

CHAPTER 23

FORESTRY

For further details on subjects dealt with in this chapter see the annual bulletins *Non-Rural Primary Industries* and (for sawmills, etc. operations) *Manufacturing Industry*.

Source of statistics

Statistics relating to forestry are, in general, provided by the various authorities concerned with forestry administration. Particulars of forest reservations contained in this chapter have been collected by the Statisticians of the various States, mainly from information provided by the State forestry authorities. Other information on forested areas, together with certain other data, has been provided by the Commonwealth Forestry and Timber Bureau. Statistics of timber and by-products have been compiled from the annual factory collections undertaken by the Statisticians in the several States. Figures of production of gums, resins and tanning barks have been provided by the State forestry authorities. Data of imports and exports of forest products and timber and timber products have been compiled in the Commonwealth Bureau of Census and Statistics as part of the statistics of overseas trade. The figures shown relate, in general, to years ended 30 June.

Forestry in Australia

Objects of forestry

The main object of forestry authorities is to manage the forests of the country in a manner that will provide the maximum benefits, both direct and indirect. Direct benefits include the provision of essential commercial commodities such as structural timber, pulpwood, plywood, veneers, firewood, bark products, tars, oil, and resins. Indirect benefits include protection of soil and stock from wind and exposure, regulation of stream flow, provision of recreational facilities, and aesthetic effects. Forestry also aims at improving existing forests and woodlands by properly controlled harvesting, by protection from such destructive agencies as fire and insect attack, and by inducing regeneration where it is desirable. The provision of a partial tree cover on denuded lands where this cover is necessary for protective purposes, and a complete cover when the land is better under forest than under any other land use, are further aims of forestry.

General account of forests and timbers

The area of land in Australia suitable for the production of commercial timber as a primary crop is very small in comparison with the size of the continent. Broadleaved forests (hardwoods) cover 97 per cent of the total forested area, and approximately 94 per cent of the broadleaved forest area is occupied by eucalypts.

Eucalypts. The genus *Eucalyptus* is remarkable in that it includes over 600 species, ranging in size from the mighty forest giants, mountain ash (*E. regnans*) of Victoria and Tasmania, and karri (*E. diversicolor*) of Western Australia, down to the small mallee species which inhabit vast areas of the inland. The habitats range from the dry inland areas to the high mountain areas in the Australian Alps, from areas with the annual rainfall as low as 10 inches to those where it is 150 inches. Of the 600 species, only about 100 are used for sawmilling, and not more than 40 of these are exploited extensively.

The better class of eucalypt forest is concentrated mainly in the higher rainfall areas such as the east coast, the highlands of southern New South Wales, Victoria and Tasmania, and the south-western corner of Western Australia. The more important species include blackbutt (*E. pilularis*), tallwood (*E. microcorys*), flooded gum (*E. grandis*), and red mahogany (*E. resinifera*) of New

South Wales and Queensland; alpine ash (*E. delegatensis*) of New South Wales, Victoria and Tasmania; mountain ash (*E. regnans*), messmate (*E. obliqua*) and blue gum (*E. bicostata*) of Victoria and Tasmania; and karri (*E. diversicolor*) of Western Australia. For height and grandeur, mountain ash and karri are unequalled among the broadleaved trees of the world and are excelled only by a few North American coniferous (softwood) species.

In the coastal regions with lower rainfall the eucalypt forests contain many durable species such as the ironbarks, grey gums and bloodwoods of the east coast, and jarrah (*E. marginata*) and tuart (*E. gomphocephala*) of Western Australia. The spotted gum (*E. maculata*) occurring in New South Wales and Queensland is another example.

Along most of the inland streams and adjacent flood-plains there are riverain forests consisting mainly of river red gum (*E. camaldulensis*), a very durable broadleaved tree which has supplied large quantities of sawn timber, railway sleepers and fence posts.

Eucalypts also occur in open forest and savannah woodland formations in areas receiving a reliable rainfall of about 10 to 20 inches per annum, as on the goldfields of Western Australia where salmon gum (*E. salmonophloia*), brown mallett (*E. astringens*) and wandoo (*E. wandoo*) occur. These forests are of considerable value for firewood, as mining timbers and for fencing. Minor forest products such as sandalwood, tan bark, essential oils, etc., also come from isolated areas in this type of country, and in the more arid areas.

In 1967-68 the volume of eucalypt sawn wood produced was 965 million super feet.

Other broadleaved timbers (hardwoods). Broadleaved genera other than *Eucalyptus* cover a comparatively small portion of the forested land in Australia; however, the areas concerned provide a great variety of timbers suitable for a multitude of uses. There are two basic types of forest containing supplies of broadleaved timbers other than eucalypts, namely, the tropical and sub-tropical rainforests of coastal New South Wales and Queensland and the temperate rainforests of southern Victoria and Tasmania, both of which yield species known collectively as rainforest or brushwood species. The total volume of brushwood species produced in 1967-68 was estimated at 83 million super feet, i.e. less than 7.9 per cent of the total broadleaved timber cut in Australia.

The tropical and sub-tropical rainforest along the eastern coast of Australia contains a large number of different species. Tropical rainforest occurs in northern Queensland in the vicinity of Cairns and on the Atherton Tableland, providing such well-known cabinet woods as Queensland maple (*Flindersia brayleana*), Queensland walnut (*Endiandra palmerstonii*) and the silky oaks. The sub-tropical rainforest found in southern Queensland and northern New South Wales yields the tulip oak, crab apple (*Shizomeria ovata*) and white beech (*Gmelina leichhardtii*). Coachwood (*Ceratopetalum apetalum*) and sassafras (*Doryphora sassafras*) occur in regions to the south near Dorrigo and have yielded valuable timber for many years.

Turpentine (*Syncarpia glomulifera*), an excellent harbour pile timber resistant to marine borer attack, and brush box (*Tristania conferta*), a superior structural and decking timber, are found in association with some eucalypts in the wetter rainfall areas on the north coast of New South Wales and in southern Queensland.

Temperate rainforest which is to be seen in southern parts of Victoria and western Tasmania consists of myrtle beech (*Nothofagus cunninghamii*), but produces also southern sassafras (*Atherosperma moschata*) and blackwood (*Acacia melanoxylon*).

Conifers (softwoods). One of the most important species of native conifers is white cypress pine (*Callitris hugelii*). The main cypress pine forests of commercial value occur in New South Wales and southern Queensland west of the Great Dividing Range. The trees are comparatively small, but the timber has particular value owing to its durability and resistance to termites. It is suitable for use as scantlings, flooring, linings, weatherboards, poles, and posts. As much of the area originally covered by cypress pine has been cleared for wheat farming and grazing, the production from the remaining State forests is now strictly regulated to ensure a continuous supply. The volume of cypress pine cut in 1967-68 was approximately 64.8 million super feet.

Another important native conifer is hoop pine (*Araucaria cunninghamii*), which occurs naturally in the sub-tropical rainforest of southern Queensland and northern New South Wales associated with tulip oak, crab apple, white beech, coachwood, and sassafras. The greater part of the original hoop pine forests has been exploited, but considerable areas have been replanted to this species in Queensland and, to a lesser extent, in New South Wales.

Other native conifers which have played a useful but minor part in the Australian timber industry include bunya and kauri pines (*Araucaria bidwillii* and *Agathis palmerstonii*) of Queensland, and celery-top, Huon and King William pines (*Phyllocladus asplenifolius*, *Dacrydium franklinii* and *Athrotaxis selaginoides*) of Tasmania. Kauri pine is found in the tropical rainforest of northern



PLATE 46

Controlled fires burning after aerial release of incendiary capsules on a predetermined pattern.



PLATE 47
A bushfire brigade unit in operation.

Queensland in association with non-eucalypt broadleaved trees, while bunya pine occurs in the sub-tropical rainforests. In the temperate rainforests of Tasmania celery-top, Huon and King William pines are found in association with myrtle beech, southern sassafras and blackwood.

Extent of forested areas

Estimates prepared for the Ninth British Commonwealth Forestry Conference held in India in 1968 show the total area of forest in Australia as 599.7 million acres, or about 32 per cent of the total land area of the continent. In making these estimates the Food and Agriculture Organization definition of 'forest' (published in *World Forest Inventory*, 1958, page 123) was used. This definition includes areas of sparse or stunted tree growth, classified as 'woodland' in the following table, and in the case of Australia some four-fifths of the total forest area falls into this category. If 'woodland' is excluded from total forested area a more realistic assessment of real forest area of 87.7 million acres is obtained.

CLASSIFICATION OF FOREST AREA(a): AUSTRALIA

(Source: Forestry and Timber Bureau)

('000 acres)

<i>Type of forest</i>	<i>Area</i>
LANDS	
Economically exploitable forest land—	
Productive forests—	
Coniferous (softwood)(b)	3,021
Other(c)	34,166
<i>Total, productive forests</i>	<i>37,187</i>
Non-productive areas—unstocked(d)	11,455
Not economically exploitable forest land	39,038
Woodlands(e)	512,010
<i>Total, forested area</i>	<i>599,690</i>

OWNERSHIP OF ACCESSIBLE FORESTS

Publicly-owned forests—	
State forests	29,699
Other forests	22,472
<i>Total, publicly-owned forests</i>	<i>52,171</i>
Privately-owned forests	29,191
Ownership not yet determined	290,166
<i>Total, accessible forests</i>	<i>371,528</i>

(a) Date of inventory 30 June 1965. (b) Includes exotics, cypress, and other indigenous pines. (c) Includes broadleaved and mixed woods. (d) Areas enclosed or within or adjacent to forest land, but which are kept cleared of tree cover for management reasons or 'are temporarily free' of tree cover. (e) All lands dominated by trees which for ecological and botanical reasons are not now capable of producing economic forest products.

Forest reserves

The distribution of forest reserves is shown by States in the following table. Detailed comparisons between States are not possible because of the lack of uniform definitions.

**LEGALLY ESTABLISHED PERMANENT FOREST RESERVES: STATES AND TERRITORIES
31 MARCH 1968**

(Source: Forestry and Timber Bureau)

('000 acres)

	N.S.W.(a)	Vic.(b)	Qld	S.A.	W.A.(c)	Tas.	N.T.(b)	A.C.T.(d)	Aust.
Production reserves—									
Productive	6,937	4,108	8,854	251	4,056	1,921	11	29	26,167
Unproductive . . . . .	..	1,382	..	23	..	1,389	..	..	2,794
Unstocked . . . . .	..	114	..	..	704	..	..	..	818
<i>Total, production reserves</i>	<i>6,937</i>	<i>5,604</i>	<i>8,854</i>	<i>274</i>	<i>4,760</i>	<i>3,310</i>	<i>11</i>	<i>29</i>	<i>29,779</i>
Protection reserves—									
Productive	20	..	..	..	33	233	..	13	299
Unproductive . . . . .	..	500	2,285	17	53	..	..	97	2,952
Unstocked . . . . .	..	..	..	..	28	1	..	..	29
<i>Total, protection reserves</i>	<i>20</i>	<i>500</i>	<i>2,285</i>	<i>17</i>	<i>114</i>	<i>234</i>	<i>..</i>	<i>110</i>	<i>3,280</i>
All other reserves—									
Productive . . . . .	..	151	39	..	..	..	2,394	..	2,584
Unproductive and unstocked . . . . .	..	..	..	..	..	..	..	..	..
<i>Total, all other reserves</i>	<i>..</i>	<i>151</i>	<i>39</i>	<i>..</i>	<i>..</i>	<i>..</i>	<i>2,394</i>	<i>..</i>	<i>2,584</i>
Total area, all reserves	6,957	6,255	11,178	291	4,874	3,544	2,405	139	35,643

(a) Not comparable with previous years due to a difference in definition on which estimates were based. (b) As at 31 March 1967. (c) South-west zone only. (d) In the Australian Capital Territory there are no permanent forest reserves, only managed forests.

Categories of forest reserves

- (i) *Production Reserves* consist of forest lands 'permanently' reserved—by law whether Federal, State or local—for the production of logs, pulpwood, pit props, poles, posts or fuelwood for commercial purposes.
- (ii) *Protection Reserves* consist of reserved lands, the management of which is principally aimed at the protection of natural resources, of fauna and flora, or at other purposes not directly related to the production of wood (e.g., parks, watersheds, soil conservation areas, etc.). Industrial cutting may or may not be allowed in these Protection Reserves. Industrial cutting includes the cutting of logs, pulpwood, pit props, poles, posts, fuelwood for commercial purposes. The production of logs for the production of sawnwood for local consumption is considered as industrial cutting; however, the cutting of poles and fuelwood for personal consumption on a casual or occasional basis is not considered as an industrial cutting.
- (iii) *All other reserves* consist of reserved forest lands not included above.

A considerable proportion of the permanently reserved areas is in inaccessible mountainous country, and many of the forests contain a mixture of species, only some of which are at present of commercial value. Much of the area consists of inferior forest, and a large proportion of the whole has been seriously degraded by recurrent fires.

Plantations

The indigenous forest of Australia does not contain adequate supplies of coniferous timber, and Australia's requirements have had to be met largely by imports. As a result of the planned policy of the forest services and of several private commercial organisations, the area of coniferous plantations, mainly of exotic species, is steadily increasing. It was natural that this aspect of forestry should receive earliest attention in South Australia, as this is the State most poorly endowed with natural forest. South Australia now has a larger area of planted conifers than any other State in Australia, and for some years has been exploiting considerable quantities of timber from these plantations. Production is also increasing in the other States, and the thinnings from their plantations are already supplying a significant volume of timber.

The total production of roundwood from Australia's coniferous plantations is now more than 75 million cubic feet per annum and is expected to increase substantially during the next decade.

A special article prepared by the Forestry and Timber Bureau giving a detailed account of the history and development of coniferous plantations and of the characteristics of individual species is included in Year Book No. 44, page 975.

Broadleaved plantations (mainly *Eucalyptus spp.*) comprise a much smaller area, and the total acreage at 31 March 1968 was about 34,000 acres, about two-thirds of which was mallee. Plantations of this species have been established in Western Australia for tan bark production.

AREA OF CONIFEROUS PLANTATIONS: STATES AND TERRITORIES, 31 MARCH 1968

(Source: Forestry and Timber Bureau)

(Acres net)

State or Territory	Government			Private			Grand total
	<i>Pinus radiata</i>	Other species	Total	<i>Pinus radiata</i>	Other species	Total	
New South Wales . . .	112,192	19,319	131,511	7,804	16,381	24,185	155,696
Victoria	68,868	9,668	78,536	98,681	3,052	101,733	180,269
Queensland	3,448	130,068	133,516	840	27,550	28,390	161,906
South Australia . . .	130,958	12,808	143,766	39,000	..	39,000	182,766
Western Australia(a) .	21,799	31,177	52,976	1,888	188	2,076	55,052
Tasmania	31,135	419	31,554	13,113	3	13,116	44,670
Northern Territory . .	..	1,500	1,500	..	50	50	1,550
Australian Capital Territory	26,815	2,217	29,032	..	..	..	29,032
Australia	395,215	207,176	602,391	161,326	47,224	208,550	810,941

(a) South-west zone only.

Forest administration and research

Commonwealth Forestry and Timber Bureau. The functions of the Commonwealth Forestry and Timber Bureau are laid down in the *Forestry and Timber Bureau Act 1930-1953* and include forestry research and education, the study of timber supply, and advice to the Government on forestry matters. The administering department is the Department of National Development.

In 1961 the Commonwealth Government decided to expand its activities in forestry research in Australia. The existing Forestry and Timber Bureau Divisions of Silvicultural Research and Forest Management Research were combined to form the Forest Research Institute as a separate branch of the Bureau. The purpose of the Institute is to provide complete coverage in forestry research, ensuring that all problems of primary importance to the practice and development of forestry in Australia are investigated. In developing a programme with this objective, the Institute takes account of the research activities and potential of the State forest services and other organisations. The research work carried out by the existing sections of the Forest Research Institute covers a wide range of studies, including the following: factors affecting tree growth, tree breeding, introduction of exotic species, forest nutrition, forest botany, forest entomology and pathology, fire protection, watershed management, forest mensuration, forest management and management economics, aerial inventory, biometrics, and tree seed. The Forest Research Institute maintains six regional establishments in the Commonwealth, two of which have an outstation in addition to the regional headquarters. These regional stations are run on a co-operative basis with State forest services and private forest companies or other government instrumentalities.

The Forestry and Timber Bureau also maintains a Timber Supply Economics Branch concerned with the compilation and analysis of statistics of production, consumption and trade in timber and other forest products. This Branch also carries out studies in forest economics and research into logging methods and machines. Advice on timber supply matters is currently made available to government departments and private enterprise. Research is also undertaken on matters associated with the marketing of timber products.

Commonwealth Scientific and Industrial Research Organization, Division of Forest Products. The Division of Forest Products was formed in 1928 to carry out investigations into Australian forest products, assist in the effective use of such products, reduce waste, reduce losses from decay and insect attack, and conduct research into the fundamental chemical, physical and mechanical properties of Australian timbers.

The research work of the Division is carried out by eight separate sections: wood and fibre structure, wood chemistry, timber physics, timber mechanics, timber preservation, timber seasoning, plywood and glueing, and timber utilisation. In addition, the Division provides assistance to individuals and local industry, administers courses of instruction on timber properties and usage, and maintains co-operative projects with several overseas authorities operating in the same field.

Forestry in the Territories. Forestry activities in the Territory of Papua and New Guinea are controlled by the Administration through its Department of Forests. The management of forests in the Australian Capital Territory is the responsibility of the Forestry Branch of the Department of the Interior.

The Forestry and Timber Bureau advises the Administrations of the Australian external Territories on the management of the forests in those Territories. Forests in the Northern Territory are under the control of the Forestry Branch of the Northern Territory Administration.

Forestry activities of the States. Forestry on State-owned lands in the various States is the responsibility of the respective State Governments, but they do not exercise any control over forestry activities on private property. The powers and functions of State forest authorities are laid down under forest Acts and Regulations. In each State there is a department or commission to control and manage State forests. Its functions include the introduction of proper measures for the control and management of forest land; the protection of forest land; the conversion, marketing and economic utilisation of forest products; the securing of an adequate and permanent reservation of State forests; and the establishment and maintenance of coniferous forests to remedy the existing deficiency of conifers in Australia. All State forest services are actively engaged on research programmes. Annual reports are issued by each State forest authority.

In addition to developing permanent forest reserves in each State, foresters are surveying all forested Crown lands with a view to obtaining dedications of new State forests to add to the permanent forest estate or to release for other uses areas unsuitable for forestry. State forest authorities control over 10 million acres of timber reserves, national parks, etc. They also usually control all timber on unoccupied Crown lands.

Private forestry. Privately owned lands contribute considerably to the total production from Australian forests. The most important areas of managed native forest in private ownership are the forests owned by pulp and paper companies. Schemes of financial assistance to individual land owners—designed primarily to encourage establishment and management of coniferous plantations—have been introduced by the Governments of New South Wales and Victoria.

The area of privately owned coniferous plantations is rapidly increasing, and here again the pulp and paper companies are very active. In step with the increase in afforestation programmes, the number of professional foresters employed in private forestry enterprise is increasing, while several are engaged on research.

An estimate of the area of coniferous plantations established by private companies and individuals is included in the table on page 963.

Forestry education

The functions of the Australian Forestry School at Canberra, previously a division of the Forestry and Timber Bureau, were taken over by the Australian National University at the beginning of the 1965 academic year. The school was absorbed into the University's School of General Studies as the Department of Forestry. This department provides a full four-year training leading to the degree of B.Sc. in forestry. The University of Melbourne also maintains a School of Forestry which gives training leading to a B.Sc. degree in forestry. The Universities in all States provide facilities for post-graduate studies in forestry leading to higher degrees.

The Victorian Forests Commission maintains a Forestry School at Creswick where recruits are trained, mainly for employment in the Commission.

The Australian Forestry Council

Following extensive discussions the Commonwealth Government and the Governments of the six Australian States agreed in 1964 to establish an Australian Forestry Council, comprising the Ministers responsible for forestry in the seven Governments and the Commonwealth Ministers of the Interior and External Territories.

The Council is intended to provide the means for the mutual exchange between the State and Commonwealth Governments of information and views on forestry. It will co-ordinate research into problems affecting the establishment, development, management, and fire protection of all forests, and the utilisation of forest products. It will assist in co-ordinating the work of State and Commonwealth Governments and also private enterprise in the development of Australian forestry.

The Council is supported by a Standing Committee, consisting of the Director-General of the Forestry and Timber Bureau, the heads of each of the six State Forest Services, the Chief of the Division of Forest Products, C.S.I.R.O., the Secretary of the Department of the Interior and the Secretary of the Department of External Territories.

Fire protection

The provision of adequate fire protection is one of the main problems facing forest and rural authorities. The commercial forest area is estimated at 37 million acres with a further 39 million acres of forest not at present exploitable. The forest services maintain a high degree of protection over a relatively accessible area of about 23 million acres, about 17 million acres in the more inaccessible area receive a lesser degree of protection, and about 8 million acres are at present not protected. The remaining area of 28 million acres is mainly vacant Crown Land or is privately owned or leased, and under some degree of fire protection from the rural volunteer fire-fighting organisations or Government-financed fire protection associations.

During the 1967-68 fire season a total of 1,754 fires were recorded over the area of 40 million acres of forest land afforded either intensive or extensive protection. An area of 754,000 acres was burnt by these fires, which represents 1.9 per cent of the area protected. This is the fifth largest area of forest land burnt over the last twelve years.

A large proportion of this burnt area was located in Victoria and southern New South Wales where particularly severe drought conditions prevailed throughout most of the summer and autumn period. The drought index exceeded a value of 700 on a scale of (0-800) over most of the forest land at higher elevations in the Australian Alps and was one of the severest droughts experienced in this region for over 100 years. Although large areas of forested land were in a state of extreme dryness, the absence of strong dry continental winds prevented severe 'blow-up' conditions, which result in extreme fire danger, except on a few isolated days.

The number of forest fires and the forest area burnt over the last twelve years is shown in the following table.

NUMBER OF FIRES AND FOREST AREA BURNT,
1956-57 TO 1967-68

Year	Protected forest areas (a)		
	Number of fires	Forest area burnt	Percentage of forest area burnt
		'000 acres	
1956-57	1,999	344	0.9
1957-58	2,908	2,078	5.2
1958-59	1,175	456	1.1
1959-60	1,504	1,314	3.3
1960-61	2,667	1,294	3.5
1961-62	1,761	297	0.8
1962-63	1,299	275	0.7
1963-64	1,494	549	1.5
1964-65	2,307	1,626	4.1
1965-66	1,865	465	1.2
1966-67	1,422	388	1.0
1967-68	1,754	754	1.9

(a) The area receiving protection has been taken as the 40 million acres for which State forest services provide protection.

Although drought conditions were not particularly severe along the coastal area of New South Wales and Queensland during the summer and autumn months of 1968, drought breaking rains which occurred over Victoria and southern New South Wales during May 1968 did not extend to the coast. Drought conditions thus prevailed during the winter months and intensified during the spring. Widespread fires occurred along the entire eastern seaboard from September onwards and an area of around 5 million acres of forested land was burnt in Queensland and New South Wales.

Very intensive fire protection is afforded to the coniferous plantation area of Australia. This area is increasing rapidly and the annual planting programme is now between 60,000 and 70,000 acres. During the 1967-68 fire season a total of 288 acres were burnt, representing 0.04 per cent of the area of 729,928 acres for which fire statistics are available. This was the smallest area of coniferous plantation burnt during the last twelve years.

The area of coniferous plantations burnt during the past twelve years is shown in the following table.

**CONIFEROUS PLANTATIONS: AREA BURNT AND
TOTAL AREA, 1956-57 TO 1967-68**

<i>Year</i>	<i>Area burnt</i>	<i>Area of coniferous plantations</i>	<i>Percentage of coniferous area burnt</i>
	acres	acres(a)	
1956-57	1,317	360,000	0.37
1957-58	1,339	386,000	0.35
1958-59	1,594	402,000	0.40
1959-60	329	435,000	0.07
1960-61	507	452,000	0.11
1961-62	598	472,000	0.13
1962-63	475	492,000	0.10
1963-64	418	515,000	0.06
1964-65	3,130	556,000	0.56
1965-66	1,520	610,000	0.25
1966-67	461	660,835	0.07
1967-68	288	729,928	0.04

(a) This area does not include some 81,000 acres of privately owned coniferous forest for which fire statistics are not available.

Protection of private property outside urban areas is undertaken by volunteer bush fire brigade organisations which are co-ordinated in each State by a committee or board carrying out functions of an advisory or educational nature and fostering the growth and organisation of the bush fire brigade movement. Throughout the main agricultural and forest areas of Australia there are over 5,000 registered volunteer bush fire brigades with a membership approaching 300,000. Although forest and rural fire organisations are entirely separate entities, a high degree of co-operation and liaison is maintained.

In addition to the forest service and rural organisations, various private and semi-governmental bodies in each State maintain fire protection organisations, which are generally concerned with the protection of private forestry operations and hydro-electric and water catchment areas.

Over the five-year period 1964 to 1968 the annual cost of protecting from fire the 40 million acres of forest land for which State forest services, semi-governmental bodies and private companies provide protection is estimated at \$6,000,000 or about 15 cents an acre. The cost of rural fire control as a whole cannot be estimated with any degree of accuracy because by far the greatest contribution comes from the personal efforts of volunteer brigade members.

The Australian fire season is very variable, especially in the eastern and southern States. On the average, damaging fires can occur over a period of four months in all climatic zones. Occasionally this occurrence can extend one month either side of the main fire period. Individual fire seasons are generally of much shorter duration than four months, and the severity of a season is judged more on the number of 'blow-up' days of extreme fire danger than on its length. On the average, four years in ten are classified as of average severity and two years in ten as severe, the remaining four years being of below-average severity. During severe seasons in the past as much as 15 per cent of the protected forest area has been burnt. However, with improving fire control services, it can be expected that the area burnt in severe fire seasons will in future be significantly reduced.

Intensive research work is being carried out on bushfire problems and both Commonwealth and State agencies maintain active research groups.

Research into the factors affecting fire behaviour has resulted in improved fire fighting techniques and safety on the fireline. In addition, research in this field has led to a greater knowledge of the effect of controlled burning on resource values and has permitted precise prescriptions to be laid down so that the work of hazard removal in forested country can be carried out more expeditiously and with greater safety.

Recent developments of techniques of aerial control burning have greatly reduced costs and permit larger areas to be burnt during favourable weather conditions. Small incendiary capsules are dropped from fixed wing aircraft or helicopters on a predetermined grid pattern at a rate of one incendiary every 5 or 10 acres (see Plate 46) and the resulting fires burn together slowly and remove excessive accumulations of fuel which have built up in the absence of fire. These very low intensity fires have low flame heights and seldom scorch the leaves on the standing forest trees. The cost of this type of control burning is around 4-5 cents per acre and one aircraft can cover an area of 15,000-20,000 acres in an afternoon. Care is taken to confine the fires within the area specified for treatment.

This technique of aerial control burning is unique to Australia and all the associated equipment and the incendiary capsule were developed by Australian fire research groups.

Control burning of forested country is one positive way in which damage from wildfires can be reduced. During 1968 an area of some 2 million acres was control burnt and of this area over 50 per cent was burnt by aerial ignition techniques (see Plate 46). During 1969 it is expected the area will increase to around 2½ million acres.

Research is continuing into the use of water bombing aircraft for the suppression of fires caused by lightning which occur in remote forested areas not readily accessible to conventional ground suppression forces. The Victorian Forests Commission now has an aerial attack system in operational practice and the use of light agricultural aircraft in this role is extending to other States. A programme of evaluation of all agricultural aircraft available for use in aerial fire suppression has been recommended by the Australian Forestry Council and is being carried out by the Forestry and Timber Bureau of the Department of National Development.

A special infra-red fire detector has been recently developed in Australia which will permit the location and mapping of bushfires through heavy continuous smoke. It will be especially valuable in picking up spotfires which may have been thrown long distances ahead of a bushfire and which are normally obscured by the heavy smoke pall. This latest equipment covers a range of wavelengths from 1-15 microns and can be operated from light aircraft.

Since fire prevention is one of the most important aspects of the problem, intensive campaigns are being conducted to reduce the incidence of man-caused fires. A study of fire causes in recent years reveals that human agencies account for about 90 per cent of all fires, and of this figure at least 80 per cent are preventable. It is estimated that 'burning-off' (much of which is started illegally) accounts for 30 per cent of all fires. Lightning accounts for a little over 10 per cent of all fires in Australia, although the incidence of fires caused by lightning is much higher in certain areas, especially the southern highlands regions in New South Wales and Victoria. Although lightning is a relatively small numerical cause of fire, the percentage area burnt from this cause is estimated at about 20 per cent. This higher figure is due to the occurrence of multiple fire outbreaks which cause fire fighting difficulties, and to the inaccessibility of the areas in which such fires generally occur.

An increasing number of fires are starting from roadsides, and smoking materials account for a high proportion of these fires. The fire proofing of roadsides by chemical and mechanical means should reduce this incidence, which has accounted for over 25 per cent of all fires in some regions.

The damage resulting from bushfires in Australia is difficult to estimate. Eucalypts, which comprise the main forest species are seldom killed by fire, and damage estimates frequently involve the complicated question of loss of increment and degradation of timber quality. It may be conservatively estimated that damage to forest values lies between \$2 and \$4 per acre burnt per year and that over the last ten years the average value of forest fire damage is of the order of \$4 million a year. In very severe fire seasons such as 1925-26, 1938-39 and 1951-52, which affected large areas of the continent, fire losses may have been as high as \$200 million. The monetary damage resulting from the Tasmanian bushfires of 7 February 1967 was estimated at \$40 million over the 640,000 acres burnt in Tasmania. These fires involved heavy housing losses in the city of Hobart and surrounding townships.

Commonwealth loans to expand softwood plantations

In February 1965 the Australian Forestry Council recommended that the rate of expansion of softwood timber planting in Australia should be increased from their existing level of about 40,000 acres a year to 75,000 acres a year for the next thirty-five years. The recommendations envisaged a phased increase in the rate of Government plantings by the various State Governments up to a level of some 65,000 acres per annum, and an average of at least 10,000 acres per annum by private forest owners. This programme would make a major contribution towards meeting Australia's future requirements for softwood products.

In February 1966 the Commonwealth Government endorsed this recommendation and agreed, as a first step towards achieving the proposed annual target of 75,000 acres, to provide financial assistance to each State, over a five-year period commencing 1 July 1966, to enable them to accelerate their rate of softwood plantings. The assistance, which will be provided to the States under section 96 of the Constitution, will take the form of long-term loans repayable over twenty-five years with repayments of principal and the payment of interest to commence ten years after the date of each advance. The *Softwood Forestry Agreements Act 1967* authorised the Commonwealth to enter into agreements with each of the States to provide financial assistance by way of loans during the financial years 1966-67 to 1970-71 inclusive. Payments under the Act by the Commonwealth to all States in 1966-67 amounted to \$291,000, in 1967-68 to \$3,456,000, and in 1968-69 to \$3,872,000. It is estimated that \$4,879,000 will be provided in 1969-70.

Employment in forestry

Persons engaged in forestry activities, 1966 census

The number of persons whose industry statements were classified to 'forestry' (excluding sawmilling) at the 1966 population census was 13,492 out of a total of 512,994 in all primary industries and 4,856,455 in the total work force. For further information see the chapter *Employment and Unemployment*, also 1966 Census Bulletin No. 9.6, *Population: by Industry and Occupational Status, Australia*.

Employment by Forestry Departments

In the table following details are shown of the number of persons employed by State forestry departments and by the Forestry and Timber Bureau in the Australian Capital Territory and the Northern Territory at 30 June 1968.

**PERSONS EMPLOYED BY FORESTRY DEPARTMENTS
STATES AND TERRITORIES, 30 JUNE 1968**

Occupational group	N.S.W.	Vic.	Qld	S.A.	W.A.	Tas.	N.T.	A.C.T.	Aust.
Professional staff	306	237	162	75	66	45	9	10	910
Non-professional field staff	282	175	103	12	247	119	22	2	962
Clerical staff	286	281	223	112	56	86	12	6	1,062
Extraction of timber	1,591	..	112	..	40	6	20	..	7,078
Milling of timber . . . . .		..	555	..	43	..	5	..	
Labour (forest workers, etc.)		1,591	1,736	313	586	349	92	70	
Total	2,434	2,284	2,336	1,067	1,038	605	160	88	10,012

Employment in milling operations

Details of the average number of persons employed, including working proprietors, in sawmills during the year 1967-68 are shown in the next table. Further details regarding the operations of sawmills in 1967-68 are shown in the chapter Manufacturing Industry.

**NUMBER OF SAWMILLS AND NUMBER OF PERSONS EMPLOYED
STATES AND TERRITORIES, 1967-68**

	N.S.W.	Vic.	Qld	S.A.	W.A.	Tas.	N.T.	A.C.T.	Aust.
Number of sawmills	685	442	478	86	199	274	..	8	2,172
Average number of persons employed during year—									
Males	7,713	5,645	5,055	(a)	3,201	2,745	..	(a)	26,498
Females	392	293	302	(a)	191	56	..			1,415
Persons	8,105	5,838	5,357	(a)	3,392	2,801	..		27,913

(a) Not available for publication; included in Australian total.

Forest production

Forest products

FOREST PRODUCTION(a): STATES AND TERRITORIES, 1967-68

Product		N.S.W.	Vic.	Qld	S.A.	W.A.	Tas.	N.T.	A.C.T.	Aust.
Logs for sawing, peeling, slicing, or pulping—										
Forest broadleaved	'000 cu ft	55,669	70,129	21,004	429	49,553	63,095	19	..	259,898
Brushwoods and scrubwoods	" "	4,157	..	8,598	..	..	..	..	..	12,755
Coniferous—										
Indigenous forest 'pines'—										
Cypress	" "	6,099	..	6,003	..	..	..	77	..	12,179
Other	" "	609	..	2,493	..	..	373	..	..	3,475
Plantation grown 'pines'	" "	9,214	14,037	4,773	26,049	2,413	1,852	..	1,460	59,798
Total logs	" "	75,748	84,166	42,871	26,478	51,966	65,320	96	1,460	348,105
Value of logs	\$'000	23,248	23,235	14,784	5,421	9,459	14,745	254	353	91,498
Hewn and other timber (not included above)—										
Firewood(b) (weight)	'000 tons	201	305	70	397	561	377	2	..	1,914
Other(c) (value)	\$'000	10,344	2,477	2,197	307	(d)1,320	264	4	12	16,925
Value of hewn and other timber	"	11,583	4,459	2,589	2,641	(d)3,948	2,455	24	12	27,712
Other forest products(e) (total value)	"	309	151	309	66	(f) 12	3	..	..	851
Total value of forest products	"	35,140	27,845	17,683	8,128	(g)14,077	17,209	278	365(g)	120,725

(a) Excludes some production from private land, thought to be relatively small, details of which are not available. (b) Excludes mill waste used as firewood. (c) Includes sleepers, transoms, girders, bridge timbers, mining timber, poles, piles, etc. (d) Excludes timber used for tannin extract, details of which are not available for publication. (e) Includes charcoal (forest production only), tanning bark, essential oils, eucalyptus leaves, crude rutin, etc. (f) Excludes value of sandalwood and substitutes, details of which are not available for publication. (g) Includes timber used for tannin extract and sandalwood and substitutes.

FOREST PRODUCTION(a): AUSTRALIA, 1963-64 TO 1967-68

Product		1963-64	1964-65	1965-66	1966-67	1967-68
Logs for sawing, peeling, slicing, or pulping—						
Forest broadleaved	'000 cu ft	245,675	251,753	252,587	249,985	259,898
Brushwoods and scrubwoods	" "	12,741	13,549	14,027	12,131	12,755
Coniferous—						
Indigenous forest 'pines'—						
Cypress	" "	13,070	13,795	12,487	11,402	12,179
Other	" "	3,950	3,766	3,706	3,568	3,475
Plantation grown 'pines'	" "	50,883	56,255	59,894	61,992	59,798
Total logs	" "	326,318	339,117	342,701	339,078	348,105
Value of logs	\$'000	79,578	86,493	87,804	88,405	91,498
Hewn and other timber (not included above)—						
Firewood (b) (weight)	'000 tons	2,329	2,322	2,301	2,143	1,914
Other (c) (value)	\$'000	13,899	15,255	17,290	15,470	16,925
Value of hewn and other timber(d)	"	27,357	28,537	31,177	28,106	27,712
Other forest products(e) (total value)	"	584	1,167	782	801	851
Total value of forest products(f)	"	107,951	116,338	120,589	117,975	120,725

(a) Excludes some production from private land, thought to be relatively small, details of which are not available. (b) See footnote (b) to previous table. (c) See footnotes (c) and (d) to previous table. (d) Incomplete; see footnote (d) to previous table. (e) See footnotes (e) and (f) to previous table. (f) Includes timber used for tannin extract and sandalwood and substitutes in Western Australia.

Value of production

While statistics of both the gross value (at principal markets) and local value (at place of production) of the forestry industry are available, particulars of the value of materials used in the process of production are not available for all States. For this reason values cannot be stated on a net basis, as has been done with most other industries. A more detailed reference to the value of production of forestry and other industries in Australia, as well as a brief explanation of the terms used, will be found in the chapter Miscellaneous.

**GROSS AND LOCAL VALUE OF FORESTRY PRODUCTION
STATES AND TERRITORIES, 1967-68**
(\$'000)

State or Territory	Gross value(a)	Marketing costs	Local value(b)
New South Wales	35,140	931	34,209
Victoria	27,845	397	27,448
Queensland	17,683	4,735	12,948
South Australia	8,128	28	8,100
Western Australia	14,077	803	13,274
Tasmania	17,209	2,442	14,766
Northern Territory	278	n.a.	278
Australian Capital Territory	365	n.a.	365
Australia	120,725	9,336	111,388

(a) Gross production valued at principal markets. (b) Gross production valued at place of production.

**LOCAL VALUE OF FORESTRY PRODUCTION: STATES AND TERRITORIES
1963-64 TO 1967-68**

<i>Year</i>	<i>N.S.W.</i>	<i>Vic.</i>	<i>Qld</i>	<i>S.A.</i>	<i>W.A.</i>	<i>Tas.</i>	<i>N.T.</i>	<i>A.C.T.</i>	<i>Aust.</i>
LOCAL VALUE (\$'000)									
1963-64 . . .	29,619	25,308	12,980	8,167	10,783	11,639	269	298	99,062
1964-65 . . .	31,586	28,358	13,482	8,801	11,334	13,270	276	314	107,421
1965-66 . . .	32,342	28,870	13,590	9,693	11,965	13,837	358	384	111,039
1966-67 . . .	30,967	29,036	12,631	8,853	12,473	14,332	303	351	108,946
1967-68 . . .	34,209	27,448	12,948	8,100	13,274	14,766	278	365	111,388
LOCAL VALUE PER HEAD OF POPULATION (\$)									
1963-64 . . .	7.26	8.24	8.14	7.98	13.50	32.08	5.36	3.87	8.96
1964-65 . . .	7.62	9.04	8.29	8.37	13.87	36.22	5.23	3.72	9.52
1965-66 . . .	7.68	9.04	8.19	8.96	14.29	37.44	6.46	4.15	9.66
1966-67 . . .	7.25	8.94	7.48	8.02	14.47	38.33	5.22	3.51	9.31
1967-68 . . .	7.87	8.31	7.54	7.24	14.87	38.92	4.57	3.37	9.34

Timber and timber products

Mill production of timber

Particulars of logs treated and the production of sawn, peeled and sliced timber by sawmills and other woodworking establishments are shown in the following table. These figures have been compiled from annual factory collections, which cover virtually all sawmills. The only omissions are some small portable mills operated by itinerants, e.g. sleeper cutters.

**OUTPUT OF AUSTRALIAN-GROWN TIMBER: ALL MILLS
STATES AND TERRITORIES, 1967-68
(^{'000} super ft)**

	<i>N.S.W.</i>	<i>Vic.</i>	<i>Qld</i>	<i>S.A.</i>	<i>W.A.</i>	<i>Tas.</i>	<i>Total(a)</i>
Logs treated (gross hoppus)(b)—							
Broadleaved . . .	689,357	499,225	327,363	6,800	467,028	352,122	2,341,895
Coniferous . . .	118,497	74,030	114,586	201,805	17,121	6,926	532,965
<i>Total, logs treated .</i>	<i>807,854</i>	<i>573,255</i>	<i>441,948</i>	<i>208,605</i>	<i>484,149</i>	<i>359,048</i>	<i>2,874,860</i>
Sawn, peeled or sliced timber produced from logs above—							
Broadleaved . . .	361,219	283,184	151,617	4,006	201,993	171,912	1,173,931
Coniferous . . .	69,934	36,718	64,050	124,085	9,643	3,254	307,684
<i>Total, timber produced .</i>	<i>431,153</i>	<i>319,903</i>	<i>215,666</i>	<i>128,091</i>	<i>211,637</i>	<i>175,165</i>	<i>1,481,615</i>

(a) Excludes Australian Capital Territory and Northern Territory. (b) Gross hoppus measure is approximately 78.5 per cent of the true volume.

OUTPUT OF AUSTRALIAN-GROWN TIMBER, ALL MILLS: AUSTRALIA(a)
1963-64 TO 1967-68
 ('000 super ft)

	1963-64	1964-65	1965-66	1966-67	1967-68
Logs treated—					
Broadleaved	2,681,691	2,767,843	(b)2,371,263	(b)2,313,256	(b)2,341,895
Coniferous	696,831	728,691	(b)569,521	(b)554,838	(b)532,965
<i>Total, logs treated</i>	<i>3,378,522</i>	<i>3,496,535</i>	<i>(b)2,940,784</i>	<i>(b)2,868,093</i>	<i>(b)2,874,860</i>
Sawn, peeled or sliced timber produced from logs above—					
Broadleaved	1,157,175	1,203,705	1,185,831	1,151,369	1,173,931
Coniferous	330,014	329,508	331,709	317,591	307,684
<i>Total, timber produced</i>	<i>1,487,189</i>	<i>1,533,213</i>	<i>1,517,540</i>	<i>1,468,960</i>	<i>1,481,615</i>

(a) Excludes Australian Capital Territory and Northern Territory. (b) Gross hoppus basis: not necessarily comparable with details for previous years, which are generally on a true volume basis.

In addition to the mill production of timber shown in the preceding tables, a large quantity of hewn and round timber, e.g. sleepers, piles, poles, fencing timber, timber used in mining and fuel, is obtained directly from forest and other areas. Complete information in respect of the volume of this output is not available.

Veneers, plywood, etc.

Cutting of timber for the manufacture of veneers, plywood, etc., has been carried out in most States for a number of years. In recent years this has been considerably extended, since plywood manufacture has allowed the use of some species unsuitable for sawing. Special attention has been paid to ensure that logs suitable for peeling are diverted to ply factories.

PLYWOOD PRODUCED: STATES, 1963-64 TO 1967-68
 ('000 square feet: $\frac{1}{8}$ -in basis)

State	1963-64	1964-65	1965-66	1966-67	1967-68
New South Wales	58,880	59,045	54,201	58,791	63,909
Queensland	97,252	94,766	80,761	81,313	93,185
Other States	60,150	63,249	52,296	60,348	71,929
<i>Australia</i>	<i>216,282</i>	<i>217,059</i>	<i>187,258</i>	<i>200,451</i>	<i>229,023</i>

Of the total plywood produced in 1967-68, 128,672,850 square feet ($\frac{1}{8}$ -in basis) were classed as 'Commercial', 73,331,689 as 'Waterproof', 2,664,942 as 'Case', and 24,353,525 as 'Sliced fancy'.

During 1967-68, 828.8 million square feet ($\frac{1}{8}$ -in basis) of veneers were produced by the rotary process for the manufacture of plywood, including 260.5 million square feet ($\frac{1}{8}$ -in basis) sold or added to stock, the bulk of which would eventually be used in the production of plywood. In addition, 73.4 million square feet of sliced veneers were produced.

Manufactured boards

Particle board, resin or cement bonded of acoustic and other composition, amounted to 115,579,513 square feet surface measurement during 1967-68.

Wood pulp and paper

Wood pulp. During 1967-68 wood pulp production was 351,268 tons of chemical, mechanical and other pulp. During the previous year production was 357,665 tons.

Detailed information relating to the types and methods of production of wood pulp in the various States was published in Year Book No. 50, 1964, page 1110.

Paper and paper board. Paper and paper board are manufactured in all States, but the greater part of the industry is in New South Wales, Victoria and Tasmania. During 1967-68 twenty-one paper mills were operating, nine in Victoria, three in New South Wales, four in Tasmania, two each in Queensland and South Australia, and one in Western Australia. A wide variety of paper and paper board is produced in Australian mills. The table below gives details of the production of some of the principal items.

PRODUCTION OF PAPER PRODUCTS: AUSTRALIA, 1965-66 TO 1967-68

Type of paper	Quantity (tons)			Value (\$'000)		
	1965-66	1966-67	1967-68	1965-66	1966-67	1967-68
Newsprint	93,211	97,255	92,648	12,106	13,365	12,688
Blotting	601	508	569	161	149	161
Duplicating	9,721	8,291	10,212	3,758	3,467	3,876
Printing and writing	120,540	114,992	112,780	35,818	35,704	35,952
Wrapping--						
Kraft	149,331	184,561	183,591	34,568	40,637	43,344
Other	11,114	13,942				
Paper felts	1,700	1,905	1,164	366	415	243
Paper boards	317,553	329,496	334,660	51,465	53,726	57,093

Overseas trade in forest products, timber and timber products**Imports****IMPORTS OF FOREST PRODUCTS, TIMBER AND TIMBER PRODUCTS
AUSTRALIA, 1966-67 AND 1967-68**

	Quantity		Value (\$'000 f.o.b.)	
	1966-67	1967-68	1966-67	1967-68
Wood in the rough or roughly squared . . . '000 sup ft	44,763	53,166	2,896	3,695
Wood shaped or simply worked--				
Timber sawn lengthwise, sliced or peeled, but not further prepared, of a thickness exceeding 5 mm--				
Conifer--				
Douglas fir . . . . .	..	177,183	171,316	16,366
Hemlock and balsam . . . . .	..	15,395	11,200	1,003
Radiata pine . . . . .	..	26,531	25,016	2,004
Redwood and western cedar . . . . .	..	22,414	28,905	2,728
Non-conifer . . . . .	..	..	..	6,981
Tanning extracts of vegetable origin cwt	79,601	74,005	550	504
Wood and cork manufactures (except furniture)--				
Veneers, plywood boards, 'improved' or reconstituted wood and other wood, worked, n.e.s. . . . .	..	..	6,355	7,777
Wood, worked, n.e.s. . . . .	..	..	2,725	3,722
Cork manufactures . . . . .	..	..	1,187	1,431

Imports of coniferous timbers, shaped or simply worked, came mainly from Canada and the United States of America in 1967-68. Malaysia was the source of by far the greater proportion of non-coniferous timber imports. Papua and New Guinea and the United Kingdom supplied most of Australia's imports of veneers, while plywood imports came mainly from Japan and Papua and New Guinea.

Exports

EXPORTS OF AUSTRALIAN FOREST PRODUCTS, TIMBER AND TIMBER PRODUCTS^(a)
AUSTRALIA, 1966-67 AND 1967-68

	Quantity		Value (\$'000 f.o.b.)	
	1966-67	1967-68	1966-67	1967-68
Wood in the rough or roughly squared . . . . .	..	..	666	636
Wood, shaped or simply worked—				
Railway or tramway sleepers '000 sup ft	26,023	5,621	3,280	863
Timber sawn lengthwise exceeding 5 mm—				
Conifer „	393	574	95	99
Non-conifer „	11,541	9,864	1,790	1,634
Timber, planed or tongued—				
Conifer „	830	808	233	228
Non-conifer „	468	588	114	146
Cork, raw and waste cwt	131	..	13	..
Plants used in dyeing and tanning „	2,590	1,920	8	5
Natural gums, resins, etc. „	9,180	8,160	63	66
Eucalyptus oil '000 lb	308	355	221	269
Veneer wood '000 sq ft	3,207	3,584	133	151
Plywood, blockboards, etc. „	3,383	1,649	444	416
Improved wood . . . . . „	..	..	24	3
Reconstituted wood '000 sq ft	1,153	1,106	151	147
Wooden beadings and mouldings . . . . . „	..	..	120	61
Wood simply shaped or worked, n.e.i. . . . . „	..	..	33	8
Wood manufactures, n.e.i. . . . . „	..	..	894	715
Cork manufactures . . . . . „	..	..	31	83

(a) Excludes re-exports.

Owing to the adoption of the new Australian Export Commodity Classification from July 1966 (see Year Book No. 54, page 339) completely comparable figures for years prior to 1966-67 are not available.

