health and Safety (WHS) Codes of Practice, legal requirements, emergency communication and evacuation
Fire precautions	Thresholds for specialist conditions and minimum standards
Site values and protected features	Flora and fauna habitat, ecology, landscape, cultural heritage, archaeology, geomorphology
Marking of harvest area items	Marking system for boundaries, access, water courses, trees (removal/ retention), hazards
Wet weather	Minimum operating prescriptions to avoid soil disturbance and water pollution
Roads and crossings	Design, use and maintenance of roads, bridges, crossings
Tree felling, processing and extraction	Standard operating procedures and specifications
Snig tracks	Design, use and maintenance
Loading, landings / log dumps	Design, use and maintenance
Water quality	Minimum standards and specifications
Soil and drainage	Minimum standards and specifications
Steep country	Thresholds for specialist conditions and minimum standards
Designated locations	First aid, fuel storage, waste collection, vehicle parking, emergency and evacuation points.
Site productivity, rehabilitation and regeneration	Minimum standards and specifications
Declarations and acknowledgements	Forest owner, contractors, site visitors, regulators

 Table 5: Typical forestry code of practice contents and requirements.

# Workplace Health and Safety

Forestry operations, especially harvesting, present a heightened safety risk. Where manual chainsaw felling of trees is proposed or where there are steep or difficult conditions, this risk is exacerbated. Specific skills are required to undertake forestry activities and landowners are responsible for ensuring that people who work on their properties are appropriately trained for the activity they are undertaking. In most Australian jurisdictions, there are specific workplace health and safety rules in place regarding forestry activities. In all states and territories there are obligations on forest owners, contractors and other parties to ensure that the workplace and any operations are undertaken safely and that any risks of injury or death are identified and managed by those parties. Planning for safe operations is critical.

# Forest products and markets

Forests are grown and managed for a wide range of products. The most common of these is logs for solid wood products and fibre (woodchips) for paper, packaging, panels and boards. Forests also produce a range of other non-timber products, such as honey, along with critical environmental services including carbon sequestration, flora and fauna habitat, potable water and heathy soils. In many parts of Australia forests play an important cultural role for both Indigenous and non-Indigenous communities.

# Commercial uses of wood and wood properties

If you are managing trees for commercial timber production, it is useful to understand the attributes of trees that are important to the market, as these will define the value of commercially grown timber into relevant markets. The realisation of value from timber products will also depend on the location of the forest relative to markets and the management objectives of the forest owner.

Wood properties vary considerably between hardwoods (flowering plant such as eucalypts) and softwoods (conifers such as radiata pine and cypress). Other factors that influence wood properties include the species, the age of the trees, their form (shape), silvicultural management and the growing conditions. Therefore, a pine log produced from a thinning operation at age 15 or 20 is not suitable to be sawn into timber that can be used in house construction and is more suited to the manufacture of fence palings, posts (treated), paper, cardboard or panels (such as medium density fibreboard, chipboard and flooring). Similarly, plantation grown eucalyptus logs on short rotations cannot substitute for native forest eucalyptus sawlogs. Durable native forest sawlogs such as spotted gum are suitable for products with in-service durability requirements, such as poles, floors, external cladding and decking.

The wood properties that are important to timber processors will vary depending on the end product. As an example, some eucalypt species are preferred as pulplogs because they have short fibres, high fibre yield and light colour, which means that are highly suited to manufacture of copy paper using efficient manufacturing systems. Softwood sawlogs for frames and trusses, by contrast, are more valued for wood properties such as density and stiffness which allows for weight-bearing structural application.

Depending on available markets and how close the forest is to them, as well as the wood properties of the species present, a wide range of log product types can be harvested from private forests. Examples of the types of log products which are typically harvested from different types of forests are presented in Table 5.

Forest type	Products
Hardwood plantation (short rotation)	Pulplogs and woodchip
Hardwood plantation (long rotation)	Pulplogs and woodchip, sawlogs, industrial veneer logs, appearance veneer logs
Softwood plantations	Pulplogs and woodchip, preservation logs, non-structural sawlogs (e.g. landscaping, fencing) structural sawlogs, industrial veneer logs
Native forest (Queensland and New South Wales)	Poles, piles, girders, sawlogs, appearance grade furniture and veneer, agricultural and domestic fencing and landscape
Native forests (Tasmania)	Sawlogs, industrial veneer logs, appearance veneer logs, pulplogs

**Table 6:** Examples of log products for different private forest types in Australia.

The examples in Table 5 relate to products and species which service larger scale and commodity markets for log products. There are also niche and smaller scale markets, particularly for rare and high value species, sometimes referred to as speciality timbers. For example, Tasmania has a well-established market for speciality timbers such as blackwood, Huon pine and celery top pine, which are sourced in much smaller volumes for high value end products such as designer furniture and veneers for feature use in architectural design. About 45% of all wood produced from Australian forests is categorised as high quality logs (sawlogs, veneer logs, poles, piles and girders). The remaining 55% is considered pulplogs. However, the percentages vary considerably between different forest types. Figure 12 presents a schematic of the economic uses of Australian logs.



Figure 13: The main economic products from harvested timber in Australia.

### Other forest products and values

While logs have historically been the most common commercial products harvested, native forests provide many other types of products and values that continue to be in demand. There is significant potential for non-traditional products and services that continue to be explored and developed.

#### Traditional and cultural products and values

There is a long and continuing history of Traditional Owners' involvement in the conventional management of native forests for timber harvesting and processing in Australia. Just as importantly, private and leasehold native forest areas are a significant and continuing source of traditional and cultural products and values for Indigenous people. This includes cultural values, sacred places and story places as well as protection of certain species that have specific cultural value or significance for Indigenous people from that Country. It also includes traditional materials and foods provided from Country.

#### Other non-wood products and values

Private forests provide a range of non-wood products such as pollen for honey production, livestock grazing and leafy material for distillation of botanical oils. In addition, private forests contribute significantly at the local, regional and national level to the provision of a broad range of ecosystem services, including biodiversity conservation and ecological health, watershed protection and management, and carbon sequestration and storage. Further, private forests may be valued for the provision of recreation values.

Non-wood products like honey and ti-tree (Melaleuca) can be managed for the generation of revenue. Ecosystem services may also have an economic value. For example, in some Australian states it is possible to participate in environmental services markets related to vegetation offsets and biodiversity credits. Similarly, there are opportunities to participate in Australia's Emissions Reduction Fund to generate Australian Carbon Credit Units (ACCUs) through projects which meet the requirements of the scheme.

### The forest and wood products supply chain

### Changing dynamics

Supply chains for forest products have expanded geographically over recent years. At the same time timber processing has rationalised. There are many reasons for this. For commodity plantation log products, the need for scale and efficiency are key drivers. For native forest log products, the drastic reduction in availability of logs from public native forests has meant that local forest supplies have contracted, making it difficult for smaller regional hardwood processors to access timber resources. Other factors across the sector include the impact of fires over the past decade as well as supply chain disruptions as a consequence of COVID-19. Forest supply chains were traditionally limited to relatively short distances between the forest and the processor. However, logs are now sourced from much larger catchments including neighbouring regions, interstate and other countries.

This situation creates both challenges and opportunities for private forestry practitioners. The market is creating demand for more privately grown timber, yet additional logistics costs can put pressure on returns to growers. If a forest is located beyond the viable economic haul distance to market, a grower may have to significantly discount the sale price and range of products compared to a forest that is able to maximise full value and volume recovery because it is close to multiple buyers in a diverse and competitive market. Markets are generally in larger population centres where volume of raw material, skilled labour, technology support services and viable centres for distribution of finished goods underpin economies of scale for manufacturing.

## Describing the forest products supply chain



Figure 14: Three sectors in the native forest and wood products industry.

The forest and wood products industry has three main sectors (see Figure 13). Each is supported by transport networks for goods and services into and out of the supply chain.

Forestry supply chains vary considerably between regions in Australia. That variation is influenced by forest type and species, availability of markets and market requirements. In East Arnhem (Northern Territory), for example, native forest log products are used locally for the construction of houses and buildings for Indigenous communities. In south-east Queensland, durable native forest timber species are harvested and transported to regional and metropolitan based processing locations for solid wood products including sawn timber, poles and girders. Short-rotation hardwood plantations in Victoria and Western Australia are harvested and either transported in log form to be chipped at centralised facilities close to ports, or chipped in the forest and transported to stockpiles at ports. In central and southern New South Wales, heavily concentrated markets for softwood logs to be used in both woodchip and sawn timber form mean that growers have access to a full range of markets with economic haulage distance and with relatively high transport efficiency. Regardless of these variations, there are a number of fundamental supply chain elements that are common in all instances. They include:

- forest management (silviculture)
- harvesting
- log and woodchip production
- transport to processing or export facilities
- processing of wood products
- distribution of processed wood products to downstream markets (including further manufacturing).

### Forest products markets

An enormous variety of markets are serviced by forest products. Timber products range from traditional firewood, fencing timbers and rough building materials, to sawn timber, engineered and reconstituted wood products, paper, packaging, fabric and biofuels. Global markets are increasingly turning to the bioeconomy to provide alternatives for non-renewable or fossil fuelbased resources. Emerging and growing markets for wood fibre include fabrics, pellets and liquid biofuels, and new products are constantly emerging.

The availability of processing or export facilities within economic transport distance is a significant factor in the success of a forestry venture and influences all aspects of forest management. Trees planted in established timber-growing regions are more likely to have a well-defined path to market as well as ready access to specialist contractors and professional advice. The proximity of markets to the forest also determines haulage costs and profitability. Obtaining local professional advice about marketing options is strongly recommended.

It is also worth considering that forest management operations are more efficient in larger, more-consolidated forest areas. Economies of scale influence the willingness of specialist contractors to accept work in farm plantations or private native forests, as well as the cost of operations. For a small, isolated forest, the cost of transporting specialist equipment can outweigh returns, which severely constrains the production and marketing options available to a smaller forestry enterprise.

# Private forestry operations

# Pricing and value determination

How much money you earn from harvesting your trees will depend on a range of factors. These might include:

- what species is being harvested
- how old the trees are
- what volume of logs is present
- what log products are being sold
- · the cost and complexity of harvest
- the distance from your forest to the customer
- what point along the supply chain you will be selling the logs.

# **Price points**

The net price you receive for your trees at harvest is usually referred to as the stumpage price. This is the value you receive for your logs once the costs of planning, road works, harvesting, hauling and any other professional advisory services are accounted for. The price paid by a customer receiving the harvested products is usually referred to as a delivered price. Usually, the delivered price will be calculated at the mill door (for domestic processing) or at wharf gate (for exported products).

In most cases, smaller private growers will sell their logs prior to harvest (on the stump). That means that the purchaser of the logs is paying for (and taking the risk on) all costs associated with harvesting and delivering the wood and paying the forest owner for the unharvested value of the trees. This is usually a low-risk option for most growers. However, some growers may feel they have the capability and confidence to engage contractors themselves. Alternatively, there may be professional service providers that you can engage on an agency basis for a fee to manage the sale, harvest and delivery of your logs to a customer. Typically, these agents will work for a set fee calculated on a value per cubic metre or for an agreed percentage of the delivered price. Whatever approach you choose, it is worthwhile testing the market to understand what options are available to maximise your net returns within the levels of risk you are comfortable to accept.

# Estimating what will be harvested

It is important that you are provided with a reliable estimate of what volume of logs will be harvested and what log products will be produced, along with a calculation of the estimated value you receive. This estimate is usually made based on a pre-harvest inventory. An estimate is made by measuring a sample of trees, identifying the harvest area and then calculating the volume and value of logs to be harvested. You should then be provided with an ongoing record of what is harvested and sold that you can use to reconcile actual volume and value against the estimate that was provided and what you observe.

# Calculating log value

Small-scale private forest growers are often concerned whether they are receiving a fair value for their logs at harvest. When you are considering harvesting and selling your forest it is useful to understand how log value is calculated.

#### **Prices**

The delivered value of a log (the price paid by the processor or exporter for logs that arrive on truck) will vary depending on the species being harvested, the end use of the log, the nature of the local market and the level of demand. The stumpage price will be the delivered price less the costs of getting the logs to the point of sale.

### Costs

The typical costs associated with harvesting and selling logs include:

Activity	Cost units
Harvest and planning approvals	Fixed
Road and landing construction and maintenance	Unit (\$/km) or by quote
Harvesting supervision	Unit (\$/hour or \$/m3)
Harvesting	Unit (\$/m3)
Loading	Unit (\$/m3)
Haulage	Unit (cents/m3/km)
Sales marketing and administration	Unit (\$/hour or \$/m3)

## Calculating the stumpage

An important principle to address when calculating stumpage values is to adjust for the units in use, as well as variations for different forest products. For example, woodchips are usually sold in bone dry metric tonnes. Therefore, it is necessary to make a conversion to determine what that value means for a log sold in cubic metres or green tonnes. As another example, if multiple products are being sold from the same operation, they will probably be sold to different destinations and for different delivered prices. Adjustments need to be made for the cost of haulage over different distances and for different price points. The example in Table 6 assumes that the forest area is 50 hectares and that both pulplogs and small sawlogs will be harvested from the site and transported to different locations. Results are presented for stumpage value by area, by volume and in total.

Harvest Variables					
Harvest area (ha)	50	Harvest cost (\$/m³)	25	Haulage cost (\$/m³/km)	0.15
Planning and levies (\$)	10,000	Roads and landings (\$/m³)	1	Marketing & Supervision (\$/m³)	6

Product	Standing volume (m³/ha)	Haul distance (km)
Large sawlog	80	49
Medium sawlog	100	49
Small sawlog	20	73
Perservation and posts	30	15
Pulplog	70	49
Total	300	

Item	\$/m³	\$/ha	\$ total
Planning, levies and advice	0.67	200	10,000
Marketing & supervision	6.00	1,800	90,000
Roads and landings	1.00	300	15,000
Harvest	25.00	7,500	375,000
Haulage pulplog	7.35	515	25,725
Haulage pres and posts	2.25	68	3,375
Haulage small sawlog	10.95	219	10,950
Haulage medium sawlog	7.35	735	36,750
Haulage large sawlog	7.35	588	29,400
Total cost	39.75	11,924	596,200

Revenue

Item	\$/m <sup>3</sup>	\$/ha	\$ total
Large sawlog	150	12,000	600,000
Medium sawlog	125	12,500	625,000
Small sawlog	90	1,800	90,000
Perservation and posts	115	3,450	172,500
Pulplog	60	4,200	210,000
Total Revenue	113	33,950	1,697,500
Net stumpage (profit)	73	22,026	1,101,300

**Table 7:** Example of a stumpage calculation for sample radiata pine clearfell harvesting operation.

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## Engagement of service providers

Depending on the complexity of the forest and the owner's objectives, forest planning and operational activities can be improved with input from specialist service providers. This may include professional advisers to measure, analyse and recommend management strategies, manage planning applications, support negotiations with customers and contractors, and with the harvest and delivery of products. Other specialists are usually involved in a shared capacity with local government, neighbours and community groups in risk and emergency response such as control of pests, disease and fire. Contractors are commonly engaged to undertake forest management and maintenance work (such as slashing firebreaks before summer and access road maintenance) as well as harvesting and haulage utilising specialist equipment.

### Professional service providers

Professional service providers, such as experienced forestry consultants and third party property managers, can provide a suite of support and advisory services, which can range from preliminary forest assessment through to preparation of harvesting plans and even management of harvest, haulage and marketing operations. Forest owners are encouraged to consider what professional services are available and how they can help ensure forest management objectives are achieved. Local and state government agencies and industry and professional associations can assist in locating appropriate providers.

### **Operational service providers**

It is usual practice to engage contractors to undertake a range of operational activities such as road construction and maintenance, harvesting and haulage. The relationship between the forest owner and contractors is important because it can mean the difference between achieving a good or a poor outcome. An important fundamental in the relationship is the contract for services, covered in more detail below, which should clearly stipulate the expectations of all parties with respect to costs, operational activities to be undertaken, required outcomes and responsibilities.

#### Sales arrangements

The point along the supply chain where logs and forest products are sold is important to determine early in the process. It has important implications for where profit is distributed, which parties carry risk and how much active supervision of operations is required by the forest owner. Regardless of the sales point, it is essential that you have a written contract that clearly identifies responsibility for factors such as:

- Responsibility for planning and approvals.
- Responsibility for safety management and specification of liability.
- Harvest and haul contractor details and expectations of performance and behaviour.
- Insurance requirements for all parties.
- How the harvested wood will be measured and how the measurement communicated to you (e.g. with log dockets or a similar system).
- How and when you will be paid for your logs.
- How contracted parties will be paid (e.g. unit fees, percentage of stumpage, lump sum).
- Whether payment is on a lump sum unconditional basis, or based on logs harvested – usually calculated by weight (tonnes) or volume (cubic metres).
- Clear contractual responsibility for all costs.
- What condition the site is to be left in following the harvesting event.

#### Stumpage sales

If you are undertaking a stumpage sale, your only direct contractual relationship will be with the log buyer. The log buyer could be the harvesting contractor, an independent log buyer or a timber processor. Under a stumpage sales arrangement, risk and responsibility is heavily weighted towards the log purchaser and this should be clear in the contractual agreement.

#### Agency sales

It may be possible to engage the services of a thirdparty agent that can manage some or all of the aspects of planning and supervising the harvesting process, engaging the contractors and establishing sales arrangements with customers on your behalf. In an agency sales arrangement, risk and responsibility is distributed somewhat more evenly between the agent and the forest owner and, as above, should be clear in the contractual agreement.

### On-truck and delivered sales

Dealing directly with a timber processing company for log sales and direct engagement of harvest and haulage contractors is generally only undertaken by growers with considerable experience and large areas of forest. In this instance, the forest owner takes on the majority of risk and responsibility, including for regulatory compliance. It is very important that the forest owner has a clear understanding of their legal and contractual requirements.

# **Operational risk management**

## Contractual arrangements

Contractual agreements are the most important tool for managing risk in forestry operations. As outlined above, contracts should provide absolute clarity about which parties are engaged and responsible for which activities. In many cases, a log purchaser or agent will provide a template contract for the activity. It is essential that you take legal advice on the contract to ensure that your interests are clearly addressed. Under delivered sales arrangements, forest owners are responsible for contracts and this should also be undertaken with legal advice.

#### Insurances

Contracts must clearly specify which parties must hold insurance, what insurances need to be held and what value should be insured. It is usual for all parties to hold public liability insurance to an agreed level. Any party that uses employees to undertake activities must also hold workers compensation insurance. Where a party is involved in providing professional or expert advice, it is normal for them to hold professional indemnity insurance. A certificate of currency must be provided which specifies what the insurance is for, what value is insured, what entities are insured and when the insurance expires. Your own insurer may require to be notified about the insurance details of other parties.

# Private forestry financial analysis

This section introduces the principles and options for financial analysis for private forestry enterprises. It is important to note that for many private forestry practitioners, forestry is one of a number of integrated land uses on a property. Financial analysis may need to include assessment of all farming activities. The discussion in this section addresses only the forestry component. There are also variations between different types of and different approaches to forest management which have implications for financial analysis. The accompanying documents Private Forestry Guidance Materials: Farm Forestry and Private Forestry Guidance Materials: Private Native Forestry provide specific financial analysis examples for private forestry and plantations.

# Financial analysis models

### Discounted cash flow and net present value

The most common approach adopted for financial analysis in forestry is discounted cash flow (DCF) analysis to calculate net present value (NPV) and internal rate of return (IRR). Using this approach, a cash flow is developed for the operation or enterprise for a predetermined time period. Future cash flows are discounted to adjust for the fact that a dollar value earned or expended today is worth more than the same dollar in the future, because of inflation. The discount rate is usually developed based on a range of factors including estimated inflation and risk.

## Simple discounted cash flows

In the most basic example, a cashflow will recognise operational cost inputs and sales revenues for a forestry activity from now until an agreed point in the future, typically the point of harvest. The NPV and IRR can be calculated for a single hectare and extrapolated across the whole forest.

## Complex discounted cash flows

Private native forest management is often multi-faceted. Costs may include the opportunity cost of choosing forestry over an alternative land use, in addition to operational costs. If the forest owner is engaged in rehabilitation and timber stand improvement, there may be ongoing costs (and revenues) that need to be accounted for. Benefits may include environmental services or enhanced productivity for integrated land uses in silvo-pastoral systems, in addition to revenue from log sales. Simple cashflows will address only the operational aspects of preparing for and undertaking forest management for log production and some enterprises will want to actively consider the broader range of costs and returns. In some cases, the returns may be intangible (e.g. ecological health improvements) and so an approach to valuing those must be developed.

**Private Forestry Guidance Materials** 

## Cost-benefit analysis

Cost-benefit analysis (CBA) is a specific technique used to capture direct and indirect, as well as intangible or difficult to quantify, costs and benefits to determine the overall value of progressing with a project. It is particularly useful in assessing projects and activities that involve complex natural systems or enterprises where there is a complex interface between various integrated or alternative actions, for example where forestry is integrated with farming. Cost-benefit analysis can be a useful tool to assist in determining the most optimal mix of land uses on a property or to compare different potential land uses at a particular location on a property.

## **Operational cash flows**

For some private forest owners, the primary financial motivation for harvesting will be generation of cash without consideration of historic costs or management activities. It is still important to understand whether a specific harvest event will be profitable or not, which requires a simple operational cash flow analysis that compares estimated revenues with estimated costs. This is commonly used for native forest operations.

# Information requirements

Reliable financial analysis and forecasting for private native forestry operations requires good quality information inputs about the forest itself, the proposed operations and likely sales.

### **Forest description**

The forest description provides the basic starting point for undertaking any financial analysis. As a minimum, this would include a detailed map of the property, including the commercial forest area as well as any exclusions, roads and other important features.

Typically, the map would be supported by an assessment of the forest, including an estimate of the standing volume and growth rates. The quality of this estimate can range from simple observation by an expert through to a full inventory and growth modelling. The amount of detail required will depend on the forest owner's objectives and budget but more detail will result in better quality analysis and decision making. A detailed forest inventory will provide quality information about the amount of harvestable wood present and what log products can be harvested.

## Infrastructure description

The presence and condition of forest management infrastructure, particularly roads, tracks and landings, is important to document. Road construction and maintenance costs represent the largest ongoing cost item for native forest management, as well as one of the biggest one-off cost items at harvest time.

#### Markets

A key element of financial analysis is to understand the available markets for log products. Important questions to answer include:

- Where are customers located (distance to market influences the net price received for logs)?
- What products can be sold (e.g. in some regions there is no market for pulplogs)?
- What are the typical prices for those products (stumpage or delivered prices)?
- What is the current and future level of demand for log products?

It may not be possible to answer these questions accurately ahead of entering a sales arrangement, but it is a good idea to develop an appreciation of these factors through enquiry to log purchasers, other forest owners or professional service providers.

### Harvest and haul costs

As with questions about markets, it may not be possible to accurately determine harvest and haul costs before entering a contract. However, it is important to get a feel for what they are likely to be based on similar enquiries.

### Forest management costs

There are a range of ongoing forest management costs that should be accounted for. These include:

- road construction and maintenance
- fire prevention and management
- fencing
- · weed and pest animal control
- professional forest management and planning advice
- insurances.

# Next steps – getting started

The Private Forestry Guidance Material series provides a large amount of information aimed at improving the knowledge base of rural landowners and encourage those who are interested to consider small-scale forestry as a viable on-farm enterprise. It is intended to break down knowledge barriers that may prevent some landowners from seriously considering forestry. If the Guidance Material has created enough interest for you to seriously consider establishing plantations or actively managing your native forests, the question is what next?

## > Define your objectives

The first step is to understand and clearly document your reasons for getting into forestry and what you hope to get out of it – your objectives. This will be different for every landowner and every situation. It could be that you want to establish a standalone plantation forestry enterprise or include plantations as a commercial element of an integrated farming operation. You may be focused on environmental and on-farm benefits, with the aim of also generating future revenue as a secondary benefit. For some landowners, the objective may be to generate carbon credits to offset on-farm emissions or you may be looking to improve the quality and productivity of a patch of native forest. Whatever your objectives and motivations are, it is important to articulate and document them clearly as your starting point.

## > Work out your information needs

With what you know about your own property and the local wood products industry, and with the help of these Guidance Materials, you will probably already be equipped with a lot of information to assist in working out how to progress. But you will probably require more information. Work out and document what you know already and what other information you require to make an informed and financially sensible decision.

## > Undertake your own research

There is a large body of information available about small-scale private forestry that will be relevant to your specific situation. It is useful to consult Forest & Wood Products Australia's online database, talk to local contractors and timber processors, look at what other private forestry practitioners are doing in your area and attend field days. There are also organisations such as the regional forestry hubs, industry organisations and government agencies with dedicated staff and useful online resources which are available.

### > Consult an expert

Even if you are an experienced private forestry practitioner, there is value in consulting expert professional forestry advisers about any aspects of the proposed forestry venture that you have concerns or questions about. A small investment in professional advice could be the difference between failure and success. It is also important that you consult your lawyer and your accountant to determine any business or personal implications of starting a forestry business.

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