Western Australia.

FORESTS DEPARTMENT.

SOME NOTES

ABOUT THE

FOREST RESOURCES OF THE STATE.

Issued under the authority of the Minister for Forests:
THE HON. JOHN SCADDAN, M.L.A.

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Western Australia:

ITS FORESTS AND TIMBERS.

HISTORICAL.

THERE is romance in the forest story of every State in the Commonwealth, and in none is the story more attractive, more picturesque, and more inspiring than in Western Australia. It is a plain statement of fact to say that the foundation in 1829, by the British Colonial authorities, of a settlement at the entrance to the Swan River was largely due to reports received in England as to the existence of immense forests of valuable hardwoods in the South-Western corner of what was then generally known as New Holland. The Government of New South Wales in December, 1826, formed a small settlement at King George III. Sound, not so much by way of developing or exploiting the great unknown region as of furnishing a gentle hint to outsiders that the "Union Jack" covered the territory. The settlement was known as "Frederick Town," so named in honour of H.R.H. the Duke of York, and this settlement has since become the prosperous town of Albany. In 1827 Captain Stirling, in the "Success," visited and partially explored the Swan River and its tributary the Canning. He also explored the country in the vicinity of the Vasse, behind which lie the forests which contain giant jarrah and karri trees. The reports furnished to Governor Darling at Sydney by Captain Stirling, of the "Success," also did much to influence the Colonial Office in its decision to establish a settlement on the Swan River. The first settlers found abundant timber for house building ready to hand, and at Perth, the capital, for 20 years at least after the foundation of the Colony, every building, including Government house, was built of jarrah or other native timbers.

LOG HAULING IN! A[illegible] JAKRAH FOREST.

EXPORT TRADE.

The extent of the forests and the high quality of the timber they contain early suggested to the hardy pioneer colonists that an export trade should be established. In these early days India and the Cape, for geographical reasons, bulked more largely in the commercial undertakings of the new Colony than did the Mother Country, and consequently the earliest shipments of jarrah were made to the countries named. There is no official record of the first shipments, although in a local newspaper established in 1832 references are made to exports of "Mahogany," the name given by the early settlers to jarrah. The first official record of export was in 1836, when a shipment of 200 loads, valued at £2,500, was sent overseas. There is a hiatus of seven to eight years when, in 1844, a note occurs of a parcel valued at £163 having been despatched. From 1846, however, the official record is complete, and it exhibits a story of steady expansion. The following figures illustrate the growth of the export trade :—

		£
1850	value	1,048
1860	,,	4,932
1870	,,	17,551
1880	,,	69,742
1890	,,	63,080
1900	,,	458,461
1910	,,	972,608
1913	,,	1,089,481

In 1914 came the war and with it a serious diminution of the export trade, owing to the lack of shipping. Since 1836 the total amount of timber exported from the State until 1914 was 3,815,134 loads of a value of £15,349,870. The timbers represented by this huge total are almost entirely jarrah and karri.

EXPLOITATION.

The early colonists found a rich asset close at hand in the sandalwood, for which Western Australia is noted. The export of this wood to the East has been large, and the returns derived from it have played a very important part in the fortunes of the agricultural districts now known as the "Wheat Belt." The first official notice of the export of the wood is in 1845, when four tons, valued at £40, was sent away. There has been a steady rise in the amount of export, the

TYPICAL KARRI FOREST

total up to the end of 1918 being 312,362 tons, of a value of £2,709,963. The war has interfered very little with the export of sandalwood, as steamers from Fremantle to China have run with fair regularity right through the war period. In 1918, indeed, the export value (£81,834) is the largest that has ever taken place in any one year.

Another forest product of Western Australia, the export of which has reached notably large dimensions, is that of mallet bark, a substance which contains a large percentage of tannin, the active principle in all tanning agents. The export trade dates from 1903, when mallet bark to the value of £859 was sent away; in two years the export had reached the phenomenal figure of £154,087, and the total export value up to the end of 1918 has been £910,933.

The important part which its forests have played in the development of Western Australia, when the figures relating to forest products are collected and set out in gross, become strikingly apparent.

The total value of timber, sandalwood, and mallet bark exports amount to	18,970,766
Total value of timber products used locally ..	8,100,000
Mining timber estimated at	25,000,000
Total	£52,070,766

The forests of the State have, therefore, already yielded products to the enormous amount of over £50,000,000, and to this must still be added the value of gums, resins, and fibres, industrial and domestic firewood, regarding which no official statistics are available.

The timber in the great forests is dealt with by milling plants with a capacity unequalled by those of any other State in the Commonwealth. The work of milling is partly in the hands of the Government and partly in those of private companies and firms. In the karri forests a log of 15 to 25 tons is by no means uncommon, and with trees 80 to 120 feet to the first branch, three logs of ordinary length can be obtained. In one mill in the karri forests a roof rests on girder spans each of which is a single beam of karri 80 feet long. The State Mills at Pemberton, in the karri country, have a capacity of 120 loads or 72,000 super feet per day. At this mill also is an extensive powellising plant, and here a large proportion of the sleepers used in the Great Western Railway were treated. Here, too, there is an extensive fruit case

LOGS AT A BUSH LANDING.

factory, cases of native timbers now taking the place of those of imported wood in use in pre-war times.

THE PRIME FLORA OF WESTERN AUSTRALIA.

It is not within the scope of this brief notice to describe the flora of the Western State. Western Australia has often been called the "paradise of botanists," and its gorgeous shrubs and flowers have been introduced into many other parts of the world and have made its flora famous. Of these probably the Blue Leschenaultia (*Leschenaultia Biloba*), the red flowering gum (*Eucalyptus ficifolia*), Christmas Bush (*Nuytsia floribunda*), the Sturt's Desert Pea (*Clianthus Dampieri*), the red and green Kangaroo Paw (*Anigozanthus Manglesii*), the black and gold Kennedya (*Kennedya Nigricans*), the Crimson Verticordia (*Verticordia Grandis*), are perhaps the best known. The State's wealth in timber trees is no less great, and the following is a list of the most important species :—

The natural order Myrtaceæ naturally takes the first place with it large genus eucalyptus :

Eucalyptus	marginata	Jarrah
,,	diversicolor	Karri
,,	gomphocephala	Tuart
,,	cornuta	Yate Gum
,,	calophylla	Marri
,,	loxophleba	York Gum
,,	patens	Blackbutt
,,	redunca	Wandoo
,,	longicornis	Morrell
,,	salmonophloia	Salmon Gum
,,	salubris	Gimlet-wood

In addition to the genus eucalyptus, there are the melaleuca, of which there are a number. Santalaceæ are represented by Santalum cygnorum (sandalwood). Casuarineæ are represented by Casuarina Fraseriana (sheaoak), Casuarina decussata (bulloak), and several other species. The proteaceæ are represented by a number of banksias, of which Banksia verticillata yields a magnificent timber. In the same natural order we have Xylomelum occidentale, the native pear. To take the place of the blackwood of the Eastern States, Western Australia possesses Raspberry Jam (*Acacia acuminata*). This tree has the characteristically beautiful figure of its Eastern sister, though it does not grow to the same magnificent size.


Jarrah Forrest. Western Australia.
Govt Litho

FOREST AREA.

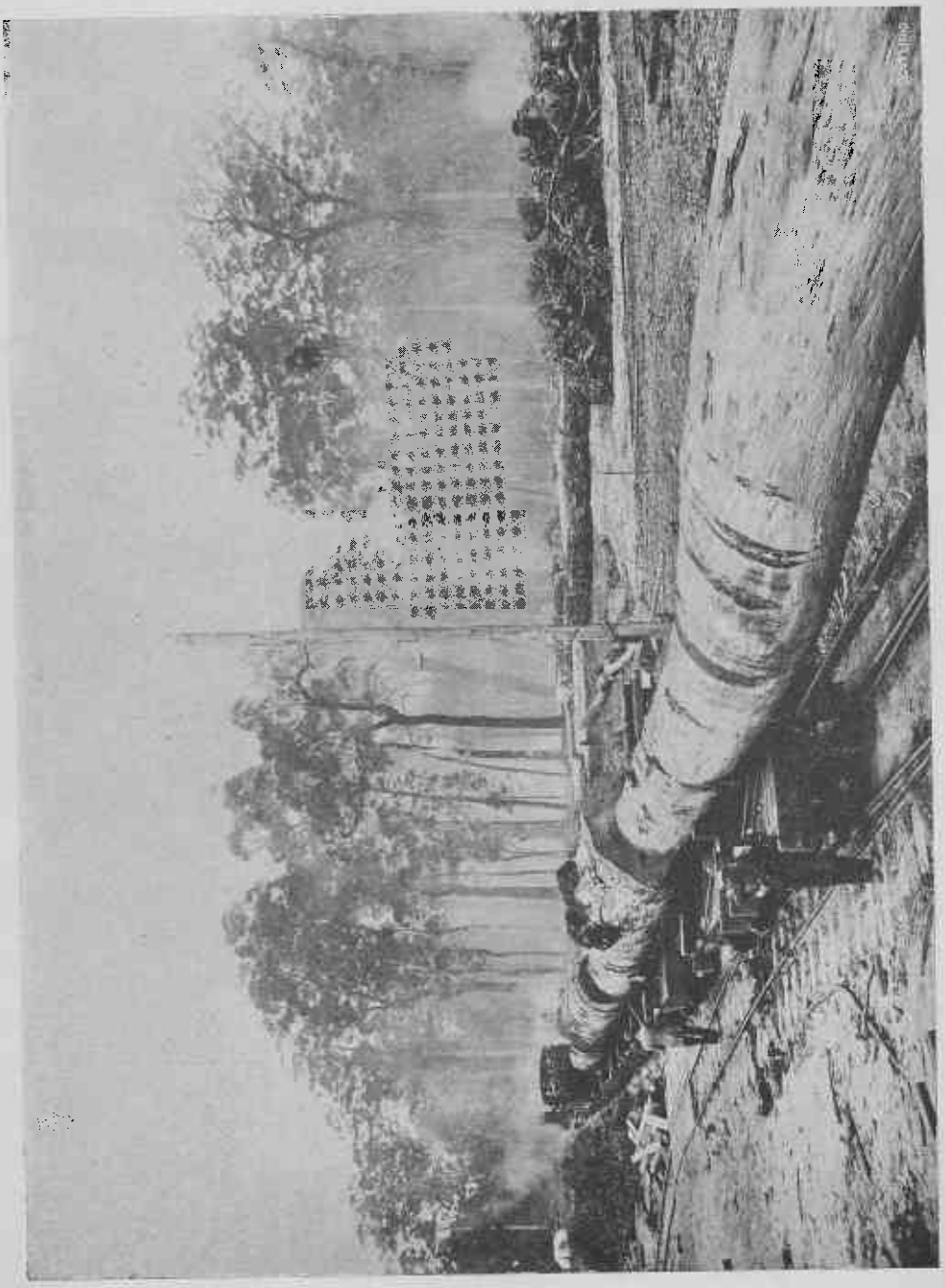
The area under prime forests in Western Australia is not yet accurately known. At the present moment the work of classification is being pushed on, and until this is completed the acreage carrying trees of commercial importance and value will not be available. Almost a generation ago a rough estimate was made by the then Forest Administration, with the following results :—

	Acres.
Jarrah, chiefly (with Blackbutt and Marri)	8,000,000
Karri	1,200,000
Tuart	200,000
Wandoo	7,000,000
York Gum, Yate, Sandalwood, and Jam ..	4,000,000
Total Area of the principal Forest surface of Western Australia	20,400,000

These figures probably are an approximation of the areas in which the timber named may be found, but they certainly do not represent the facts so far as forests of commercial timbers are concerned. Wandoo, for instance, is placed at 7,000,000 acres, but this tree is nowhere found in masses deserving to be called forests. It is scattered over immense areas as "Savannah Forest." The same may be said of the figures regarding jarrah and some of the other woods named. At the present time it may be estimated that the existing area of prime forests in Western Australia does not exceed 3,000,000 acres. But, under the conditions set up by the Forests Act, conservation on a sufficient scale will come into force, and the area of marketable timber will in due time gradually expand.

NORTH-WEST TIMBERS.

What has already been said applies only to the South-West area of the State. In the North-West there are many valuable timbers, but none of them is found existing to an extent that deserves the name of forest. Some of these woods are of commercial importance, for example coolabah and native ebony, and some of the varieties of the many mangroves of the Northern rivers hold large percentages of tannin. In the Cambridge Gulf district, Cypress Pine (*Callitris robusta*) exists in some quantity, particularly between



A Log Train.

the Gulf and the Northern Territory border. So far, little effort has been made to utilise this timber commercially. The whole of the forests of Western Australia are rich in gums, resins, and tanning agents, and these await further investigation by such skilled agencies as a Forest Products Laboratory.

PHYSICAL PROPERTIES OF WESTERN AUSTRALIAN TIMBERS.

Nowhere in the Commonwealth are stronger timbers found than in Western Australia. A glance at the following table of transverse strengths of certain Western Australian and foreign timbers brings this clearly into view. It is this exceptional strength and durability which has procured for the timbers of the State the ready acceptance accorded to them abroad.

TRANSVERSE STRENGTH OF BEAMS OF W.A. TIMBERS COMPARED WEIGHT FOR WEIGHT.

Name of Timber.	Weight in lbs. per cubic foot at 12 per cent. moisture.	Extreme fibre stress in lbs. per square inch at apparent elastic limit.	Comparison with Yate.		
			Strength.	Weight.	Strength. Weight for weight.
		W.A. TIMBERS.			
			%	%	%
Yate	71	17,000	100	100	100
Red Tingle Tingle ..	62	14,776	86.9	87.3	99.6
Karri	58	13,550	79.7	81.7	97.6
Tuart	68	15,900	93.5	95.8	97.6
Raspberry Jam ..	62	14,200	83.5	87.3	95.6
Salmon Gum	66	15,000	88.2	92.9	94.9
Red Gum	56	12,600	74.1	78.9	93.9
Sheaoak	52	11,100	65.3	73.2	89.2
Banksia	35	7,290	42.9	49.3	87
Blackbutt	54	11,000	64.7	76	85.1
Wandoo	71	13,650	80	100	80
Morrell	64	12,250	72	90.1	79.9
Jarrah	55	10,300	60.6	77.4	78.3
Coolabah (*a*)	82	14,461	85.1	115.2	73.8
York Gum	67	11,000	64.7	94.3	68.6
Native Pear	46	6,500	38.2	64.8	58.9
Karri-Sheaoak * (*Casuarina decussata*)	44	5,000	29.6	62	47.7
		FOREIGN TIMBERS.			
Padouk (*c*)	50	11,539	67.9	70.4	96.4
Teak (*b*)	49	10,583	62	69.6	89.2
Oregon, select ..	34.4	4,690	27.6	48.4	57
Oregon, merchantable	32.4	4,625	27.2	45.6	59.6
Oregon, 2nd quality..	33.9	3,740	22	47.7	46.1

* The corky-barked Casuarina from the Karri country. (*a*) At 16 per cent. of moisture. (*b*) At 21 per cent. of moisture. (*c*) At 17 per cent. of moisture.

ADMINISTRATION.

For 90 years, that is from the foundation of this Colony in 1829 until 1918, the vast forest wealth of Western Australia was to all intents and purposes at the disposal of all and any who cared to avail themselves of it. The restrictions on cutting were few and ineffective, with the result that there was much wanton and reckless exploitation. Until the year last named the forests were administered under certain clauses attached to the Land Act, but in January, 1919, Parliament, recognising what the great forest resources meant in the national economics of the State, passed an Act "to provide for the better management and protection of Forests." With the passing of this Act, a new era is opened in the history of Western Australian forests, as, under it, the Executive will be able to take measures of conservation and regeneration which in due time will bear beneficent fruits. Under the new Act a Forests Department is created, which will have the exclusive control and management of all matters of forests policy, all State forests and timber reserves, and the forest products of other Crown lands.

The Act provides for the planting or thinning of forests and the making of plantations and nurseries, and the distribution of trees therefrom; also the granting of permits, licences and leases, and for the enforcement of the conditions of timber concessions, leases, permits, licences and other forms of conversion granted under the Act or any former Act. The Head of the Executive is the Conservator of Forests, who, under the Act, is declared to be a corporate body with all powers thereto attaching. Power is given to the Governor to dedicate Crown lands as State forests and to create timber reserves and State forests, and power is also given to the Executive to make such regulations as shall in its opinion be necessary for the protection of the State timber areas and for the good government of the resources placed under its care.

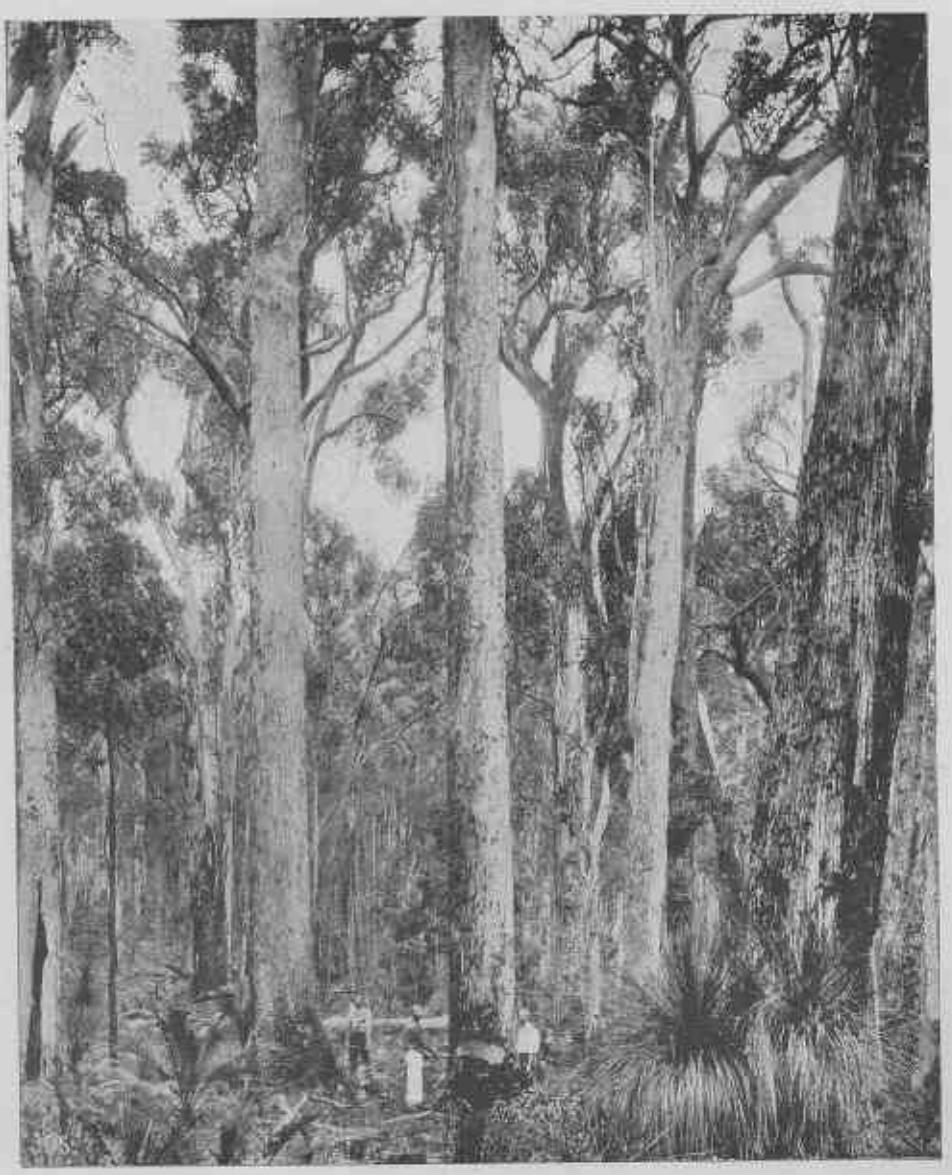
The forest "Working Plans," on which the continuity of forest policy, and incidentally the whole future of the forests, depends, are laid down by the Conservator, and having been approved cannot be altered except on the recommendation of the Conservator.

PRIVATE PLANTING OF TREES.

In America and Canada, where the importance of State forests is keenly appreciated, what is known as the farmer's "wood lot" receives every attention. Farmers are encouraged to plant suitable trees on a portion of their holdings, and the various Forest Departments assist farmers in this direction in every way possible.

The Parliament of Western Australia has wisely introduced in the Forests Act clauses designed at once to assist the farmer, and by so doing to extend the State's production of timber on alienated land. It is provided that—"On the disposal of land under the conditional purchase provisions of 'The Land Act, 1898,' it shall be a condition that the purchaser shall use an area of not less than two per centum of the acreage of the holding acquired by him for the growth of timber or other forest produce," and in a subsequent sub-section it is declared that "the planting of trees on not less than five acres of any such land shall be deemed an improvement within the meaning of the Act."

In order that the financial question shall not embarrass the operations of the Department, the Act states that "three-fifths of the net revenue shall be placed to the credit of a special account, and shall form a fund for the improvement and reforestation of State forests and the development of forestry."



JARRAH FOREST.

JARRAH

(Eucalyptus marginata).

THE forests of Western Australia hold many trees of prime commercial value, but undoubtedly the one which has been the principal factor in securing the State's high reputation as a timber producer is Jarrah. Jarrah and Western Australia are inseparably connected in the minds of all residents outside the State. It was the knowledge that Jarrah existed in immense forest areas in the South-West part of New Holland that influenced to a large extent the British authorities in founding the Swan River Settlement. It was Jarrah that formed the universal building material of the early settlers, and exports of the timber brought in the necessary cash to tide the young Colony over many a trying and anxious period. These hardy pioneers of the early thirties were so impressed by the quality and beauty of Jarrah timber that they gave it the name of " mahogany," and at one time an optimistic little band of settlers sent a parcel home to certain London piano manufacturers, with the hope that they might use it for piano cases. If the London piano makers did not immediately adopt Western Australian " mahogany," it was not because they were dissatisfied with the wood—indeed they admitted its high qualifications for the purpose indicated—but was due to the fact that the product of Honduras and Guatemala could be had in London at a cheaper rate than the Western Australian article. The term " Jarrah," which is the native name for the tree, came into use in the fifties, although even to-day the word " mahogany " is still in use by the older settlers.

There was something prophetic in the effort of the pioneers to place Jarrah on the London market, as a decorative wood, for at the present time it is largely used for this purpose. Beautiful furniture and cabinet work of every description

are manufactured from it. Jarrah in building finds opportunities for usefulness in roofs and flooring beams and other purposes where the timber is hidden from the eye, and its other qualities are recognised in its frequent use for material decoration in panelling and the like. Some of the biggest blocks in Perth exhibit Jarrah in every possible position in which wood can be used, doors, architraves, window frames, dadoes, panelling, stair railings, and so on. Its beauty of texture and the high polish which it takes make it admirably adapted for all these purposes. It matters not whether it be the settler's rough house or the city mansion, Jarrah finds its place for numberless purposes.

But building construction by no means sets a limit to the range of usefulness of this fine Australian wood. In railway rolling stock work it is extensively used throughout the State, and for similar purposes it has been adopted by several of the great English railway companies. Its durability in the ground is so remarkable that in South Africa, into which it is largely imported, it is commonly known as "everlasting wood." It is no abuse of language to say that there is not a bridge or pier or wharf or jetty in Western Australia into whose construction Jarrah does not extensively enter, either in the form of piles or stringers or decking. Piles being over 50 years in position and show very little signs of decay. Posts that have been driven into the ground as part of early buildings have been taken out after being 70 years in position, and their state of preservation is remarkable. In 1918 a building was demolished in Perth which had been erected in 1833, 85 years ago. The roof, wall plates, and joisting were as good as the day they were put in position. The hardness and durability of the timber were amongst the happiest incidents in the lot of the first settlers.

Communication with what are now the Eastern States was in the thirties very irregular, and the colonists had no capital wherewith to import such machinery as was at that time used in flour mills, but the grinding of the wheat that was raised was a matter of urgent necessity, and Jarrah met the difficulty. The early flour mills around Perth were constructed of Jarrah and the machinery and shafting inside them, including the cogwheel, were also of that timber, as was the huge wind-wheel which propelled the whole.

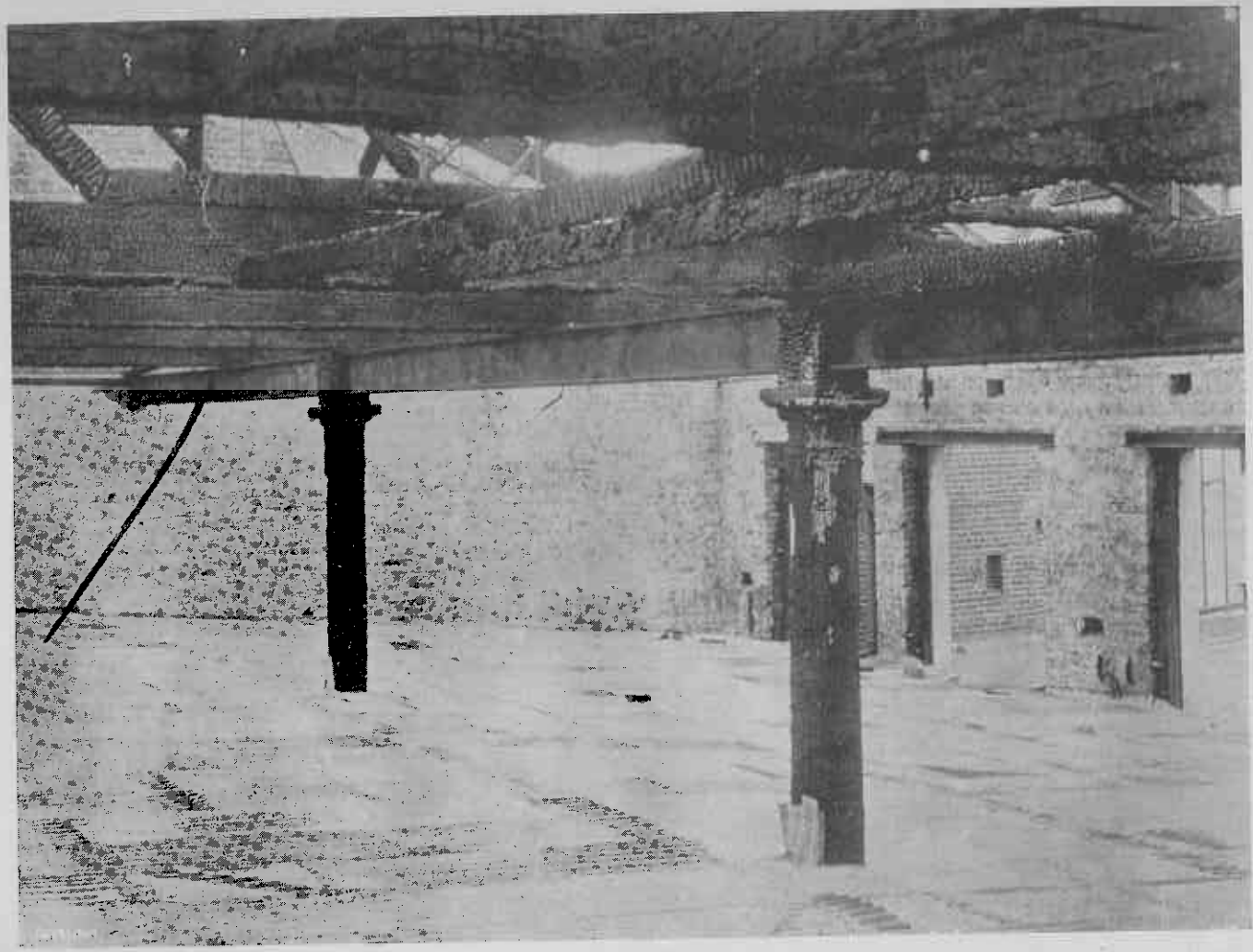
Jarrah is the most plentiful timber in the Western Australian forests. It extends from the Moore River, about 31° S. southerly to within a few miles of the Southern Ocean.

The main forests are confined to between 116° and 117° E. long. and detached patches may be found a good deal further to the eastward. The tree attains a height of from 90 to 120 feet, with a bole of 50 to 60 feet and a diameter of 72 inches and sometimes more. The colour is reddish brown when freshly cut, but darkens with age to a deep, rich mahogany colour. It weighs 68 lb. per cubic foot when green, and when dried to 12 per cent. moisture the weight is about 55 lb. The wood is hard, but easily worked. Its qualities of density and comparative ease of working brought it under the notice of the British Admiralty, who, over half a century ago, adopted it as a timber that might be used in the Royal dockyards in shipbuilding and for other purposes. Lloyd's Committee about the same time recognised its value, and it is upon their list as a timber suitable for building ships. Jarrah was used very largely for shipbuilding in the first half-century of the Colony's existence. During that period every boat that plied on the rivers was of Jarrah, while vessels were built in Fremantle and Bunbury and other places of sufficient size to be engaged in trading operations between the Colony, India and the East, the Cape of Good Hope and Great Britain. At the present moment nearly all the hundreds of luggers engaged in the pearling industry on the Nor'-West coast of the State are built of Jarrah.

To meet the demand for the timber there are many saw-milling plants in the Jarrah areas, some of them belonging to the State and others to private corporations and firms. Some of these plants are the largest in the Commonwealth, having a daily capacity of 120 loads, or 72,000 super. feet. In addition to these milling plants, a good deal of cutting is done by hand and takes the form of piles, poles, very large beams, and sleepers. Almost from the inception of the Colony, the export of timber has been one of Western Australia's chief primary industries.

Among the numberless purposes for which Jarrah is eminently suited may be mentioned the following :—

Furniture and cabinet work.
Carved goods.
Bodies of vehicles.
Wagon scantling.
Wagon under-carriages.
Building construction of all kinds.
Bridge and wharf timbers.
Piles.
Poles.
Railway sleepers.
Packing cases.
Fruit cases.
Picture frames.
Coopers' work, vats, etc.
Veneers.



JARRAH PILLARS ONLY CHARRED AFTER A DESTRUCTIVE FIRE.

The Fire-Resisting Qualities of Jarrah.

IN considering the merits of any timber for constructional purposes the degree to which it resists fire is a matter of the first importance. In point of non-inflammability the whole eucalypt family holds a deservedly high place. Fires which would consume pine and other softwoods, and which would damage beyond repair such timbers as beech, elm, and oak, would do comparatively little harm to jarrah. Its fire resistance quality has led to the utilisation of jarrah for beams and pillars, in place of steel, in large constructions such as warehouses and factories. In the city of Perth and in Fremantle some of the largest warehouses have floors of jarrah carried on beams of jarrah, and supported by jarrah pillars. The space occupied by such beams and pillars is no greater than that required for steel. In the tension of a great fire steel bends and buckles, leading to the collapse of the whole structure, whereas jarrah chars only to a limited depth, and, by remaining in position, minimises the loss. The illustration on the opposite page shows portion of a warehouse in Perth which suffered severely from a fire. It will be observed that the jarrah pillars are charred only, and are still efficiently doing their duty of supporting the great steel beam over them. The intensity of this fire was such that steel pillars would have bent and failed at the critical moment; and what, owing to the use of jarrah, was only a moderately destructive visitation would, if steel pillars had been employed, have become a conflagration involving the whole of the extensive premises. Wharves, quays, jetties, and bridges in Western Australia are constructed almost exclusively of native timbers, but no instance of a destructive fire on any of them is on record.

In the reconstruction of the damaged premises, part of which is shown in the illustration, it has been decided to use jarrah and karri throughout, and the beams, pillars, and principals will be of those timbers.

KARRI FOREST.

KARRI

(Eucalyptus diversicolor).

KARRI is far and away the largest tree in the Western Australian forests, and stands in the matter of bulk on the same platform as the very largest trees in each of the States. A height of 200 feet, with a length of bole of 120 feet to the first limb, is common. There are many to be found of greater height; only recently one was measured which has attained the extraordinary height of 278 feet. One of the finest specimens of the species growing at Karridale was destroyed some time ago. Its dimensions were—

34 feet in circumference at three feet from the ground.
160 feet to the first branch.
14 feet in circumference at the first limb.
Over 200 feet in extreme height.

From these figures it is not difficult to calculate that the bole of this tree from the bottom to the first limb contained nearly 6,000 cubic feet of timber.

Another tree, measured recently, was found to be 42 feet in circumference at three feet from the ground. This tree, however, has, at some time in the past, been damaged by fire, and when it is felled it will have to be cut above the damaged portion. The magnificent proportions of Karri render forests of it singularly impressive.

Unfortunately, the habitat of Karri is somewhat circumscribed, and it is not to be found anywhere outside of certain specified areas. Jarrah occurs in great forests in the South-West of the State, but single specimens of it and patches are to be found over a much wider region than that of the forests. Karri, on the other hand, is never found outside the districts known as the Karri regions. Karri is confined to the Western portions of the South-West of the State, not very far from the Southern Ocean, and its Northern limit is Nannup and the upper waters of the Donnelly, whence it spreads South-Eastwards to Denmark. There is then a gap in the belt, and it is to be met with once near the Porongorup Range. Another isolated patch occurs on the extreme South-West, near Cape Leeuwin. At this spot a generation or more ago was a settlement known as Karridale, and from a harbour on the West

coast the timber was exported. It is estimated that about 500,000 acres of prime Karri forest are still in existence, but regrowth is rapidly coming forward at places which have been milled over during the last 50 years or so.

It is an extraordinarily hard wood, reddish brown in colour when freshly cut, becoming darker with age. Jarrah and Karri timbers are so similar in outward appearance that the inexpert sometimes has difficulty in distinguishing between them.

For every above-ground purpose that Jarrah can fulfil Karri is equally, or more, suitable. It has all the constructional qualities inherent in Jarrah, and to these it adds that of greater strength, but the chief advantage and feature of Karri for constructional work lies in the facility with which beams of extraordinary length may be obtained of it. Beams for super-structural purposes up to 100 feet may be had, and at one large milling plant in the Karri forests the roof of the mill is carried upon cross beams 12 inches square and 80 feet long. Wherever large sections and lengths of wood are required in such construction as warehouses and factories, Karri meets all the requirements, not only as cross beams, but as supporting pillars. There are several large milling plants operating in the Karri forests, some of these belonging to the State. At Manjimup, for instance, there is No. 1 State Sawmill, and at Pemberton (Big Brook), in the heart of the Karri country, are State Mills Nos. 2 and 3 working in conjunction. These latter mills have a capacity of 100 loads, or 60,000 super feet per day. At Pemberton also the State has erected extensive powellising works, at which Karri is treated. The timber to be treated is piled on trucks, which are run bodily into the vats. These vats are then sealed, and the liquor pumped in. The boiling process continues from five to eight hours, according to the sections of the timber under treatment. Owing to the density of the liquor, the boiling point is some degrees above 212°. The timber is allowed to remain in the vats until the temperature of the solution is 100°, or perhaps a little more, according to circumstances. Then the solution is drawn off, and the trucks are withdrawn from the vats. The effect of this treatment is that the timber is impregnated with the solution. Sleepers of powellised Karri were largely used on the Great Western Railway.

At Pemberton also, adjoining the sawmill is a planing mill from which dressed timber is despatched, and there is also a case mill turning out pieces for fruit cases. Imported timber is no longer used in Western Australia for fruit cases, and Karri is a most efficient substitute.

The prime physical properties of Karri are as follows :—

Weight per cubic foot (green) ..	72 lbs.	
At 12 per cent. moisture ..	58 lbs.	
Transverse strength	17,300 lbs.	per sq. inch.
Tensile strength	18,750 lbs.	per sq. inch.

Above ground Karri is as durable as Jarrah, but in the ground it does not possess the resistant qualities of its sister wood. The uses of Karri are numerous. It is on Lloyd's list of shipbuilding timbers, and for the manufacture of wooden pipes it has been found eminently satisfactory. It makes good wagon spokes, but its main use, up to now, has been for railway wagon scantling and telegraph pole arms. Several of the English railway companies use it in the construction of rolling stock, and the London Post Office authorities are strong in their praise of the timber for pole arms. Its deservedly high reputation has suffered to some extent owing to its similarity to Jarrah. It is well adapted for all kinds of furniture and cabinet work, and for interior decorations of every kind. It cuts into excellent veneer. In shipbuilding it is now used principally for keelsons, for which very long lengths can be obtained, and is, therefore, appreciated by shipbuilders. Before the days of steamships, vessels built wholly of Karri were constructed in Western Australia ; and at Hamelin Harbour, from which the product of early Karridale was exported, there was kept quite a fleet of large lighters, built entirely of Karri.

TUART.

TUART

(Eucalyptus gomphocephala).

TUART is in some respects unique. It is one of the toughest and densest timbers in the world, and for that reason has found acceptance wherever these qualities are prime essentials. The technical designation (*gomphocephala*) has reference to the markedly peculiar swelling or hanging-over appearance of the lid of the calyx tube. This is a very marked feature of the species. It is a handsome eucalypt, and has a wonderfully bright and cheerful appearance in the forest. In its younger stages the species is very beautiful, and on this account it has been utilised for ornamental purposes in places in the Eastern States. It is straight and well-clothed, and it has an attractive bright green leaf, and in this respect is not unlike the Karri. When it has developed out of the seedling and sapling stages, the leaves get narrower and more elongated than formerly. It is confined in its natural habitat to the limestone belt lying along the coast between Lake Pinjar, on the North, and the Sabina River, on the South, some 12 miles North of Busselton. Curiously enough, it is not to be found anywhere else in the State, although limestone occurs all round the coast line. The best Tuart is to be found between the Sabina River and the Capel. It attains a height up to 100 feet, with a bole 35 to 45 feet, and a diameter 7 to 8 feet. Its prime physical properties are :—

Weight per cubic foot (green) . .	78 lbs.
At 12 per cent. moisture . .	68 lbs.
Transverse strength	17,900 lbs. per sq. inch.
Tensile strength	16,500 lbs. per sq. inch.

The timber is very hard and dense, with an interlocked grain, and its colour is yellow. In the early days of the Colony's history its remarkable toughness was quickly noted, and in the Pioneer Flour Mills, where all the machinery was made of local timber, the cogs in the wheels were invariably of Tuart. At the present time the timber is extensively used locally for wheelwright work, especially the large naves required for the 9ft. and 10ft. wheels of the timber whims which

operate in the Jarrah and Karri forests. Its main use, along with Wandoo, is for railway wagons and truck construction. On the Western Australian Government Railways the cost of maintenance on trucks has been reduced from £3 7s. 6d. to 10s. per annum per truck by substituting for steel Tuart and Wandoo in the under-carriages. Like Wandoo, the cutting of Tuart, except for departmental purposes, is forbidden on Crown lands.

WANDOO

(Eucalyptus redunca, var. elata.).

WANDOO does not grow in close forests, but in open savannah form, and it is found scattered in patches over nearly the whole of the South-West, either by itself or more frequently mixed with Jarrah and Marri. It prefers a clayey soil, although occasionally it is met with on the sand-plains. It was at one time known as the "White Gum," but in order to differentiate it from trees appearing under the same vernacular name in some of the Eastern States, the native aboriginal term of "Wandoo" has been adopted for the Western Australian variety. Its prime physical properties are—

Weight per cubic foot (green) . .	79 lbs.
At 12 per cent. moisture . .	71 lbs.
Transverse strength	16,100 lbs. per sq. inch.
Tensile strength	16,100 lbs. per sq. inch.

The colour is light brown, although trees with a yellowish tint are not uncommon. Its durability is remarkable, as the following instances will show :—

1. A pile from the old Serpentine bridge on the Bunbury Road, driven in 1854, when drawn in 1899, 45 years after driving, was in a remarkable state of preservation.

2. Cogs of this timber were in use at Ellen's Brook Flour Mill since 1837, and in 1899 showed very little wear, and were in a thorough state of seasoning and preservation.

It is used for all the purposes to which Tuart is applied, as mentioned above. In under-carriages of trucks it has a life of 25 years. The top planks ot the trucks on the Western Australian Government Railways are always made of Wandoo, which stands the wear of loading and unloading better than steel. The stanchions also of such trucks are of Wandoo. A remarkable quality which this timber possesses is that, when used in conjunction with steel, there is no chemical action set up between the wood and the metal. Bolts have been taken from under-frames of trucks after 20 years' use and have been found to be quite as clean as when put there, while the auger marks were still visible in the holes.

KINGIA GRASS TREE.

GRASS TREE FIBRE

(Kingia Australis).

THE Kingia, which takes its name from one of the State's pioneer explorers, and botanically belongs to the lily family, is peculiar to Western Australia. In appearance it has a close resemblance to "Blackboy," but the properties of the two trees and their commercial possibilities differ widely. The Kingia does not grow in close forests, and it is found scattered over a considerable portion of the South-West, more particularly between the Darling Ranges and the sea and through the Karri country to Albany. It is to be met with in abundance on the poorer classes of soil, and it may be said that the leaner the quality of the ground, the better does the Grass Tree seem to flourish. It attains a height of from six to 25 feet, and the bole has an average diameter of from nine to 10 inches. The outer portion of the trunk is made up of layers of hardened masses of leaf processes. This part of the trunk is particularly rich in cellulose, and the future commercial usefulness of this portion of the tree will probably depend largely upon the utilisation of this cellulose. The trunk, it may be remarked, is almost always a black colour, like that of the "Blackboy," caused through the scorching of the outer layer of pressed leaves by bush fires. The core of the tree, which is hard and brittle, is also rich in cellulose, and is surrounded by a hard, matted covering of fibrous material from an inch to three inches in thickness, according to the size of the tree. At the present time the main commercial value of the tree lies almost wholly in this fibrous ring round the core. It is already the basis of a considerable industry in Western Australia in the manufacture of brooms and brushes. Under treatment there can be made from the fibre the coarse and heavy brooms used for street scavenging and similar purposes, as well as the finer material suitable for higher grade brushes. In the matter of street cleaning, brooms of Kingia fibre have been used in Perth and Melbourne, and in both cities it has been recognised that the life of such brooms is longer than that of a broom fitted with any other fibre. The strength, toughness, and pliability of Kingia

fibre, after proper treatment, are remarkable, and its qualities only require to be more widely known to ensure for it a large demand. The process of separating the fibre from the rest of the trunk is a simple one. The heart or core of the Kingia has also commercial possibilities. It contains sugar, but not to an extent which would make the extraction a commercial proposition worthy of consideration, and under distillation an alcohol has been obtained. It also presents possibilities in the direction of insulate for freezing works. The outer sheathing of the tree as well as the core being rich in cellulose, are adapted for the making of paper pulp, more particularly for the coarser kinds of paper. In freezing works, cooling chambers and ice safes, the outer sheath of the Kingia acts as an insulator of the first order, and little preparation is necessary to fit it for that purpose. The Kingia, unlike the " Blackboy," is non-resinous. The attention of the manufacturers of brooms and brushes might well be given to the Kingia Grass Tree of Western Australia. It ought to replace much of the imported fibre, and the extent to which it is found in Western Australia is a guarantee that large and regular supplies may be had.

BLACKBOY.

BLACKBOY (Xanthorrhoea Preissii) AND ITS USES.

THE Western Australian "Blackboy" belongs to the same species as the "grass-tree" of the Eastern portions of Australia. It is a familiar feature in the forest areas of Western Australia, and it is to be found in more or less abundance throughout the agricultural areas. The stems of the common Western Australian species are ordinarily from seven to eight feet high, but often run up to 15 feet in height, and are usually branched. It may interest many to know that the "Blackboy" belongs to the lily family, a botanical paradox more readily appreciated by the scientist than by the layman. It is constructed of a centre core and a very fibrous, somewhat spongy material sometimes hard enough to be termed wood, which contains a large amount of easily fermentable, sugary substance, surrounded by a thick coating of "husk" formed of the persistent bases of the old leaves lying very closely packed together, and more or less cemented by resin into a hard, coherent mass. When fire spreads through an area in which "Blackboy" is found, it readily attacks this hard outside layer, burning and scorching it, and this accounts for the fact that the barrel of the tree is always black, with all the appearance of having suffered from recent fire. When the "husk" is broken up and beaten the brittle resin is easily reduced to a fine powder, which may be with little difficulty separated from the fibrous skeleton on which it is built up. When heated this powder forms into lumps and becomes a substance known as "Blackboy gum." In areas covered by "Blackboy" this gum is found in lumps in the ground, the gum having probably been separated from the tree by fire and coagulated where it reached the surface of the ground. As the "Blackboy" covers very large tracts in Western Australia, its trunks can be obtained in enormous quantities, and the gum or resin might well form the basis of a large industry. From experiments made by competent analysts, something of the potentialities contained in "Blackboy" have been ascertained. Among the products obtained have been glucose, treacle, scents, alcohol, and certain tar products, and from these latter

again two dyes have been obtained. Picric acid, so much used in explosives, is also yielded by the tree, the gum, on treatment, giving up to 50 per cent. of its weight in the form of picric acid. The Munitions Department in England during the war made experiments with "Blackboy" gum as a producer of picric acid and was highly satisfied with the result. There would seem to be a great future for "Blackboy" by-products. The subject, although well investigated by competent authorities, has not yet been exhausted. In the early days of Western Australia the settlers obtained a form of alcohol from "Blackboy," which they used as a stimulant. This aspect of the question has been further treated by Mr. E. A. Mann, Analyst to the Government of Western Australia. The following table gives the results obtained by Mr. Mann :—

Month.	Weight of sliced core.	Proof gallons spirit per bushel (60 lbs.).	Equivalent sugar per 100 core.	Per cent. sugar by analysis.
September	330 grms.	1.24	20.6	26.1
February	6 lbs.	0.8	13.2	not determined
June	2½ cwt.	0.5	10.0	10.5

Western Australia is in a position to supply annually thousands of tons of clean "Blackboy" gum at a price which should meet the views of manufacturing chemists whose business includes the many valuable distillates that can be obtained from the gum. Particularly in the matter of dye stuffs the capabilities of the resin should form the subject of a thorough investigation.

PAPER-MAKING MATERIALS.

THE shortage and high price of paper during the war period and the knowledge that the world's supply of those materials that for a generation or more have been the basis of the world's paper output is in danger of being exhausted has everywhere drawn attention to the necessity for finding additional fibrous matter for the purpose. Western Australia, like the Eastern States, possesses many fibres from which paper can be made, but long and patient investigation is necessary before is can be determined from what materials it is possible to manufacture suitable papers at a cost which would justify their employment. It would seem that all the Australian States suffer alike in this matter. Each possesses many materials from which paper may be made, but there are inherent difficulties in most cases in transforming laboratory experiments into commercial practice. Sometimes the material is in short supply and difficult of cultivation; at other times the supply would seem to be abundant, but considerations of labour and transport render their utilisation impossible from a financial point of view. In Western Australia spinifex has been experimented with, and has been found to make a suitable paper for many purposes, newspaper, for instance, and, although there are many millions of tons of the material scattered over the Northern and Eastern sections of the State, the difficulties connected with collecting the same and getting it to a port of shipment are such as to make it unprofitable as against imported materials of equal, or perhaps, better quality. Many grasses have also come under observation, and samples of one of those from the Northampton district, known as *Ecdeiocolea monostachya*, were submitted to the Imperial Institute, London, which reported that the yield of pulp from the material when air dried was 44 per cent. as against that of 52 per cent. for the commercial esparto grass. The samples of paper made from this were equal to many papers now in use, but the supply of the plant itself is so limited that as a commercial proposition it is negligible. Investigations are now being conducted into the question of paper-making materials by the Advisory Council of Science and Industry in Melbourne. In Western Australia independent investigations have also been undertaken with some local Eucalypts. The most promising of these is Karri.

From laboratory experiments with young Karri very satisfactory newsprint has been made, and it cannot be doubted that similar pulp treated with proper machinery for preparing and calendaring will produce results in paper of the class used in books and magazines. A large parcel of young Karri will probably be sent to a pulping establishment in Canada for a report. If that report be satisfactory, and it is proved that paper on a commercial basis can be produced from Karri, a great step will have been taken in the matter of producing good paper in Australia. Karri is probably the quickest grower amongst the Eucalypts, and, strangely enough, its most rapid period of growth is during the first 20 or 25 years (as much as 500 cubic feet per acre per year being observed), and it has been found that young Karri is a very much better material for pulping than the wood when of more mature years. There is abundant Karri forest and land in suitable districts in Western Australia for the cultivation of young Karri on a 10 or 15 years' rotation, so that if this material turns out satisfactorily there need be no doubt as to the supply of Karri for future paper-making operations. Experiments have also been conducted with a mixture of Karri and certain fibrous grasses and sedges found in abundance in the regions in which Karri is found. The result has been eminently satisfactory, and a good quality of paper has been produced in the laboratory. It was also ascertained that the reddish brown colour natural to Karri wood is eliminated at a comparatively low expenditure of bleach, and a perfectly white paper is the result. Until a Forests Products Laboratory undertakes the work, the extent and variety of materials suitable for paper-making in the Western Australian forests will not be known, but so far experiments into the matter are all of a promising nature. The investigations have been in the hands of Mr. I. H. Boas, chemist of the Technical School, and here are the results as furnished by him :—

> "Of the two outstanding processes whereby wood is converted into cellulose pulp for paper-making and the like, the Sulphite Process is practically exclusively used for the pulping of resinous woods, whilst the Soda Process is used on the grasses and non-resinous material.
>
> "In the experiments carried out on local materials under my direction, the unsuitability of the Sulphite Process to these raw materials has been borne in mind and the Soda Process has been exclusively used.
>
> "Briefly, the production of pulp by the latter method may be described as follows :—The wood in the form of crushed chips is fed into digesters with the requisite amount of alkali—caustic soda—solution and boiled under steam pressure for a period depending on the nature and condition of the raw material, generally

four hours and upwards. Spent liquor is then run off and the material thoroughly washed to remove the soluble products of decomposition. Thence it is transferred to machines which tease the particles or fibres out from the bundles in which they are still aggregated. Bleaching of the grayish to brownish pulp is then carried out by means of solutions of chloride of lime (Bleaching Powder), and when this has gone sufficiently far and the desired degree of whiteness attained, the pulp is again washed and, after the very important beating stage which follows, is ready for the ' machine ' to convert it into ' sheet,' etc.

KARRI SUCKERS.

8-year growth.

" The ' cut ' per acre of this material is estimated at about 133.5 tons, a cord weighing (green) 6,670 lb. From laboratory results it has been calculated that one acre of this growth should yield approximately 38.5 tons of unbleached pulp, or 36.5 tons bleached material.

" The table attached will indicate clearly the gradual decrease in pulp yield as the tree matures and also the increased consumption of ' bleach ' following the same course. Alkali consumption appears to reach a maximum at a definite age, remaining constant afterwards for green timber. It will be noted that the mature timber (' Mill Waste ') shows a slightly lower consumption of soda, possibly due to bleaching during seasoning in the open."

Raw Material.	Pulp. % Unbleached.	Yield. % Bleached.	Loss of Weight on Bleaching %.	Bleach Consumed % 3rd B.P.	Soda Consumed % Caustic Soda.	Fibre dimensions. Length L	Diameter D	Ratio $\frac{D}{L}$	Pressure lbs. sq. inch.	Soda strength (concentration) at start.	Time, hours.
8-year "suckers"	48	45.5	5.2	4.0	19.5	1.0	.016	.016	80	4.4	6
15-year saplings	44	41.4	5.6	4.8	22.8	1.0	.015	.015	82	4.72	6
20-year saplings	38.8	37.2	4.1	6.5	22.8	1.02	.016	.015	100	5.2	6.5
Mature trees "Mill Waste" ..	40.7	38.0	6.7	7.4	20.4	1.0	.014	.014	80	4.8	6
Gahnia Decomposita	31.9	28.7	10.0	9.8	26.4	1.25	.008	.0066	90	4.76	6
Cladium Preisii	25.7	23.0	15.0	35.0	19.0	2.5	.015	.006	100	7.5	6.5

Note the effect of stronger solution and higher pressure on the yield in the case of the "20-year" material.

SANDALWOOD

(Santalum cygnorum).

THIS tree played an important part in the development of the Colony of Western Australia in its earlier decades. In pioneer times the tree was found in the vicinity of Perth, extending over the Darling Ranges into and beyond the farming areas. When markets for agricultural farming produce were, owing to the want of regular communication by ships, few and far between, and ready money in consequence was scarce, the Sandalwood was of the greatest assistance to farmers in tiding them over difficulties. There was always a ready market for it in the East, and shipments from Fremantle were made with fair regularity in the first half century of the Colony's existence. At present the tree has ceased to exist on the Wheat Belt, and much of the supplies that still leave the State is drawn from the Eastern Goldfields. Sandalwood is found interspersed throughout the Mulga belts from which the firewood supplies of the gold mines on the Eastern Goldfields are drawn. In those portions of the Gascoyne, of which Carnarvon is the port, Sandalwood is fairly plentiful, and a considerable quantity is annually sent away. It is reported also to extend along the route of the Great Western Railway, but no reliable information as to the quantity or its position is yet available. Up to the end of 1918 312,362 tons of Sandalwood, valued at £2,709,963, had been exported from Western Australia. It is a small tree, attaining a height of from 12 feet to 16 feet, with a diameter of from six inches to eight inches. The wood is a light yellow, and is aromatic. Very little of the wood is used within Western Australia for cabinet or decorative purposes. The bulk of that exported to the East is used for religious and ceremonial purposes, and for the manufacture of glove, jewel, and such-like boxes, although it is believed that a fair proportion of it is subjected to destructive distillation.

The wood yields the well-known Sandalwood Oil of commerce, and a factory distilling the oil product is in operation in Western Australia. The Western Australian oil product

has a sesquiterpene constituent which is absent from the oil distilled from Indian Sandalwood, but this constituent can now be eliminated. It differs from the Indian oil, having a positive refraction. It is extensively used in medical practice in Australia, and has given every satisfaction. When conditions become normal again it is probable that there will be a considerable extension of the Sandalwood Oil industry in Western Australia.

TAN BARKS.

THE forests of Western Australia are rich in timbers, leaves, and barks containing more or less tannin, the active principle in all tanning agents. Every member of the Eucalypt family holds a certain percentage of tannin, but in very few is the percentage so great that the material can be used directly for tanning purposes. In some of them the proportion is sufficiently high to justify the making of extracts from the bark, wood or leaves. In others, such a proceeding would not under present conditions be a commercial success. With the exception of Mallet Bark, which is dealt with later, the percentage of tannin derived from Western Australian Eucalypts is, as a rule, under twenty. Certain of the Mangroves in the Northern rivers show a higher percentage, but so far the barks of these mangroves have only been used locally for tanning purposes. Sufficient is known, however, to justify the statement that the forests of Western Australia hold a wealth of tanning materials, and that only investigations such as lie within the province of a Forests Products Laboratory are needed to determine the actual value of all of them and the best means of exploitation for commercial purposes. The following list gives the result of analyses for tannin of the barks of certain Western Australian trees, made from time to time by the Government Analyst and others :

Local Name.	Tannin Content. Per cent.
Marri (Redgum) " kino "	68
Blue Leaf Mallet Bark	47
Silver Mallet Bark	45
Brown Mallet Bark	41
Swamp Mallet Bark	36
Round Leaf Moort Bark	33
Gimlet-wood Bark	26
Spotted Gum Bark	24
Blackbutt Bark	19
Moort or Territt	16
Black Mangrove Bark	46
Red Mangrove Bark	44

Black and golden wattle of the Eastern States have been introduced only to a very limited extent in Western Australia, but steps are under consideration for a systematic cultivation, in order that their high qualities as a tanning agent may be utilised.

MARRI (REDGUM)

(Eucalyptus calophylla.)

However valuable this tree may be for its wood, it is likely in the near future that its commercial importance will depend mainly upon its kino or gum. The Marri of Western Australia is unique of its kind, so far as its kino is concerned. The gum exudes in large quantities, and often the ground under the tree is deeply stained by falling drops of kino. This kino contains a very large percentage of tannin. The objection to its use hitherto has been its red colour. Investigations are in progress with a view to the elimination of this objectionable feature. If success should attend these investigations, the kino of the Marri of Western Australia will become one of the most valuable products of the State's forests. The tannin material is collected by scraping the trunk of the tree, and so removing the kino and kino-impregnated loose bark. The operation does not damage the tree and may be repeated at intervals of a few years. Experiments are being carried out with a view to improving the yield by tapping the liquid gum in the same way as resin is tapped from the pines. These experiments have so far proved failures. Bark which has been saturated by the kino yields, of course, a correspondingly high percentage of tannin. It is this perennial yield of gum without destroying the tree that promises in the future, when means have been found of eliminating the red colour, to be the principal factor in the establishment of a steady and large industry in kino collecting. With the exception of certain fruits yielding tannin the collection of tan bark means, in all cases except the Marri, the death of the tree.

MALLET BARK

(Eucalyptus occidentalis, var. astringens).

MALLET bark is peculiar to Western Australia, and is one of the world's largest yielders of tannin. To this quality is due the fact that the tree has, from some quarters, entirely disappeared, while in others only seedlings and saplings are visible. Up to 1903 Mallet Bark was appreciated only in the districts where it exists, that is along the line of the Great Southern Railway, and also for some distance along the Eastern Railway. In the year mentioned the first export was made to the value of £859. Within two years the qualities of the bark had been recognised abroad, and a phenomenal demand for it set in. In 1905 the exports rose to the value of £154,087, which marks the high-water point in the industry. Since then exports have gradually fallen until in 1913 they amounted to £47,477, and in 1918, £16,886. The stringent regulations for the protection of the Mallet tree were, unfortunately, not enforced, so that large areas have been destroyed, but measures are in hand for the regeneration of the destroyed areas, and for the planting of new ones. The Germans were the largest customers for the Mallet bark, and after treating it in Germany, they sent out the result all over the world, including Australia, in the form of extracts. A German chemist reporting to a meeting of the Leather Manufacturers' Society in Berlin, after giving particulars of a series of analyses in which the average of the tanning content obtained is 43 per cent., goes on to say, "Thus it is seen that we have in Mallet bark a tanning agent which in regard to tanning property equals those hitherto known as the richest in tanning substances." This is high praise for Mallet bark, and it is unfortunate that it was left to a German to publicly express his appreciation.

WOODEN ROOFING.

THE history of roofing in Western Australia is not without interest. The first settlers at Fremantle and Perth, knowing nothing of shingles, but being well acquainted with the picturesque and efficient thatched roof so common in English country districts, looked round for a thatching material, and they discovered a very suitable article in the sedges and rushes to be found along the banks of the Swan River. The first Government House in Perth, the first Court House, and the first Church had rush roofs. Long before the first decade of the Colony's existence had passed, the settlers, through communication with New South Wales, had learned something of the art of shingling, and they found materials for its practice in abundance at their hands. In Perth and Fremantle jarrah was the material used almost invariably for the making of roof shingles. It was sometimes sawn, but more often split.

The life of a jarrah-shingled roof which receives ordinary care and attention is marvellous. There are buildings to-day in Perth covered with shingles which have been in position more than half a century. The Town Hall of Perth, a fine and characteristic specimen of early colonial architecture, is covered with a roof of sawn jarrah shingles, and is still faithfully doing its appointed work. The roof was put on in 1870. In the country districts settlers shingled their roofs with the timbers that they found in the immediate neighbourhood. The whole of the West Australian eucalypts can be used for shingling, although, it goes without saying, some are distinctly better for the purpose than others. Sheaoak is decidedly the best shingling timber of the State, and has been very extensively used. It splits well and is easily put on. With the advent of galvanised iron, shingled roofs in the town ceased to have a monopoly, and prior to the war the shingle was used to a comparatively small degree even in the country districts. But the increased price and scarcity of roofing iron again attracted attention to wood as a material for covering roofs, and the trade in shingles has experienced a considerable revival. Within the war period a good number of forms of wooden roof covering other than shingles have been put upon the market, the claims of each being duly set forth by its projector or inventor. In most of these new forms of roofing the longitudinal board is used with various ingenious devices for making the joints quite tight.

There is no valid reason why wood should not be much more largely used in building construction in Australia than it is, more particularly in the case of dwelling houses. In the United States and Canada wood in building construction is used to a very much larger extent than here, and in those States where the forest areas are large whole towns are built of wood, the buildings being designed in a manner which makes them both attractive and picturesque. In Western Australia wood as a roofing material in the larger towns is now prohibited by the local governing bodies, the reason given being the danger from fire. It seems strange that Australian civic authorities should be obsessed by a dread of fire, while similar authorities in America and Canada have no such dread. And the case is more remarkable when it is remembered that the hardwoods of Australia are much less inflammable than the softwoods of the American continent. In the country districts of Western Australia the wooden shingle, either sawn or split, has been within the last year or two used quite freely. It is cooler in summer than iron and it is warmer in winter, and the wooden covering can be put in position at something like half the cost of iron at its present price.