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THE CHANGING FACE OF Justalia's FORESTS





A summary of major changes in Australia's forests since 1992

Prepared by the Bureau of Rural Sciences for Forest Industries Branch

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KEY POINTS

- » This publication summarises changes in Australia's forests and forest industry since the National Forest Policy Statement (NFPS) was agreed in 1992.
- The regional forest agreement (RFA) process, an initiative arising from the NFPS, resulted in the transfer of many large areas of public native forests used for timber production into conservation reserves and strengthened ecologically sustainable forest management. Structural adjustment packages introduced as part of the RFA process helped industry to adapt to these changes.
- » About 13.6 million hectares of forest has been added to the nature conservation reserve network since 1990. The area of public native forests available for timber production declined from 13.4 million hectares in 1998 to 9.4 million hectares now.
- » National accountability and reporting on forests improved over the period and forest certification has developed rapidly in recent years.
- » Log volumes harvested from native forests managed for wood production have been in the range 8.5–11 million m³. However, the 8.5 million m³ harvested in 2006–7 was the lowest since 1990–1. As harvesting moves to regrowth native forests, logs now are, on average, smaller in diameter and of different wood quality.
- » Australia's plantations expanded from about one million hectares in 1994 to over 1.8 million hectares in 2006. At present, 44% of plantations is hardwoods, a significant increase over the 15% in 1994. Ninety percent of new plantations established in 2006 is focussed on pulpwood production; the remainder at sawlog production. Plantations make up only about 1% of the forest estate. Private ownership of plantations increased from about 30% in 1990 to 59% in 2006.

- Job losses in the native forest industries have been compensated by employment in new hardwood plantations, maturing softwood plantations and new manufacturing based on plantation wood. Forestry and logging employment remained at about 11,000 and total employment in forestry, logging and manufacturing at 80,000–90,000 over the period 1999–2000 to 2006-7.
- The real value of timber production rose from about \$14 billion in 1992–3 to \$19 billion in 2005–6 (indexed to 2006–7). The production of hardwood sawn timber, mainly from native forests, fell from about 1.8 million m³ in 1984–5 to about 1.1 million m³ in 2006–7. The production of softwood sawn timber rose from about 1.2 million m³ in 1984–5 to nearly 4 million m³ in 2006–7.
- » Australia's exports of forest products increased in value from about \$300 million (non-indexed) in 1984–5 to over \$2.4 billion in 2006–7. Imports also rose, from about \$1.3 billion (non-indexed) in 1984–5 to \$4.3 billion in 2006–7. The trade deficit increased from about \$1 billion in 1984–5 to about \$2 billion in the mid 1990s and has remained at around \$2 billion per year.
- » Forests are now managed for many values in addition to wood production, including carbon sequestration and storage, biodiversity, water quality and quantity, and salinity mitigation.



The National Forest Policy Statement (NFPS) represents a significant milestone in the management of Australia's forests. Released by the Australian Government in December 1992, it embodied many developments in forests, both nationally and globally, including:

- the Resource Assessment Commission's Forest and Timber Inquiry, a comprehensive, independent study on forests in Australia. This was accompanied by strategic initiatives, including the National Strategy for Ecologically Sustainable Development, the Inter-Governmental Agreement on the Environment, the Endangered Species Protection Act 1992, and the National Greenhouse Response Strategy; and
- » the United Nations Conference on Environment and Development, also known as the Earth Summit, which was held in Rio de Janeiro, Brazil, in June 1992. This focused world attention on environmental issues and produced five important documents: i) the *Rio Declaration on Environment and Development*, ii) *Agenda 21*, iii) *Statement of Principles on Forests*, iv) *United Nations Framework Convention on Climate Change*, and v) the *Convention on Biological Diversity*.

The NFPS built on over two decades of continuous efforts towards sustainable management of forests and vegetation. The NFPS was agreed by the Australian, State and Territory governments to ensure the ecologically sustainable development of a commercial timber industry in conjunction with the identification and retention of nature conservation reserves and wilderness areas. It comprised eleven broad national goals (see box) and a range of policy measures aimed at increasing the competitiveness of forest industries and reducing conflict over the use of Australia's forests.

This report summarises changes in Australia's forests and forest industry since the publication of the NFPS.







GOALS OF THE NATIONAL FOREST POLICY STATEMENT

The eleven goals of the National Forest Policy Statement are:

- 1. Conservation: to maintain an extensive and permanent native forest estate and to manage it in an ecologically sustainable manner for the full range of forest values
- Wood production and industry development: to develop internationally competitive forestbased industries that maximise value-adding opportunities within Australia
- 3. Integrated and co-ordinated decision-making and management: to streamline land-use decisions and improve State Commonwealth interaction
- 4. Private native forests: to encourage the retention and better management of private native forests, both for resource and conservation reasons
- 5. Plantations: to expand commercial plantation development on cleared private land, both to provide additional timber resources and to help address land degradation problems on farmland
- 6. Water supply and catchment management: to ensure the protection of water catchment values
- 7. Tourism and other economic and social opportunities: to give greater recognition to the value of forests for tourism and to ensure that this use does not lead to a decline in these values
- 8. Employment, workforce education and training: to expand employment opportunities and the skill base of people working in forest management and forest-based industries
- 9. Public awareness, education and involvement: to foster community understanding of sustainable forest management and their participation in decision-making
- Research and development: to increase Australia's forest research effort and to ensure that it is well-coordinated and directed to appropriate goals
- 11. International responsibilities: to promote nature conservation and sustainable use of forests outside Australia and to ensure that Australia fulfils its obligations under international agreements

Source: National Forest Policy Statement



THE SIGNING OF THE NFPS INITIATED A NUMBER OF PROCESSES:

- >> the development of criteria for the establishment of a reserve system to meet the objectives of the NFPS;
- >> comprehensive regional assessments;
- >> regional forest agreements (RFAs): and
- >> expansion of the plantation estate.



FIGURE 1: Regions with regional forest agreements

Development of criteria for a reserve system

In 1993, an intergovernmental technical working group on reserve criteria (JANIS¹) produced a draft report called *Broad Criteria for the Establishment* of a Comprehensive, Adequate and Representative (CAR) Forest Reserve System. Taking into account this draft report, the Australian Government developed a set of criteria for a national reserve system, which included broad benchmarks for the conservation of forest biodiversity, old-growth forest and wilderness areas.

Comprehensive regional assessments

Comprehensive regional assessments involving significant stakeholder engagement were conducted over the period 1995–2000 to evaluate the economic, social and environmental values of forest regions. The information generated by these assessments and by additional consultation with stakeholders enabled State and Territory governments to make informed decisions about forest conservation, use and sustainable development. It was also used in the development of RFAs, which followed next.

Regional forest agreements

Ten 20-year RFAs were negotiated and agreed between the Australian and four State governments² – New South Wales, Tasmania, Victoria and Western Australia – over the period 1997–2001 (Figure 1). Collectively, these agreements cover about 20 million hectares and account for the majority of commercial forest areas in Australia. They specify areas that can be managed for timber production and for conservation and are monitored and reported on using Montreal Process criteria and indicators for sustainable forest managment.

The Environment Protection and Biodiversity Conservation Act 1999 came into effect in July 2000 and the Regional Forest Agreements Act 2002 in August 2002; both give effect to Australian Government objectives related to RFAs. The States and Territories continue to hold primary responsibility for land management and to develop forest policies outside the RFA regions.

Expansion of plantations

The NFPS provided the enabling environment for the expansion of Australia's plantations of softwoods and hardwoods so as to provide additional resources for industry and to increase on-farm planting to rehabilitate cleared agricultural land.

1 JANIS – Joint ANZECC / MCFFA NFPS Implementation Sub-committee, where the acronyms, respectively, stand for the Australian and New Zealand Environment and Conservation Council; the Ministerial Council on Forestry, Fisheries and Aquaculture (originally the Australian Forestry Council), and the National Forest Policy Statement.

2 A comprehensive regional assessment was undertaken in Queensland for an area of 3.2 million hectares. The RFA intended for South East Queensland, a region with productive native forests, was not finalised. Instead, the Queensland Government decided to end native forest harvesting in the region by 2025 and to reduce it in its Western Region forests by 2012.



TENURE CHANGES

One of the achievements of the RFA process was the establishment of comprehensive, adequate and representative reserve systems based on nationally agreed conservation criteria that take into account regional social and economic considerations. The area of protected forests in the RFA regions is very high.

The area of native forests in formal nature conservation reserves in Australia has more than doubled since 1990, from 6% to 16% of all forests (Figure 2). About 13.6 million hectares of forest has been added to the nature conservation reserve network. The RFA process also led to an increase in informal reserves³ in multiple-use forests.

Since the RFAs were agreed, State governments in New South Wales, Victoria and Western Australia have made additions to their formal nature conservation reserve systems. Recent additions to the reserve system have been made in Tasmania as a result of the Tasmanian Community Forestry Agreement, which was struck in 2005 by the Australian and Tasmanian governments. In New South Wales, the *Brigalow and Nandewar Community Conservation Area Act 2005* added 352,000 hectares of forest to nature conservation reserves stretching from Dubbo to the Queensland border.

Following the establishment of the Regional Forest Agreements in NSW, Tasmania, Victoria and Western Australia, the area available for wood production within the RFAs has declined (Figure 3). In NSW and Victoria the multiple-use forest area available for wood production, respectively, declined by 67 and 25% by 2002; data for 2006 were not available for these States at the time of writing. By 2006, areas under multiple-use forests in Tasmania and Western Australia declined by 32 and 24%, respectively (Figure 3).







FIGURE 3: Multiple-use forest area for wood production in the regional forest agreement (RFA) regions

3 Informal reserves are areas of public forested land where timber harvesting and other commercial activities are not permitted.

NATIVE FOREST HARVESTING

Between 1990–1 and 2006–7, the volume of logs harvested from public and private native forests each year was in the range of 8.5–11 million m³ (Figure 4); the volume harvested in 2006–7 was the lowest since 1990–1. Annual sawlog harvests from native forest declined from a peak of more than 4.5 million m³ in 1994–5 to less than 3 million m³ in 2006–7. Trees harvested now from native forests are, on average, smaller in diameter (younger age) and of different wood quality than those harvested 15–20 years ago, with harvests now moving into regrowth stands. Native forest pulpwood harvests were in the range 5–7 million m³ between 1990–1 and 2006–7 (Figure 4).

In Figure 4, harvests are expressed as gross log equivalents. 'Sawlogs' includes logs used for sawnwood, veneers and plywood. 'Other' includes posts, poles and railway sleepers. Data exclude native cypress pine sawlogs, firewood and residues used in manufacturing processes or exported in the form of woodchips or recycled wastepaper.

The harvest of native cypress pine sawlogs averaged 290,000 m³ per year between 1990–1 and 2005–6 and then declined to about 160,000 m³ in 2006-7. Firewood harvests were an estimated 4 million m³ per year in 1990–1 and 5–6 million m³ in 2005–6. Wood-fibre residues used in manufacturing were an estimated 1–2 million m³ per year over the period.



FIGURE 4: Harvest levels in Australian public and private native forests, 1990–1 to 2006–7







OLD-GROWTH FORESTS

Old-growth forests are ecologically mature forests in which the effects of disturbance are negligible. Their management has often been contentious because of their value for both conservation and timber production.

The RFA process led to significant increases in the area of old-growth forests in nature conservation reserves. Of the 20 million hectares of forest covered by RFAs, about 4.9 million hectares, or 24%, is classified as old-growth. About 74% of these forests was placed in nature conservation reserves as a result of the RFAs, with some of the remaining areas available for timber production. An additional 270.000 hectares of old-growth forests was identified in the South East Queensland Comprehensive Regional Assessment, of which 196,000 hectares was placed in reserves. More old-growth forests have been placed in nature conservation reserves in recent years through the creation of new national parks and the extension of existing ones in Victoria and in Tasmania.

Debate continues over the best way to manage old-growth forests. While some protected old-growth forest will inevitably cycle naturally through younger growth stages, the aging of protected forest now at the mature growth stage may mean that the extent of old-growth forest will increase over time. Conversely, both old-growth and mature forests will revert to young regrowth forest in the event of severe fires.

FOREST FIRES

Fire has played a major role in shaping the Australian environment over millions of years. Many of it's plants and animals have evolved to survive fire events and most Australian ecosystems have developed very specialised relationships with fire. In southern Australia, hot, dry and windy conditions in summer mean that bushfires are often intense and some develop into large landscape - scale fires. Such fires (sometimes called mega-fires) can result in a loss of human life, destroy and degrade assets and impact on carbon, biodiversity and catchment water values. Recent mega-fires in the Australian Capital Territory, New South Wales and Victoria have increased concerns about the impact of fires on communities, the forest industry and the environment and placed current fire management practices under increased scrutiny.





PLANTATIONS

The NFPS provided the impetus for plantations for Australia: Vision 2020, a partnership created in 1997 involving Australian, State and Territory governments and the plantation timber-growing and processing industry, aims to treble the area of plantation from about one million hectares in 1994 to three million hectares in 2020. The establishment of plantations is also being promoted with limited success on private land as part of farming systems. Commercial Environmental Forestry promotes forest establishment on cleared lands for both environmental and economic benefits.

Planting rate

The rate of establishment of hardwood plantations (mainly eucalypts) accelerated rapidly between 1995 and 2000, declined to 2003 and increased again (Figure 5), largely reflecting changes in taxation policy. Over the same period, the rate of establishment of softwood plantations (mainly pine) was low. Between 1995 and 2006, the total area of hardwood and softwood plantations expanded by an average of about 70,000 hectares per year.

Extent of plantations

Australia's plantations expanded from about one million hectares in 1994 to over 1.8 million hectares in 2006 (Figure 6). Most of the increase was in hardwoods: 44% of all plantations in 2006 was hardwoods, up from 15% in 1994. Ninety percent of new hardwood plantations established in 2006 is aimed at pulpwood production and the remainder at sawlog production. Plantations make up only about 1% of the area of the total forest estate.

Prior to 1990, native forests were often cleared for plantation establishment. This practice has declined substantially in the past decade or so, with most new plantations established on previously cleared land such as former pasture lands. The practice of clearing native forests for plantations has ceased on public lands Australia-wide.

Plantation ownership

At the same time as the balance between softwood and hardwood plantations has been changing, their ownership has become more diverse. Up to the early 1990s, State governments owned most plantations but, since then, most investment has come from the private sector and two State governments have sold off the bulk of their plantation estates; one sold all; the other sold a 50% interest. The private ownership of plantations increased from about 30% in 1994 to 46% in 1999 and to 59% in 2006. Figure 7 shows that the percentage of the plantation estate owned through managed investment schemes grew from 5% in 1994 to 26% in 2006, while the proportion owned by timber industry companies declined from 25% to 15%.

About 86% of all hardwood plantations is owned privately, compared to 36% of softwood plantations. Most (94%) of the new plantations established in 2006 is owned privately.

Tree breeding

Australia's native and exotic tree plantations are supported by a range of government and private tree-breeding and genetic improvement programmes. The genetic resources currently available for use in plantations have been developed through selective breeding over the past 60 years. Future genetic improvement is likely to play an important role in salinity mitigation, carbon sequestration and adapting trees to climate change. The practice of modifying tree genetic stock by the laboratory transfer of genes or parts of genes is not employed in any Australian tree-breeding programme.



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FIGURE 5: Planting rate of new plantations, 1995–2006*











FARM FORESTRY

Building on the NFPS, the Australian government established the National Farm Forestry Roundtable (1998-2000) resulting in the release of the Farm Forestry National Action Statement (2005). The Statement outlines actions for the Australian, State and Territory governments and the farm and wood products' industries to encourage development of farm forestry. Farm forestry incorporates commercial tree-growing in farming systems, using both plantations and native forests. By careful planning and location in the landscape, farm forestry can simultaneously address several natural resource management issues, making it a cost-effective public investment. It can also provide landholders with income from wood and non-wood products and improve agricultural production by providing shelter for livestock and crops.

Strategic farm forestry extension and research projects were conducted in most jurisdictions over the period. Despite the substantial investment in these projects, the available data show that only a small proportion of farmers have adopted farm forestry.

Market-enabling projects, such as on-line trading, have also been undertaken with the aim of linking farm foresters with timber processors. Opportunities and impediments for carbon sequestration and the sale of carbon offsets are also being investigated.



PRODUCTION FROM PLANTATIONS VS NATIVE FORESTS

Australia's total sawlog and pulpwood harvest grew from about 17 million m³ in 1992–3 to 27 million m³ in 2006–7. The annual yield from native forests was around 10 million m³ over the period and was exceeded for the first time by the yield from softwood plantations in 1996–7 (Figure 8). Volumes harvested from hardwood plantations are increasing rapidly and, while still at a low level, are responsible for keeping the total annual timber yield relatively constant in the face of recent decline in harvests from native forests.

STRUCTURAL REFORM OF THE TIMBER INDUSTRY

The production of native hardwood sawn timber has been declining by about 2% per year since the early 1980s, while production of softwood sawn timber has been growing by about 5% per year (Figure 9). The reasons for the decline in native hardwood sawn timber are a reduction in the allowable harvest in most public native forests, a change in average log size and quality as production has moved into regrowth native forest, and increasing competition from plantation softwoods. The volume of softwood sawn timber production exceeded that of native hardwood sawn timber in 1991–2 (Figure 9).

Declining volumes of hardwood sawlogs have led to the closure of a number of hardwood sawmills, particularly small, family-owned businesses. At the same time, some of the remaining sawmills have sought to increase in size and incorporate kiln drying and other means of value-adding.

The restructuring of the sawmilling industry has been supported by a range of assistance schemes funded by state and federal governments. The industry structural adjustment packages were designed to provide assistance to workers and businesses directly affected by the provision of, or changes to, Regional Forest Agreements. The Forest industry structural adjustment packages resulted in investment in upgrading sawmilling equipment, industry redevelopment and staff retraining.







FIGURE 8: Volume of sawlogs and pulpwood harvested, 1992–3 to 2006–7





CHANGING PRODUCTS AND NEW TECHNOLOGY

In the hardwood sector, there has been increasing market interest for hardwood flooring using timbers with natural 'features' such as knots and resin ducts, which previously sold at lower prices than clear wood. The use of 'waste' wood – wood remaining at the harvest site after merchantable products have been removed – is increasing, particularly for hardwoods. Various markets are developing for the processing of such wood for paper, engineered wood products such as medium density fibreboard and laminated veneer lumber, landscape products and bioenergy.

Australia's softwood processing industry expanded over the period, with new processing investments in panels, sawn timber and pulp and paper manufacturing. New products such as laminated veneer lumber, engineered strand lumber and hybrid beams have also entered the market. The industry has continued to upgrade and expand its existing softwood manufacturing facilities and to restructure through buy-outs and takeovers.

Improvements in information technology as well as advances in other processing and harvesting technologies have led to many changes in the industry. For example, new drying techniques have improved mill recovery rates. In the composite products' industry, research has focused on producing environmentally sound adhesives, often involving by-products from other processes.

Building regulations and trends are important factors influencing the direction of wood-product research and development. For example, fire-safety regulations have encouraged the emergence of new technology to minimise the fire hazard presented by the use of wood products in construction.

AUSTRALIA'S TIMBER PRODUCTION

Despite resource constraints and continued industry restructuring, the real value of turnover in Australia's timber products industry increased by an average of 2.2% per year during the period, from about \$14 billion in 1992–3 to \$19 billion in 2005–6 (Figure 10).

The estimated value of all logs harvested from Australian native forests and plantations increased by an average annual rate of about 6% from 1992-3 to 2006-7 after allowing for inflation (Figure 11). That rate of increase is about twice the rate of inflation during that period.

The proportions of the value of logs from native forests and from plantations were similar early in the period. From about the turn of the century, the native forest proportion decreased and the hardwood plantation proportion experienced a marked increase (Figure 12).

The trend in total consumption of timber products can be assessed from data on total log volume harvested and timber product exports and imports (Figure 13). Timber product volumes in this graph are expressed in log volume equivalent terms. This shows a steady upward trend in production, consumption, exports and imports with fluctuations that follow the level of activity in housing and construction. This trend is consistent with the rate of population growth. Total consumption of timber products has averaged about 1.05 cubic metres per person per year since 1992.

FIGURE 10: Estimated real value* of Australia's timber production, 1992-3 to 2005-6















FIGURE 13: Timber products consumption, Australia.



CERTIFICATION AND CHAIN OF CUSTODY

Discussion of forest certification – the voluntary, independent assessment of sustainable forest management activities and operations undertaken in a particular area of native forest or plantation – commenced in 1995 as a result of work associated with the development of RFAs. However, actual forest and chain-of-custody certification began more recently.

Following a comprehensive three-year review of an Interim Australian Standard published in 2003, Standards Australia recognised The Australian Forestry Standard as a full Australian Standard in 2007. This Standard along with a Chain of Custody Standard underpins the Australian Forest Certification Scheme, which is endorsed by the international Programme for the Endorsement of Forest Certification schemes (PEFC). It has now certified more than 8.5 million hectares of Australia's native forests and plantations in both the public and private sectors (Figure 14). The Scheme has issued over 14 Chain of Custody certificates (Figure 15).

The Forest Stewardship Council (FSC) scheme, which also operates internationally, has certified about 0.5 million hectares of private plantation and native forest in Australia (Figure 14). It has issued over 85 Chain of Custody certificates covering Australia's major paper manufacturers and wood products producers (Figure 15).







Chain of Custody certificates issued by the Australian Forest Certification Scheme and the Forest Stewardship Council





EXPORTS AND IMPORTS

In volume terms, Australia exports more wood-based products than it imports. However, the volume of paper-based imports has increased slowly to be now almost double the exports. Imports of solid wood products are lower in volume terms now than they were in 1991–2, while exports of these products have grown to the extent that they are now more than double the imports. The decline in import volume of solid wood products is due largely to the increased domestic availability of timber from maturing pine plantations.

In value terms, the converse applies (Figure 16). The value of imports is considerably higher than the value of exports; imports have exceeded exports by about \$2 billion per year for the past decade.

Woodchip exports have grown in both volume and value in the past decades (Figure 17) due to strong international demand for pulp, paper and paperboard products and increasing availability of plantation hardwood woodchips. Prices for hardwood woodchips from plantations have generally held firm, while those for woodchips from hardwood native forest and softwood plantations have weakened. Where RFAs are in place, export licences are not required under the *Export Control (Hardwood Chips)* (1996) Regulations (Amendment).

FIGURE 16: Value* of imports and exports of Australia's forest products, 1984–5 to 2006–7



FIGURE 17: Weight and value* of Australia's woodchip exports, 1988–89 to 2006–7







EMPLOYMENT

Forestry, logging and wood-based manufacturing continue to provide significant employment (Figure 18), including for people living in rural and regional Australia. Job losses in the native forest industries have been compensated by new opportunities in hardwood plantations, maturing pine plantations and wood-based manufacturing using increasing supplies of plantation wood.

Indigenous Forestry Strategy

The Australian Government launched its Indigenous Forestry Strategy in 2005. As a result of this strategy and an agreement between Australian Government agencies, the forest sector and Indigenous organisations, projects have been initiated with the aim of providing greater engagement, employment and business opportunities for Indigenous people in the forest sector, including from the increased use of Indigenous-owned and -managed forest resources.

Labour shortage

Australian manufacturing industries are facing a shortage of both skilled and unskilled labour. The forestry and forest products' sector has been particularly affected, with all facets of the industry, from timber harvesting to further processing, experiencing labour shortages. A rapidly expanding timber plantation resource and significant planned investments are likely to exacerbate pressure on labour resources.

Declining numbers of graduates in forest management

The qualifications needed to acquire a position in forest management have become broader, covering skills such as conservation management, forest law, biodiversity, stakeholder involvement, forest operations and economics. Prior to 1990, the Australian National University and the Melbourne University were the only two tertiary institutions offering forestry education. By 1997, however, institutions offering relevant degrees included Southern Cross University, the Australian National University, the University of Melbourne, the University of Queensland, the Curtin University of Technology, the University of Tasmania, Monash University, Griffith University, the University of Western Australia, the University of Ballarat, the University of New England and Deakin University.

Notwithstanding this increase, the number of graduating forestry professionals has declined over time, from 125 in 1989–90 to about 30 per year now. Given the diversity of opportunities for forestry graduates, including in conservation, land management, consulting and international work, total demand for graduates probably exceeds 75 per year.

Employers in Australia's forest-growing and management sub-sectors have identified the lack of professional foresters as the most serious component of their skills' shortage. To compensate, many have been recruiting entry-level foresters from abroad, drawing around 20% of their 2005–6 recruitment from this source. The forestry and forest industry sectors are expected to require at least 50 graduates per year in the future.



FIGURE 18: Employment in forests and wood manufacturing, 1986–87 to 2006–7

CHANGING VALUES

Forests are now managed for many values in addition to wood production, including carbon sequestration and storage, biodiversity, water quality and quantity, and salinity mitigation. Issues such as water management, biodiversity conservation, tree and soil health, fire management, ecological burning regimes, tree breeding and genetic manipulation have received increased public attention in both native forests and plantations. For example, the South Australian government recently announced that commercial plantation forestry will need to acquire licensed water allocations in that State equal to the amount of groundwater potentially taken up by the trees.



Kyoto Protocol

Australia ratified the Kyoto Protocol in December 2007 and will actively participate in negotiations towards a pact to replace the Kyoto Protocol after 2012.

Carbon

Forests play a crucial role in the sequestration of carbon. Under the Australian Government's Climate Change Policy, domestic emissions of greenhouse gases are to be reduced at least economic cost. The National Carbon Accounting System has been developed to assist in tracking the emission and sequestration of greenhouse gases from land use and land-use change. The system combines satellite imagery with models and data to provide a 30-year account of trends across the continent. It is now being used to determine Australia's land-based sources and sinks, track progress towards national emissions' targets, and inform policies and programmes in vegetation and land management.

Australia's native-forests and conservation reserves hold about 6.5 billion tonnes of carbon in the total tree biomass stock (ie above-ground biomass plus roots), excluding soil carbon (Figure 19). This is equivalent to keeping 24 billion tonnes of carbon dioxide (CO_2) out of the atmosphere, or 46 year's worth of Australia's current total emissions from all sources. There was almost no change in this stock between 1989 and 2004. Another 5.5 billion tonnes of carbon is held in soils under native forests, some of which is in the form of black carbon or charcoal, a very long-term sink.

FIGURE 19: Carbon stored in Australia's native forest biomass (above ground plus roots), 1989–2004







The stock of carbon in plantations is rising by 4.6% per year and has more than doubled since 1989 (Figure 20). In 2004, 84 million tonnes of carbon was stored in the standing stock of plantation total tree biomass. The rise since 1998 has been driven by the expansion of the hardwood plantation resource.

In 2005, 96 million tonnes of carbon was stored in Australia's wood and wood products in service (Figure 21). In the same year, over 140 million tonnes of carbon was stored in wood and wood products in landfill (Figure 21).

Native forests, plantations and wood products are net absorbers of CO_2 , sequestering 56.5 million tonnes of the gas in 2005. Forest clearing (mainly for agriculture and urban expansion) caused a total of 53.3 million tonnes of CO_2 -equivalent emissions in the same year. Therefore, the land use, land use change and forestry sector was responsible for a net sequestration of 3.2 million tonnes of CO_2 in 2005.

Renewable energy

The Mandatory Renewable Energy Target is a key plank in the Australian Government's strategy to restrict Australia's greenhouse gas emissions to 108% of 1990 emissions by 2012 and in positioning the country to reduce its greenhouse gas footprint. It is aimed at delivering clean energy to Australians and also regional development and employment growth. Forests and vegetation are deemed to be sources of renewable energy pending commercialisation of new technologies for extracting cellulose from biomass and then making biofuels from the cellulose.

Forests could therefore play a role in helping to meet the Australian Government's Mandatory Renewable Energy Target, under which 12%, or 9,500 gigawatts of the country's energy generation must be met by renewable energy sources by 2010. Australia currently generates only 650 megawatts of electricity from biomass.

FIGURE 20: Carbon stored in Australia's forest plantation biomass, 1989–2004



FIGURE 21: Carbon stored in wood and wood products in service and in landfill in Australia, 1990–2005



Land clearing

Stringent controls on land clearing are in place in most jurisdictions with many changes to legislation introduced since 1992. Nevertheless, forests are still being cleared, mainly for agriculture but also to make way for housing and infrastructure, particularly in coastal areas.

The rate of forest clearing declined over the period 1973–2004 and the rate of regrowth increased (Figure 22), with a consequent decline in greenhouse emissions (Figure 23).

Change in patterns of investment in research and reporting

Public expenditure on research related to primary production in and environmental management of native forests and plantations declined by 55% in real terms between 1981–2 and 2001–2. The relative importance of different categories of research in exotic (softwood) species' plantations, native species' plantations (hardwood eucalypts plus *Araucaria*), and native forests also changed.

In 1981–2, 42.8% of forest research expenditure was on exotic species' plantations, 2.5% on native species' plantations and 41.8% on native forests. By 2001–2, 35% of available resources for research was spent on exotic species' plantations, 31.4% on native species' plantations and 25.2% on native forests. These changes











occurred as the area of native forests available for timber production declined, the area of eucalypt plantations increased steeply and the area of new pine plantations declined.

When adjusted for inflation, exotic species' plantation research fell by 68%, or 3.4% per year, between 1981–2 and 2001–2. Investment in native forest research also fell, by 2.5% per year and 50% in total over the same period, as did environmental research, which declined by 54% over the period (2.7% per year). In contrast, research into plantations of native species rose by an average of 52% per year over the period.

Manufacturing is increasingly important as a driver of forest-related research and now exceeds research expenditure on forestry primary production and environmental management. Of the \$211 million spent on all forest-related research in 2004–5, \$108 million (51%) was for private-sector manufacturing research.

The Forest and Wood Products Research and Development Corporation funded research and development across the spectrum of forest industries after its creation in 1994. In September 2007, it was replaced by Forest and Wood Products Australia, which will continue the work of its predecessor and expand its role to include marketing and the promotion of forest industries.

The Natural Heritage Trust was set up by the Australian Government in 1997 to fund a range of research projects aimed at restoring and conserving Australia's environment and natural resources. The Trust provides funds for environmental activities at a community level (through the Australian Government Envirofund), a regional level, and a national and State level. Among other things it has delivered substantial increases in revegetation.

Plantations and water use

The National Water Initiative (2004) is Australia's blueprint for water reform. Increasing demand for water across Australia has given rise to concerns about the effects of land-use change on water supply. Although forest plantations are a minor land use at the national scale, the establishment of plantations on former pasture sites has become an issue in some catchments where water is in short supply.

Recent studies of two catchments in the headwaters of the Murray-Darling Basin indicate that an expansion of forest plantations of 30,000 hectares may reduce stream flow by up to about 1% in an average rainfall year. At a local scale, this impact may be noticeable in some years, particularly if new plantations are concentrated in certain sub-catchments. The impact will also vary under different groundwater scenarios. In some catchments, rising saline groundwater can cause surface soils and streams to become saline and the establishment of plantations may slow this process. In other catchments, where there is little usable surface water, plantations may be in direct competition with agriculture for the scarce groundwater resource.

The Australian, State and Territory governments have made a commitment through the National Action Plan for Salinity and Water Quality to jointly fund actions for tackling salinity and water quality management issues. The Plan provides practical ways for protecting and rehabilitating waterways, native vegetation and engineering works, and managing changes in land and water use.



FURTHER READING

Australian Government (1992, 1995) National Forest Policy Statement – a new focus for Australia's forests. Canberra

Australian Government (2004) Intergovernmental Agreement on a National Water Initiative. Canberra

Australian Department of Agriculture, Fisheries and Forestry (2005) *Farm Forestry National Action Statement*. Canberra

Bureau of Rural Sciences (2007) *Australia's Forests At A Glance*, Bureau of Rural Sciences, Canberra

Montreal Process Implementation Group for Australia (2008) *Australia's State of the Forests Report 2008*, Bureau of Rural Sciences, Canberra (in press) National Forest Inventory (2007) National Plantation Inventory 2007 Update, Bureau of Rural Sciences, Canberra

Parsons, M., Frakes, I. and Gavran, M. (2007) Australia's Plantation Log Supply 2005-2049, Bureau of Rural Sciences, Canberra

Parsons, M., Frakes, I. and Gerrand, A. (2007) *Plantations and Water Use*. Science for Decision Makers Series, Bureau of Rural Sciences, Canberra

CHRONOLOGY OF MILESTONES ASSOCIATED WITH THE NATIONAL FOREST POLICY STATEMENT

1992	1993	1994	1995
National Forest Policy Statement; National Strategy for Ecologically Sustainable Development; National Greenhouse Response Strategy; Intergovernmental Agreement on Environment	Montreal Process Criteria and Indicators; JANIS Reserve Criteria	Forest and Wood Products Research and Development Corporation	JANIS codes and standards; Regional Forestry Agreement process
2000	2001	2002	2003
North East NSW, Southern	Australian Mandatory	Mega-fires (NSW);	Australian Forestry

NSW, Gippsland, Victoria and West Victoria RFAs; National Action Plan for Salinity and Water Quality Australian Mandatory Renewable Energy Target Mega-fires (NSW); Regional Forest Agreements Act 2002 Australian Forestry Standard (Interim); NSW Greenhouse Gas Abatement Scheme; Mega-fires (ACT, NSW and Victoria)



1996	1997	1998	1999
Montreal Process Implementation Group established; Export Control (Hardwood Wood Chips) Regulations; Interim Forest Agreements	RFAs: East Gippsland, Victoria and Tasmania; National Forest Reserve Criteria; Plantations Australia 2020 Vision; Natural Heritage Trust	Central Highlands, Victoria, RFA; Kyoto Protocol and carbon emission targets; National Farm Forestry Roundtable	Western Australia, North East Victoria and Eden, NSW RFAs; <i>Environment</i> <i>Protection and Biodiversity</i> <i>Conservation Act 1999</i>

2004	2005	2006	2007
Chain-of-custody	National Indigenous	National Carbon	Australian Forestry
Standard (Interim);	Forestry Strategy; Farm	Accounting System;	Standard; Forest and
National Water Initiative	Forestry National Action	Prime Ministerial Task	Wood Products Australia
	Statement; Tasmanian	Group on Emissions	(formerly Forest and Wood
	Community Forest	Trading; Mega-fires	Products Research and
	Agreement	(Victoria, 2006 – 07)	Development Corporation);
			Australia's Climate Change
			Policy; Australia ratified
			Kyoto Protocol



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