

CHAPTER XXV.

FORESTRY.*

§ 1. General.

NOTE.—Values of Australian oversea trade shown throughout this chapter are expressed in £A. f.o.b., port of shipment, except where otherwise indicated.

1. **Objects of Forestry.**—The main object of forestry is to manage the forests of a country in the way 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, oils and resins. Indirect benefits include protection of soil and stock from wind and exposure, regulation of stream flow, and aesthetic effects.

Forestry aims to improve existing forests and woodlands by properly controlled exploitation, by protection from destructive agencies such as fire, and by inducing natural regeneration where it is desirable. Forestry also aims to provide a partial tree cover on denuded lands when such cover is necessary for protective purposes, and a complete cover when the land is better under forest than under any other crop.

2. **General Account of Forests and Timbers.**—The area of land in Australia suitable for the production of commercial timber as the primary crop is very small in comparison with the size of the continent. It is concentrated mainly around the wetter coastal belts and the eastern highlands and it includes the bulk of the land suitable for intensive development by agricultural or pastoral undertakings.

The allocation of land for agricultural and pastoral purposes led to the clearing of much of the original forest of Australia, particularly of the more readily accessible parts. In the early period of agricultural and pastoral expansion, only the best timbers found their way into commerce, and species now prized as providing high quality woods were often put to inferior uses. During this period, the forest resources of the country were considered by the majority of the people to be inexhaustible, and relatively little care was taken to prevent the degradation of the remaining forests by fire and uncontrolled grazing. This state of affairs is rapidly changing; it is now recognized that the remaining forest land must be protected and properly managed in the interests of the community.

The trees which make up the forests of Australia are mainly evergreen hardwoods. The characteristic genus is *Eucalyptus*. There are over six hundred different kinds of eucalypts and with few exceptions the natural occurrence of all of them is restricted to Australia. The genus includes species such as the mountain ash (*Eucalyptus regnans*) of Victoria and Tasmania, the world's tallest growing hardwood, and the karri (*E. diversicolor*) of Western Australia, another forest giant. At the other end of the scale there are many eucalypts which do not grow to tall trees, including the species collectively known as the "mallees". The mallees develop a number of small stems from an underground structure called the "mallee root".

* A specially contributed article dealing with Forestry in Australia appeared as part of Chapter XIX. in Official Year Book No. 19 (see pp. 701–12 therein). See also "The Commercial Timbers of Australia, Their Properties and Uses" by I. H. Boas, published by the Council for Scientific and Industrial Research in 1947, "Timbers and Forest Products of Queensland" by E. H. S. Swain, published in 1928 and "Australian Standard Nomenclature of Australian Timbers" published by the Standards Association of Australia.

Less than 100 eucalypts are used for sawmilling and not more than 30 to 40 are exploited extensively. The main commercial eucalypts were listed in Official Year Book No. 39 and earlier issues.

The eucalypts satisfy the Australian requirement for timbers having great strength and durability. They also provide a large proportion of the building timber and some of the wood required for packaging. In recent years, some eucalypts have been used extensively for papermaking and for the manufacture of hardboard and fibreboard. The species most commonly used for pulping are mountain ash (*E. regnans*), alpine ash (*E. gigantea*), and messmate, stringybark or Tasmanian oak (*E. obliqua*).

A large number of other genera represented in the Australian forest flora also produce commercial hardwoods. Among the outstanding furniture, cabinet and veneer timbers are red cedar (*Cedrela toona* var. *australis*), Queensland maple (*Flindersia brayleyana*), Southern and Northern silky oak (*Grevillea robusta* and *Cardwellia sublimis*, respectively), Queensland walnut (*Endiandra palmerstoni*), blackwood (*Acacia melanoxylon*), rose mahogany (*Dysoxylum fraserianum*), etc. Turpentine (*Syncarpia laurifolia*) ranks with the world's best as a harbour piling timber. Coachwood (*Ceratopetalum apetalum*) came into prominence for rifle furniture and for aircraft plywood during the 1939–45 War.

The foregoing are but a few examples indicating the range of use of the timbers of the Australian hardwood forests.

The most important indigenous softwood resources of Australia were in the forests of hoop pine (*Araucaria cunninghamii*) of Queensland and New South Wales. These forests occurred on rich land suitable for intensive agriculture. The greater part of the original hoop pine forest has gone but the wood removed made an important contribution to the Australian timber industry. Some areas of the hoop pine forest have been replanted with this species in Queensland and, to a lesser extent in New South Wales.

There are still considerable areas of the useful white-ant-resisting cypress pine (*Callitris* spp.) in the inland areas of Queensland and New South Wales. They have been seriously overcut but are gradually being brought under management.

Other native softwoods which have played a useful but minor part in the Australian timber industry include bunya pine (*Araucaria bidwillii*) and kauri (*Agathis* spp.) of Queensland, and huon pine (*Dacrydium franklinii*), celerytop pine (*Phyllocladus rhomboidalis*) and King William pine (*Athrotaxis selaginoides*) of Tasmania.

The savannah woodlands of the interior of Australia yield commercial commodities such as sandalwood, tanbarks and essential oils. They also have an important function in providing fuel and rough timbers for the development of agricultural and pastoral holdings.

3. Extent of Forests.—According to data assembled for the Seventh British Commonwealth Forestry Conference held in Australia and New Zealand in 1957, the total area of forest in Australia is estimated at 186,791 square miles, or about 6.3 per cent. of the total land area of the continent. This is an increase of 27,040 square miles over the estimate made for the 1952 Conference, and has resulted from the inclusion of a large area of mallee in South Australia, together with 4,500 square miles of forests, mainly low grade woodlands, in the Northern Territory. The estimated forest area is distributed amongst the States as follows (the proportion of forest land to the total area of each State is shown in parentheses):—New South Wales and the Australian Capital Territory, 37,942 square miles (12 per cent.); Victoria, 26,222 (30 per cent.); Queensland, 28,000 (4 per cent.); South Australia, 36,000 (including 25,000 square miles of mallee suitable for firewood only) (10 per cent.); Western Australia, 41,826 (4 per cent.); Tasmania, 12,301 (47 per cent.) and the Northern Territory, 4,500 (1 per cent.). The areas given are rough estimates only and are considerably in excess of those which are both suitable for reservation and likely to be maintained for timber production. Considerable areas of low grade forest which, in many cases, are suitable for little more than the production of firewood, are included. It is doubtful if the remaining prime native forest area of Australia exceeds 20,000 square miles. The proportion of Australia carrying commercial forests is therefore very low and apart from forests on the coastal fringe of the continent, the tree density is very low.

The table below shows a classification of the estimated total forest area referred to above:—

CLASSIFICATION OF FOREST AREA(a): AUSTRALIA.

Class of Forest.	Area (Square Miles).				Proportion of Total Forest Area.
	State Forest.	Communal Forest.	Private Forest.	Total.	Per cent.
<i>Exploitable—</i>					
Softwood	10,512	5	2,808	13,325	7.1
Mixed wood	754	..	..	754	0.4
Hardwood	41,691	75	13,129	54,895	29.4
<i>Total</i>	<i>52,957</i>	<i>80</i>	<i>15,937</i>	<i>68,974</i>	<i>36.9</i>
<i>Potentially Exploitable—</i>					
Softwood	58	..	100	158	0.1
Mixed wood	100	..	..	100	0.1
Hardwood	13,002	..	12,200	25,202	13.5
<i>Total</i>	<i>13,160</i>	<i>..</i>	<i>12,300</i>	<i>25,460</i>	<i>13.7</i>
<i>Other Lands Classed as Forest</i>	<i>81,023</i>	<i>450</i>	<i>10,884</i>	<i>92,357</i>	<i>49.4</i>
<i>Grand Total</i>	<i>147,140</i>	<i>530</i>	<i>39,121</i>	<i>186,791</i>	<i>100.0</i>

(a) Based on the 1955 classification of forests.

State forests accounted for 78.8 per cent. of the total forest area, private forests for 20.9 per cent. and communal forests for 0.3 per cent.

The bulk of the softwood area of approximately 13,325 square miles is in Queensland and New South Wales and consists principally of slow-growing cypress pine (*Callitris spp.*) in low rainfall areas. The total area has been increased in comparison with previous estimates by the inclusion of a large area of crown land carrying scattered cypress pine. The volume of this species per acre is comparatively low.

4. Forest Reservations.—The first attempt to determine the forest areas which should be reserved solely for purposes of timber production was made at an Interstate Forestry Conference held at Hobart in 1920. This Conference decided that an area of 24½ million acres of indigenous forest should be permanently reserved. According to statements furnished by State and Commonwealth authorities, reservations of forest areas in Australia as at 30th June, 1957, totalled 32,901,370 acres, of which 22,391,728 acres were Dedicated State Forests and 10,509,642 acres were Timber and Other Reserves. The area of Dedicated State Forests increased by 262,000 acres during the year 1956–57 and Timber and Other Reserves by 41,853 acres. These changes were mainly a result of government policy to increase the forest estate but to dedicate only those areas which are suitable for permanent forest management. The distribution of these areas is shown by States in § 5, para. 2, p. 981.

In general, the Timber Reserves are temporary and are liable to be alienated after the timber on them has been exploited. Some of these areas contain land of high value for forestry purposes, but the greater part does not justify permanent reservation.

If the permanently reserved areas were all of good quality, accessible, and fully productive forests supplying the class of timber required, they could be regarded as adequate for a much larger population than exists in Australia at the present time. Actually, however, a considerable proportion 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. Also, the indigenous forest does not contain adequate supplies of soft-woods producing commercial timbers and Australia's requirements of these have to be met largely by imports from other countries.

It is freely acknowledged by Australian forestry authorities that information on forest resources is very imperfect. It is not possible at present to give a reliable estimate of the forest areas needed to meet all future demands because of the number of unknown variables involved—in particular, the yield capacity per acre, future consumption of different classes

of timber per head, and the future population. It appears, however, that all available potentially good forest country, including adequate areas for plantations of conifers, will need to be reserved, protected and systematically managed, if Australia is to approach the goal of self-sufficiency in timber supplies in the future. One of the most urgent requirements in this connexion is a comprehensive estimate of forest resources.

5. **Plantations.**—Reference has been made to the inadequacy of indigenous softwood supplies, but, as a result of the planned policy of the forest services of the States and the Commonwealth and, to a less extent, of several private commercial organizations, the area of softwood plantations, mainly of exotic species, is steadily increasing. It was natural that this aspect of forestry received earliest attention in South Australia as it is the State most poorly endowed with natural forest. This State now has a larger area of planted softwoods than any other State in Australia, and for some years has been exploiting considerable quantities of timber from these plantations. The total production is now over 130,000,000 superficial feet per annum and is expected to be increased substantially during the next decade. Production is also increasing in the other States and first thinnings from their plantations are already supplying a significant portion of the requirements of the case-making industry.

The total net area of Commonwealth and State softwood plantations as at 30th June, 1957, was 346,750 acres. In addition, the area of privately owned plantations at 30th June, 1956, was about 98,000 acres. Hardwood plantations (mainly *Eucalyptus spp.*) comprise a much smaller area and the total acreage is about 30,000 acres, nearly two-thirds of which is mallet (*Eucalyptus astringens*), which has been established in Western Australia for tan bark production.

A special article giving a detailed account of the history and development of softwood plantations and of the characteristics of individual species has been prepared by the Commonwealth Forestry and Timber Bureau for inclusion in this Year Book, see § 2. Softwood Plantations, page 975.

6. **Fire Protection.**—Fire control measures in Australia are the responsibility of the individual State Governments, and the provision of adequate fire protection is one of the main problems facing forest authorities at the present day. The forest services are responsible for fire protection measures over an area of some 43 million acres of dedicated and reserved forest areas throughout Australia, including some 10 million acres of Crown Land in Victoria.

The responsibility for the protection of private property outside urban areas rests with volunteer bush fire brigade organizations 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 organization of the bush fire brigade movement. Throughout the main agricultural and forest areas of Australia there are over 4,500 registered volunteer bush fire brigades with a membership approaching 200,000. Although both forest and rural fire organizations are entirely separate entities, a high degree of co-operation and liaison is maintained.

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

Over the five-year period 1952–57, the annual cost of protecting from fire 43 million acres of forest land for which State Forest Services are directly responsible is estimated at £1,500,000 or about 8½d. per acre. The cost of rural fire control as a whole cannot be estimated with any degree of accuracy, owing to the fact that by far the greatest contribution comes from the personal efforts of volunteer brigade members.

The Australian fire season is very variable, with an average of a particularly bad fire season every seven years or so. Such years as 1926, 1939, 1944 and 1952 account for a large proportion of the average annual burn which, for the period 1945 to 1955, amounted to 2.16 million acres or 1.8 per cent. of the total forested area of Australia. In disastrous fire seasons, such as 1938–39 and 1951–52, the acreage burnt on protected forest areas was as high as 15 per cent., compared with an average burn of 1.2 per cent. when such seasons are excluded.

Since the 1939–45 War, forest services have greatly expanded their fire detection facilities and big advances have been made in the use of power pumping equipment. Radio communication is now being used extensively by both forest services and rural organizations, and considerable progress has been made in the provision of legislative power for the rural bush fire movement, although the volunteer movement itself dates back to the turn of the century.

Recognizing that fire prevention is one of the most important aspects of the problem, intensive campaigns have been conducted to reduce the incidence of man-caused fires. A study of fire causes in recent years reveals that human agencies account for 95 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 35 per cent. of all fires; smokers, hunters, fishermen and travellers cause 13 per cent. of all fires; whilst only 5 per cent. of fires in Australia are caused by lightning.

§ 2. Softwood Plantations.

1. **Introduction.**—In recent years, there has been a growing awareness of the importance of softwood plantations in the Australian timber industry. In view of this, the following special article has been prepared by the Commonwealth Forestry and Timber Bureau, outlining the current position and future prospects of softwoods in the industry.

2. **General.**—The term “softwood” has long been used to represent the wood of the *Coniferae*, of which the most important family is the *Pinaceae*. This family consists primarily of trees and includes such well known producers of commercial timbers as the genera *Pinus* (pines), *Picea* (spruces), *Abies* (firs) and *Pseudotsuga* (Douglas fir).

The timber of the *Coniferae* is, in general, relatively light, of satisfactory strength in relation to weight, straight-grained, moderately soft and easy to work, machine and nail. In contrast, hardwoods as a group, and particularly the genus *Eucalyptus*, are heavy, strong, hard, not straight-grained and not readily nailed or worked by hand. Certain other properties, especially microscopic cell structure, result in softwoods seasoning much faster and more evenly than hardwoods. Because of these features, softwoods are more suitable than hardwoods for light building construction such as houses, fittings, most furniture and the very large box and case industry. The conifers also produce the bulk of the world's pulpwood and, in most industrial countries, represent 80–90 per cent. of the timber consumption.

3. **Timber Resources, Production and Consumption.**—Compared with countries of the temperate regions in the northern hemisphere, the indigenous forest resources of Australia are markedly deficient in softwoods. In “A Statement on Forestry in Australia 1951–55”, prepared by the Forestry and Timber Bureau for the Seventh British Commonwealth Forestry Conference, which was held in Australia and New Zealand during the latter half of 1957, it was estimated that the total volumes of softwoods and hardwoods in the forests were:—

Type of Timber.						Million cubic feet under bark, true volume.	Per cent.
Softwoods	..	..	..	..	..	1,336	4.1
Hardwoods	..	..	..	..	..	31,473	95.9
Total	..	..	..	..	..	32,809	100.0

In contrast to the above, the availability (corresponding roughly to consumption) of sawn timber for the year 1955–56 was as follows:—

						Million superficial feet.	Per cent.
Hardwoods—							
Australian production	..	..	..	..	..	1,110.3	
Plus imports ..	..	..	..	..	..	72.9	
Less exports ..	..	..	..	..	..	19.8	
Availability	..	..	..	..	..	1,163.4	67.9
Softwoods—							
Australian production	..	..	..	..	..	289.3	
Plus imports ..	..	..	..	..	..	260.8	
Less exports ..	..	..	..	..	..	0.7	
Availability	..	..	..	..	..	549.4	32.1
Total Availability	..	..	..	..	..	1,712.8	100.0

The trend of Australian softwood sawn timber production during recent years is given in the following table:—

Year.	Rain forest, e.g. virgin hoop pine, etc.	Cypress pine.	Plantation grown.	Total Softwood.
(Million superficial feet.)				
1938-39	108.9	48.7	16.9	174.5
1945-46	79.6	38.0	67.2	184.8
1950-51	42.0	56.3	103.2	201.5
1955-56	37.8	78.0	173.5	289.3

Notable in the above table is the steady decline in the production of hoop pine and associated softwood species from the virgin rain forests of Queensland and northern New South Wales, and the striking increase in plantation-grown timber. The latter is mainly *Pinus radiata*, but already includes a small amount of plantation-grown hoop pine.

In future, rain forest production will probably stabilise at a still lower figure, whereas plantation-grown timber will steadily increase in quantity. In the case of South Australia alone, the State which has the largest area of softwood plantations, the output of *Pinus radiata* within a decade is expected to exceed 250,000,000 superficial feet in the round.

4. Early Plantation Establishment in Australia.—The first steps for the creation of government plantations in Australia were taken, most appropriately, by the State which had the poorest natural resources—South Australia. This was in 1870, when attention was drawn to the seriousness of the position. Planting commenced in 1876, and has continued without interruption ever since, though it was not until shortly before the 1914-18 War that appreciable areas were established each year. These very early plantings here and elsewhere provided valuable evidence in later years as to the suitability of various sites for *Pinus radiata* and other species. The commencement of plantings in South Australia also led to the formation of the Woods and Forests Department of that State, one of the oldest forest services in the British Commonwealth.

Under the aegis of Lands Departments and other State organizations, small plantations were established in other States, notably Victoria, shortly after that time, although it was not until much later that independent forest services were created.

5. The Planting Programme and the Future of Softwood Plantations.—The States have long been aware of the desirability of establishing coniferous plantations, and in the 20 years following the 1914-18 War substantial areas were established under softwoods. It is largely due to this planting that Australia is now in a position to provide a significant part of its softwood consumption from locally-grown timber.

After the 1939-45 War, planting programmes were reviewed and, in most cases, were substantially increased. At the present time the objectives in total softwood areas by State forest services are: Queensland, New South Wales, Victoria and South Australia each 200,000 acres, Western Australia 100,000 acres, Tasmania 50,000 acres and the Australian Capital Territory 40,000 acres, comprising a total of 990,000 acres.

There are a number of factors to be considered in estimating the need for softwood plantations in the future. Some of these are:—

(a) *The relative demand for softwood and hardwood.* Because of the general suitability of softwood for many purposes, it seems likely that the future demand for softwood will trend upwards until it reaches at least 60-75 per cent. of total timber consumption. In this connexion it is interesting to note that in South Australia, the only State which has significant home-grown softwood supplies in relation to population, softwoods at present comprise 83 per cent. of the total sawn timber consumption. For Australia, as a whole, the figure is only 32 per cent.

(b) *Forestry and land utilization.* Many species of the genus *Pinus* can grow satisfactorily on relatively poor sandy soils with a mean annual rainfall which may be less than 30 inches. Under such conditions only the poorer types of eucalypts will grow and the mean annual increment in timber is very low, whereas with the pines it may average 165 cubic feet or 1,980 super. feet of timber in the round per acre. Since land of the above type is usually not good enough for agriculture and only of moderate value for pasture, utilization for softwood plantations may produce the greatest benefit to the nation. The main species of introduced pines now grown in Australia will grow to maturity within 40 years, whereas the better types of eucalypts require double that length of time to mature and, unless on exceptionally favourable sites, do not produce as high a mean annual increment of timber.

(c) *Policy in relation to self-sufficiency in timber supplies.* Since most of Australia's timber imports consist of softwoods, any policy directed towards increasing self-sufficiency in timber supplies, and reducing the amount of foreign exchange needed, will require expansion of the present rate of softwood plantation establishment. Growth in population will also increase the overall demand for timber. It has been stated recently that the need for plantations, even on a conservative estimate, will amount to 1,700,000 acres 35 years hence and that, allowing for increased population and using 60–70 per cent. of softwoods instead of the present 32 per cent. the requirements in 70 years could amount to 4,000,000 acres.

Heads of forest services agree that the target of one million acres decided upon immediately after the 1939–45 War is now conservative in relation to the potential requirements of Australia and that an increase of an additional one million acres would not be excessive.

6. *The Extent of Existing Softwood Plantations.*—The position as at 30th June, 1956, was estimated to be as follows:—

State or Territory.	Government.			Private (mainly <i>P. radiata</i>).	Total.
	<i>Pinus radiata</i> .	Other species.	Total.		
	Acres.	Acres.	Acres.	Acres.	Acres.
New South Wales	42,937	17,265	60,202	9,041	69,243
Victoria	33,091	13,395	46,486	45,057	91,543
Queensland	976	68,335	69,311	2,000	71,311
South Australia	94,555	7,022	101,577	39,226	140,803
Western Australia	4,125	17,408	21,533	100	21,633
Tasmania	9,914	397	10,311	2,832	13,143
Australian Capital Territory ..	16,640	1,942	18,582	100	18,682
Australia	202,238	125,764	328,002	98,356	426,358

This table shows the predominance of *Pinus radiata* in all States except Queensland and Western Australia. This species is not climatically adapted to growing in the former State, where the native hoop pine is the most important plantation species, with slash pine (*Pinus elliottii* var. *elliottii*) in second place. The main species in Western Australia is maritime pine (*P. pinaster*), which is particularly adapted to growing on sandy soils too poor for the satisfactory growth of other species.

Private plantations have now assumed a position of importance in the softwood economy. The bulk of them comprise relatively large areas belonging to tree-planting or sawmilling companies, or to larger organizations in the pulp and paper industry. The first phase of extensive private planting was in South Australia and Victoria during the decade 1925–35, and these plantations now form the basis of expanding timber-using industries. The second phase began after the 1939–45 War, when the pulp and paper industry commenced planting on a fairly large scale in order to provide part of the raw material for its future requirements. An encouraging aspect of recent years has been that several sawmilling companies are planting in order to assure future timber supplies. With the exception of the relatively small areas in Queensland and New South Wales, *P. radiata* has been used almost exclusively.

7. *Notes on the More Important Softwood Species used in Plantations.*—(i) *Native species.* (a) *Hoop pine*—*Araucaria cunninghamii*. Hoop pine is a high class softwood and is the main species used in plantations in Queensland. It is also planted to a less extent in northern coastal areas of New South Wales. Where it occurs naturally in the rain forests, it attains very large dimensions, reaching 150 feet in height and four feet or more in diameter. To grow hoop pine to this size in plantations would take too long, and it is considered that a height of 100 feet and a diameter of 20 inches will be satisfactory for utilization. On good sites this would require a rotation of 50–60 years.

All tests to date indicate that the rapid, controlled growth possible in plantations does not affect the quality of the wood in the case of hoop pine; in fact, the wood properties of rapidly-grown plantation trees are equal to and sometimes superior to those of average wood from virgin forests. On the evidence available, branch size (with its effect on the knotiness of the timber) appears to be a factor that can be more readily influenced by genetic rather than silvicultural measures. The Forestry Department of Queensland is conducting research on this and other aspects of tree breeding.

The timber of hoop pine is in strong demand for most purposes where durability is not a prime consideration.

(b) *Bunya pine*—*Araucaria bidwillii*. This species, which is closely related to hoop pine, is planted to only a limited extent on account of its slow growth, is more heavily-branched and more difficult to establish than hoop pine.

(c) *South Queensland kauri*—*Agathis robusta*. Kauri has been planted to a more limited extent by the Forestry Department of Queensland because seed supplies are less readily obtained and establishment is more difficult.

(ii) *Exotic species.* (a) *Radiata pine*—*Pinus radiata*. This pine was first introduced into Australia, as well as into New Zealand and South Africa, about 100 years ago, and has become one of the most important softwood species. It is a native of the Monterey Peninsula in southern California, where it is of negligible importance. When it was introduced to countries overseas it frequently showed a far superior rate of growth and attained much greater dimensions than in its native habitat, with the result that one of its common names is "remarkable pine". Heights at 20 years of age may vary from 60 to over 100 feet, and at maturity attain 130–140 feet. In Australia its planting is mainly restricted to the winter rainfall regions where the summers are dry and warm. Successful plantations have been established in south-eastern South Australia, southern Victoria, in Tasmania and on the southern and central tablelands and the south-western foothills of New South Wales. The mean annual increment of timber per acre varies from about 165–300 cubic feet, or 2,000–3,500 superficial feet in the round, true volume. Expressed in terms of a 40-year rotation, an average acre can be expected to produce a total volume of about 120,000 super. feet of sawn timber and possibly ten cords of pulpwood or small case logs. The timber, like that of most species, needs to be mature, and requires careful milling and seasoning. Under these conditions it is at least equal to red deal (the timber of *Pinus sylvestris*) which is one of the main building timbers of northern Europe.

(b) *Slash pine*—*Pinus elliottii* var. *elliottii*. This species replaces *Pinus radiata* as the main exotic species in Queensland and in coastal New South Wales north of Newcastle, which are areas of summer rainfall. Slash pine is one of the main timber species of the southern States of U.S.A., and in that country it is used extensively for pulp, sawn timber and veneers. Thinnings from plantations in Queensland have yielded sawn timber of good quality and there is no reason to expect that the quality will be in any way inferior to that of timber in its natural habitat. The rotation will probably be much the same as for *P. radiata*—about 40 years. Slash pine was first introduced into Queensland in 1925 and after 1930 began to play an important part in the planting programme of the State.

(c) *Loblolly pine*—*Pinus taeda*. This is another species from southern and eastern parts of the U.S.A., where it grows on a wide variety of soils and under a similar range of climatic conditions to slash pine. It is not generally quite as uniformly healthy and vigorous as slash pine, and for this reason has not been planted as extensively, though, if certain aspects of development can be controlled, it is likely to receive increased attention.

(d) *Patula pine*—*Pinus patula*. Patula pine is a fairly common species on the moist mountains of south-eastern Mexico at elevations of 7,000 to 8,000 feet above sea level. It is planted to a moderate extent in selected localities by the Forestry Department of Queensland.

(e) *Maritime pine*—*Pinus pinaster*. This is the most important exotic pine in Western Australia, where it grows on sandy soils which are too poor for satisfactory development of *P. radiata*. It is also used in similar areas in South Australia. Maritime pine is a native of the Mediterranean region and very large areas of it have been planted for sand dune control in Les Landes region of France.

Maritime pine does not attain a height comparable with *P. radiata*, 80–90 feet being common for well-grown mature trees, but diameters are relatively large. The timber is useful for a wide range of purposes.

(f) *Other species.* In addition to the pines already mentioned, there are several other conifers which have a place in the Australian softwood plantation programme. Possibly the most important species of the future will be Douglas fir (*Pseudotsuga menziesii*) in the higher rainfall zones of the mountains of Victoria and southern New South Wales. The timber of this tree (sometimes known under the name of Oregon) has been, and still is, imported on an extensive scale from Canada and the U.S.A. In suitable areas in Australia it shows considerable promise, but the rotation will be considerably longer than that of *P. radiata*. A pine which is very suitable for hard soils in areas of rainfall as low as 20 inches is Canary Island pine (*P. canariensis*). This species is a native of the Canary Islands and grows well under conditions too dry and hot for most other exotic conifers. It is of excellent form and has a marked resistance to fire damage once it has attained pole size. The timber is of exceptional strength and density for a conifer.

In addition to the conifers referred to above, there may be afforestation possibilities with artificial hybrids on which forestry research institutions in Australia are now working. Controlled pollination offers wide scope since pollination can be carried out not only between individuals of the same species but also between closely allied species. Work on agricultural plants has shown that cross pollination not uncommonly has produced new varieties possessing more desirable features than those of either parent alone. Work on these lines is a long-term project, but one that is nevertheless of fundamental importance in forest research.

§ 3. Forestry Activities of the Commonwealth.

1. *Prior to 1925.*—When the Commonwealth of Australia was established on 1st January, 1901, forestry was not included among the matters transferred from the States to the control of the Commonwealth, and Federal jurisdiction was therefore restricted to the then relatively unimportant forests of the Australian Territories. After the 1914–18 War, these Territories (including Papua-New Guinea and Norfolk Island) covered a large area, and in the aggregate contained substantial forest resources. In the early twenties of this century, a professional forester was appointed as forestry adviser to the Commonwealth Government, and he submitted preliminary reports on the forest resources of Papua-New Guinea, Norfolk Island and the Australian Capital Territory, with suggestions for future policy.

2. *Forestry and Timber Bureau.*—In 1925, the Commonwealth Forestry Bureau was instituted, and the Commonwealth Forestry Adviser became the Inspector-General of Forests. By an Act of 1930, the Bureau received statutory powers, and its functions included the advising of the various Territorial Administrations on forestry matters, the management of forests placed under its control, the establishment of experimental forest stations, the training of students in forestry, etc.

At the end of the 1939–45 War, the Commonwealth Government decided to continue certain advisory functions which during the War had been carried out by War-time Timber Control, and such functions were incorporated in the Forestry and Timber Bureau Act 1946, under which the title of the Bureau was altered to Forestry and Timber Bureau. The powers and functions of the Bureau were extended to embrace the collection of statistics and information, and advising the Governments of the Commonwealth and the States or other interested bodies on matters relating to the supply, production, oversea trade and distribution of timber in Australia. The Bureau was placed under the administration of a Director-General.

The activities of the Bureau under its statutory functions are summarized below:—

(a) *Forestry Education.* The Australian Forestry School was opened at Adelaide University in 1926 in continuation of the School of Forestry of that University established in 1911. In 1927, the School was transferred to Canberra. The purpose of the School is to train students as professional officers to manage the forests of Australia. It also accepts students from overseas.

Training at the School covers the third and fourth years of a four-year course. The first two years are spent at an Australian university in a study of prescribed science subjects. Courses at the School lead to Commonwealth Diplomas in Forestry and in Forest Technology and, in the case of the former, can lead further to a degree in forestry of an Australian university. Applicants possessing a university degree granted for approved natural science subjects, or applicants with academic qualifications accepted by the Director-General as equivalent, may also be admitted to this School and proceed to the Diplomas. Graduates or Diploma holders approved by the Director-General may be admitted to the School to take selected subjects or to carry out research work.

The Board of Higher Forestry Education advises regarding pre-requisite university courses leading to the diploma courses and in regard to the maintenance of the standard of the School Diploma course.

In addition to students nominated by State Governments and other Australian and oversea authorities and organizations, private students are accepted at the School, and the Commonwealth Government offers up to ten forestry scholarships each year. These scholarships provide a salary allowance for the four years of the full diploma course.

During 1950, the number of students enrolled reached 80, owing to the intake of ex-servicemen taking university courses under the Commonwealth Reconstruction Training Scheme. The normal capacity of the School is 40.

(b) *Silvicultural Research.* Research headquarters and a Central Experimental Station have been established at Canberra. Other Forest Experimental Stations have been established at Mount Burr in the south-east of South Australia, in Tasmania, and at Dwellingup in Western Australia, on a co-operative basis with the Forest Services of those States. It is proposed to establish similar co-operative experimental stations in other States and Territories.

With its present limited staff, the research work of the Bureau has been concentrated largely upon studies of forest and climatic conditions, the genetical relationships and silvicultural requirements of various species, forest nutrition and the improvement of forest yields. A considerable expansion in the research activities is planned for the next few years as suitable trained staff becomes available.

(c) *Forest Management Research.* In the national interest, it is essential that over-cutting of forests should be avoided and in consequence it is a matter of primary importance that reliable information be available as to the country's forest resources and potentialities. To this end, a national forest stocktaking is being carried out by the Bureau in co-operation with the Forest Services of the States and, to assist in the work of forest assessment, special consideration is being given to the development of the use of aerial surveys.

Consideration is also being given, in co-operation with the State Forest Services, to the establishment of increased areas of plantations of exotic pines with a view to providing additional supplies of softwood timber to meet requirements.

The general economics of forest management are also being studied.

(d) *Timber Supply.* The value of reliable statistical data covering availability of timber and timber requirements was so forcibly demonstrated during the 1939–45 War that it was considered essential to maintain at least a skeleton organization against times of future national emergency. Apart from this, it became clear that, for many years to come, shortages of timber on the one hand and heavy post-war reconstruction demands on the other, accentuated by a rapidly increasing population, would necessitate assessment of requirements and availability of supplies being kept constantly under review as a basis for short and long term policies of timber supply and distribution.

Advice is currently provided to government departments and the trade in matters pertaining to timber supply, including—(a) the availability of total quantities and quantities of particular grades and specifications required to meet Australia's needs; (b) the quantity of timber that should be imported; (c) the extent to which exports of timber and related products might be allowed without detriment to local needs; and (d) distribution of timber within Australia.

(e) *Management of Forests.* The Bureau manages the forests of the Australian Capital Territory and maintains a forestry officer in the Northern Territory. In addition, it is responsible for advising the administrations of the Northern Territory and the External Territories on the management of the forests under their charge.

3. **Commercial Forests.**—The forest areas under Commonwealth control include the following:—

- (a) *Australian Capital Territory.* The forests of the Australian Capital Territory are administered by a Division of the Forestry and Timber Bureau. Further information is contained in Chapter V.—The Territories of Australia.
- (b) *Northern Territory.* The forests of the Northern Territory are administered under ordinance by the Administrator of that Territory. The native forests of the Territory are very limited, consisting largely of open eucalypt forest in the north, with very restricted patches of rain forest along streams, river-fringing forests of paper bark tea-tree, patches of cypress pine, and elsewhere savannah woodland deteriorating to mallee and mulga in the interior. The Bureau maintains a forestry officer in the Territory for investigation and advisory purposes.
- (c) *Norfolk Island.* The forests of Norfolk Island are administered by the Administrator of that Territory. The area reserved for forest covers 1,037 acres, of which the main species is Norfolk Island pine.
- (d) *Papua and New Guinea.* The forests of the Territory of Papua and New Guinea are managed by a Forestry Department under the control of a Director, and are administered under an ordinance of the Territorial Administration. Forestry in the Territory commenced with the appointment of two officers in 1938. Further information is contained in Chapter V.—The Territories of Australia.

4. **Forest Products Research.**—Fundamental investigations connected with the properties and uses of timber and forest products generally are carried out by the Forest Products Division of the Commonwealth Scientific and Industrial Research Organization. These investigations cover a very wide field, e.g., pulp, paper, seasoning, structure and chemistry of wood, tans, etc.

Details can be obtained from the annual reports and publications of the Forest Products Division.

§ 4. Forestry Conferences.

The first British Empire Forestry Conference was held in London in 1920. Subsequent conferences were held in Ottawa in 1923, Australia and New Zealand, 1928, South Africa, 1935 and again in the United Kingdom in 1947. In conformity with the development of the British Commonwealth of Nations, the name of these conferences was changed to British Commonwealth Forestry Conference. The sixth was held in Canada in 1952 and the seventh was held in Australia and New Zealand in 1957.

§ 5. State Forestry Departments.

1. **Functions.**—Except for Queensland, the powers and functions of State forest authorities are laid down under Forestry Acts and Regulations. In each State, there is a department or commission to control and manage the forests of the State. The functions of these administrations are as follows:—(a) The securing of an adequate reservation of forest lands; (b) the introduction of proper measures for scientific control and management of forest lands; (c) the protection of forests; (d) the conversion, marketing and economic utilization of forest produce; and (e) the establishment and maintenance of coniferous forests to remedy the existing deficiency in softwoods. Annual reports are issued by each State forest authority. In Queensland, forestry is a sub-department of the Department of Public Lands. Victoria maintains a forestry school at which recruits are trained for the forestry service of that State.

2. **Forest Reservations.**—As mentioned in § 1, para. 4, p. 973, State forest authorities agreed that, in order to secure Australia's future requirements, an area of 24½ million acres should be permanently reserved. At June, 1957, the area of State Forests reserved in perpetuity totalled 22,391,728 acres or 91.4 per cent. of the area recommended as the goal to be attained.

In addition to the work of permanently reserving areas in each State, foresters are endeavouring to survey all timbered lands with a view to the elimination of those unsuitable for forestry. Considerable areas have been revoked in certain States, while dedications of new areas have resulted in gains to the permanent forest estate. The Forestry Departments also usually control all timber on open Crown lands as well as over 10 million acres of timber reserves, national parks, etc., but, while these areas contain some land of high value for forestry purposes, the greater part does not justify permanent reservation.

In the following table, details of forest areas as recorded by State Forest Authorities, distinguishing between dedicated State forests, timber reserves and other forest reserves, are shown for each State as at 30th June, 1957. In addition, details of forest reservations in Northern Territory and Australian Capital Territory are shown.

AREA OF FOREST RESERVATIONS, 30th JUNE, 1957.
(Acres.)

State or Territory.	State Forests.	Timber Reserves (Forest Acts).	Other Reserves.	Total.
New South Wales	6,323,337	1,399,610	..	7,722,947
Victoria	4,818,554	712,523	(b) 173,358	5,704,435
Queensland	5,008,031	3,071,075	(c) 788,152	8,867,258
South Australia	267,609	..	..	267,609
Western Australia	3,990,295	1,821,389	(b) 935,793	6,747,477
Tasmania	1,977,002	137,028	987,714	3,101,744
Northern Territory	6,900	..	352,000	358,900
Australian Capital Territory .. .. .	..	..	131,000	131,000
Australia	22,391,728	7,141,625	3,368,017	32,901,370

(a) Includes 1,380,429 acres of national forests.
(c) National parks.

(b) Timber reserves under the Land Act.

3. **Employment.**—In the table below, details are shown of the number of persons employed by State Forestry Departments, and by the Forestry and Timber Bureau in respect of the Australian Capital Territory and the Northern Territory, at 30th June, 1956.

PERSONS EMPLOYED BY FORESTRY DEPARTMENTS, 30th JUNE, 1956.

Occupational Group.	N.S.W.	Vic.	Qld.	S.A.	W.A.	Tas.	N.T.	A.C.T.	Aust.
Professional Staff ..	163	189	76	45	44	24	1	6	548
Non-professional Staff ..	206	282	81	4	106	97	1	..	777
Clerical Staff ..	328	211	155	82	52	52	..	4	884
Extraction of Timber ..	..	111	103	34	10	..	..	..	..
Milling of Timber ..	..	42	..	493	24	..	..	..	..
Labour (forest workers, etc.) ..	1,135	784	1,882	251	482	220	..	66	5,637
Total ..	1,832	1,619	2,297	909	718	393	2	76	7,846

§ 6. Forestry Production.

1. **Timber.**—Particulars of logs treated and the production of rough sawn timber by sawmills and other woodworking establishments are shown in the following table by States for the year 1955–56.

OUTPUT OF NATIVE TIMBER: ALL MILLS, 1955-56.
(⁰000 super. feet.)

Particulars.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	Aust.(a)
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LOGS TREATED, INCLUDING THOSE SAWN ON COMMISSION.(b)

Hardwood ..	469,136	536,784	327,368	7,273	507,610	291,166	2,139,337
Softwood ..	115,089	51,430	111,453	165,326	11,959	7,956	463,213
Total ..	584,225	588,214	438,821	172,599	519,569	299,122	2,602,550

SAWN TIMBER PRODUCED FROM LOGS ABOVE.(c)

Hardwood ..	296,668	322,695	192,920	5,467	216,404	146,782	1,180,936
Softwood ..	66,041	28,576	68,810	95,516	5,993	3,850	268,786
Total ..	362,709	351,271	261,730	100,983	222,397	150,632	1,449,722

(a) Excludes the Australian Capital Territory and the Northern Territory, details for which are not available. (b) Includes logs used for plywood and veneer production. (c) Includes the sawn equivalent of timber peeled or sliced for plywood and veneers.

The following table shows logs used and sawn timber produced in Australia for the years 1938–39 and 1951–52 to 1955–56.

OUTPUT OF NATIVE TIMBER: ALL MILLS, AUSTRALIA.(a)

Particulars.	Unit.	1938–39.	1951–52.	1952–53.	1953–54.	1954–55.	1955–56.
Logs used—							
Hardwood ..	⁰ 000 super. feet (hoppus measure)	1,015,136	2,000,032	1,970,126	2,047,906	2,101,306	2,139,337
Softwood ..	..	293,680	363,829	369,881	414,827	444,536	463,213
Total ..	..	1,308,816	2,363,861	2,340,007	2,462,733	2,545,842	2,602,550
Sawn Timber Produced—							
Sawn equivalent of Timber Peeled or Sliced for Plywood and Veneers ..	⁰ 000 super. feet	21,639	29,159	21,606	28,492	27,676	27,957
Used for other purposes ..	..	695,376	1,363,607	1,318,191	1,371,606	1,421,612	1,421,765
Total Sawn Timber—							
Hardwood ..	..	526,229	1,166,114	1,115,423	1,157,124	1,184,992	1,180,936
Softwood ..	..	190,786	226,652	224,374	242,974	264,296	268,786
Total ..	..	717,015	1,392,766	1,339,797	1,400,098	1,449,288	1,449,722

(a) Excludes the Australian Capital Territory and the Northern Territory, details for which are not available.

The next table shows the sawn output of native timber in sawmills and other wood-working establishments in each State for the years 1938-39 and 1951-52 to 1955-56.

SAWN OUTPUT (a) OF NATIVE TIMBER : ALL MILLS.
(⁰⁰⁰ super. feet.)

State.	1938-39.	1951-52.	1952-53.	1953-54.	1954-55.	1955-56.
New South Wales ..	179,350	380,633	350,792	370,279	372,920	362,709
Victoria ..	120,197	348,478	322,209	338,957	362,334	351,271
Queensland ..	193,250	291,681	285,074	288,380	264,914	261,730
South Australia ..	14,537	67,121	68,500	68,190	82,942	100,983
Western Australia ..	125,453	178,290	203,314	216,021	225,794	222,397
Tasmania ..	84,228	126,563	109,908	118,271	140,384	150,632
Australia (b) ..	717,015	1,392,766	1,339,797	1,400,098	1,449,288	1,449,722

(a) Includes the sawn equivalent of timber peeled or sliced for plywood and veneers. (b) Excludes the Australian Capital Territory and the Northern Territory, details for which are not available.

In addition to the sawn timber shown in the preceding table, a large amount of other timber, e.g., sleepers, piles, poles, fencing material, timber used in mining, and fuel, is obtained from forest and other lands. Complete information in regard to the volume of this output is, however, not available. The annual reports of the Forest Departments of the States contain particulars of the output of timber from areas under departmental control but, owing to lack of uniformity in classification and measurement, accurate determination of total production cannot be made. Moreover, there is a moderate quantity of other timber produced from privately owned land, but information regarding output is not available.

2. Wood Pulp and Paper.—(i) *Wood Pulp.* The manufacture of wood pulp from Australian-grown timber was established in Australia in 1939, after years of experimentation with eucalypt hardwoods, production in 1938-39 being 6,165 tons of wood pulp. At the end of 1956, four wood pulp mills were operating in three States and production during 1955-56 was 110,998 tons of chemical pulp and 75,055 tons of mechanical pulp, a total of 186,053 tons.

(a) *Victoria.* In Victoria, Australian Paper Manufacturers Ltd. produce wood pulp at Maryvale in Gippsland by a chemical process known as the kraft or sulphate process. The timber used at this mill consists mainly of eucalypt hardwoods at present unsuitable for other purposes and, in addition, a small quantity of plantation pine thinnings and mill waste and special softwood for production of cellulose. During 1956-57, the wood taken from Crown lands for the production of pulpwood and cellulose amounted to 6,799,949 cubic feet, of which 5,925,490 cubic feet were hardwood and 874,459 cubic feet were softwood. Pine plantations are being established in Gippsland by A.P.M. Forests Pty. Ltd. The initial aim is 20,000 acres to provide a perpetual yield of 20,000 tons of long-fibred pulp per annum. Planting commenced in 1951 and it is estimated that 19,700 acres were planted by the end of 1957.

(b) *South Australia.* In South Australia a paper board mill operates near Millicent, using raw material in the form of logs from the State Forests in the south-east of South Australia. Up to date, groundwood pulp has been produced, but future expansion allows for the introduction of an additional semi-mechanical process. During 1955-56 and 1956-57, 6,046,309 and 6,577,728 super. feet of pulpwood respectively were used in this establishment. The forests of South Australia are also supplying large quantities of pulpwood in log form to Australian Paper Manufacturers Ltd., Victoria.

(c) *Tasmania.* In Tasmania, two large mills are making pulpwood from indigenous hardwoods. At Burnie, on the north-west coast, Associated Pulp and Paper Mills Ltd. use a chemical method, the soda process, to produce wood pulp for fine writing and printing papers from eucalypt hardwoods. This plant is of the most modern design and pulp and paper manufacture are combined with sawmilling and hardboard production. Offcuts and rejects from the timber mill are used for pulping and the manufacture of hardboard. Utilization of the freehold and concession forest areas held by the company is being extended to logging areas held by other sawmilling firms, who supply logs unsuitable for milling to the pulp mills. A continuous digester has been installed at the Burnie mill, making it the only one in Australia using a continuous pulping process. The forests are managed on a permanent yield basis with regeneration of the eucalypts in all suitable areas. Pine plantations are being established to provide softwoods for pulping.

Australian Newsprint Mills Ltd. at Boyer, 20 miles from Hobart, is the only producer of newsprint in Australia. Wood pulp is produced by mechanical process from hardwoods drawn from State timber concession areas. Eucalypts provide about 80 per cent. of its requirements for wood pulp, the remainder being imported long fibre softwood pulp. To secure more complete bush utilization, the company has established three sawmills to convert understory species such as myrtle, sassafras, blackwood and celery top pine to sawn timber. The forests are managed on a sustained yield basis. Forest utilization and management are designed to obtain eucalypt regeneration. Experimental work into the problems involved is being carried out by the company and the Tasmanian Forestry Commission.

(ii) *Paper and Paper Board.* Paper and paper board are manufactured in all States but the industry is centred mainly in New South Wales, Victoria and Tasmania. At the end of 1956, seventeen paper mills were operating, six in Victoria, five in New South Wales, three in Tasmania and one each in Queensland, South Australia and Western Australia. A new mill, Shoalhaven Paper Mills Pty. Ltd., commenced production in February, 1956, when the first of two mills to be installed began operating. The mill, situated near Nowra in New South Wales, is the first superfine paper mill to operate in Australia, and is expected to produce 8,000 tons of watermarked, rag-content and other fine writing, printing and industrial papers each year. A wide variety of papers and paper boards is produced in Australian mills, the quantity and value of paper produced in 1955-56 being as follows:—newsprint, 79,015 tons valued at £5,649,906; blotting, 732 tons, £112,785; duplicating, 4,122 tons, £642,454; printing and writing, 43,363 tons, £6,557,826; kraft wrapping, 46,450 tons, £5,594,919; other wrapping, 1,227 tons, £181,889; felt and carpet felt, 3,739 tons, £306,635; and other paper, 35,124 tons, £3,312,933. In addition, 140,257 tons of paper boards valued at £10,787,706 were produced in 1955-56.

3. *Other Forest Products.*—(i) *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. Recently, however, this has been considerably extended, and much greater use has been made of locally-grown timbers, both hardwoods and softwoods. In recent years, special attention has been paid to the selection of logs suitable for peeling.

The following table shows the production of plywood for each of the years 1938-39 and 1951-52 to 1955-56:—

PLYWOOD PRODUCED.
(‘000 square feet— $\frac{3}{16}$ in. basis.)

State.	1938-39.	1951-52.	1952-53.	1953-54.	1954-55.	1955-56.
New South Wales	24,194	31,784	22,557	28,601	35,039	39,256
Queensland ..	66,100	110,028	81,400	114,545	130,330	133,230
Other States ..	14,511	17,341	11,771	18,435	21,235	28,213
Australia ..	104,805	159,153	115,728	161,581	186,604	200,699

Of the total plywood produced in 1955-56, 158,507,000 square feet ($\frac{3}{16}$ in. basis) was classed as “Commercial”, 19,833,000 as “Waterproof”, 4,949,000 as “Case” and 17,410,000 as “Sliced Fancy”.

During 1955-56, 501.8 million square feet ($\frac{1}{16}$ in. basis) of veneers were produced by the rotary process for the manufacture of plywood, and 147.1 million square feet ($\frac{1}{16}$ in. basis) were sold or added to stock, the bulk of which would eventually be used in the production of plywood. In addition, 49.7 million square feet of sliced veneers were produced.

(ii) *Hardboard.* The production of hardboard for building purposes from pulped wood has increased considerably in Australia in recent years. There were three factories producing hardboard in 1956 (two in New South Wales and one in Tasmania) and during the three years ended 30th June, 1956, the following quantities and values were produced:—1953-54, 16,992,000 square yards, £3,284,000; 1954-55, 19,834,000 square yards, £3,810,000 and 1955-56, 22,619,000 square yards, £4,326,387. Preliminary figures for 1956-57 show a recorded total production of 22,456,000 square yards, £4,360,051.

Most of this hardboard enters into normal usage in the condition in which it leaves the producing factories. The remainder is further treated and surfaced mainly to a glossy "tiled" finish, and in 1955-56 this production accounted for 1,011,000 square yards valued at £679,000.

(iii) *Eucalyptus Oil*. Oil may be distilled from the foliage of all varieties of *Eucalyptus*, and several of them furnish a product widely known for its commercial and medicinal uses. Complete information regarding Australian production and consumption of eucalyptus oil is not available, but considerable quantities are manufactured, particularly in New South Wales and Victoria. The value of oversea exports of eucalyptus oil distilled in Australia was £215,283 in 1952-53; £163,763 in 1953-54; £155,291 in 1954-55; and £274,037 in 1955-56. The quantities exported in the years 1952-53 to 1955-56 were 721,330 lb., 504,628 lb., 451,741 lb. and 683,131 lb. respectively.

(iv) *Gums and Resins*. Gums and resins are produced in most States of Australia, the main product being grass tree, or yacca gum. This gum, which is used in the preparation of varnishes and lacquers, comes chiefly from South Australia while small quantities are also produced in New South Wales and Western Australia. In 1955-56, the recorded production for Australia of gums and resins was 15,578 cwt. Exports of yacca gum from Australia during the same period amounted to 14,324 cwt. valued at £36,429.

(v) *Tanning Barks*. The forests of Australia are capable of yielding a wealth of tanning materials; many species of *Eucalyptus* and other genera contain varying proportions of tannin, chiefly in the bark, but also in the wood and twigs. Scattered distribution however, has resulted in only the richest tan-bearing species being used in Australia. These are:—Golden wattle (*Acacia pycnantha*), black or green wattle (*Acacia decurrens* or *mollissima*), and mallet (*Eucalyptus astringens*). Mallet (*E. astringens*), of Western Australia, is not extensively used in Australian tanneries, but is exported to Europe and other countries. Reference to oversea trade in tanning barks is made in § 7, para. 3, p. 988.

The production of extract from the bark of karri (*E. diversicolor*), of which very large quantities are available at karri sawmills, has passed the experimental stage, and private enterprise has started production on a commercial scale. The experimental work in kino impregnated marri (*E. calophylla*) bark is not yet complete. The total factory production of tanning bark in Australia approximated 25,000 tons per annum in the years prior to 1939, but since then production has declined and in 1955-56 was only 9,288 tons. However, this decrease is offset by the increased use of vegetable tanning extracts and synthetic tanning agents.

4. Value of Production.—(i) *Gross and Local Values, 1955-56*. The values of forestry production on a gross and local basis are shown in the following table for the year 1955-56.

GROSS AND LOCAL VALUE OF FORESTRY PRODUCTION, 1955-56.
(£'000.)

State.	Gross Production Valued at Principal Markets.	Marketing Costs.	Gross Production Valued at Place of Production.
New South Wales	15,774	431	15,343
Victoria	12,668	845	11,823
Queensland	9,499	839	8,660
South Australia	4,736	140	4,596
Western Australia	5,237	360	4,877
Tasmania	5,174	583	4,591
Northern Territory	40	(a)	40
Australian Capital Territory ..	140	11	129
Australia	53,268	3,209	50,059

(a) Not available.

No information is available on the value of materials used in the process of production for 1955-56 and hence it is not possible to calculate net value of forestry production.

(ii) *Local Values, 1934-35 to 1938-39 and 1951-52 to 1955-56.* In the following table, the local value of forestry production and the local value per head of population are shown by States for the years 1951-52 to 1955-56 in comparison with the average for the five years ended 1938-39. Local value is gross value less marketing costs and is the value at place of production.

LOCAL VALUE OF FORESTRY PRODUCTION.

Year.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	Aust.(a)
LOCAL VALUE. (£'000.)							
Average, 1934-35 to 1938-39(b) ..	2,094	837	2,226	547	1,176	394	7,274
1951-52 ..	12,461	8,479	7,040	3,179	3,689	3,057	37,905
1952-53 ..	13,692	8,904	7,102	3,790	3,328	3,248	40,064
1953-54 ..	12,905	9,475	7,797	4,373	3,615	3,555	41,720
1954-55 ..	13,686	9,987	7,895	4,427	3,850	4,037	44,047
1955-56 ..	15,343	11,823	8,660	4,596	4,877	4,591	50,059

LOCAL VALUE PER HEAD OF POPULATION. (£ s. d.)

Average, 1934-35 to 1938-39(b) ..	0 15 7	0 9 1	2 5 2	0 18 7	2 11 8	1 13 9	1 1 4
1951-52 ..	3 15 3	3 13 5	5 13 7	4 5 0	6 5 1	10 8 5	4 9 3
1952-53 ..	4 1 4	3 15 1	5 11 8	4 18 11	5 8 11	10 14 8	4 12 2
1953-54 ..	3 15 10	3 18 3	5 19 11	5 11 3	5 14 7	11 9 10	4 14 3
1954-55 ..	3 19 1	4 0 3	5 19 2	5 9 8	5 18 8	12 17 11	4 16 11
1955-56 ..	4 7 1	4 12 2	6 8 0	5 10 2	7 5 10	14 7 8	5 7 5

(a) Details for the Australian Capital Territory and the Northern Territory are excluded for years prior to 1954-55. (b) Net value of production (i.e., local value less value of materials used in the course of production) has been included for certain years for Victoria and Western Australia.

5. *Employment.*—(i) *Forestry Operations.* The estimated number of persons employed in forestry operations at 30th June, 1954, including working proprietors, but excluding those employed in the sawmilling industry, as recorded at the 1954 Census, was 15,300.

(ii) *Milling Operations.* Details of the average number of persons employed, including working proprietors, in the milling operations of sawmills during the year 1955-56 are shown in the next table. Further details regarding the operations of these mills are shown in Chapter VII.—Manufacturing Industry.

SAWMILLS : AVERAGE NUMBER OF PERSONS EMPLOYED, 1955-56.

Sex.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	Australia. (a)
Males ..	9,371	7,674	6,519	2,068	4,492	2,679	32,803
Females ..	378	233	290	174	39	64	1,178
Total ..	9,749	7,907	6,809	2,242	4,531	2,743	33,981

(a) Excludes Northern Territory and Australian Capital Territory, details for which are not available.

§ 7. Imports and Exports of Timber and Tanning Substances.

1. Imports of Timber, Veneers and Plywood.—The quantities of timber imported into Australia during the year 1955-56 are shown in the following table according to countries of origin:—

IMPORTS OF TIMBER, VENEERS AND PLYWOOD INTO AUSTRALIA :
COUNTRIES OF ORIGIN, 1955-56.

Country of Origin.	Logs (including desapped).		Undressed timber.(a)		Box shooks.	Dressed timber.	Veneers.	Ply-wood.
	('000 super ft.).		('000 super ft.).		('000 super ft.)	('000 super ft.)	('000 sq. ft.)	('000 sq. ft.)
United Kingdom	140	..	..	3,759	..
Australian Territories—
New Guinea	2,503	3,587	288	..	..	4,810	20,038
Borneo	30,315	123	17,861	..	..	..	..
Canada	117,878	85	..	..	62	..
New Zealand	33,976	19	1,439	346	..	..
Pacific Is. (British)—Solomon Is. ..	2,552	1,323	..	..	..	..	..	..
Other Commonwealth Countries ..	3	629	460	28,665	981	240	495	95
Brazil	12,059	..	..	..	1,709	..
Finland	131	..	..	4,121	..	..
Norway	5,257	..	..
Sweden	1,801	..	..	10,035	..	..
United States of America	65,561	614	..	49	..	..
Other Foreign Countries	556	1,166	1,513	489	34	2,996	3,683
Total ..	2,555	35,326	236,742	49,185	2,909	20,082	13,831	23,816

(a) Excludes railway sleepers.

Most of the logs imported are hardwoods from Borneo, the value of all logs imported being £917,000 during 1955-56. In the same year, the value of undressed timber imported totalled £13,192,000, of which nearly 80 per cent. was softwood. Of the imports of undressed timber, softwoods came principally from Canada, United States of America and New Zealand, while hardwoods came mainly from Malaya and Borneo. The bulk of the imports of dressed timber now comes from Finland, Sweden and Norway. The total value of dressed timber shown in the table above amounted to £1,579,000 during 1955-56. The United Kingdom and New Guinea supplied the greater part of the imports of veneers, which were valued at £151,000 while New Guinea was the largest supplier of plywood, imports of which were valued at £658,000.

2. Exports of Timber, Railway Sleepers, Veneers and Plywood.—The quantities of timber, railway sleepers, veneers and plywood exported during the year 1955-56 are shown below, together with the countries of consignment.

EXPORTS OF TIMBER, RAILWAY SLEEPERS, VENEERS AND PLYWOOD FROM
AUSTRALIA : COUNTRIES OF CONSIGNMENT.

Country of Consignment.	Logs (including desapped).		Undressed timber.		Railway sleepers.	Dressed timber.	Veneers.	Ply-wood.
	('000 super ft.).		('000 super ft.).		('000 super ft.)	('000 super ft.)	('000 sq. ft.)	('000 sq. ft.)
United Kingdom	4,228	382	605	6,287	548
Australian Territories—
New Guinea	27	..	250	..	12	..	62
Papua	1	..	1,073	..	139	..	54
Other	249	50	..	199	..	..
New Zealand	3,929	..	11,914	11,569	..	648	250
Pacific Islands (British)—
Fiji	334	..	136	..	..
Gilbert and Ellice Is.	222	301	..	..	..	..
Other
Other Commonwealth Countries	109	190	132	..	111	..	..
Foreign Countries	112	7	2,368	601	205	49	23
Australia	2	1,486	213	52	2	23
Australian Produce	4,178	179	22,131	12,765	1,431	6,982	959
Re-exports	491	5	..	28	4	1
Total	4,178	670	22,136	12,765	1,459	6,986	960

Exports of timber were consigned mainly to New Zealand and the United Kingdom, and consisted largely of the Western Australian hardwoods, jarrah and karri, which have earned an excellent reputation for such purposes as harbour works and wood paving, etc. The total value of exports of undressed timber, excluding railway sleepers, during 1955-56 was £1,363,000 (hardwood £1,303,000, softwood £60,000). Railway sleepers exported were valued at £711,000.

3. **Classification of Imports and Exports.**—(i) *General.* The quantities and values of timber, according to items, imported and exported during the year 1955-56 are shown in the following table:—

TIMBER: IMPORTS AND EXPORTS, AUSTRALIA, 1955-56.

Item.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	'000 super. ft.	£A. f.o.b.	'000 super. ft.	£A. f.o.b.
Logs, not sawn—				
Softwood	2,555	72,882	..	..
Hardwood	35,326	844,427	4,178	247,816
Timber, undressed (including railway sleepers)—				
Softwood	236,742	10,320,443	670	60,335
Hardwood	49,185	2,871,586	34,901	2,014,081
Timber for boxmaking	2,909	186,375	(a)	(a)
Timber, dressed—				
Flooring, lining and weatherboards ..	19,727	1,357,316	1,459	130,280
Other	355	35,610		
Veneers	13,831	150,674	'000 sq. ft. 6,986	150,831
Plywood	23,816	658,489	960	55,246
Other Timber (b) .. .. .	..	2,229	..	3,236
Total .. .. .	..	16,500,031	..	2,661,825

(a) Not recorded separately.
not available.

(b) Includes dunnage and timber for which quantity data are

(ii) *Tanning Substances.* The imports of tanning substances of natural origin in 1955-56 amounted to 173,035 cwt. valued at £602,555 (bark, 2,083 cwt., £4,192; extracts, 131,474 cwt., £500,189; and other tanning substances including valonia, myrabolans, cutch, etc., 39,478 cwt., £98,174) compared with 199,096 cwt. valued at £648,769 (bark, 2,499 cwt., £5,163; extracts, 154,390 cwt., £592,414; and other tanning substances 42,207 cwt., £51,192) in 1954-55. Exports during the same periods were 139,709 cwt. valued at £480,190 and 96,965 cwt. valued at £350,801 respectively.

The imports of tanning bark consist almost exclusively of wattle bark from the plantations in South Africa. One species of Australian wattle, *Acacia mollissima*, is chiefly relied upon for the production of wattle bark in the South African plantations, most of the seed being obtained from the best wattle bark areas in eastern Tasmania and western Victoria. Two reasons are given to account for the success of the industry in the Union of South Africa:—(a) The suitability of the treeless, grassy highlands of Natal; and (b) the availability of native labour.