

Criterion 2

Maintenance of productive capacity of forest ecosystems

The five indicators in this criterion canvass the forests available for timber production, the volumes of timber harvested against the calculated sustainable yield, the volumes and types of non-timber forest products extracted, and the regeneration of harvested native forests and plantations. The indicators also consider the role of wood production in native forests and plantations and the sustainability of harvesting.

Key findings

Native forests

- In 2005–06, 112.6 million hectares of native forest was in tenures in which timber harvesting is allowed, compared to 119.8 million hectares in 2000–01. While large, much of the available area contributes little to timber supply.
- The area of multiple-use public native forests declined from 11.4 million hectares in 2000–01 to 9.4 million hectares in 2005–06.
- With the exception of Tasmania, the sustainable level of harvest from multiple-use public native forests continued to decline, due to reductions in the area allocated to harvesting, further restrictions on harvesting, and revised downward estimates of sustainable yield.
- In Tasmania, the sustainable sawlog yield from multiple-use public native forest fluctuated slightly in line with forest management strategies in the short term, but without adversely affecting long-term sawlog availability.
- The volume of sawlogs harvested from multiple-use public native forests over the period from 1992–93 to 2005–06 was less than the prescribed sustainable level in New South Wales, Victoria and Western Australia.

- The success rate in regenerating multiple-use public native forests after harvesting was high (above 85%) in those states for which data were available; remedial action was taken in those areas where standards were not achieved.

Plantation forests

- The area of plantations increased from 1.63 million hectares in 2003 to 1.82 million hectares in 2006. Nearly all the increase was in hardwood (mostly pulpwood) plantations, from 503,000 hectares in 2000 to 807,000 hectares in 2006.
- Plantations produce about two-thirds of Australia's log supply, by volume.
- Based on current plantings, wood production from softwood plantations is expected to plateau by 2010, while production from hardwood plantations will increase substantially, to over 14 million cubic metres per year by 2010.
- The reported success rate in restocking harvested plantations with replacement seedlings was generally over 90%.

Non-wood forest products

- A number of non-wood native forest species are subject to commercial harvesting regimes, some of which are significant in terms of value, quantity or both.
- Indigenous Australians rely to varying degrees on the use of non-wood forest products for customary (e.g. food and medicine) and commercial (e.g. arts and crafts) purposes.
- Approaches to assessing the sustainability of the Australian non-wood forest product sector are being developed. Adaptive management plans are in place for native species subject to significant harvest to assist regulators in managing for sustainability.

Indicator 2.1a

Native forest available for wood production, area harvested, and growing stock of merchantable and non merchantable tree species

Rationale

This indicator reports the capacity of forests to sustainably produce wood to meet society's needs into the future. The area of native forest available for wood production, the nature of the growing stock and the area harvested over time provide means to demonstrate the sustainability of forest management.

Key points

- In 2005–06, 112.6 million hectares of native forest was in tenures in which timber harvesting is allowed, compared to 119.8 million hectares in 2000–01. The area of multiple-use public forests declined from 11.4 million hectares in 2000–01 to 9.4 million hectares in 2005–06, while the area of public nature conservation reserves increased from 21.5 million hectares to about 23 million hectares over the same period.
- Multiple-use public native forests continue to provide most of the native forest wood and wood product harvest. Leasehold and private tenure forests are also potentially available, subject to landholder intent, markets and environmental constraints.
- Harvesting in multiple-use public native forests is subject to substantial requirements to maintain non-wood values.
- The increased capacity of industry to use small-diameter logs as a feedstock has, to some extent, offset the impact of decreases in the area available for harvesting in multiple-use native forests.

The area of native forests available for timber harvesting¹ affects the forest sector's capacity to meet domestic and export demand for native timbers and wood products and the level of sustainable yield. In Australia, the area available for harvesting is a function of tenure, codes of practice and requirements to manage for multiple values.

Native forest area available for harvesting

The major source of Australia's native timber and wood products is multiple-use public forests in New South Wales, Queensland, Tasmania, Victoria and Western Australia; forests on land with leasehold and private tenure also contribute to supply. Timber harvesting is not permitted in nature conservation reserves.

In 2000–01, the area of forest not legally restricted from timber harvesting was 119.8 million hectares; this declined to 112.6 million hectares or 76% of Australia's native forests in 2005–06 (Table 32). In practice, much of the available area currently contributes little to timber supply because it comprises leasehold land predominantly used for grazing, does not contain marketable species, is too far from

¹ Under the Montreal Process, the emphasis of this indicator is to report on the area of native forests in which harvesting is not legally restricted.

Table 32: Area of forest not legally restricted from timber harvesting in 2005–06, by jurisdiction ('000 hectares)

Tenure	ACT	NSW	NT	Qld	SA	Tas.	Vic.	WA	Australia
Leasehold forest	8	9,891	13,920	34,304	3,083	–	35	3,891	65,132
Multiple-use public forest	–	1,980	–	1,991	2	1,026	3,163	1,248	9,410
Private land (including Indigenous)	–	8,076	16,317	8,908	1,399	885	1,025	1,489	38,099
Total	8	19,947	30,237	45,203	4,484	1,911	4,223	6,628	112,641

Table 33: Area of multiple-use public native forest available for harvesting, New South Wales ('000 hectares)

	1999–2000	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06 ^a
Area	1,368	1,190	1,187	1,172	1,164	983	846

a The reduction in the area available for harvesting in the period from 2004 to 2006 was due to the finalisation of the Western Regional Assessment and the Southern Icon areas; the resulting tenure changes affected most Forests NSW management zones.

Source: Forests NSW (various)

Table 34: Gross and net forest areas available for wood production, Tasmania, 30 June 2006 ('000 hectares)

Tenure	Gross forest area	Net native forest area
Public	2,335	607
Private	1,018	Not available

Source: Forest Practices Authority (2007)

markets, or is not operationally feasible. For example, there is relatively limited commercial native forest harvesting in the Northern Territory and none in South Australia or the Australian Capital Territory. Moreover, the Queensland Government has signalled a significant phase-out of native forest harvesting on public land across that state in favour of hardwood plantations in areas where they can be developed.

Leasehold, private and multiple-use public forests are managed for a range of values as well as timber production, and in some cases are dedicated to water protection, flora and fauna protection and other key values. This has contributed to major reductions in the availability of multiple-use public forests for timber harvesting that are not apparent in data on tenure changes.

The area of forests not legally restricted from timber harvesting declined from 11.4 million hectares in SOFR 2003 to 9.4 million hectares in 2005–06, a decrease of 17.5%. This reduction is complemented by an increase in the area of forest in public nature conservation reserves, from 21.5 million hectares in SOFR 2003 to about 23 million hectares in 2005–06.

The overall decline in the area available for timber harvesting occurred across jurisdictions. In New South Wales, for example, the area of multiple-use native forest available for timber harvesting declined from 1.37 million hectares in 1999–2000 to 846,000 hectares in 2005–06, a reduction of 38% (Table 33). The area of multiple-use native forests set aside from harvesting in state forest reserves and special protection zones increased over the period.

In Tasmania, the area of public native forest land potentially available for timber production decreased by about 15% between 2001 and 2006, to 607,000 hectares (Table 34), partly due to the transfer of land from multiple-use public forest to the conservation reserve system as a result of the 2005 Tasmanian Community Forest Agreement.

Available growing stock

'Growing stock' is the total volume of wood in all living trees in a forest at a particular time. Changes in growing stock – whether it is increasing or decreasing – can indicate (among other things) the sustainability of resource use. In multiple-use public forests, assessments of the growing stock of merchantable timber (i.e. timber of saleable quality) and tree growth rates are used to estimate sustainable harvesting levels.

In recent years, the wood processing industry has adopted technologies and developed markets that have increased its ability to use small-diameter timber that was previously often unused. Provided that it is within sustainable limits, this increased resource-use efficiency is one way in which the timber industry can maintain its timber supply even as the area of forest available for timber harvesting decreases. The increased use of small-diameter timber also provides an incentive to improve the management of regeneration in forests previously regarded as relatively unproductive, improving long-term productivity and sustainable yield. In the past, the absence of markets for small-diameter timber has strongly affected long-term productivity under selective felling regimes. Sustainable yield is further considered in Indicator 2.1c.

With the exception of data for Tasmania, few or no data are available on growing stock, potential sustainable yield or owners' management intentions in private native forests.

References

Forests NSW (various), Forest Practices Authority (2007) (list at the back of the report).



Assessing trees in native forest prior to harvest, southeast New South Wales.

Indicator 2.1b

Age class and growing stock of plantations

Rationale

This indicator uses the area, age class and growing stock of native and exotic species plantations to assess the volume of timber that Australia's plantation forests can supply now and into the future.

Key points

- The area of plantations increased from 1.63 million hectares in 2003 to 1.82 million hectares in 2006, with almost all of the increase achieved by planting on cleared agricultural land.
- Of the total area of plantation estate, 55% is softwood and 45% is hardwood.
- While the area of softwood plantations has been stable for several years, the area of hardwood plantations has increased substantially, from 503,000 hectares in 2000 to 807,000 hectares in 2006.

Plantation forestry has come to dominate Australia's forestry and timber industries. Growing and harvesting logs and processing them into sawn timber, paper, panels and other products provides substantial employment, especially in rural areas. Although plantations provide the raw material for major rural industries, they occupy a small part of the rural estate.

The Montreal Process Working Group identifies 'growing stock' – the total volume of wood in all living trees in a forest at a particular time – as an indicator of potential wood supply from plantations. However, growing stock is not usually measured in Australia. Instead, the National Plantation Inventory develops forecasts of plantation log supply every five years. The 2007 forecast is summarised in Indicator 2.1c.

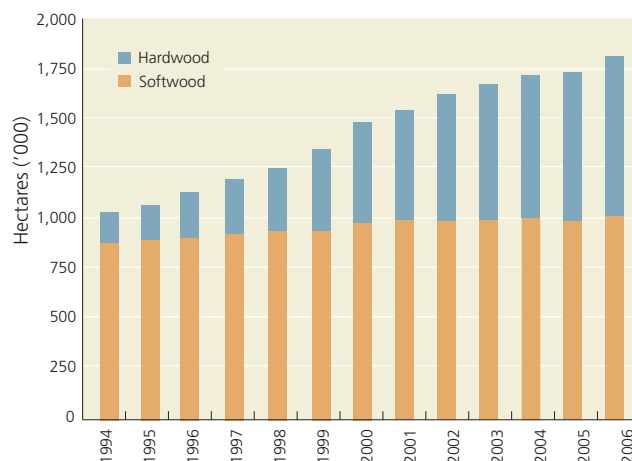
Most plantations established in Australia until the 1990s were pines and other softwoods grown to produce sawn timber. Many were planted on land where there had previously been native forests; however, the clearing of native vegetation (including native forests) for plantation

development is now prohibited or restricted by state and territory policies and legislation, and new plantations are now almost exclusively established on cleared agricultural land.

Plantation areas and values

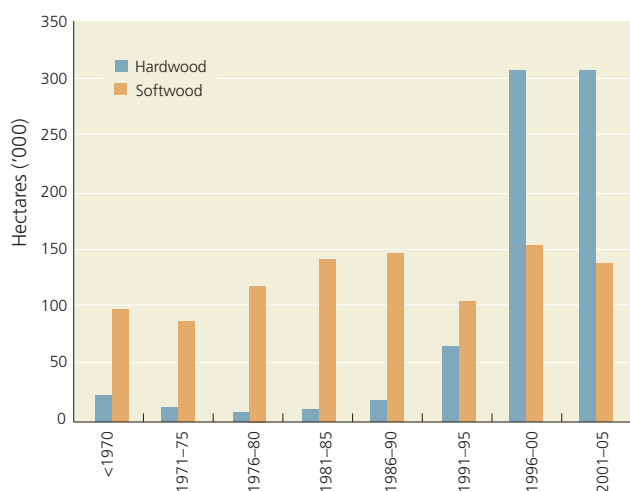
Australia's plantations have expanded rapidly since the National Plantation Inventory began collecting data in 1993. Supportive policies and programs such as *Plantations for Australia: the 2020 Vision* were important in removing impediments to plantation development. The inventory's first comprehensive map-based report showed in 1994 that Australia had 1,042,600 hectares of plantations. SOFR 2003 reported a plantation estate of 1.63 million hectares; by 2006 it had reached 1.82 million hectares (Figure 29). About 55% of the total area is softwood plantations (mainly exotic pines) and 45% is hardwood plantations (mainly eucalypts). Figure 30 shows the planting year distribution of these plantations.

Figure 29: Total plantation area, Australia, 1994 to 2006



Source: National Plantation Inventory

Figure 30: Plantation planting year distribution to 2005



Source: National Plantation Inventory

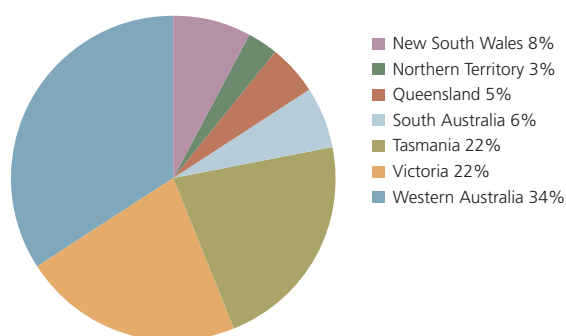
Figures 31 and 32 show the distribution of hardwood and softwood plantations, respectively, by jurisdiction. Victoria has the largest plantation area, with 22% of the national total of both hardwood and softwood plantations, closely followed by Western Australia with 21% (34% of all hardwoods and 11% of all softwoods) and New South Wales with 19% (8% of hardwoods and 28% of softwoods).

After 1990, there was a shift from mainly government investment in plantations of exotic softwoods towards private sector planting of a wide range of native and exotic hardwoods. Table 35 shows the main types of plantation and the main uses for the timber they produce.

Further reading

Parsons et al (2007a), Parsons and Gavran (2007), Parsons et al (2006) (list at the back of the report).

Figure 31: Total hardwood plantations, 2006, by jurisdiction



Source: National Plantation Inventory

Figure 32: Total softwood plantations, 2006, by jurisdiction

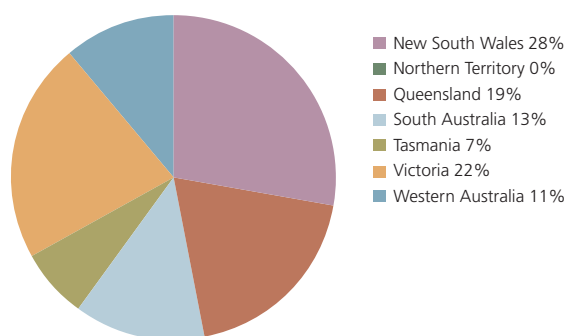


Table 35: Types of plantation, by region

Region	Main species	Main uses
Tropical – high rainfall	Mangium (<i>Acacia mangium</i>)	Paper products, veneer and sawn timber
Subtropical – medium rainfall	Flooded gum (<i>Eucalyptus grandis</i>), Dunn's white gum (<i>E. dunnii</i>)	
Temperate – medium-to-high rainfall	Blue gum (<i>E. globulus</i>), shining gum (<i>E. nitens</i>)	
Tropical – high rainfall	African mahogany (<i>Khaya senegalensis</i>), teak (<i>Tectona grandis</i>), some native species	Sawn timber for furniture, flooring and other high-value uses
Several regions	Various eucalypts	Sawn timber for building and furniture
Temperate – medium rainfall	Radiata pine (<i>Pinus radiata</i>)	Sawn timber for building, joinery, furniture, plywood, other high-value uses, posts and poles; residues used for paper, particleboard and other panels
Tropical, subtropical – medium rainfall	Caribbean pine (<i>P. caribaea</i>), slash pine (<i>P. elliottii</i>) and hybrids	
Temperate – low-to-medium rainfall	Maritime pine (<i>P. pinaster</i>)	
Tropical, subtropical – high rainfall	Hoop pine (<i>Araucaria cunninghamii</i>)	

Indicator 2.1c

Annual removal of wood products compared to the volume determined to be sustainable for native forests, and future yields for plantations

Rationale

This indicator measures the harvest levels of wood products in relation to future yields. The capacity to implement strategies to deal with changing demand for forest products based on future yields from both native and plantation forests is an integral part of sustainable forest management.

Key points

- The volume of sawlogs harvested from multiple-use public native forests in the period from 1992–93 to 2005–06 was within the prescribed sustainable level in New South Wales, Victoria and Western Australia.
- In New South Wales, Victoria and Western Australia, the prescribed sustainable yield in multiple-use public native forests declined between the SOFR 2003 and SOFR 2008 reporting periods due to reductions in the area allocated to harvesting, further restrictions on harvesting, and revised estimates of forest growth and yield.
- In Tasmania, the sustainable sawlog yield from multiple-use public native forest fluctuated slightly in line with forest management strategies in the short term, without adversely affecting long-term sawlog availability.
- Plantations produce about two-thirds of Australia's log supply. Hardwoods make up 45% of plantation-grown pulp logs; softwoods provide 55% of the plantation pulp log supply and 98% of sawlogs.
- Based on current plantings, total wood production from softwood plantations is nearing its maximum potential and is expected to plateau by 2010, while total production from hardwood plantations will increase substantially, to over 14 million cubic metres per year by 2010.

This indicator examines the extent to which a sustainable harvest of timber and wood products is being achieved in native forests. It reports the average annual sustainable and actual harvests in multiple-use public forests, the actual harvest on private land, and plantation harvesting rates and projected future yields. Indicator 2.1a describes the impact of changes in tenure and forest reservation on the area available for the harvesting of wood products.

This indicator reports only on those states where there is significant ongoing native forest harvesting: New South Wales, Queensland, Tasmania, Victoria and Western Australia. The main primary wood products harvested in native forests are veneer logs, sawlogs and pulpwood (the last comprising logs used for paper and wood-based panel products). Other wood products harvested in native forests include posts and poles, bush sawn/hewn timber, firewood, specialty timber and sleepers. The data presented under this indicator pertain mainly to sawlogs (including veneer logs) and pulpwood.

Native multiple-use public forests provide most of Australia's native timber and wood products. Harvesting is subject to a



Loading redgum sleepers, Horsham, Victoria.

regulatory framework designed to maintain environmental values and the productive capacity of forests. Harvesting volumes are set according to a calculated sustainable yield, which is the estimated volume of timber that can be removed each year while ensuring the functioning of the forest system continues as a whole.

Sustainable yield from native forests

Those jurisdictions in which native forest harvesting occurs have formal processes, backed by legislation or codes of forest practice, to calculate sustainable sawlog yields for publicly managed native forests, primarily multiple-use forests.² The volume of timber available for harvesting is calculated based on the net area of forest available for high-quality sawlog and veneer production after areas unavailable for economic, environmental and other reasons have been excluded. Low-quality sawlogs and pulpwood are also harvested from native forests, usually as a residual product of sawlog and veneer log harvesting; therefore, sustainable yields are not determined for low-quality sawlogs or pulpwood.

Sustainable volumes vary over time according to management strategies, improved resource data and utilisation standards, and the area of land available for harvesting. Estimates are therefore reviewed periodically, usually every five years. For a range of reasons, annual harvesting levels are likely to fluctuate around the sustainable volume, but overcuts in some years must be at least balanced by undercuts in others.

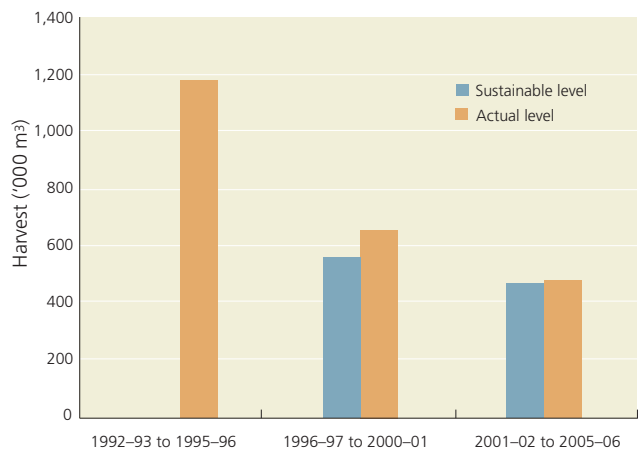
Figures 33–37 show the reported average volume of harvesting from native multiple-use public forests averaged across the periods covered by the three SOFR reports: 1992–93 to 1995–96 (SOFR 1998), 1996–97 to 2000–01 (SOFR 2003) and 2001–02 to 2005–06 (SOFR 2008). For all states except New South Wales, harvested volumes were, on average, lower than the prescribed sustainable yields for each of the periods. In New South Wales, the actual harvest was slightly higher than the sustainable yield in some years of the SOFR 2008 reporting period (Figure 33). Under state forest agreements, industry in New South Wales is permitted to vary its actual cut by $\pm 5\%$ of the allowable cut, which allows it to take into account previous undercuts to its allocations when required.

Average sustainable yield declined in all states except Tasmania between SOFR 2003 and SOFR 2008, due mainly to reductions in the area of native forest available for harvesting and improved information on forest yields. In Tasmania, the sustainable sawlog yield from multiple-use

public native forest fluctuated slightly in line with forest management strategies in the short term, but without adversely affecting long-term sawlog availability. The actual annual harvest volume from public forest in the SOFR 2008 reporting period was generally slightly below the estimated sustainable sawlog yield; the harvest from private forests also declined over the period.

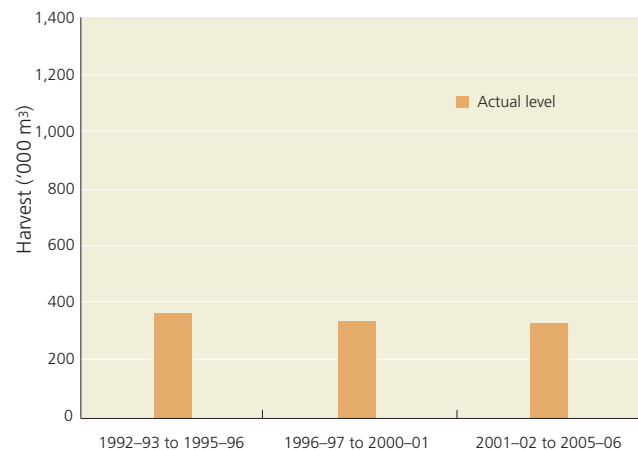
In Queensland, the state government agreed in 1999 to a 25-year transition in which public native forests in the state's southeast – its major timber-producing area – will be withdrawn from timber harvesting and recategorised as nature conservation reserves. For this reason, Figure 34 does not show a sustainable yield volume, although it does show that timber harvest volumes are declining. Hardwood plantations are being established in the region to provide an alternative timber resource. Other areas of the state are the subject of the Statewide Forests Process, in which decisions are being made progressively on future harvesting levels and conservation areas.

Figure 33: Average annual sustainable harvest level in native multiple-use public forests in New South Wales, by SOFR reporting period



Sources: Forests NSW, NFI (2003)

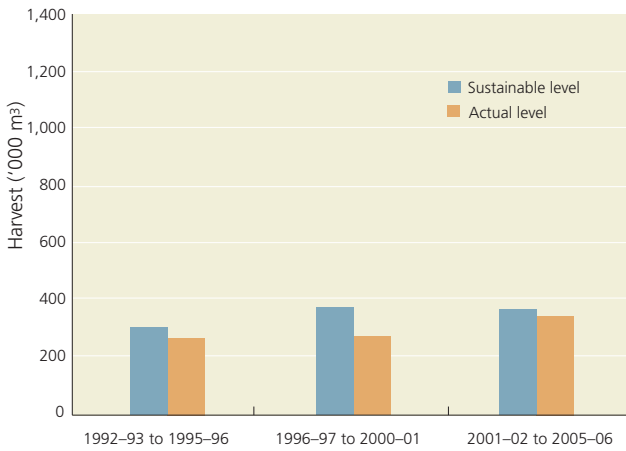
Figure 34: Average annual harvest level in native multiple-use public forests in Queensland, by SOFR reporting period



Sources: Department of Natural Resources and Environment (Qld), NFI (2003)

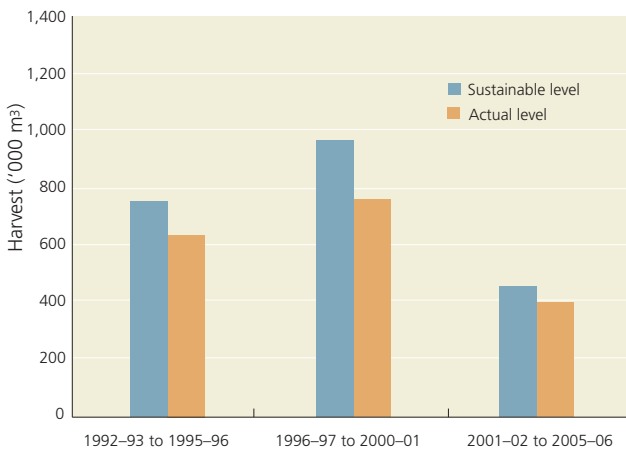
² Sustainable sawlog volumes are calculated using data on forest type and age class, standing timber volumes, terrain, accessibility, timber growth and yield, recreational use, water and conservation. Estimates also take into account restrictions on harvesting imposed by codes of practice and other regulations. Once calculated, the sustainable volumes are used to produce harvesting schedules and forecasts of the future spatial and temporal characteristics of the forest.

Figure 35: Average annual sustainable harvest level in native multiple-use public forests in Tasmania, by SOFR reporting period



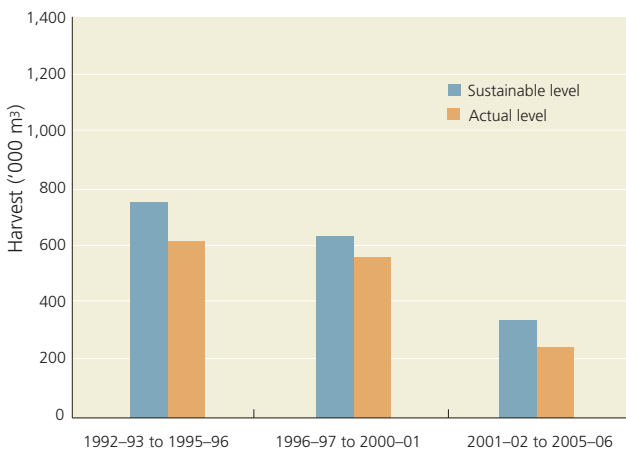
Sources: Forestry Tasmania, NFI (2003)

Figure 36: Average annual sustainable harvest level in native multiple-use public forests in Victoria, by SOFR reporting period



Sources: Department of Sustainability and Environment (Vic.), NFI (2003)

Figure 37: Average annual sustainable harvest level in native jarrah and karri multiple-use public forests in southwestern Western Australia, by SOFR reporting period



Sources: Department of Environment and Conservation (WA), NFI (2003)

The general decline in sustainable yield and harvesting in Western Australia and Victoria is further highlighted in Case studies 19 and 20, respectively. The case studies also illustrate the assessment processes undertaken to provide the basis for sustainable yields.

Private native forests

The supply of sawlogs from private native forests is significant in New South Wales, Queensland and Tasmania (Figure 38). In Tasmania, this supply declined markedly in the SOFR 2008 reporting period compared to the supply reported in SOFR 2003; for other states, recent data on private sawlog supply were not available.

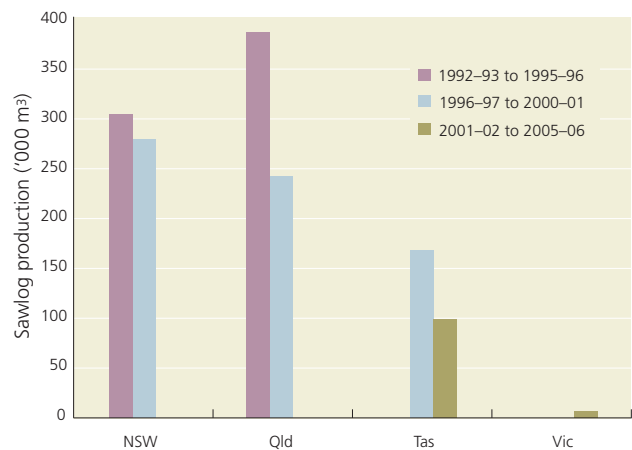
While there is no calculated sustainable yield for wood production in native forests on private land, private-forest harvesting operations face substantial and increasing restrictions. In practice, most private forest managers make limited use of their forests for wood production, responding to immediate needs and opportunities in the market.

The Queensland Timber Board and the Australian Government jointly commissioned an assessment of timber and some non-timber values for private native forests in southeast and central western Queensland. That work, which was completed in 2003, provided timber resource estimates for private native forests in those regions. The work also provided assessment methods that can be applied to private native forests in other regions.

Pulpwood

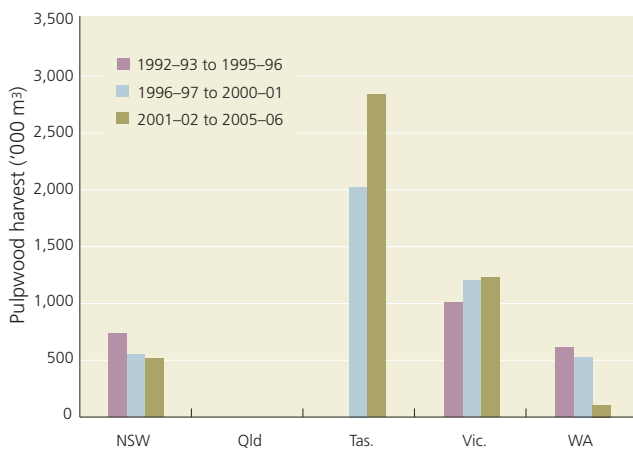
The volume of pulpwood harvested on public land increased in Tasmania and Victoria and declined in New South Wales between the SOFR 2003 and SOFR 2008 reporting periods (Figure 39). Tasmania is the country's major provider of private pulpwood; at the national level, however, available data for the pulpwood harvest in private native forests are insufficient to show volume trends.

Figure 38: Average annual sawlog production from private native forests, by SOFR reporting period



Source: State agencies

Figure 39: Average annual pulpwood harvest from multiple-use public native forests, by SOFR reporting period



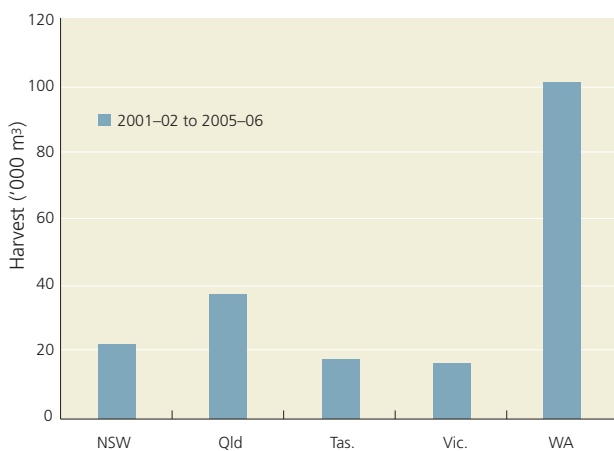
Note: No pulpwood is harvested from public native forests in Queensland.

Source: State agencies

Other wood products

The supply of minor and other wood products, such as posts and poles, bush sawn/hewn timber, specialty timber and sleepers, is often opportunistic. They are generally harvested in relatively small quantities compared to sawlogs and pulpwood and are not always factored into sustainable yield calculations. Figure 40 shows estimates of harvest rates for all these products combined for the period from 2001 to 2006; it does not include firewood, which is discussed next. About three-quarters of the volume shown for Western Australia comprises wood used to make charcoal for silicon smelting.

Figure 40: Average annual 'other wood products' harvest from native multiple-use public forests, 2001-02 to 2005-06



Source: State agencies

3 Driscoll et al (2000).

4 ANZECC (2001).

5 The forecast is based mainly on plantation areas as at 2005, combined with assumptions about the yield of log products per unit land area. The forecast assumes that all plantation sites harvested are replanted.

Firewood

One of the most commonly used forest products is firewood. Excluding industrial uses, Australian households use an estimated 4.5–5.5 million tonnes of firewood per year, with New South Wales and Victoria accounting for over half of this.³ The five most common tree species used are river red gum (*Eucalyptus camaldulensis*, 1.10 million tonnes), jarrah (*E. marginata*, 0.61 million tonnes), red box and yellow box (*E. polyanthemos* and *E. melliodora*, 0.54 million tonnes combined) and ironbark (*E. sideroxylon*, 0.47 million tonnes).

Approximately half of the wood burned in households is collected by the residents, and 84% is obtained on private property. Sixty per cent of firewood is purchased through small suppliers; this component is worth about \$240 million.

Firewood collection is an important segment of the forest sector, particularly in regional communities. It is regulated in many jurisdictions through permit systems, controls on the clearing of native vegetation, and voluntary codes of practice among commercial operators; several jurisdictions developed firewood strategies over the period. A national approach has also been developed to increase the effectiveness of existing controls and to protect threatened species and ecological communities from the impacts of firewood collection.⁴ In October 2005, the Firewood Association of Australia was created. This is a not-for-profit organisation that certifies the compliance of firewood suppliers with a national, voluntary code of practice for sustainable firewood suppliers.

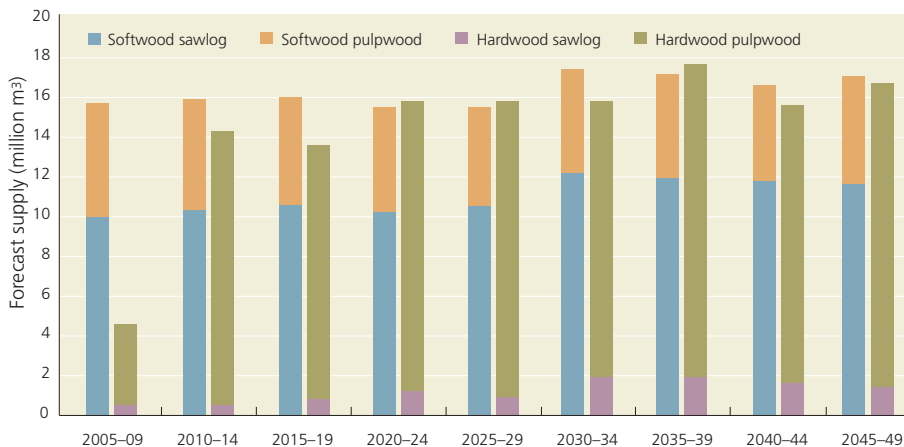
Forecast plantation log supply

Plantations now produce about two-thirds of Australia's total log supply (half of the logs are pulplogs and half sawlogs). Hardwoods make up 45% of plantation-grown pulp logs; softwoods provide 55% of the plantation pulp log supply and 98% of sawlogs. Plantations are developed mainly for timber production and managed as businesses, so the timing and volume of harvest are determined primarily by market forces.

The National Plantation Inventory has developed a forecast of potential future timber supply from existing plantations (Figure 41).⁵ For softwood plantations, more than 100 years of growth and yield data are available to underpin the assumptions used to develop the forecast. Fewer data are available for hardwood plantations, so the forecasts are less reliable. The proportion of the total volume suitable for sawlogs is particularly difficult to estimate accurately.

Total wood production from softwood plantations is expected to plateau by 2010. Most of the hardwood plantations are immature: wood production from them will increase substantially in the next few years from about 2 million cubic metres per year in the period to 2004 to over 14 million cubic metres per year from 2010.

Figure 41: Forecast plantation log supply, Australia, 2005 to 2049



Source: National Plantation Inventory

References

ANZECC (2001), Driscoll et al (2000), EPA WA (2007), Forestry Tasmania (2007), NFI (2003) (list at the back of the report).

Web resources

Case study 19: Reduction in sustainable yield in Western Australia (including Figures 42–44)

Case study 20: Responding to sustainable yield challenges in Victoria

Victoria has continued to develop its capacity to adapt to changes in sustainable yield caused by reduced resource availability arising from changes in tenure, other management restrictions, wildfire and improved resource information.

In response to an independent analysis of timber resources,⁶ the Victorian Government released a policy statement called *Our Forests, Our Future* in February 2002 to ensure the sustainability of the state's native forests and the timber industry communities they support. The major components of the initiative are:

- a 31% reduction in logging across the state
- an \$80 million assistance package, which includes funding for a voluntary licence reduction program and a workers' assistance package
- new legislation to ensure resource security
- independent forest auditing
- the establishment of a new commercial entity, VicForests, to help separate commercial forestry objectives from the policy and regulatory functions of government and to ensure that the logging industry is managed efficiently.

Legislation developed under *Our Forests, Our Future* came into effect in 2004 as the *Sustainable Forests (Timber) Act 2004*. Among other things, the Act provided for the development of a Sustainability Charter in 2006. The charter sets out objectives, consistent with both the Montreal Process for sustainable forest management and the National Principles of Ecologically

Sustainable Development, for the sustainability of public native forests and the sustainability of the timber-harvesting industry on public land.

The charter sets the future direction for sustainable public native forest management in Victoria and commits the Department of Sustainability and Environment and VicForests to respond to and support the objectives set out in the charter.

VicForests, which is responsible for sustainable timber harvesting and commercial sale in eastern Victoria, will develop initiatives and targets to ensure that progress is made in conforming to the charter, include the initiatives and targets in its statement of corporate intent, and report on their outcomes as part of its normal business reporting. In this way, both the department and VicForests will work towards achieving the government's vision for sustainable forest management.

Our Forests, Our Future and other initiatives, such as *Growing Victoria Together, Our Environment, Our Future* (Victoria's environmental sustainability framework created in 2005) and the *Sustainable Forests (Timber) Act*, demonstrate and strengthen the Victorian Government's commitment to regional communities and the sustainable management of Victoria's state forests. Performance will be communicated through five-yearly state of the forest reports and regular third-party auditing.

Source: DSE (Vic.)

⁶ www.dse.vic.gov.au/DSE/nrenfor.nsf/FID/-1D47A25DE8DAA3C24A256B670015BEED?OpenDocument

Indicator 2.1d

Annual removal of non-wood forest products compared to the level determined to be sustainable

Rationale

This indicator is used to assess the sustainability of the harvest of non-wood forest products. These products can represent a significant asset base supporting the livelihoods of remote communities.

Key points

- A number of non-wood native forest species are subject to commercial harvesting regimes. Some species are significant in terms of value, quantity or both.
- Permits are usually required to harvest native plant and animal products from forests, although the requirements for permits may differ by jurisdiction and land tenure. All Australian states and territories have legislation restricting the harvest of threatened species.
- Indigenous Australians rely to varying degrees on the use of non-wood forest products for customary (e.g. food and medicine) and commercial (e.g. arts and crafts) purposes.
- Approaches to assessing the sustainability of the Australian non-wood forest product sector are being developed. Adaptive management plans are in place for native species subject to significant harvesting to assist regulators in managing for sustainability.

This indicator examines the extent to which sustainable harvest of non-timber products from forests is being achieved. It also discusses the legislative process related to non-wood harvest.

Non-wood forest products (products of biological origin other than wood derived from forests) include hundreds of products that are generated directly or indirectly from organisms living in forest ecosystems. They include landscape and garden products, health and personal care products, food products, and decorative and aesthetic products. For convenience, wood-based products, such as wood carvings and aromatic items produced from sandalwood (*Santalum spicatum*), are also considered in this indicator.

The sustainable management of non-wood forest products is essential both for the conservation of the species subject to harvesting and for maintaining the livelihoods of people dependent on them. Research on the ecological sustainability of the non-wood forest product harvest has grown rapidly over the past two decades, but mostly in the form of studies specific to certain species or regions. Approaches to assessing the sustainability of the Australian non-wood forest product sector are being developed.

Direct harvest of forest flora and fauna

Table 36 gives examples of the kinds of non-wood products harvested from Australian forests. These products provide income for many Australians; moreover, communities of Indigenous people in the Northern Territory may be at least partly dependent on them as a source of food and income.⁷



Stripping cork bark.

⁷ Altman and Taylor (1989).

Table 36: Examples of non-wood forest products produced and used in Australia

Category	Examples
Landscape and garden products	Transplants (tree, shrubs, wildflowers, grasses), mulches, soil amendments, seed
Health and personal care products	Essential oils, herbal health products, fragrances
Food products	Mushrooms, herbs, berries, seeds, teas, flavouring agents, honey
Animal products	Meat, skins, eggs
Decorative and aesthetic products	Specialty wood products, Christmas trees, foliage, cones, wildflowers, tannins, dyes
Indigenous products	Bark paintings, wooden sculpture, weaving, pigments and dyes, subsistence products

Permits are usually required to harvest native plant and animal products from forests, although the requirements for permits differ between jurisdictions and across the various land tenures within each jurisdiction. All Australian states and territories have legislation restricting the harvest of threatened species across all land tenures (see Appendix E). Threatened species of national environmental significance are also protected under Australia's *Environment Protection and Biodiversity Conservation Act 1999*. Among other things, the Act regulates the commercial export from Australia of most wild-harvested native plants and animals and their derivatives. The export of some species, such as cycads, and crocodile products are also subject to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

The natural abundance of several species, such as sandalwood in Western Australia, has been reduced by clearing for agriculture and pastoral activities (specifically, grazing by introduced herbivores). Other species, such as the saltwater crocodile and cycad species, have been listed in CITES appendixes because of poor management practices in the past or the unsustainable management of similar species internationally. In Australia, the management of certain species has enabled their continued harvest without deleterious effects on the species as a whole. Indicators 6.1b and 6.1d include case studies on saltwater crocodiles and sandalwood, respectively.

Flora

The removal of native plant products from Australian forests for commercial purposes is subject to regulations enforced by government agencies. Factors that influence harvest sustainability include the plant part that is harvested; the plant's reproductive strategy, habitat specificity and growth rates; other uses for the land on which the plant grows (such as timber production or grazing); variations in harvest methods; remoteness from human settlements; and variations in land-use context or environmental factors.

A growing number of non-wood plant product industries are subject to sustainability assessments. In Tasmania, for example, tree fern products (*Dicksonia antarctica*) have been harvested for many years for transplanting in public and private gardens. This practice was largely unregulated until 2002, when the Tree Fern Management Plan was formulated and additions were made to Tasmania's *Forest Practices*

Act 1985 to improve the sustainability of the industry. As a result, harvested tree ferns must now be tagged with a 'Tasmanian tree fern' tag. The fees levied on the tags are used to fund the industry's self-regulation and monitoring, as well as research into the sustainable management of the species.

Case study 21 describes the approach being taken to the harvesting of cycads in the Northern Territory.

Fauna

The removal of native animals from Australian forests is prohibited or subject to regulations enforced by government agencies in all jurisdictions. Harvesting for meat and skin products is largely restricted to those species considered to be common, and in most cases requires a permit. Permits are usually only issued for a species after a detailed sustainability analysis. The analysis takes into account factors such as local population levels (including trends in population numbers), reproduction rates, and pressures such as disease or habitat loss likely to adversely affect the species.

Many species of kangaroo are harvested commercially for meat and skins. Annual national quotas are set for each species by the relevant state agencies and endorsed by the Australian Government Department of the Environment, Water, Heritage and the Arts under delegated authority provided via approved species management plans approved by the responsible minister. The annual harvest quotas are percentages of the estimated populations based on direct population monitoring. In some states, subquotas are then set regionally and allocated to individual property holders on a permit basis. In all states, a sealed tag must be attached to each carcass before it can be processed.

Exotic fauna species are also harvested in Australia for meat and skins. Many of these species, such as pigs, goats and water buffalo, are officially declared pests that adversely affect forest health. For these species, the harvesting rate is usually determined by forest management rather than by ecological sustainability criteria. The live export of water buffalo from Arnhem Land is the subject of a case study in Indicator 6.1d.

Indigenous harvest, including traditional use

Indigenous Australians harvest wildlife for both traditional and commercial purposes. Non-wood Indigenous forest products include carvings, bark paintings, wooden sculpture, weaving, pigments and dyes, and subsistence products used for food and ceremonial purposes.

The sustainable use of non-wood forest products is extremely important to Indigenous communities in remote regions of Australia; such products often constitute a significant proportion of local customary and non-welfare cash economies.⁸ Despite the importance of the non-wood forest product harvest to the conservation of particular species and the livelihoods of many Indigenous communities, few studies have attempted to assess its size and impact. However, one survey that looked at the Indigenous use of wood for carving in central Arnhem Land found the practice to be sustainable despite a steep increase in output.⁹ Indicator 6.1b includes a case study on the Indigenous arts and crafts industry.

References and further reading

Altman (1987), Altman and Taylor (1989), Belcher et al (2005), Davies (2005), Griffiths et al (2003), Koenig (2007), Marrfurra et al (1995), Puruntatameri et al (2001), PWCNT (1997), PWSNT (2003, 2007), Raymond et al (1999), Russell-Smith et al (1998) (list at the end of the report).



Tree or man ferns (*Dicksonia antarctica*).

Case study 21: The sustainable harvesting of cycads

Researchers in Arnhem Land in the Northern Territory assessed the wild harvest of the native cycad (*Cycas arnhemica*), an understory plant in tropical eucalypt savannas. All Northern Territory cycads are listed in CITES Appendix II, which means that they can only be traded under an approved management plan that meets specified standards for impacts on wild populations. In 1997, the Parks and Wildlife Commission of the Northern Territory introduced a management program for cycads that allows seed and leaf harvest and makes provision for the limited harvesting of adult stems. The plan was modified in 2000 to allow experimental non-salvage harvests of a number of native cycad species, including *C. arnhemica*.

Based on this management program, replicated harvest treatments were monitored for two years to determine the effects of wild harvest and environmental factors such as fire frequency and disturbance by feral animals on cycad survival, recruitment and stem growth. Researchers suggested that the wild harvest of the species would have minimal impact if it focused on juvenile stems and if the return time (the time before next harvest) was extended to 15–40 years.

The outcomes of this and other research were taken into consideration by the Northern Territory Government in formulating the management program for cycads for the period from 2003 to 2008, allowing annual wild harvests not exceeding 5% of the population, assessed on a case-by-case basis.

Sources: Griffiths et al (2003), PWCNT (1997), PWSNT (2003, 2007)

⁸ Altman and Taylor (1989).

⁹ Koenig (2007).

Indicator 2.1e

The area of native forest harvested and the proportion of that effectively regenerated, and the area of plantation harvested and the proportion of that effectively re-established

Rationale

This indicator is used to assess the success of the re-establishment of forests after harvesting. Re-establishment is critical to the maintenance of the productive capacity of the forest.

Key points

- Relevant jurisdictions have codes of forest practice and other regulations requiring the regeneration and/or restocking of harvested multiple-use public native forests to specified standards; some states have similar codes of practice and regulations for private forests.
- Reported regeneration success rates in multiple-use public native forests are high. In plantations, success rates are generally above 90%.
- Remedial action is carried out in areas where specified standards are not achieved.
- The regeneration rates reported for Victoria and Tasmania are equal to or exceed those reported in SOFR 2003, but no comparisons were possible for other jurisdictions.

The term 'forest regeneration' usually refers to new trees that establish in a forest after timber harvesting, fire or other causes have removed some or all trees from the forest overstorey. This indicator provides information on the area of native forest regenerated each year after harvesting, the proportion of the total area of harvesting this represents, and the success of the regeneration effort for Tasmania, Victoria, New South Wales and Western Australia, where significant volumes of wood are harvested in native forests. It also reports on the area of plantations replanted after harvesting and the success of the replanting effort.

Native forest regeneration

The relevant jurisdictions have established standards for the effective regeneration of multiple-use public native forests; some also have standards for private forests. Regeneration is usually assessed 1–3 years after harvest, although the period is longer in some jurisdictions. Further treatments are carried out if regeneration standards are not met. The definition of, and standard for, effective regeneration varies between jurisdictions, but all aspire to the full stocking of the site.

Managers of multiple-use public forests are required by codes of forest practice and other regulations to measure the effective regeneration (e.g. by stocking, density and species composition) of areas harvested for timber production and to report the results publicly. Regional differences in forest type, climatic and biophysical conditions and management objectives mean that each jurisdiction has its own method for assessing the success or effectiveness of regeneration. While assessment techniques are well developed in even-aged native forests, they are less so in multi-aged stands, where there may be trees of markedly varying age and height. Prescribed fire and site disturbance are employed to encourage regeneration in many multiple-use public native forests.

In New South Wales, the effective regeneration for the period from 2000–01 to 2004–05 was generally over 80% (Table 37). The impact of drought has been a significant factor in the regeneration of some forests because successful regeneration requires adequate soil moisture for seedling establishment. Wildfires have also affected regeneration in some forests. Further silvicultural treatment is undertaken to meet specified standards wherever feasible.

Table 37: Area of multiple-use public native forest effectively regenerated, New South Wales, 2001–02 to 2005–06

Year	Total area effectively regenerated (ha)	Proportion of total harvested area effectively regenerated (%)
2001–02	5,215	68
2002–03	10,076	87
2003–04	10,044	86
2004–05	4,670	83
2005–06	3,870	74

Source: Forests NSW

In Victoria, the area of even-aged multiple-use public native forest regenerated after harvesting is reported only up to 2000–01 because of a 4–5-year lag between regeneration treatment and assessment. Table 38 shows results from initial regeneration treatments for the period from 1996–97 to 2000–01; under the state’s code of forest practice, a harvesting coupe that does not meet the minimum standard is re-treated so that, over time, the harvested area is effectively restocked. The data in Table 38 compare favourably to those reported in SOFR 2003 for the period from 1993–94 to 1996–97.

In Western Australia, the Forest Management Plan 2004–13, which covers all the main timber production areas in the state’s southwest, and supporting guidance documents such as the *Silvicultural Guidelines* require that regeneration success and effective stocking rates be monitored in

publicly owned forests. In the mixed-age jarrah forest, the regeneration stocking rates in areas cut over to establish regeneration are sampled; a target has been set that no more than 5% of the area regenerated will require remedial action. Similarly, in karri forest the regeneration stocking rates within even-aged forest are assessed after the first winter and infill planting is undertaken if the stocking of patches falls below given standards. Key performance indicators have been developed for the public reporting of the timeliness and effectiveness of regeneration.

Forestry Tasmania reports annually on the level of regeneration achieved in all harvested native forest areas in multiple-use public forests. It requires that at least 85% of harvested forest meets the required stocking rate, which is based on the number and spatial distribution of acceptable seedlings, saplings or trees that occur within the area being assessed and varies depending on forest type. In the period from 1998–99 to 2005–06, the standard was achieved on 95% or more of regenerated areas (Table 39), well above the target of 85%. These results are similar to or slightly better than those reported in SOFR 2003 for the period from 1994–95 to 1997–98.

Under the Tasmanian code of forest practice, sowing and planting mixtures must approximate the natural composition of the canopy trees of the harvested forest. The code also requires that regeneration surveys be conducted one year after clearfelling or two years after partial harvesting in eucalypt forest. Where surveys show that survival is less than the required stocking, measures to increase stocking to the required standard are considered.

Table 38: Area of even-aged multiple-use public native forest effectively regenerated, Victoria, 1996–97 to 2000–01

Year	Total area treated (ha)	Total area effectively regenerated (ha)	Proportion of total harvested area effectively regenerated (%)
1996–97	6,650	5,050	76
1997–98	5,590	5,140	92
1998–99	6,730	5,820	86
1999–2000	5,820	5,210	90
2000–01	2,350	2,150	92

Source: Department of Sustainability and Environment (Vic.)

Table 39: Percentage of regenerated native forest meeting stocking standards in Tasmanian multiple-use public native forest, 1998–99 to 2005–06

Reporting year	Regeneration year – eucalypt clearfelling and partial logging	Regeneration year – rainforest/blackwood swamp	Total area treated (ha)	Total area that achieved standard (ha)	% area meeting standard
1998–99	1995–96	1993–94	4,006	3,815	95
1999–2000	1996–97	1994–95	5,466	5,184	95
2000–01	1997–98	1995–96	4,145	4,011	97
2001–02	1998–99	1996–97	4,808	4,568	95
2002–03	1999–2000	1997–98	4,148	3,837	93
2003–04	2000–01	1998–99	5,526	5,141	93
2004–05	2001–02	1999–2000	6,569	6,526	99
2005–06	2002–03	2000–01	7,226	6,942	96

Source: Forestry Tasmania



Certified native forest regrowth stand, Tasmania.

Plantation re-establishment

The size of Australia's plantation estate is increasing as areas are replanted after harvesting and new plantations are established, almost all on cleared agricultural land. The decision to re-establish plantations depends on factors such as site suitability, grower intent, market availability and alternative land uses, particularly for plantations funded through private investment.

In Tasmania, conditions for plantation re-establishment were generally favourable over the reporting period. About 40,700 hectares of harvested plantations was replanted and only 1,730 hectares was converted to other uses, a conversion rate of about 4% (Table 40).

The choice of species deployed in re-established or new plantations varies. In 2006, hardwood plantations accounted for 86% of new plantation areas established in Australia.

State agencies and most private growers have internal management systems to assess plantation regeneration or re-establishment stocking levels and prescribe remedial treatment. Where plantations are re-established, the level of stocking is usually close to 100%: for example, in South Australia the proportion of plantations restocked effectively was 98–100% between 2001–02 and 2004–05 (Table 41). Results in other jurisdictions and in private plantations vary but are consistently high for both softwood and hardwood plantations.

References

Forest Practices Authority (1996–2006), Forestry Tasmania (2001–2005) (list at the back of the report).

Table 40: Area of public and private plantation forest harvested and proposed for re-establishment or converted to non-forest land use, Tasmania, 2000–01 to 2005–06 (hectares)

Year	Clearfelled, followed by plantation re-establishment	Clearfelled, followed by conversion to non-forest use
2000–01	5,230	90
2001–02	5,350	360
2002–03	7,740	130
2003–04	8,250	420
2004–05	6,550	220
2005–06	7,590	510
Total	40,710	1,730

Source: Forest Practices Authority (Tas.)

Table 41: Softwood plantation establishment in South Australian public plantations, 2001–02 to 2004–05

Year	Total area treated (ha)	Total area effectively replanted (ha)	Proportion effectively replanted (%)
2001–02	2,603	2,603	100
2002–03	2,267	2,225	98
2003–04	2,470	2,468	100
2004–05	2,521	2,517	100

Source: ForestrySA



New plantations established during the reporting period are mainly hardwood eucalypts. Stocking levels achieved are usually above 90%.