

2 *A Short History of the Forests*



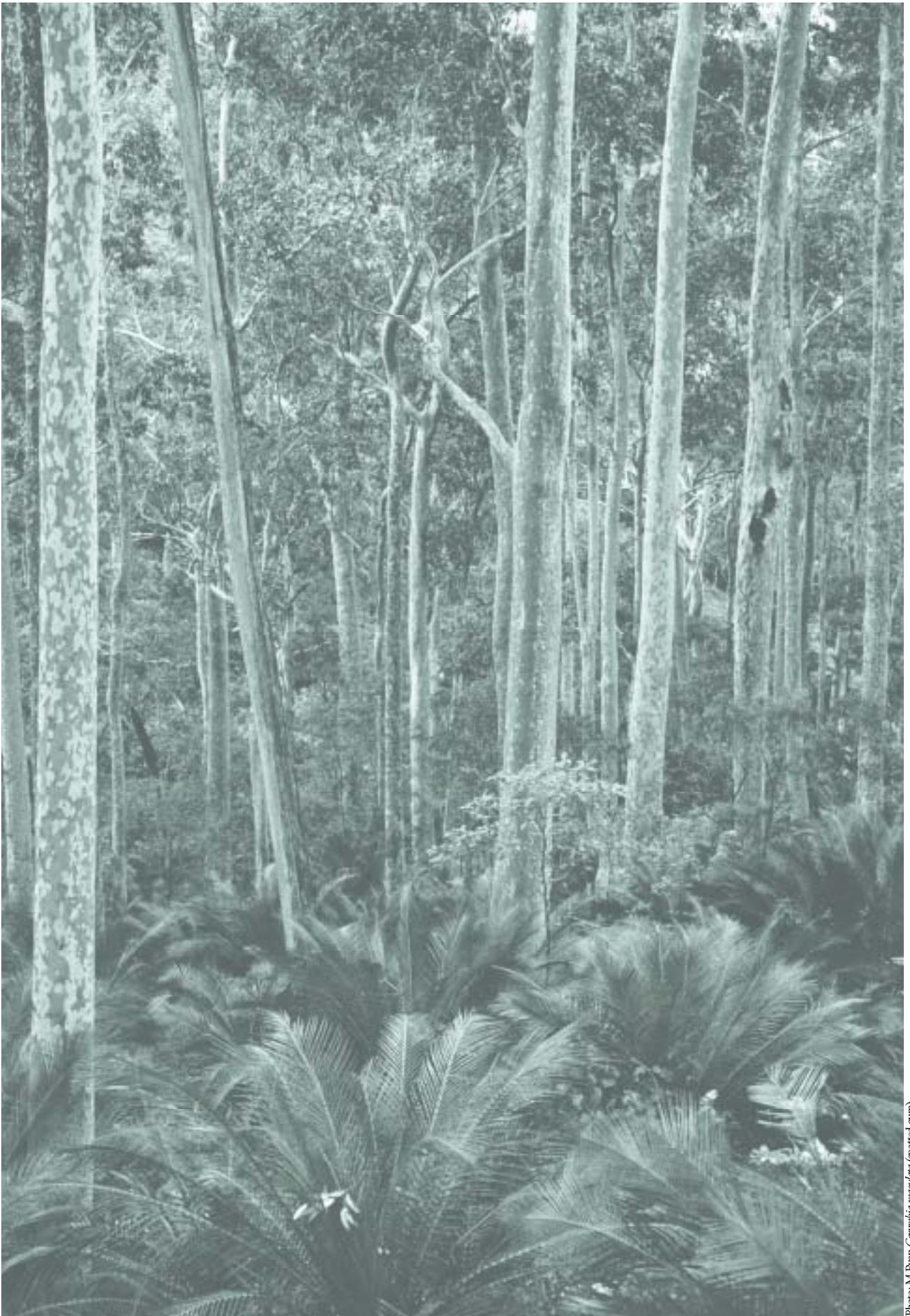


Photo: M. Ryan *Corymbia maculata* (spotted gum)

A Short History of the Forests

Australia's forests have ancient origins that determined their nature, affected how they could be used and influence how they are valued today. Their distinctive ecology evolved with the drift of what became the Australian continent breaking from the land mass of Gondwana about 135 million years ago, the great changes to the climate, the rise and fall of the seas, and the eventual separation of New Guinea and Tasmania from the mainland 10–15 thousand years ago.

From Pangaea via Gondwana to Great Southern Land

Current scientific opinion holds that the first trees on earth probably developed in the Devonian period, more than 400 million years ago. Trees we would recognise today started to develop much later, in the Cretaceous period, which began about 144 million years ago.

The Cretaceous period was a long and comparatively stable period of about 80 million years. A rich variety of plant and animal life developed and spread across the single world continent, Pangaea, as it slowly separated into two continents, Laurasia and Gondwana. Dinosaurs dominated animal life, and conifers – non-flowering plants – dominated the forests. On the Gondwanan part of the continent, the conifers were largely podocarps, araucarias and taxodiums.

Angiosperms, the flowering plants, evolved during the Cretaceous period. Before Pangaea broke fully apart, the families of flowering plants we know today had spread widely, as can be seen from the similarity and common ancestry of flowering plants on now-separate continents. By the end of the Cretaceous period, Australia was breaking away from Gondwana; flowering trees capable of competing with the dominant conifers were becoming more widespread, as were mammals. The polar ice-caps of today had not yet

developed, so sea levels were high and there was an inland sea on what was to become central Australia. Moist, closed-canopy forests dominated much of the land; fossil evidence indicates that they were rich in plant and animal life.

The last million years or so of the Cretaceous period were marked by the mass extinction of numerous species of plants and animals, including dinosaurs. (The Wollemi pine, *Wollemia nobilis*, discovered recently in the Blue Mountains skirting Sydney, is believed to be a survivor of this era.)

About 38 million years ago, the Australian continental plate finally separated completely from Gondwana and moved northward, colliding with Asia about 13 million years later, coincidentally forming the mountain backbone of New Guinea as the land buckled. Australia's climate became warmer and drier as the continent drifted away from the South Polar Region.

But climate change was gradual, ameliorated by new ocean and atmospheric circulation patterns caused by the separation of Australia from Gondwana and a general cooling of the world's climate. It was gradual enough to avoid mass extinctions of plant and animal life but, inevitably, the progressive drying of the continent disadvantaged the conifers and allowed new species to dominate the landscape. Cool and warm rainforests were gradually replaced by sclerophyllous vegetation, including eucalypts and acacias. The tough-leaved sclerophyll forests, both 'wet' and 'dry', developed the characteristic colour and texture we associate with most Australian forests today. In addition, the gradual collision of the Australian and Asian continents created opportunities for some species to move between these long-separated land masses, contributing to the richness of our current forest vegetation.

From the end of the Cretaceous period until the present, the Australian continent has been geologically stable. Throughout the intervening 65 million years, the surface of the

land has been subjected to continuous weathering and erosion, but not to the intense glaciation (except in Tasmania) that occurred in the northern hemisphere. There has been little recent volcanic activity (which, geologically speaking, means for the past 10 000 years or so), and so few new rocks or soils have been formed to replace those weathered away. For these reasons, Australia is often referred to as the oldest continent on earth.

Australia's Gondwanan remnants

Most of the Gondwanan forests were gone by 2 million years ago, but there remain some isolated remnants.

These include the cool temperate rainforests of eastern Australia, from Tasmania to the high mountains of New South Wales and Queensland. Remnants of forests from warmer, but still Gondwanan, times are found in the wet tropical rainforests of north-eastern Queensland, in isolated areas of the Northern Territory and in the Kimberley region of Western Australia. The dry rainforests, or 'scrub' forests, of northern Australia, with biogeographic links to similar habitats of Africa and southern Asia, are also remnants of this period.

Climate change and fire

Since the Cretaceous period, Australia's climate has been drying, with the forests dying or retreating to favourable niches. It has not been a steady retreat: the forests have advanced and retreated as the climate has fluctuated, but there has been a net loss of forest over the last few million years.

The geological record shows that for most of the past 2 million years the Australian continent was subject to periodic fires, facilitated by the general drying of the continent. Recently (geologically speaking), there was a sudden, significant increase in fire incidence. Given that Indigenous peoples used fire extensively, some researchers consider that the sudden increase in fire occurrence marks the arrival of humans in Australia.

Populating the continent

The first Australians

The people who arrived in Australia at least 40 000 and perhaps over 100 000 years ago developed the means to live on the continent during periods when its climate, the levels of its inland waters and seas, and the distribution of its ecosystems were slowly changing. By the start of the current climatic period, 10 000–15 000 years ago, the population – probably somewhere between 415 000 and 1.5 million – occupied all the land, with the exception of the Bass Strait islands. The material cultures and means of livelihood they developed were individually adapted to each ecosystem.

The open canopy of most forests enabled fire to be used extensively as a management tool in some forest types, modifying the condition of the ground and understorey vegetation to suit the browsing animals that could be hunted and for ease of travelling. Burning in some areas had the dual effect of promoting eucalypts over rainforest and limiting the extension of rainforest into eucalypt-dominated forest.

The forest management practices used by Indigenous peoples were – and in some forests still are – set within a system of spiritual beliefs about the origins of landscape features, people, animals and plants in the actions of the creation beings of the Dreamtime. These beliefs are accompanied by profound senses of spiritual identity with sites that remain sacred and of personal responsibility for stewardship of the country according to traditional custom.

Colonisation and settlement

The colonisation and settlement of Australia by non-Indigenous cultures, primarily the British, drastically altered the state of the forests from that under Indigenous management. All land became the property of the crown, some of which was then allocated as freehold or leasehold to the colonists for agriculture, grazing or urban use. Many areas were not so allocated, leaving the 46.6 million hectares currently remaining as State forests, timber reserves, nature conservation reserves or

other crown land. In 1993, the High Court found that Indigenous, or native title, rights to land had not been completely extinguished in some areas, although their extent over crown and leasehold forest areas is still uncertain.

When the colonies federated in 1901 to become the States of the Commonwealth of Australia, the States retained their powers over the allocation and control of land, including forests. These powers were exercised differently so that the state of the forests today differs by State and Territory as well as by ecosystem and type of use. This short history can give only a national overview of some of the major influences that still affect the forests.

Pastoralism

Grazing became the most important factor affecting extensive areas of Australia's forests. The naturally open canopy and management under Indigenous fire management regimes, which had created a 'park-like' landscape in certain types of forests, enabled the number of introduced sheep and cattle to increase rapidly (Figure 1). The economic benefits were substantial: Australia, it was said, 'rode on the sheep's back'. Where grazing was intense, it changed the state of the forests, both intentionally and inadvertently, by four salient processes. The settlers changed the pattern of fire intensity and frequency, which affected forest composition and structure. The hard-hoofed sheep and cattle compacted the soil more than did the marsupials. The runs, fully stocked in good seasons, were overgrazed in droughts and eaten out by plagues of rabbits. And to encourage grass, the settlers felled and ringbarked as many trees as they could.

The consequences of pastoralism vary with the type of forest and the time it takes for changes to become apparent. In the open forests and woodlands, the most widespread effect is the lack of effective regeneration. Although in temperate Australia there are still many large old trees standing in the pastoral areas, there are few younger ones to replace them when they die. Moreover, evidence of their poor health and shortened life expectancy is clear, with trees commonly exhibiting 'dieback' symptoms due to soil compaction, stock abrasion, fires and increased insect attacks. The once park-like landscape appears to be in the process of becoming virtually treeless.

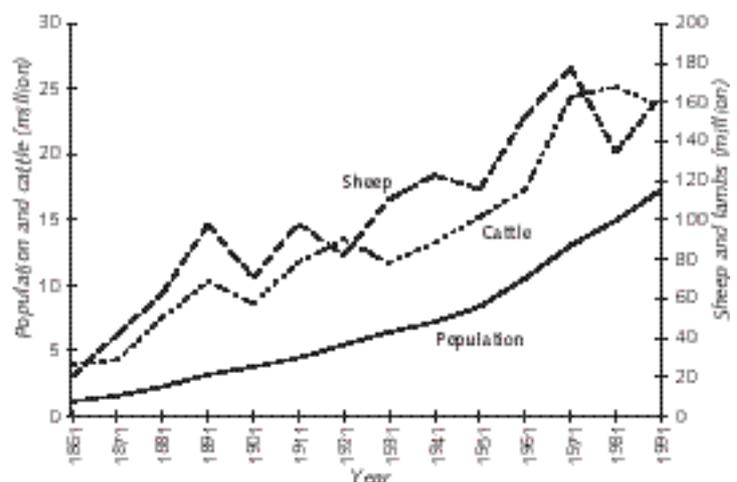
Some forests show remarkable persistence. In the acacia and callitris forests, the change from Indigenous fire management, coinciding with particularly favourable seasons, commonly stimulated a dense regrowth of seedlings and sucker shoots that turned into almost impenetrable thickets. In other areas, temporary release from grazing pressure enabled regeneration to take hold and the forests to recover. However, from the 1950s, mechanical clearing and the application of chemical herbicides reversed the natural recuperation of many such forests.

Agriculture

While the effects of pastoralism were extensive and gradual, those of agriculture were intensive and immediate. To grow crops, the best land had to be found and the trees removed as completely as possible. Farmland was developed where the topography, climate and soils appeared suitable, which often meant that agricultural land took the place of tall eucalypt forests and rainforests. Initially, land on the highly productive valley floors was selected but, as agriculture expanded, as new markets were developed and as technology changed, other types of forest were also selected.

From the 1870s, lowland rainforests in Queensland and northern New South Wales were so extensively cleared for dairying and to

Figure 1: Population and livestock numbers, 1861 to 1991



Source: YearBook Australia (1997).

grow sugar cane that now only remnant patches remain. Some of the best tall forests, even on steep slopes, were also cleared in the 1880s up to the 1920s for dairying. In part, this was encouraged by schemes for closer settlement and, after World War I, for soldier settlement. Most of Australia's largest continuous tract of sub-tropical rainforest in the Big Scrub on the Richmond River in New South Wales was cleared, as was much of the tall eucalypt forests and rainforests of the Dorrigo Plateau. In Victoria, most of the tall eucalypt forests dominated by *Eucalyptus regnans* (mountain ash) in the Strzelecki Ranges were cleared, while some similar sites were cleared in Tasmania. Areas of tall *E. marginata* (jarrah) and *E. diversicolor* (karri) forest were cleared under a group settlement scheme to encourage migrants to Western Australia. Many of the farms created by these schemes subsequently failed.

The medium height and some low height open forests and woodlands were cleared on a vast scale throughout what are now the wheatbelt regions of South Australia, Victoria and New South Wales. Much of this clearing was completed by the 1920s, but the development of hardier varieties of wheat, the discovery of trace element deficiencies in the soils, the use of cropping systems with legumes, and the availability of bulldozers led to extensive areas of low woodlands being cleared from the 1950s in Western Australia and Victoria. A scheme to clear mallee in Victoria's Little Desert region provoked protests over both its economic feasibility and its environmental consequences. Its abandonment in 1970 was seen as an expression of the public's increasing recognition of forest values.

Every type of Australian forest has been cleared for agricultural crops to some extent, but it has only been since the 1980s that the full consequences of deforestation have come to be evaluated with those of pastoralism and other forms of forest use on a regional or catchment scale. For example, irrigated agriculture required some areas of forest to be cleared to grow crops such as fruit, cotton and rice, but had wider consequences. The forests in the catchments upstream had to be managed to limit the rate of siltation in the dams, while the health and growth of riverine forests downstream were affected by alterations to river flow and flood patterns.

The history of deforestation from agriculture, forest burning and grazing shows that environmental consequences may be long delayed. This is apparent not only in the loss of trees across the pastoral and agricultural landscapes, and the associated loss of biodiversity, but in the problems of dryland salinity and increasing salinity of water supplies.

Coastal development

Some coastal and estuarine land was deforested by the creation and expansion of the major port cities and by the urbanisation that increased markedly from the 1960s. Within these areas, some mangrove forests were cleared in projects to create dry land for docks and airports, to permit canal estate and resort developments, and to provide effluent ponds. Many smaller local developments also contributed to the reduction in mangrove area. For example, the once continuous 20-kilometre strip of mangrove forest along the Parramatta River has been reduced to one short stretch and a few small patches. Industrial and urban pollution and the practice of spraying insecticides near urban areas have further degraded the condition of mangrove remnants.

Mining

Some of the earliest extensive effects of mining on the forests were caused by the gold rushes of the nineteenth century, most notably to the central Victorian goldfields in the 1850s and to the Kalgoorlie goldfields in the 1890s, but also to many other smaller fields. There were urgent demands for timber for mining-related activities, poles and sawn timber for shelter and for wood to fuel the steam engines as mining moved deeper underground. The surrounding forests were rapidly denuded of their standing trees. This process continued until either the particular field was exhausted or until wood was replaced by diesel oil as the major fuel. The two largest areas affected were the tall eucalypt forests of the Victorian goldfields and the low to medium height open eucalypt forests and woodlands of the Western Australian goldfields, where 25–30 million tonnes of fuel wood were produced by clear-felling about 3.4 million hectares of forest between 1893 and 1965. Of these, some were

taken up for agriculture and some were left to regenerate and are now maturing again.

Mining can have a profound local effect on forests. For example, a large area of rainforest on the west coast of Tasmania was cut to fuel the smelters at the Mt Lyell copper mine. Subsequently, the forested mountains downwind of the smelters were denuded of all vegetation by acid rain.

Sawmilling

All the timber required for houses, boats, bridges, carts, warehouses, barracks and all the other uses of wood in colonial society was produced manually by pit-sawing, hewing and splitting in the most accessible forests. Highly prized species such as *Toona australis* (red cedar) and *Lagarostrobos franklinii* (huon pine) were cut further afield, but the quantities and overall impacts on the forests were relatively small. The situation changed from the mid-1850s as demand for timber increased sharply, stimulated primarily by the gold rushes, pastoralism and population increases. The demands were met by increasing and mechanising domestic production in sawmills, and by importing softwood timber from the Baltic, the west coast of North America and, from the 1880s, New Zealand.

Opening up the commercial timber producing forests, 1850s to 1940s

The number of sawmills steadily increased, but during the nineteenth century most were small, locally owned affairs. The cost of transporting timber to the main capital city markets governed where timber was cut. Water was cheapest for long-distance transport, so an inter-colonial trade flourished from coastal forests. Thus, Tasmanian forests supplied Adelaide, and Queensland and northern New South Wales forests supplied Sydney. Sawmills also followed the gradual extension of railways that enabled more of the inland forests to be opened up. For example, sawmills built in some of the callitris forests were able to send their softwood timber to compete with imports in the Sydney market from the 1880s, and both river boats and rail were used to open up the *E. camaldulensis* (river red gum) forests along the Murray River.

Sawmilling and the continued manual production of poles and hewn and split timbers were concentrated in the tall and medium height eucalypt forests and the rainforests, with some cutting for purely local use occurring in all other forest types. Although about 20 per cent of the total forest area was potentially suitable for commercial timber production, the area that was practically and economically accessible was considerably less. Sawmilling had to rely on bullock wagons or tramway systems to bring logs to the mills and to take sawn timber to rail or water. Although these systems became increasingly ingenious and were supplemented by steam winches, and although roads and trucks started to replace bullocks and tramways from the 1920s, the industry did not enter remote mountainous forests. Moreover, felling remained a manual and selective process in which only the best and accessible trees were felled.

The *E. marginata* (jarrah) and *E. diversicolor* (karri) forests of Western Australia were opened up later than those on the east coast, and on a much larger scale by far larger sawmills. These sawmills mainly served an export trade – at its height between the mid-1890s and World War I – in railway sleepers, mine and other heavy construction timbers, and paving blocks, where their durable qualities were needed. Part of the trade was supplied by hewing, as this was often preferred for sleepers. An extensive railway and tramway system was developed to link the forests, mills and ports. Clear-felling was the norm until the 1920s, when the Forests Department introduced selective systems.

The state of the commercial timber producing forests at the end of World War II was one in which all those on the east coast, apart from remote mountainous areas, were honeycombed with the tramways, tracks and cutting areas of many small sawmills. Selective felling had left many standing trees and untouched patches in gullies and similar places. Many standing trees were also left through the jarrah and karri forests of the west coast.

1940s to the present

The intense demand for timber during the boom following World War II was met largely from the hardwood forests, supplemented, as

discussed later, by increasing quantities of softwood sawlogs from the plantations. By 1960, total production had doubled, to reach a plateau. Since then, sawn timber has been progressively replaced by concrete, metals, plastics and wood panel products, so that the total demand has remained roughly constant despite population increases. Wood imports remained mostly in the long-established 25–35 per cent range of consumption.

The expansion of sawlog production in eastern Australia was achieved in three main ways: roads were constructed into remote mountain forests; bulldozers equipped with winches extracted logs from steep slopes and the patches previously bypassed; and areas previously logged were cut over again, sometimes repeatedly, taking increasingly poorer quality logs. The repeated selective logging of particular lower elevation tall and medium height open eucalypt forest types resulted in insufficient time for regenerating timber to mature and thus the diminution of their productive capacity.

The state of the commercial timber producing forests in this post-World War II period has been affected by six further factors, discussed in the remainder of this chapter: the declaration and management of State forests; the establishment of plantations; the expansion of the pulp and paper industry; the export of woodchips; the recent move to add value to wood products; and increased concern over environmental consequences.

State forestry

The devastation of the goldfields forests, wasteful felling and hewing, widespread fire damage and the clearing of fine timber for farms led, from the 1860s, to calls for some of the commercial timber producing forests to be reserved from agricultural selection. Colonial and State governments were urged to follow the model adopted throughout the British Empire of selecting, or ‘demarkating’, some of the best forests, permanently reserving them as State forests (a term equivalent to ‘multiple-use forests’, used as a tenure category later in this report), and making their protection and management the responsibility of a specific agency staffed with professionally trained foresters. Against opposition from agricultural

interests, each government was eventually persuaded to pass appropriate forestry legislation between 1870 (New South Wales) and 1920 (Tasmania).

The new forest services faced considerable difficulties: the sawmillers had to be regulated and fires controlled; the forests had to be mapped and their resources assessed; silvicultural systems had to be devised to regenerate the forests; and plans had to be prepared to sustain future yields. Some of the classical forestry principles developed elsewhere in the world proved unworkable in forest types with periodic severe fires and there was never enough money to fully regenerate all the areas selectively cut over. Moreover, there were considerable difficulties in having crown land transferred from the control of lands departments and reserved as State forest. For example, even though the national target to have 25 million acres (10 million hectares) reserved as State forest was adopted by the Interstate Forestry Conference and endorsed by the State premiers in 1920, it took over 40 years to reach this target.

The State forest services were sufficiently well established before World War II to expand rapidly and become far more effective in managing the State forests thereafter. They made many advances, of which only four are mentioned here. First was the way in which they opened up the previously inaccessible, remote and mountainous forests of the east coast. This was partly to facilitate the expansion of sawlog production, mentioned earlier, and partly to provide access for fire control. Second was the detailed mapping and resource assessment of the forests that informed the expansion of sawlog production and later informed its reduction to a more sustainable level. Third were the silvicultural methods developed to regenerate some of the forests, particularly the high-value ash-type forests. Fourth was the establishment of softwood plantations, which successfully offset the reduction in hardwood log production.

Grazing persisted in many open forests and woodlands and in those callitris forests that were declared as State forests, and was allowed in some plantations. Stock reduced the fire hazard but ate the tree seedlings and shoots, even when grass was abundant, and damaged pole stands. Control proved difficult, especially

when grazing was left for many years in the hands of lands departments, or during periods of drought. On some crown tenures, denudation of vegetation and accelerated soil erosion led to grazing being stopped. The most notable example of this was the elimination of grazing in the catchments of the Snowy Mountains Hydro-electric Scheme in the 1960s; this was subsequently extended to other sub-alpine forests and to national parks generally. A body of professional foresters was built up by overseas recruitment, overseas training and, increasingly, by training in Australia, forming a professional institute in 1935. The Victorian School of Forestry trained small numbers from 1910. It later expanded and sent some of its graduates to Melbourne University, into which it was eventually incorporated. An Australian Forestry School, started in 1926 in Adelaide, soon moved to Canberra and was incorporated into The Australian National University in 1965.

Identification of forest and forestry

For most of the twentieth century, forest policy and forestry have been identified mainly with the concerns of State forestry, primarily those related to timber production (the obverse of this was a lack of attention to the state of private forests). This identification was largely the result of the long struggle to reserve State forests, establish effective forest management agencies and build a close-knit cadre of foresters. However, the protection of water catchments on public land had also been part of the rationale for declaring State forests and this was given increasing attention from the 1920s. For example, New South Wales legislated in 1935 that the purposes of some of its forest reserves were to protect watersheds, develop recreation and conserve wildlife, as well as to produce timber and allow grazing. In Victoria, the Forests Commission formalised its relations with water trusts in the 1950s and issued special prescriptions covering logging within them: these prescriptions were the forerunners of today's codes of forest practice. In Queensland, the Forestry Department managed the national parks as well as the State forests until 1975.

Timber from private forests

Private forests were an important source of sawlogs, although this varied between States. Some hardwood sawlogs were salvaged from land being cleared for agriculture, others were selectively cut from areas left as forest, but the total quantity gradually decreased from the mid-1960s (Figure 19). The state of most of the commercial timber producing forests on private land was little affected by the concepts of forestry practised in State forests. Their productive capacity probably generally deteriorated under the grazing, burning and felling regimes of many landowners, but changes to the overall resource were not monitored.

Plantation establishment

Plantations were established from the 1870s onwards to offset Australia's limited natural endowment of softwoods. South Australia took the lead and was eventually able to establish sawmills, pulp and paper mills and panel board factories based on them. Aided by Commonwealth loan funds, all States increased their rate of planting in the 1960s when the inevitable future decline in sawlog supplies from the native forests was realised. Some of the pulp and paper companies also started plantations to provide softwood pulpwood. These and plantations established by the larger timber companies gradually supplied increasing quantities of sawlogs as well as pulpwood. The establishment of eucalypt plantations has increased significantly in the last decade or so.

Various schemes to encourage smaller scale, or 'woodlot', planting on farms and other private land were undertaken from the 1920s. The rate of planting on farms increased in the 1990s, aided by schemes described later. So far they have made only a small contribution to wood supplies.

Pulp and paper

After World War I, Australia's drive to replace imports, promote manufacturing and add more value to its primary products led the Commonwealth to establish the research laboratories that became CSIRO. The organisation worked closely with industry,

with research for the forest sector concentrated on the eucalypts, successfully finding ways to kiln-dry sawn timber and to make pulp for paper-making.

Between 1936 and 1941 three pulp and paper mills were built in Tasmania and Victoria to use eucalypts, and one in South Australia to use wood from pine plantations. The Tasmanian Government provided exclusive, long-term concessions over large areas of State forests, while the Victorian Government provided rights to the pulpwood only, because sawlogs from its forests were already allocated to sawmillers. The new mills demanded the pale, relatively long-fibred ash-type eucalypts, *E. regnans* (mountain ash or swamp gum) and *E. delegatensis* (alpine ash). The world's tallest hardwood forest, the *E. regnans* of the Florentine Valley, was included in a Tasmanian concession. A large area of the Victorian resource was burnt in the disastrous 1939 bushfires, but the pulp mill was able to salvage its wood for many years.

The existing pulp mills expanded rapidly and new ones were built during the 1950s and 1960s. They were supplied with softwood from the pine plantations, and with hardwood from new areas, and a wider range of eucalypt species which further research had found ways to use.

The increasing demand for pulpwood altered the state of those forests within economic reach of the pulp mills. During the 1950s much of the pulpwood cut in Tasmania came from one of the companies' own forests, while in Victoria much of it came from land being cleared for agriculture. The proportion coming from State forests increased as demand increased. Pulpwood could be obtained from trees not suitable for sawmilling, enabling stands to be clear-felled and regenerated with uniform crops of even-aged trees. This particularly affected two classes of forests. New areas in the valuable mountain forests being opened up for sawmill logging could be fully regenerated, aided by new seeding methods developed by silvicultural research. Old areas in the foothill forests that had been selectively logged in the past could have their mostly old, defective trees removed to allow a new stand to grow. The advent of a pulpwood market thus enabled the forest services to advance their objective of making the forests more

productive. Gains in efficiency and environmental controls were achieved by integrating the logging so that both sawlogs and pulpwood were cut in one operation.

Woodchip exports

The Japanese pulp and paper industry expanded rapidly from the mid-1960s and sought supplies of wood for its pulp mills. In the 1970s a woodchip export trade from Australian forests was started by constructing five large woodchip mills in southern New South Wales (1), Tasmania (3) and Western Australia (1). Other operations were started later in western Victoria (1 hardwood, 1 softwood), northern New South Wales and Tasmania. Softwood woodchips have been exported from south-east Queensland.

Part of the trade was supplied from sawmill waste, but the bulk came from several types of forest and logging operations. The bulk of the trade in the east was supplied by clear-felling areas of tall and medium eucalypts in State forest that had previously been selectively cut over, while in the west it came from both clear-felling and selective cutting. As the industry expanded, wood was obtained from several other types of operation, most importantly by thinning regrowth stands. It was also integrated into operations that were still advancing into previously unlogged areas on steeper terrain. Private forests provided over 40 per cent of the wood exported from Tasmania during the 1970s. Many of these forests then reverted to rough grazing use, rather than being regenerated, which led the Tasmanian Government to establish a Private Forestry Division, and woodchip companies to adopt various schemes to address the situation.

The overall effect of the domestic pulp and woodchip export industries has varied with location. In some areas it permitted the rehabilitation of degraded forest, in others it provided increasingly efficient utilisation of forest products to previously unavailable markets, and for some it converted stands of mixed-age and sometimes old trees to even-aged young ones. The area converted is thought to be over 1 million hectares.

Adding value to wood products

The desire to process raw materials into manufactured products prior to export and to replace imports, which had been expressed in the 1920s, continued and was re-asserted in the 1980s and 1990s. This was expressed as the desire to add more value and provide more employment by processing the wood being cut through further stages of manufacturing. It led to industry policies that only indirectly affected the state of the forests.

The major proposal was to process much of the woodchips into pulp prior to being exported. Large mills to do this have been investigated for northern Tasmania, East Gippsland and Western Australia.

CSIRO and industrial companies continued the forest products research and development work which had commenced in the 1920s. Notable improvements continued to be made in kiln-drying and machining to add value to domestic production and to provide small quantities of high-quality eucalypt timber for premium export markets.

In Victoria, a policy was adopted of allocating the logs cut from State forests only to mills equipped to process them to the highest possible value. This policy was applied across major regions and enabled some mills to develop niche product lines. By contrast, in Western Australia, purchasers of first and second-grade jarrah sawlogs are required to add value to at least 50 per cent of their sawn output.

Environmental protection

Three associations to encourage forest conservation and four to encourage more national parks were formed between 1930 and 1957. This small beginning rapidly expanded from the 1960s as local groups, regional, State and national organisations sprang up throughout Australia to create the large, diverse environmental movement we know today. The Australian Conservation Foundation, founded in 1965, and The Wilderness Society, founded in 1976, are the principal national organisations concerned with forests, and conservation councils and forest alliances are the principal State

organisations. These organisations took a critical stance and sought the preservation of all the natural environmental values of the forests. Proponents thought that conservation should be achieved by having larger areas placed in conservation reserves secure from exploitation, although the older calls for forest conservation to be achieved through 'wise use' also persisted. Associations for the wood-using industries sought continued access to the wood resources of State forests. Their National Association of Forest Industries was formed in 1987.

Public controversies between the views of environmental organisations and the timber industry have lasted until the present. Such controversies concentrated on the use of public land and especially on State forests used for commercial wood production. Less attention was directed to the state of the forests on private and leasehold land, to forests not suited to commercial wood production, or to the effects of grazing. Seven major environmental concerns, discussed below, were central to many of the controversies.

Clearing for pine plantations

Clearing low-productivity eucalypt forest in order to plant higher productivity pines attracted widespread criticism. By the 1980s all State forest services had stopped clearing extensive areas and bought already cleared grazing properties instead. Plantation silviculture became more intense as soil cultivation, chemical weed control and fertilisation regimes were advanced, and tree-breeding improved growth rates and tree form.

Forest practices

The expansion of clear-felling, especially for woodchip exports, also attracted widespread criticism, particularly related to the loss of wildlife habitat provided by large old trees. Silvicultural practices were modified to leave a number of such trees in the clear-felled coupes and to reserve strips of uncut forest to protect streams, provide corridors for wildlife and soften the appearance. Further modifications were made in some areas to conserve particular species.

From the 1980s, detailed coupe planning and codes of forest practice were adopted in all

States to cover road and track construction, soil disturbance and many other factors. The codes have been extended to apply to logging in private forests in some States.

National parks

The establishment of national parks and State forests has proceeded sporadically since the 1870s. From the 1960s, continued calls for their expansion were heeded and more parks declared in all major ecosystems. The area of tall and some medium eucalypt forest and rainforest types in such reserves was increased from 1.8 to 6.2 million hectares between 1971 and 1991. Most increases involved the transfer of unoccupied crown land, but some involved State forest.

All States and Territories, as well as the Commonwealth, set up national parks and wildlife services to manage the larger areas.

Rainforests

Although, as noted earlier, much of the original area of rainforest had been cleared for agriculture prior to World War II, there were still some areas that had hardly been disturbed by either agriculture or logging. Disputes over whether State forests in the Border Ranges of northern New South Wales should be dedicated as national parks erupted into a direct confrontation to stop logging at Terania Creek in 1979. There were further confrontations in 1983 and 1984 to stop the construction of a road through tropical rainforest north of the Daintree River in north Queensland. In both cases, the calls for preservation of rainforests were eventually recognised by the inclusion of these areas in national parks and their declaration as World Heritage Areas. Tasmania produced an interim rainforest policy to protect all areas greater than 10 hectares and to take special care of its limited resource of natural conifers; this was recently revised in a regional forest agreement that identified separate areas for conservation and harvesting. Victoria banned logging in its rainforest, which it also protected with buffer strips.

Biodiversity

Widespread community concern for the protection of forest wildlife reached a turning point in the mid-1970s. It focused on the arboreal fauna, such as koalas, possums and gliders, and some of the birds, whose survival depended on big old trees remaining in the forests. In 1987 the Commonwealth set up a national catalogue to list endangered and vulnerable species of both plants and animals in a systematic way. Each State and Territory also maintains its own lists which, although coordinated with the national list, provide greater regional detail.

In the 1990s such concern was expressed as a call to preserve the full biological diversity of the forests. This provided a stronger ecological footing by recognising that the ecological functioning of the forest as a whole needed to be ensured because it was the framework within which measures to preserve individual species had to be taken.

The 1992 United Nations Conference on Environment and Development produced the Convention on Biological Diversity. The Australian Government ratified the Convention in 1993, having already developed a National Strategy for Ecologically Sustainable Development in 1992. In 1996 all States and Territories and the Commonwealth signed the National Strategy for the Conservation of Biological Diversity.

Wilderness

Part of Kosciuszko National Park was reserved as a 'primitive area' in the 1930s. The term 'wilderness' became used in the mid-1970s for areas in which there had been negligible human disturbance since European settlement, although this term is unacceptable to many Indigenous peoples. Calls were made for the protection of wilderness in New South Wales by the Colo Committee, nationally by the Australian Conservation Foundation, and brought to public prominence by The Wilderness Society.

Disputes over a proposal to dam the Franklin River in Tasmania made the calls for wilderness protection more widely known. A National Wilderness Inventory was commenced in 1986, and the concept has been recognised in

State and Territory legislation, the National Forest Policy Statement and other policy documents.

Old-growth

The ideas of preserving areas of wilderness and of high ecological value were combined in calls to delineate and preserve areas of old-growth forest (a concept dealt with in greater detail in Chapter 4). By the early 1990s the Resource Assessment Commission estimated that about 20 per cent of Australia's State forests had never been logged. This was based on a narrower definition of forest than now and also on estimates of areas unlogged, rather than precise mapping. Information for the whole forest estate is currently not known. Some of these areas in tall eucalypt forest carried stands of mature old trees that were the focus of major controversies because they were highly prized for their aesthetic and environmental values and contained some of the most valuable sawlogs.

