



# Australian forest profiles

## Plantations

In many ways, plantation forests are not much different to most agricultural crops, although they take longer to mature. They are sometimes established solely to provide environmental benefits, such as salinity or erosion control. In this profile, however, 'plantation forest' refers to plantations established mainly to produce a commercial product, wood.

Plantation forests are composed of softwood or hardwood tree species. Softwood species are cone-bearing trees with needle-like foliage (conifers); they mostly produce relatively soft, light-coloured wood. Hardwoods are angiosperms; they have flowers and broad leaves and their wood is generally dense, hard, strong and richly coloured.

Most softwood plantations in Australia consist of exotic (non-native) species, especially radiata pine (*Pinus radiata*). The one native softwood species used in plantation forestry, hoop pine, is described later in this profile. Most hardwood plantations in Australia are made up of native eucalypts.

### Why grow plantations?

Plantations provide an economically viable and environmentally sustainable log resource that can be used to make timber products. They can also rehabilitate land, improve water quality and meet other environmental and economic objectives.

Australian plantations produce about two-thirds of the nation's log supply. They dominate the economically important forestry and forest products industries, which generate about \$19 billion per year in turnover and employ an estimated 120 000 people. On average, each Australian uses about one cubic metre of timber products per year, much of it derived from plantations.

### The history of plantations in Australia

Australia's first plantations were established in the 1870s, prompted by the need for timber to support settlement in regions that had little useful local supply. The early mining industry also used substantial amounts of timber and left large areas of land denuded and in need of reforestation.

Many exotic and native species were tested to identify those best suited to the climate and available sites. Radiata pine was first planted for forestry in 1876 at Bundaleer, South Australia, and in 1880 at Macedon, Victoria. By 1900, it was evident that this species was suitable for plantation forestry in many parts



Shining gum (*Eucalyptus nitens*) plantation, New South Wales.

of southern Australia. Over time, other conifers were tested for their suitability in other regions, including the tropics and sub-tropics, and successful species were planted on a larger scale from the 1920s onwards.

Eucalypts were also tried; small areas of eucalypt plantation dating from the late 19th and early 20th centuries still exist today. The establishment of large areas of eucalypt plantations, however, didn't start until the 1990s.

In 1997, the Australian, state and territory governments and the plantation timber-growing and processing industry formed a strategic partnership called *Plantations for Australia: The 2020 Vision*. The aim of the partnership is to increase the plantation estate to 3 million hectares by 2020. In the ten years to 2007, the plantation area increased by about 50% at an average annual rate of nearly 77 000 hectares, due mainly to private investment.



Historic place, the first Conservator's hut, Bundaleer, South Australia.

## Area

Today, forest plantations cover about 1.90 million hectares, which is just more than 1% of Australia’s total forest estate and a relatively small area compared to other crops like wheat and barley (Table 1). About 1.0 million hectares (53% of the total plantation estate) is softwoods and 883 000 hectares (46%) is hardwoods.

Victoria and Western Australia each has around 21% of the nation’s total plantation forest estate. New South Wales has 19%, followed by Tasmania with 14% and Queensland with 13% (Table 2 and Figure 1).

Table 1: Australia’s major crops by area

Crop	Area (million hectares)
Wheat	12.3
Horticulture	5.7
Barley	4.2
Timber plantations	1.90
Canola	1.24
Lupins	0.93
Oats	0.92
Sorghum	0.75

Notes: Agricultural crop areas are the five-year averages shown in *Australian Crop Report 2007* (Australian Bureau of Agricultural and Resource Economics). The horticulture area comes from Bureau of Rural Sciences land use data and includes fruit and nut trees, vineyards, vegetables and flowers. The timber plantation area is for 2007.

Table 2: Total area of plantation forest by state and territory (hectares)

Plantations	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Australia
Hardwood (mostly eucalypts)	0	70 616	23 689	49 446	54 974	199 068	190 986	294 714	883 494
Softwood (mostly pines)	9 500	285 702	2 239	188 751	122 871	75 005	219 426	106 662	1 010 155
Total*	9 500	359 139	25 928	240 305	178 301	274 173	411 876	403 681	1 902 903

\* Includes mixed hardwood and softwoods and plantations for which species were not reported.

Figure 1: Plantation forest distribution

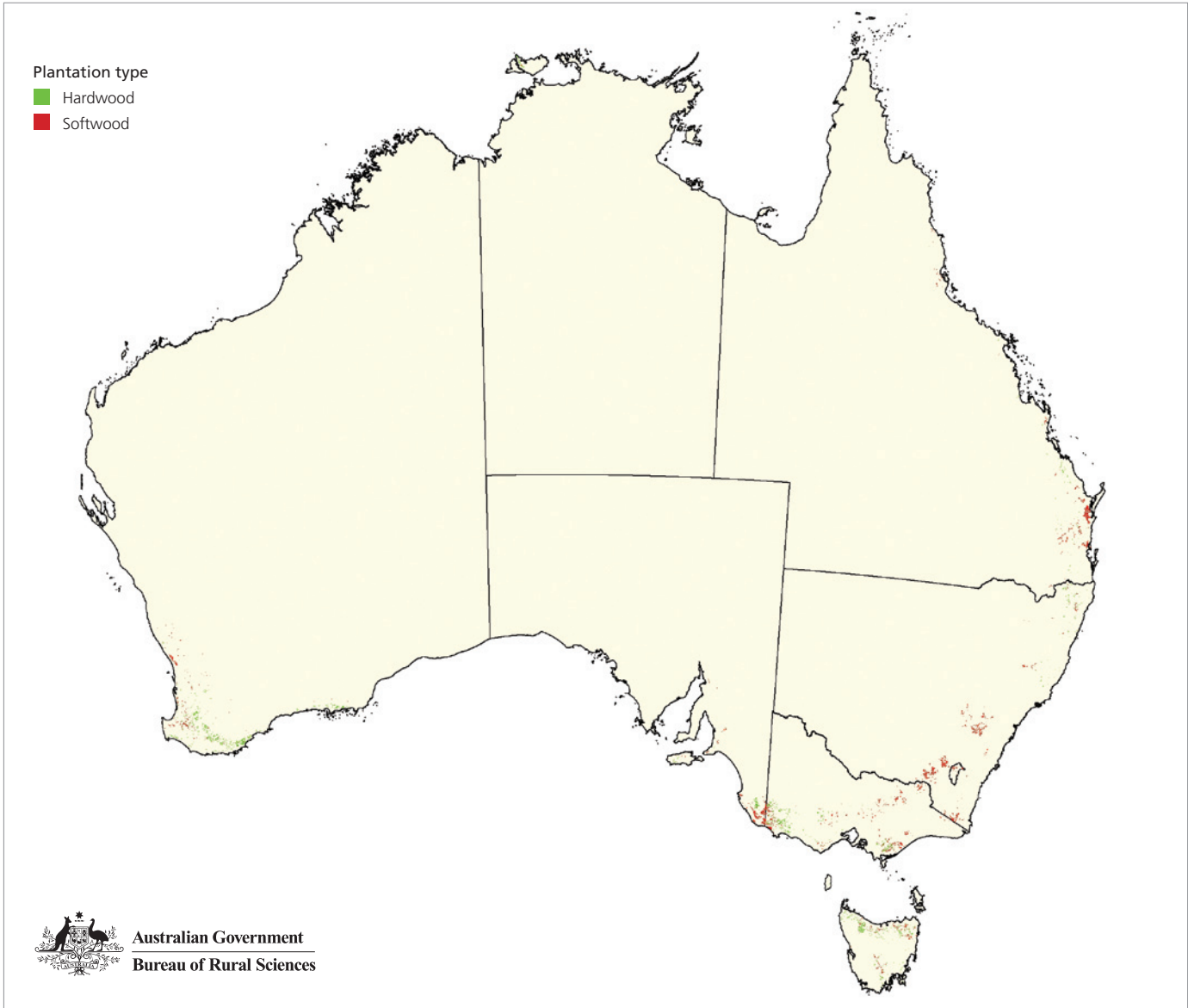
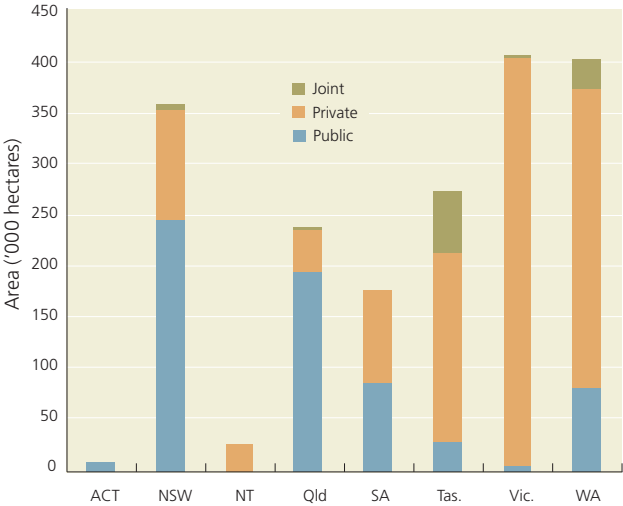




Figure 2: Tenure of plantation forest by state and territory\*



\* 'Public' comprises plantations owned by governments; 'Private' comprises plantations owned by superannuation funds, timber industry companies, managed investment schemes and other private owners; 'Joint' comprises plantations owned jointly by public and private entities.

Source: National Plantation Inventory data.



Hoop pine at Wongabel, North Queensland.

## Plantation ownership

Until the 1990s, state governments owned most plantations in Australia, but the ownership mix is changing. Governments have sold large areas of plantations and, in addition, most new plantations are now established by the private sector. In 1999, the proportions of public and private plantations were equal at 46% (the balance being owned jointly). By 2007, however, governments owned 36% and 60% were owned privately (Figure 2).

## Plantation species

Softwood species are widely used in plantation forestry because they grow well on a broad range of sites and the wood they produce is suitable for many purposes. The dominant plantation softwood species in temperate regions is radiata pine, although maritime pine (*P. pinaster*) is also planted widely in southern Western Australia. The main exotic softwoods planted in tropical and sub-tropical regions are Caribbean pine (*P. caribaea*) and slash pine (*P. elliottii*) and hybrids of those species.

The only native conifer planted for wood production in Australia is hoop pine (*Araucaria cunninghamii*). It occurs naturally in rainforests and, in plantations, performs best on deep loam soils. First planted in 1916, the total hoop pine plantation estate covered 45 684 hectares in 2005, of which 95% was in southeast Queensland, 3% was in northern Queensland and 2% was in northern New South Wales.

Due to the rapid expansion of hardwood plantations, the proportion of softwoods in the total plantation estate declined from more than 80% in 1995 to 53% in 2007.

More than 90% of the hardwood plantation estate is composed of Eucalyptus species, particularly Tasmanian blue gum (*Eucalyptus globulus*), which makes up almost two-thirds of the total. Other commonly planted eucalypts are shining gum (*E. nitens*), blackbutt (*E. pilularis*), flooded or rose gum (*E. grandis*), mountain ash (*E. regnans*), Gympie messmate (*E. cloeziana*) and Dunns white gum (*E. dunni*). Other hardwood species used in Australian plantations include Corymbia species (which are closely related to *Eucalyptus*), acacias, African mahogany and teak.

Table 3 shows the main plantation species grown in various climatic regions and their uses.

## How are plantations managed?

Forest plantation management has many similarities to the management of agricultural crops. The species is chosen depending on the desired end-use and site suitability, the site is prepared using mostly mechanical means, and the crop is established and tended to ensure efficient production. Pesticides are used to reduce weed growth when the trees are small and fertilisers are sometimes applied to boost growth. The pesticides used by plantation forestry in Australia were all first developed

Table 3: Main plantation species used, by climatic region

	Region	Main species	Main products
Hardwoods	Tropical – high rainfall	Mangium	Paper products
	Sub-tropical – medium rainfall	Flooded gum, Dunns white gum, Gympie messmate	
	Temperate – medium-to-high rainfall	Blue gum, shining gum	
	Tropical – high rainfall	African mahogany, teak, some native species	Sawn timber for furniture, flooring and other high-value uses
	Several regions	Various eucalypts	Sawn timber for building and furniture
Softwoods	Temperate – medium rainfall	Radiata pine	Sawn timber for building, joinery, furniture, plywood, other high-value uses, posts and poles. Residues are used for paper, particleboard and other panels
	Tropical, sub-tropical – medium rainfall	Caribbean pine, slash pine and hybrids	
	Temperate – low-to-medium rainfall	Maritime pine	
	Tropical, sub-tropical – high rainfall	Hoop pine	



Softwood sawn timber used for house framing.

for use in agriculture. The process of establishing, growing and harvesting a single crop of trees is called a rotation.

In Australia, softwood plantations are managed primarily to produce sawlogs, usually on rotations of 30 years or more (50 years for hoop pine). At specified times, thinning operations remove the smallest and most poorly-formed trees, leaving the best-performed ‘sawlog’ trees to grow to the end of the rotation. These trees may also be pruned to remove lower branches, helping to improve sawlog quality. Harvested sawlogs are processed in sawmills and their products used in the 150 000–170 000 houses built in Australia each year, as well as to make furniture, toys and other items. In 2007, nearly 4 million cubic metres of sawn timber were made from sawlogs harvested from Australian softwood plantations. The products of thinnings are used as fence posts and poles and, along with the residues of sawmilling, to make fibreboard, particleboard and paper products.

Most hardwood plantations are managed to produce pulpwood for paper. Pulpwood from some eucalypts – including Tasmanian blue gum – is especially suitable for printing and writing papers, whereas softwood pulp is generally used to make packaging and other lower-quality papers. Eucalypt and acacia pulpwood plantations can be grown in rotations as short as 10 years.

A small proportion of Australia’s hardwood plantations are managed on rotations of 20 years or more to produce sawlogs for furniture, flooring and other products where appearance is important. Interest in growing hardwood sawlogs in plantations is increasing as supplies dwindle from native forests.



Loading pine logs.

As well as producing fibre for paper, logs from short-rotation eucalypt plantations can also be used to make structural timber products. Technology has been developed to saw young eucalypt logs to make timber suitable for studs, bearers, joists and trusses in residential, commercial and industrial building. Small eucalypt logs can also be shredded and recombined to make ‘engineered strand lumber’ that has applications in industrial flooring, engineering, formwork and exceptionally long-span girders.

## Environmental aspects

Many studies have found that timber has a lower environmental impact than alternative materials such as steel, aluminium, concrete and plastic. Table 4 shows, for example, that the materials used in a typical wood-framed house act as a net store of carbon, while the materials used in a steel-framed house cause net emissions of greenhouse gases.

**Table 4: Comparison of material use and effect on carbon emissions and storage to build a typical 180 m<sup>2</sup> house**

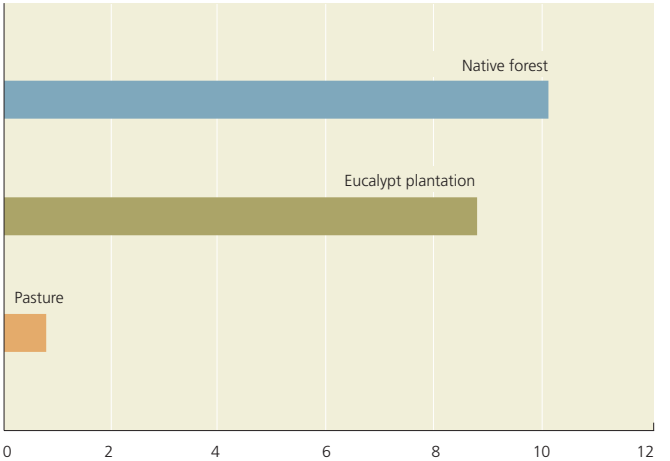
	Wood-framed house	Steel-framed house
Frame only	13 m <sup>3</sup> wood	5 tonne steel
Total house	21 m <sup>3</sup> wood	8 m <sup>3</sup> wood
Total carbon stored (tonnes)	9.7	3.7
Total carbon released to the atmosphere (tonnes)	2.2	6.6
Balance of carbon (tonnes stored (+) or released (-) to the atmosphere)	+7.5	-2.9

Source: Turner (1990).

Forest plantations provide habitat for flora and fauna species that might be absent on cleared agricultural land. Surveys in northeast and central-west Victoria, for example, found that eucalypt plantations supported higher densities of forest birds than nearby cleared farmland, and slightly lower densities than native forest (Figure 3).

Native animals frequently observed in exotic softwood plantations include echidnas, kangaroos, wombats, possums, birds (such as the yellow-tailed black-cockatoo) and a wide range

**Figure 3: Number of bird species observed during surveys in three habitats in northeast and central-west Victoria**



Source: Loyn et al. (2006).



of insects. Generally, however, the level of biodiversity in such plantations is less than in eucalypt plantations.

Codes of Practice or other regulatory requirements apply to plantations across Australia to protect environmental and other values. These codes and regulations prescribe operational practices such as stream buffer areas that can't be planted, how to build and maintain roads, use of chemical fertilisers and pesticides and fire protection requirements. In addition, plantation owners may voluntarily apply for certification under schemes that require assessment of environmental management practices by independent organisations. Over half of Australia's plantations have been certified.

Properly sited in the landscape, plantations provide other environmental benefits; they can act as windbreaks, increase water quality, reduce erosion and help control salinity.

## Other uses

Plantation forests are widely used for recreational activities such as walking, cycling, riding and camping. Plantations are also being established to supply non-wood products, especially essential oils. In Western Australia, for example, mallee eucalypt plantations produce eucalyptus oil for use in pharmaceutical and cleaning products, and sandalwood (*Santalum spicatum*) plantations produce sandalwood oil, which is highly valued for its aromatic properties. In New South Wales, tea-tree oil, an antiseptic, is extracted from plantations of *Melaleuca alternifolia*. Other products produced in small quantities in plantations include resins, bush foods, fodder, cut flowers and foliage, and medicines.

An expanding plantation industry also has the potential to supply biomass for electricity and ethanol production. Some plantation timber residues are already used in place of coal for electricity generation and a number of new projects to make fuel pellets or generate energy from plantation biomass are being developed.

## Other benefits and impacts

Plantations provide other benefits as well as timber products, for example, providing employment and contributing financially to the economy (Table 4). They also have impacts that are sometimes contentious, especially in rural communities where other agricultural land uses are considered more traditional. There are divergent perspectives on aspects such as social and economic values, impacts on water use, salinity and soils, use of chemicals and fire risk. A summary of these and other aspects is provided in *Australia's Plantations 2006* (Parsons et al. 2006).



Export woodchip mill, Burnie, northeast Tasmania.



Pine plantation, ForestrySA's Kuitpo Forest Reserve, certified under the Australian Forest Certification Scheme.

Table 4: Socio-economic contribution of plantations

Plantation region	Employment <sup>1</sup>	Economic value <sup>2</sup>
South east Queensland	3 452	\$571 million
Green Triangle, South Australia and Victoria	8 765	\$778 million
Central Tablelands, New South Wales	1 947	\$525 million
Murray Valley, New South Wales and Victoria	5 885	\$837 million
Central Gippsland, Victoria	2 997	\$512 million

Notes:

- 1 Direct and indirect employment in plantation timber growing, harvesting and processing.
- 2 The measures of economic value used in regional studies differ so that it is not practical to compare these figures directly.

Source: Compiled from regional study reports published from 2000 to 2005 (refer Parsons et al. 2006).

Competition for water has become a major issue in many water supply catchments around Australia. Annual crops and pasture use less water than perennial vegetation, including trees, primarily because of their shorter growing seasons and shallower root systems. The canopies of native and plantation forests intercept more rainfall than pastures and other crops; this adds to their higher water use. Reforestation of pasture with timber plantations can therefore lead to reduced run-off and streamflow.

Because plantations generally occupy only a few percent of the catchments in which they are located, their impacts on water availability are usually limited. The main land uses are agriculture and native forests (Table 5).

**Table 5: Land use in catchment areas with above 600mm average annual rainfall**

Land use	Plantations <sup>5</sup>		Agriculture %	Native forest %	Other uses %
	Proportion of catchment %	Proportion of all Australian plantations %			
Catchment					
Millicent Coast	13.6	8.8	72.2	11.1	3.1
Glenelg, Portland, Hopkins	7.2	9.2	74.9	17.0	0.8
Lachlan, Macquarie–Bogan	1.5	3.6	73.9	21.7	3.0
Murrumbidgee	4.0	6.2	53.8	40.0	2.2
Upper Murray	2.5	2.2	27.1	68.1	2.5
Northern Victoria <sup>1</sup>	2.2	2.9	43.1	52.9	1.8
Tamar, Esk	4.1	2.2	29.9	63.9	2.1
North-west Tasmania <sup>2</sup>	9.6	4.4	35.0	54.1	1.2
Western Australia <sup>3</sup>	5.7	16.3	35.0	58.1	0.3
South east Queensland <sup>4</sup>	2.5	9.6	47.5	48.2	1.8

**Notes:**

- 1 Northern Victoria is the Goulburn, Broken, Ovens and Kiewa River catchments.
- 2 North-west Tasmania data are for the Smithton–Burnie Coast, Mersey, Rubicon and Forth River Catchments.
- 3 Western Australia data include all catchments in south west Western Australia from Perth to Albany.
- 4 South east Queensland data are for the Brisbane, Burnett, Noosa, Maroochy and Mary River catchments.
- 5 Based on plantation areas as at 2005.

## References and further reading

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### Website

[www.daff.gov.au/forestsaustralia](http://www.daff.gov.au/forestsaustralia)



Eucalypt plantation, Tasmania.

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