Australian Government
Bureau of Rural Sciences

Australian forest profiles
Australia's forests

Left to right: rainforest, acacia, casuarina and plantation forest types.

Australia has just over 147 million hectares of native forest and about 1.82 million hectares of plantations. With an estimated 4% of the global forest estate, Australia has the world's sixth-largest forest area and the fourth-largest area of forest in nature conservation reserves.

Australia's forests play an essential role in biodiversity conservation, the global carbon cycle, the supply of fresh water, and the maintenance of many cultural, social and environmental values. Forests also provide the resource base for economic activities that employ thousands of people across Australia, particularly in rural and regional areas.

The Australian Government, in cooperation with state and territory governments and other stakeholders, collects, compiles and analyses national information on forests and prepares comprehensive national reports on the state of Australia's forests, most recently in 2008. The *Australian forest profiles* series presents information on each of Australia's eight major forest types (eucalypts, acacia, callitris, casuarina, mangroves, melaleuca, plantations and rainforest). This profile provides an overview of all forests.

What is a forest?

In Australia, a forest is defined as an area, incorporating all living and non-living components, that is dominated by trees having usually a single stem and a mature or potentially mature stand height exceeding two metres and with existing or potential crown cover of overstorey strata about equal to or greater than 20%.

Under this definition, a large part of Australia's mallee qualifies as forest, as do very large areas of tropical savanna and woodland, where trees are spread out in the landscape. What many people would traditionally regard as forests – expanses of tall, closely spaced trees – comprise a relatively small part of Australia's total forest area.

Origins

The origins of Australia's forests can be traced to the beginning of the Cretaceous period, at least 135 million years ago, when the supercontinent Gondwana began to fragment into Africa, South America, India, Australia/Antarctica and many smaller islands. During the intervening millennia, Australia evolved a new and unique biota.

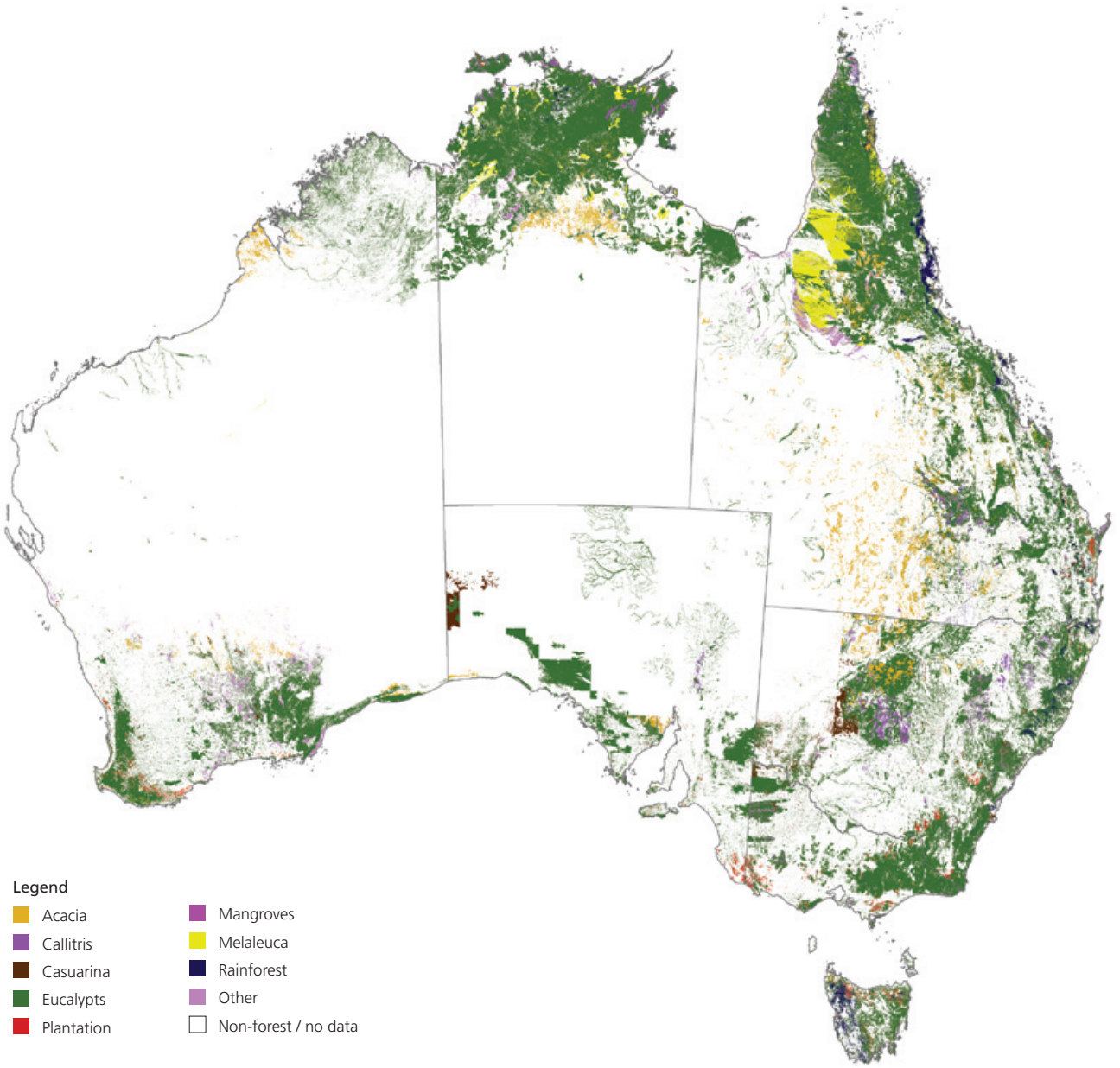
About 38 million years ago, the Australian continent broke away from Antarctica and shifted northwards, colliding with Asia about 13 million years ago. As it drifted northward, the climate became progressively warmer and drier and the vegetation adapted accordingly. Cool and warm rainforests were replaced by sclerophyllous genera such as *Eucalyptus* and *Acacia* – plants that have hard, spiky or shiny leaves to reduce moisture loss and are adapted to a regime of frequent fire. Nevertheless, Gondwanan flora continued to survive in isolated pockets, such as in remnant cool temperate rainforests in eastern Australia, the wet tropical rainforests of northeastern Queensland, isolated areas of the Northern Territory, and the Kimberley in Western Australia.

Over the past two million years, the forest estate has expanded and contracted as the climate has fluctuated between warm-and-wet and cool-and-dry periods. New species have also arrived, first from Asia and later from almost all parts of the world.

Humans have undoubtedly had the biggest impact. Indigenous Australians are thought to have occupied the continent for at least 60 000 years. Over millennia, their use of fire as a land-management and hunting tool probably had a major effect on the structure and composition of the vegetation, including forests, although the extent of this effect is still debated.

Europeans settled continuously in Australia in 1788. In the decades that followed, the new arrivals sought out and cleared land for agriculture and urban development, introduced intensive cropping and grazing and many new plant and animal species, and altered fire regimes. Much of Australia is now affected in some way by the impacts of European settlement.

Figure 1: Forest types and extent, 2008



Source: MIG (2008).

Note: The resolution of forests shown on this map has been enhanced to ensure their distribution is visible at the national scale.

Forest types

The distribution of forests is broadly determined by climate and soil properties, although other factors such as fire regimes are also important. By far the most common forest in Australia is eucalypt forest, which comprises 78% of Australia's total forest estate, followed by acacia, melaleuca, rainforest, casuarina, mangrove and callitris (Table 1 and Figure 1). Native conifers (cone-bearing trees, commonly called softwoods) such as *Araucaria cunninghamii* (hoop pine), *Araucaria bidwillii* (bunya pine) and *Athrotaxis selaginoides* (King Billy pine) dominate some forests, but their total area is insufficient to constitute major forest types. Plantation forests comprise just over 1% of Australia's forests and are mostly composed of eucalypts and non-native pine species, especially radiata pine (*Pinus radiata*).

Figure 2 shows the percentage of Australia's total native forest estate in each state and territory. Queensland has the largest proportion (35% of the total), followed by the Northern Territory (20%). Queensland and the Northern Territory also contain almost all (98%) of the melaleuca forest. New South Wales has 18% of the total forest area, while Tasmania contains only 2%. Table 2 shows the area of forest in each jurisdiction.

Table 1: Australia's forest area, by forest type, 2008

Forest type		Total ('000 hectares)	% of total
Native forest	Acacia	10 365	7
	Callitris	2 597	2
	Casuarina	2 229	1
	Eucalypt	116 449	78
	Mangrove	980	1
	Melaleuca	7 556	5
	Rainforest	3 280	2
	Other	3 942	3
Native forest total		147 397	99
Plantation		1 818	1
Australian forest total		149 215	100

Note: Totals may not tally due to rounding.
Source: MIG (2008).

Table 2: Forest as a percentage of land area, by jurisdiction, 2008

	Native forest area ('000 hectares)	Plantation area ('000 hectares)	Total land area ('000 hectares)	Forest as % of jurisdiction
ACT	123	10	243	54
NSW	26 208	345	80 064	33
NT	31 010	26	134 913	23
Qld	52 582	233	173 065	31
SA	8 855	172	98 348	9
Tas.	3 116	248	6 840	49
Vic.	7 838	396	22 742	36
WA	17 664	389	252 988	7
Total	147 397	1 818	769 202	19

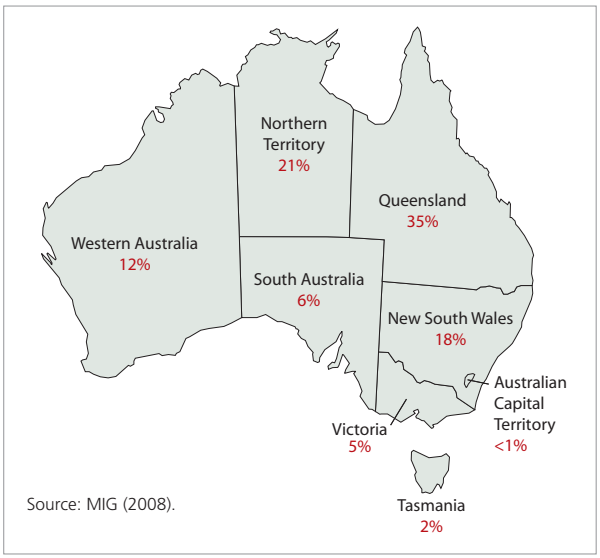
Note: Totals may not tally due to rounding.
Source: MIG (2008).

Crown cover and height classes

Crown cover is the area of ground covered by tree canopies, ignoring overlaps and gaps within individual canopies. Within the three crown cover classes of woodland, open and closed there are three height classes – tall, medium and low (Figure 3).

Table 3 shows the area of each native forest type by crown cover class. The distribution of crown cover class varies across the continent (Figures 4 and 5) depending on climate, soil type and land use. It is often related to the soil moisture regime and declines with lower water availability. Almost 100 million hectares, or two-thirds of the native forest estate, is classified as woodland and almost one-third as open forest.

Figure 2: Distribution of native forest in Australia, by jurisdiction



Source: MIG (2008).

Eucalypt low woodland.

Tenure

About 70% of Australia's forests is under private management – 44% on leasehold land and 26% on land either held under freehold private title or managed by Indigenous communities. About half the 65.1 million hectares of forest on leasehold land is in Queensland and there are also significant areas in the Northern Territory and New South Wales (Figure 7). More than 80% of forests classified as private are in Queensland, New South Wales and the Northern Territory.

Sixteen per cent of Australia's forest is now formally protected in public nature conservation reserves. Multiple-use public forests, where timber harvesting is generally permitted, cover 9.43 million hectares, or about 6% of Australia's total native forest estate.

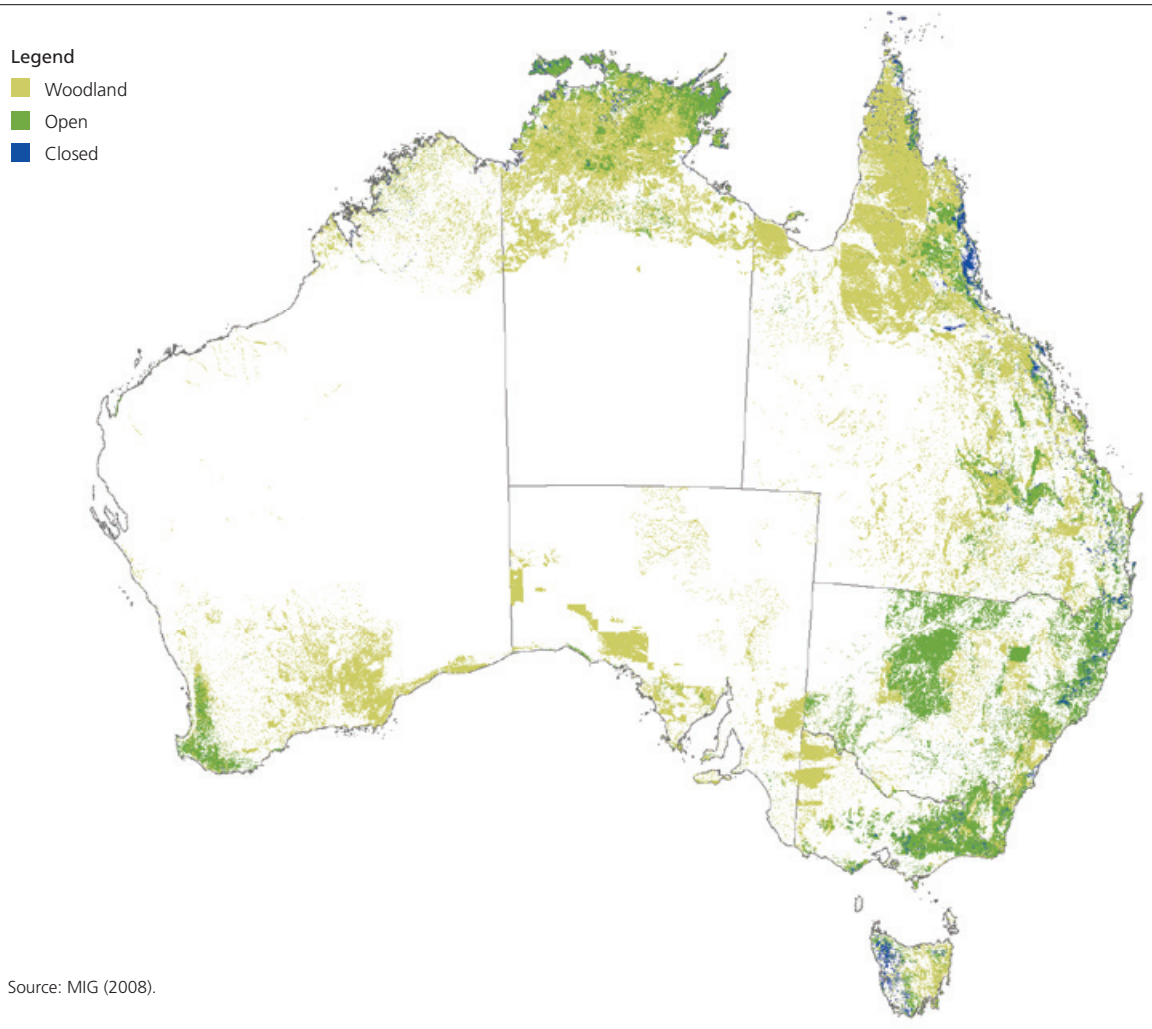
There are notable differences in the ownership of different forest types. About half of the drier and sparser woodland forests is on leasehold land and another quarter is on private land. The open forest types are distributed more-or-less evenly between public and private owners, while closed forests, comprising rainforest and mangroves, are mostly in public ownership.

Forest types: (left to right) callitris, mangrove, melaleuca and eucalypt medium woodland.

Figure 3: Crown cover and height classes

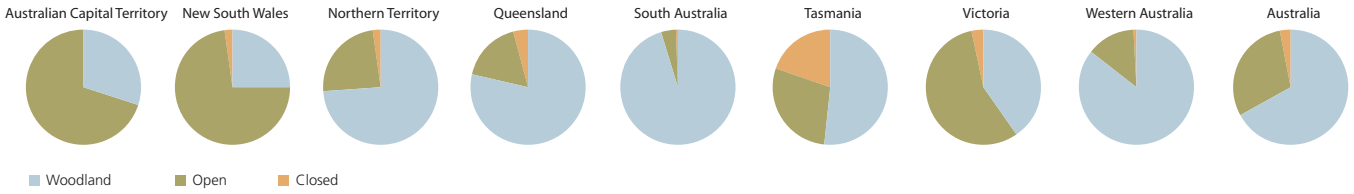
Source: Australian Land Information Group and JA Carnahan (1990), *Atlas of Australian Resources, Vegetation*. Australian Government Publishing Service, Canberra.

Figure 4: Native forest, by crown cover class



Source: MIG (2008).

Figure 5: Crown cover class, by jurisdiction



Source: MIG (2008).

Table 3: Area of native forest, by crown cover class, 2008 ('000 hectares)

Forest type	Woodland	Open	Closed	Total
Acacia	7,059	3,306	–	10,365
Callitris	803	1,793	–	2,597
Casuarina	2,082	191	–	2,274
Eucalypt	79,878	37,050	421	117,349
Mangrove	99	331	552	980
Melaleuca	6,654	878	26	7,556
Rainforest	–	–	3,280	3,280
Other	3,240	693	–	3,942
Total	99,007	44,120	4,270	147,397

Note: Totals may not tally due to rounding.
Source: MIG (2008).

Indigenous people manage about 21 million hectares of forests, using them for a wide range of customary and commercial activities.

Forest clearing for pasture in Queensland

The State of Queensland monitors the rate of change of woody vegetation cover and remnant native vegetation ecosystems. The Queensland Government introduced a range of measures designed to phase out the broadscale clearing of remnant native vegetation in the State by the end of 2006. Levels of clearing in 2005–06 (latest available data) are indicative of final broadscale clearing permits being activated before the deadline.

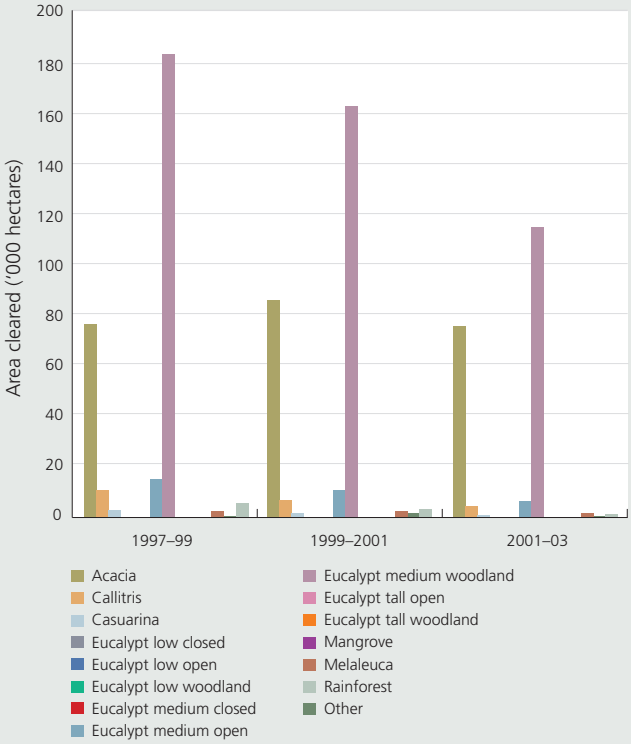
The Statewide average annual woody vegetation clearing rate for the 2005–06 period was 375 000 ha/yr. This is 49% lower than the peak measured woody vegetation clearing rate in 1999–2000 of 758 000 ha/yr. Clearing of remnant woody vegetation was 222 000 ha/yr in 2005–06, 59% of the total.

Clearing to pasture across freehold and leasehold lands remained the single major replacement cover, making up 95% of the clearing for 2005–06, though clearing also for animal fodder occurred in response to sustained drought in the Mulga Lands. The remaining clearing was for cropping, forestry, mining, infrastructure and settlement.

The region with the highest woody vegetation clearing rate for 2005–06 was the Mulga Lands, with 169 500 ha/yr, or 45% of the State's woody vegetation clearing. This was followed by the Brigalow Belt, with 32% of the State's woody vegetation clearing. Almost all of this clearing, therefore, has occurred in the drier open acacia and eucalypt medium woodland forest types, as has been the case in earlier years (Figure 6).

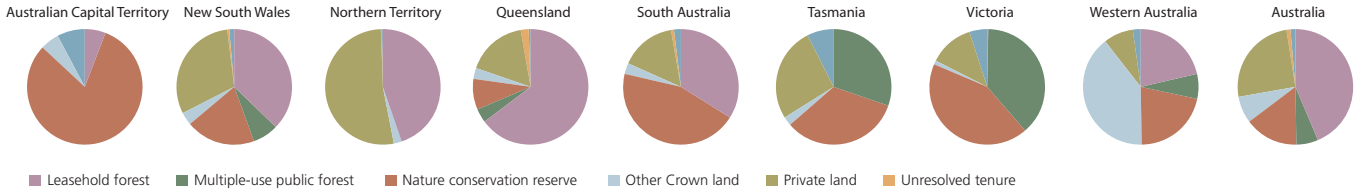
Source: ©The State of Queensland (Department of Natural Resources and Water) (2008).

Figure 6: Forest clearing in Queensland, 1997–99 to 2001–03, by forest type



Source: MIG (2008).

Figure 7: Forest area, by tenure and state ('000 hectares)



Source: MIG (2008).

State of Australia's forests

Forests are complex ecosystems that provide a wide and dynamic array of environmental and socioeconomic benefits and services. The aim of sustainable forest management is to maintain the broad range of forest values in perpetuity, but assessing progress towards this aim is difficult. Criteria and indicators are used to simplify the task by characterising the essential components of sustainable forest management. They are intended to provide a common understanding of what is meant by sustainable forest management and a common framework for describing, assessing and evaluating a country's progress towards sustainability at the national level.

Australia's 2008 report on the state of the nation's forests drew conclusions under seven broad criteria.

Criterion 1: Conservation of biological diversity

About 23 million hectares of forest (16% of the total forest estate) is now in formal nature conservation reserves.

It is difficult to measure the change that has occurred in the extent and distribution of forests since European colonisation. One estimate suggests that about 25% of the total forest estate existing before European settlement has been cleared for agricultural and urban development. Australia therefore retains about three-quarters of its original forest estate, although in many cases in a highly modified form.

The rate of clearing has been higher in the intensively managed agricultural and urban zones, where an estimated one-third of the native vegetation has been cleared or substantially modified. In some regions, this percentage is much higher. As a result, those areas exhibit a relatively high level of fragmentation. The cessation of broadscale tree clearing in much of Australia and increased protection of forests have been critical in reducing forest fragmentation in recent times.

The net loss of woody vegetation (mostly forest) in Australia was 260 000 hectares (0.25%) a year between 2000 and 2004, mainly because of to clearing for agriculture and urban development. This rate is declining in response to changed land management practices and increased legislative controls.

Old-growth forest

The growth stage of a forest provides an indication of its biodiversity and ecological values. Some growth stages, such as old-growth[1], provide specific habitat for particular species, wood products and a range of aesthetic and cultural values. Of the 23 million hectares of forest assessed for old-growth, 5.03 million hectares (22%) is classified as old-growth. More than 70% of known old-growth forest is in nature conservation reserves.

Old-growth eucalypt forest, Tasmania.

Criterion 2: Maintenance of productive capacity of forest ecosystems

Plantations produce about two-thirds of Australia's log supply.

Overall, the volume of timber harvested from multiple-use public native forests is declining, as a result of reductions in the area allocated to timber extraction and other restrictions on harvesting, and revised downward estimates of sustainable yield.

A number of non-wood native forest species are subject to commercial harvesting regimes. Approaches to assessing the sustainability of the Australian non-wood forest product sector are being developed.

1 Australia's National Forest Policy Statement defines old growth as 'forest that is ecologically mature and has been subject to negligible unnatural disturbance such as logging, roading and clearing'.

Left to right: Echidna (*Tachyglossus aculeatus*); stripping cork bark; fire in a pine plantation near a log dump, Tumut, New South Wales, December 2006; rainforest in a gully helps prevent erosion and protects water quality in the riparian zone.

Criterion 3: Maintenance of ecosystem health and vitality

Drought has recently affected large areas of Australia, with significant impacts on forest health. Drought contributed to a series of intense wildfires that affected large areas of forest in southeastern Australia, especially in 2002–03 and 2006–07. There is evidence that global climate change could further exacerbate the risk of wildfire in southeastern Australia.

Planned fire is an important forest management tool in Australia because many forested ecosystems are ecologically adapted to fire and require it for regeneration, and it can also reduce the severity of wildfire.

Although damage to forest ecosystems from most native insect pests and pathogens is widespread, it is usually of low severity. Occasional outbreaks and epidemics occur and the resultant damage can adversely affect commercial values, particularly in plantations.

Criterion 4: Conservation and maintenance of soil and water resources

Forests are important to many communities as a source of clean drinking water. In catchments managed specifically for water supply, activities that cause disturbances are either not permitted or are stringently controlled.

In most states and territories, forest harvesting is subject to codes of practice or other instruments that specify the measures that must be taken to mitigate soil erosion and their impacts on soil physical properties, and to maintain water quantity and quality. Recent major wildfires have affected water quality in some catchments.

Criterion 5: Maintenance of forest contribution to global carbon cycles

Forests are an important component of the global carbon cycle. Australia's forests sequester (absorb) more greenhouse gases from the atmosphere than they emit (release) and therefore help to offset Australia's contribution to global greenhouse gas emissions. In 2005, plantations offset about 3.5% and managed native forests about 5.5% of total Australian greenhouse gas emissions. Additional storage in wood products offset a further 1% of emissions. Deforestation, mainly for agriculture but also for urban development, was responsible for about 9% of total Australian greenhouse gas emissions in 2005.

The Australian Capital Territory's Corin Dam during drought. A wildfire in the catchment in 2003 caused significant erosion, affecting water quality.

Criterion 6: Maintenance and enhancement of long term multiple socio-economic benefits to meet the needs of societies

In 2005–06, the turnover of Australia's forest product industries was more than $19 billion, which was 5.3% of total manufacturing industry turnover. The annual production of non-wood forest products is worth hundreds of millions of dollars to the Australian economy. Total national employment in businesses dependent on growing and using timber in 2006 was estimated to be about 120 000 people.

Just under 21 million hectares (14%) of Australia's forests are under Indigenous ownership, the vast majority (98%) in the Northern Territory, Queensland and Western Australia. About 471 000 hectares of nationally listed non-Indigenous heritage places in forests is protected under the provisions of the national *Environment Protection and Biodiversity Conservation Act 1999*.

Criterion 7: Legal, institutional and economic framework for forest conservation and sustainable management

A comprehensive legal, institutional and economic framework designed to achieve the conservation and sustainable management of forests is in place at the state, territory and national levels.

There has been rapid growth in forest certification as a means of verifying the quality of forest management and maintaining access to markets. In addition, most multiple-use public forests and some private forests are now managed in accordance with codes of forest practice and externally accredited environmental management systems, which provide a structured approach to the planning and implementation of measures to protect the environment.

Left to right: Wood used in buildings is a long-term carbon sink; the area of native forest available for harvesting has declined and so has the volume harvested; safety helmets and high visibility vests are specified for all in-forest activities, including tree-marking; Pine plantation, ForestrySA's Kuitpo Forest Reserve, certified under the Australian Forest Certification Scheme.

The forest-growing and wood-processing industries are important employers in Tumut, New South Wales.

The tall eucalypts in Tasmania's Styx Valley are a significant tourist attraction.

References and further reading

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Website

www.daff.gov.au/forestsaustralia

White mallee (*Eucalyptus dumosa*) Lake Mungo National Park, New South Wales.

This is one in a series of profiles on Australia's major forest types. It has been compiled by the Bureau of Rural Sciences using information from the Australia's State of the Forests Report series. The latest in this series, *Australia's State of the Forests Report 2008*, and the profiles, can be obtained from:

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Eucalypt tall open forest.