

# forests & fires



“ There is a crucial interrelationship between our native forests (and, in time, plantations), water uptake and fire. In heavily forested areas of Australia, this may have major impacts upon our future water supplies to farmers and population centres ...

*The reality is, that if you look at Australia, the amount of land that receives over 600 mm of rainfall, that's in a temperate zone and that's reasonably flat, is probably only equal to a country half the size of England. It's a well-intentioned drive to plant more trees in Australia and replace imports and so on, but our available arable land is so very scarce that what's happening seems almost irresponsible. Then we've got all the steep land, the eroded land, the salty land that doesn't have a tree on it. Looking back in 30 years this [plantation mania] is not going to look all that clever.*

Terry Buckley, Mt Gambier potato farmer, 'Treechange', ABC TV *Four corners* program, 9 April 2007

*Studies have shown water uptake by Mountain Ash regrowth, following bushfire or logging, can reduce water yield in disturbed areas by 50% of pre-disturbance runoff rates, some 25 to 30 years after a bushfire. The impact on water yield is most pronounced in drought years when stream flow can be significantly compromised due to greater uptake of water by regrowth trees.*

Melbourne Water submission to Victorian Bushfire Inquiry, May 2003

All vegetation needs water to grow and trees are no exception. During the life of a typical tree (many can live for hundreds of years), water uptake is highest for the first 30 or so years. Water is drawn from the soil by a tree's roots, transported up through the trunk and branches to the leaves, from where a lot of it evaporates. This process is called transpiration.

In a forest this component of the water cycle occurs continuously, detracting from the runoff of surface water into the rivers and streams of a catchment area. If about 1000 mm of rain falls in an average year, about 150 mm may never reach the ground, being held on all the leaves in the forest canopy. The rest of the rain will land on the soil, but another 750 mm will be removed by transpiration. Only 100 mm will be available to move across and through the soil to enter the streams that drain the catchment.

This water uptake by growing trees can reduce the amount of surface water that reaches the watercourses flowing through the catchment. Studies have shown that in growing trees, water uptake from the catchment is maximal, at a rate of 5–6 ML per hectare for the first 20 to 25 years.<sup>1</sup> While the amount of water being taken up by the trees drops off as they mature, a degree of water uptake continues for between 25 and 50 years, depending on the eucalypt species.<sup>2</sup>

Eucalypt trees are very fire prone because of the high oil content in the leaves. After fire, a regrowing forest begins this water-uptake process again and vast amounts of water can be taken up, especially during the first 25 years.

**Trees have a long growing cycle, more foliage and deeper roots than pasture and crops. As a result, water runoff from forested catchments is generally lower than from catchments supporting other land uses.<sup>3</sup>**



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## THE FOREST RESOURCE

Australia has about 164 million ha of native forest, including rainforest. Most of the trees are on Crown land. Commercial forestry is permitted on about 11.4 million ha of this Crown land and is concentrated in Western Australia, Victoria, Tasmania and New South Wales. Another 1.7 million ha of commercial trees are located in plantations.<sup>4</sup> Commercial timber harvesting on Crown land is carried out under 20-year Regional Forestry Agreements between each state government and the Commonwealth of Australia.<sup>5</sup>

The forest industries are Australia's second-biggest manufacturing sector, contributing about only 1% to GDP and about 7% of manufacturing output.<sup>6</sup> Forest industries also

provide direct employment for approximately 80 000 people.<sup>7</sup> This employment is widely dispersed, with employment in many small communities critically dependent upon logging contracts, haulage, and jobs in around a thousand local saw mills, manufacturing plants and paper mills.

## THE MOVE TO A REGULATED INDUSTRY

Commercial harvesting of native timber was well established in NSW as early as 1820. Port facilities had been constructed in Sydney Harbour, the floodplains of the Parramatta and Lane Cove rivers were littered with farms and, as settlers continued to spread out and clear land, ancient stands of red cedar trees were

discovered. Each summer these trees were felled by groups of timber cutters, and cedar became one of the young colony's first export products.<sup>8</sup>

For more than a century, extensive commercial timber harvesting was a feature of Australia's development. Timber was produced for building and construction, for railways, ports, roads and mines as well as furniture, paper products and packaging. During this time, state governments introduced legislation and regulation to manage logging in each jurisdiction.

Today's forest industry is highly regulated. Most harvesting of native forests is carried out on Crown land in upper catchment areas. Areas with commercial trees are usually harvested using a method called clear-felling, so that most of the suitable trees are felled at one time. Some

time after the sawlogs have been removed, the residual material is burned and, after rain, the eucalypt seeds germinate. Seedlings are allowed to grow into mature trees which will be harvested about 80 years later.<sup>9</sup> Not all forest management, however, observes this rotation interval.

Logging is not allowed on steep slopes or close to the edge of streams. Mature trees that provide seed for forest regeneration, and also shelters and nesting sites for wildlife, are preserved. These regulations are in place to ensure that disturbed soil is not washed into the watercourses of the upper catchment and that logging impacts upon native fauna are moderated. Loggers operate under contracts with state governments and their operations must comply with prescribed codes of practice.

## PLANTATIONS & FARM FORESTRY

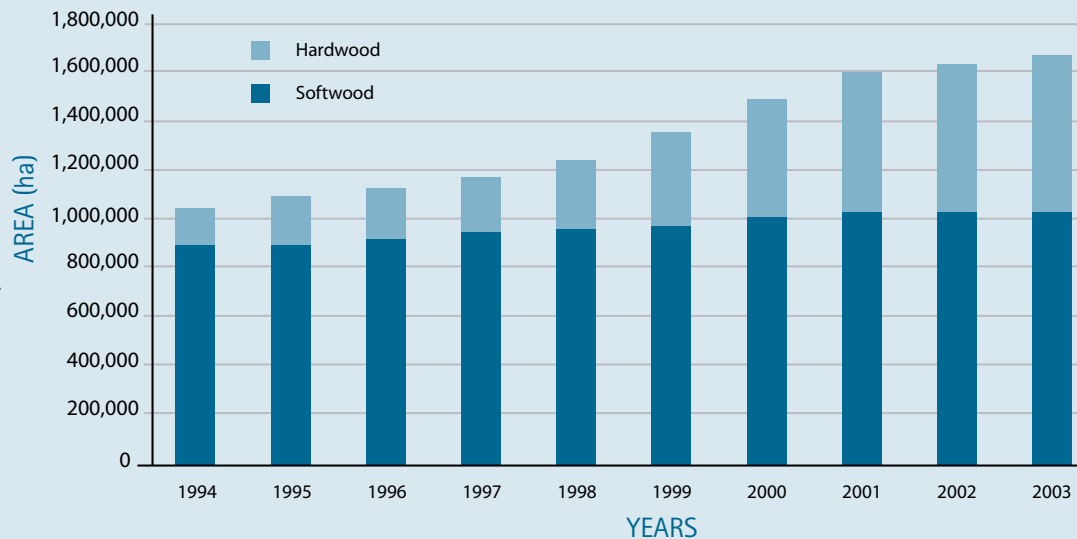
Commercial timber can be grown either on Crown land or on private land in plantations. Although trees have been grown in plantations in Australia for about 100 years, there has been a major expansion in the past 10 years, with the conversion of productive farmland to tree plantations on a large scale.

Driving this development was the 2020 Vision Statement, released by the then deputy prime minister, John Anderson, in 1997. This statement proposed that: 'Plantations have the potential to be of significant benefit to the natural environment, and a sustainable and viable land use in regional Australia. Commonwealth, state and territory governments have in place a set of national principles for the sustainable management of plantations, providing a framework for environmental, socio-economic

**Figure 1. Changes in area planted to softwoods and hardwoods, 1994–2004**

Since 1994 there has been significant change in the composition of tree plantations across Australia. While the planting of pines (softwood) has remained fairly steady, there has been a major increase in the area of land planted to eucalypt (hardwood) species. This has been occurring in those parts of Australia with the most reliable rainfall.

Source: Department of Agriculture Fisheries and Forestry – Bureau of Rural Sciences, *National plantation inventory Australia, 2006 Update*, p. 1.





and cultural issues to be addressed in the context of plantation establishment and management.<sup>10</sup> Significantly, the issues of water use and water balance are mentioned in passing only twice in the document.

Today there are three plantation types: softwood (pine), hardwood (eucalypt), and 'exotic' timbers (mixed species). All up, plantations (mainly softwood and hardwood) now cover about 1.7 million ha (or around 3%) of Australia's agricultural land. Current government policy settings, incentive schemes and taxation arrangements are aimed at reaching a target of 3 million ha by 2020.<sup>11</sup>

Pine plantations (softwood plantations) are now a feature of landscapes in the southeast of the mainland. Large-scale plantations have been established, mainly on Crown land. The volume of production and developments in the chemical treatment of the timber means it can be used for a wide range of requirements in building and flooring, as structural and furnishing timber and as packaging. Furthermore, this product has, in many cases, substituted the use of native forest timbers.

**Eucalypt plantations (hardwood plantations) account for most of the current expansion. In the last 10 years nearly 700 000 ha of new hardwood plantations (41% of the total plantation area) were established.<sup>12</sup> In 2004–05 alone, over 53 000 ha of new eucalypt plantations were planted.<sup>13</sup>**

Plantation eucalypts are usually harvested at around 12 to 15 years and converted to woodchips for export. Plantations of exotic timbers are small scale, long term and high value, aiming to produce timber for furniture products.

In the areas where most plantation eucalypts are being established, the young trees have an appreciable water requirement of about 1–2 ML per hectare per year.<sup>14</sup> However, in contrast to native forests where water uptake from the catchment decreases as trees age, water demand by plantation eucalypts never drops because the short rotation of the plantation cycle means that the trees are always young and vigorously growing.<sup>15</sup>

The scale of recent eucalypt plantings on private land is now attracting attention in rural communities. Serious concerns are

now being expressed about the additional water demand created by plantations and the capacity of catchments to meet this demand.<sup>16</sup>

In addition, this conversion results in the removal of money from local economies. For instance, a study has shown that for every 10 000 ha of dairy farms that were converted to plantations under managed investment schemes, \$361 million was removed from local economies over a period of 11 years.<sup>17</sup>

### FORESTS & FIRE

Over millennia, Indigenous Australians used fire as a tool to manage grasslands, forests and fauna. European settlers, fearful of fire, had to learn to live with naturally occurring bushfires. The modern-day response to bushfires is a sophisticated one, with the goals of protecting life, property and water catchments. We're accustomed to seeing television images of helicopters dropping water bombs on fire fronts and fire crews quelling spot fires with hoses. Depending upon the circumstances, the fire may be suppressed or merely contained.

We're also familiar with the response of the bush to a big fire. Immediately following the fire, tree trunks and the land surface are blackened. No animals or insects are to be seen and there is a distinctive acrid smell. A few weeks later, green shoots emerge out of the main trunks and branches; a good indicator of which trees have survived. New green shoots emerge from the soil and, as soon as it rains, the vegetation bursts into life again. Three to four years later the bush looks green again, the insects have returned, the birds have followed them and native animals are once again visible.

#### What we can't see is the longer-term impact that the fire will have upon the hydrology of the catchment.

When rain falls on a forest soon after a bushfire, surface water runoff actually increases for a short period of time. There may even be a serious flood because the trees have no canopy, so there are no leaves to absorb water and very little transpiration. As the new growth begins, leaf density in the canopy explodes, transpiration rises and surface water runoff lessens.

**Table 1. Areas burnt by major fire in Victoria, 1939–2007**

YEAR	AREA (ha)
1939	2 million ha
1983	486 000 ha
2003	1 300 000 ha
2006–07	1 238 000 ha

The fire of 1939 in Victoria destroyed a forested area equivalent to nearly one-third the area of Tasmania. The three major Victorian fires since 1983 have destroyed more forest area than the fire of 1939.

Subsequent regrowth of these forest areas is now placing high water demand on catchments. This will continue for several decades to come. Future fires will impose additional demands. Climate change predictions of hotter summers and drier catchments point to increased fire risk.

Source: Victorian Department of Sustainability and Environment, *Significant fire years*, <<http://www.dse.vic.gov.au/dse/nrenfoe.nsf/childdocs>>.



# THE BIG PICTURE

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### POST-FIRE EFFECTS

The water-demand effect often peaks 30 years after the fire, although it can sometimes last for up to 70 years. The long-term effects upon water supply can be huge, especially when a very large area of forest is destroyed.

For example, the 1939 fires in Victoria resulted in the destruction of nearly 2 million ha of forests. The water required for the natural regeneration and regrowth of these forests meant that less surface water was available for agriculture and industries in rural areas. Apart from the reduction in surface water to support these activities, Melbourne's water supply was also affected.

Some of the forests in Melbourne's water catchments were also destroyed by the 1939 fires. The authorities were able to quantify the resultant shortfall in surface-water runoff into Melbourne's water storages. This shortfall was a staggering 6 000 000 L per year for every hectare of forest. This deficit was experienced every year for the next 30 years.

**On 25 December, 2001, lightning strikes sparked a series of fires in several of Sydney's water catchments. These fires burned for several weeks and 225 000 ha of forested areas were blackened. Water supply from the Nattai Catchment has subsequently been reduced by 50%.<sup>18</sup>**

Predictions of the impact of global warming upon southern Australia include a rise in average daily temperatures, more hotter days and drier catchments. If this eventuates, we will experience more frequent fires and larger areas within catchments will be burned. This will result in water runoff in these catchments declining further. In addition, rainfall over many of these catchments is also predicted to decline. The shortfall in surface-water runoff due to fire effects and subsequent revegetation will become an even greater constraint on the overall availability of water.

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