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WESTERN



AUSTRALIA.

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STATEMENT PREPARED

FOR THE

**BRITISH EMPIRE FORESTRY  
CONFERENCE**

LONDON, 1920,

BY

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ISSUED UNDER THE AUTHORITY OF THE MINISTER FOR FORESTS,  
**THE HON. JOHN SCADDAN, M.L.A.**

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Prime Forest Regions of Western Australia

Vegetation Map of Western Australia

Habitat of Jarrah (*Euc. marginata*)

„ Karri (*Euc. diversicolor*)

„ Sandalwood (*Santalum cygnorum*)

„ Wandoo (*Euc. redunca* var. *elata*)

„ Yate (*Euc. cornuta*)

„ Tuart (*Euc. gomphocephala*)

„ Blackbutt (*Euc. patens*)

„ Sheoak (*Casuarina Fraseriana*)

„ River Banksia (*Banksia verticillata*)

„ Salmon gum (*Euc. salmonophloia*)

„ Marri (*Euc. calophylla*)

„ Raspberry Jam (*Acacia acuminata*)

„ Native Pear (*Xylomelum occidentale*)

„ Mallet (*Euc. occidentalis*, var. *astringens*) and others

„ Red Tingle Tingle (*Euc. Jacksoni*) and Yellow Tingle Tingle (*Euc. Guilfoylei*)

„ Morrell (*Euc. longicornis*)

„ York Gum (*Euc. loxophleba*)

Geological Map of Western Australia

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## PREFATORY NOTE.

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Since this statement was printed a conference was held at Melbourne of the Premiers of all the States of Australia, at which the Commonwealth Government was also represented, and the conference decided—

- (1.) That an Australian School of Forestry be established in New South Wales, and the cost and maintenance of the school be borne by contribution from each State on a population basis, and a subsidy from the Commonwealth equal to one-sixth of the total contributions from the States.
- (2.) That an area of 24,500,000 acres be set aside as a permanent national forest for Australia.

It is happily clear from these resolutions that the leaders of the Governments of Australia recognise the urgency of the forest position, and are prepared to adopt a remedial policy on an adequate scale. The acreage of 24,500,000 referred to is based on data supplied by the forest authorities of the various States, and consists of the whole of the prime timber country of Australia. This area, when compared with the total area of the Commonwealth, 1,903,360,000 acres, works out at only one per cent. But these

figures do not convey an adequate conception of the forestry position. It must not be lost sight of that the topographical and climatic conditions of Australia are unique and, if it is recollected that only a very limited portion of the whole of the Commonwealth enjoys a sufficient regular rainfall for the growth of large timber, the area to be reserved assumes an entirely new complexion, and bears a rather more satisfactory relationship to the real resources of the country as regards land suitable for timber growing.

The establishment of one forest school for the whole of Australia for the education of higher grade officers is a guarantee that the forest services of the Commonwealth will, in the near future, be able to obtain the services of men whose training will get them to take in hand the first operations necessary to set the forest estate on such a footing as to assure a sustained yield of an adequate supply of timber for all time.

C. E. LANE-POOLE.

25th May, 1920.





## SECTION I.

### GENERAL DESCRIPTION OF THE COUNTRY FROM A Forestry Point of View.

From a forestry standpoint, Western Australia may be divided into four regions:—

1. Sclerophyllous Woodlands.
2. Savannah Woodlands.
3. Mallee or Mulga Bush.
4. Savannah.

The map in appendix, based on Diels, shows the distribution of these regions.

1. It will be seen that the sclerophyllous forests are confined entirely to the extreme South-Western portion of the State, where the main milling timber is found, and the whole of this region is within the 30in. rainfall belt. Some writers have contended that the most southerly portion of this region might well be termed rain forest, but an examination of the vegetation shows that, while the trees, mainly karri (*Euc. diversicolor*), marri (red-gum, *Euc. calophylla*), tingle-tingle (*Euc. Jacksoni*) and (*Euc. Guilfoylii*) grow in denser masses than in the jarrah (*Euc. marginata*) and marri forests further north, and the undergrowth is so thick as to be impenetrable on horseback, yet the trees and undergrowth that make up the forest are not of the true hygrophyllous forest type, and the term "sclerophyllous forest" is therefore the more correct. The jarrah forests, which cover a larger area of the region, are purely sclerophyllous, as are the tuart forests (*Euc. gomphocephala*), which are confined to a strip of limestone country around the South-Western coastline, and the wando forests (*Euc. redunca* var. *elata*)

which only occur in forest formation on the northern edge of the prime jarrah belt, and then extend as a fringe around its eastern and, here and there, along its western edge in savannah formation.

Throughout these sclerophyllous forests, the only truly forest region of the State, are to be found more or less large areas of country where the soil is such as to preclude dense forest growth. In particular, there extends between the jarrah forests on the Darling Range and the limestone formation along the coast a low-lying plain consisting mainly of silicious sand which carries only a very poor forest growth, small jarrah and marri, banksias (*B. grandis*, *B. illicifolia*, *B. Menziesii*, *B. littoralis*, *B. attenuata*), native pear (*Xylomelum occidentale*), Tea-trees and bottle brushes (*Caestemon*), also the very typical Loranthaceae (*Nuytsia floribunda*), a parasite which attains the dimensions of a tree and grows rooted in the ground, using as host the surrounding vegetation (Herbert, Journal Royal Society, W.A., 1919). In swampy ground we find two paper barks (*Melaleuca raphiophylla* and *M. striata*) and thicker growth of shrubs of the natural order *Myrtaceae* and *Leguminosae*, particularly spearwood (*Agonis linearifolia* and *A. parviceps*), stinkwood (*Jacksonia Sternbergiana*), and swishbush (*Viminaria denudata*). All through this sclerophyllous region we find three typical plants which are of special botanical interest, a Cycad, the zamia palm (*Macrozamia Fraseri*), and two Liliaceae (*Xanthorrhoea Preissii* and *Kingia australis*).



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2. Stretching eastwards and northwards around this small area of sclerophyllous forests occurs the savannah forest proper, and this extends out to the limit of the 10in. rainfall, and is intersected throughout by sand plain carrying mallee woodlands. On the edge of the jarrah country and eastwards for 20 miles wandoo timber occurs plentifully. Beyond that the forest becomes more mixed and a number of eucalypti are to be found, such as—

- York gum (*Eucalyptus loxophleba*).
- Yate (*Eucalyptus cornuta*).
- Salmon Gum (*Eucalyptus salmonophloia*).
- Morrell (*Eucalyptus longicornis*).
- Gimlet (*Eucalyptus salubris*).
- Redwood (*Eucalyptus oleosa* var. *glauca*).
- White gum (*Eucalyptus corrugata*).
- White gum (*Eucalyptus Griffithsii*).
- White gum (*Eucalyptus le Soeufii*).
- White gum (*Eucalyptus transcontinentalis*).
- Blackbutt (*Eucalyptus Clelandi*).
- Merrit or ribbon tree (*Eucalyptus incrassata* var. *dumosa*).
- Red flowering gum (*Eucalyptus torquata*).
- Blackbutt (*Eucalyptus Stricklandi*).
- Silver-top gimlet (*Eucalyptus campaspe*).
- Snap and rattle (*Eucalyptus calygonia* var. *gracilis*).
- Raspberry Jam (*Acacia acuminata*).

In the savannah forest belt occur also the two Santalaceae (*Santalum cygnorum*), the Western Australian sandalwood of commerce, of which there is a very large export to China, and *Fusanus spicatus*, the quandong, the wood of which has no value, but which bears an edible nut. Sandalwood extends beyond the savannah forest well into the mulga region. Indeed, with our present knowledge, it is not possible to establish the northern and eastern limits of this species.

In this belt occur also the mallets, the barks of which have been the subject of an extensive export trade in the past. The value of this export to date amounts to £929,808. There are four mallets, namely:—

- Brown mallet (*Eucalyptus occidentalis* var. *astringens*).
- Blue-leaf mallet (*Eucalyptus* sp. *ind.*).
- Silver mallet (*Eucalyptus falcata*).
- Swamp mallet (*Eucalyptus spathulata*).

The tannin content of these barks varies between 35 and 47 per cent.

3. The savannah forest is intersected by sandy areas of mallee or mulga formation. The mallees consist of shrubby eucalypts, which for the most part do not make a single stem but send up from the ground a clump of shoots. The following is a list of mallees found in this region:—

- Eucalyptus calygonia*.
- Eucalyptus erythronema*.
- Eucalyptus Ewartiana*.

- Eucalyptus foecunda*.
- Eucalyptus foecunda* var. *loxophleba*.
- Eucalyptus incrassata*.
- Eucalyptus leptopoda*.
- Eucalyptus occidentalis* var. *eremophila*.
- Eucalyptus Oldfieldii*.
- Eucalyptus pyriformis*.
- Eucalyptus redunca*.
- Eucalyptus uncinata*.
- Eucalyptus Websteriana*.

Mulga consists purely of acacias (*Acacia aneura*, *Acacia stereophylla*, and *Acacia craspedocarpa* being the most common).

4. This savannah forest, as will be seen from the map, stretches inland until it reaches the pure savannah or the pure mallee or the pure mulga. It extends north around the coastline and covers a fairly large area near Wyndham in the extreme north; in this region entirely different species of the genus eucalyptus are met with of which the writer has little knowledge. Mr. Fitzgerald's report on the North-West is very informative; also his list of botanical species (Royal Society, W.A., 1919).

A large area of Western Australia falls within the tropics, but nowhere occur any tropical rain forests, the rainfall even in the extreme north being insufficient to support jungle vegetation. The large area of land in the interior consists mainly of savannah, and the typical shrub of the region is the spinifex.

The occurrence in the central-eastern region of a large area—probably 100,000 square miles—of limestone country overlying the granite is of interest. Here no tree vegetation exists, and this plain derives therefrom the name Null-arbor. It is covered with blue bush and, after a rain, with grasses, and therefore cannot by any stretch of imagination be regarded as desert; indeed, the bulk of it is now held under pastoral lease for sheep raising. The porous nature of the soil makes the retention of the light rainfall—7 inches—difficult; and this is the main bar to more rapid development of the region.

*Geology.*—The geological survey of Western Australia under Mr. Gibb Maitland (v. Bulletins 1 to 77, Government Printer, Perth, W.A.) has covered a very large area of the State, so that the geological information obtainable is more extensive than that regarding botany. The map appended shows that, in the sclerophyllous forest region the formation is mainly igneous, and the rock granite and gneiss. The granite all through the jarrah belt is capped with laterite. Along the coastline in the same region and beyond it occurs a Cainozoic formation consisting of tertiary and post-tertiary limestones, silicious sand and alluvium. Here and there occur carboniferous formations, of which the richest is at Collie. The savannah forest, it will be seen by comparing the vegetation map with the geological map, grows on all geological formations and, except in sand plain



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country, it is a question of rainfall whether savannah forest, mallee, mulga, or pure savannah is met with. The vegetation on areas of sand plain in any region is always much smaller, and so in the savannah forest country in the 10in. rainfall belt we find sand plains carrying mulga and mallees, and in the latter belts, sand plain carrying pure savannah.

*Topography.*—The sclerophyllous forest region contains the Darling fault, which extends from a point some 50 miles north of Perth for 200 miles to Bridgetown and Nannup in the south. This very well defined range, some 800 feet high, is separated from the Indian Ocean on the west by a low lying plain of sand and coastal limestone hills, and rises eastward to the central plateau. Southward and eastward of Bridgetown and Nannup the country is much more broken, and the granites extend almost to the coast. The whole area is well watered by numerous streams and a few rivers. In the extreme south, between Cape Leeuwin and Albany, two rivers, the Frankland and Deep, fall into the Southern Ocean, and here, around the estuary known as Nornalup, the forests of tingle-tingle and karri come down the steep slopes of the hillsides to the waters' edge.

East of Mount Barker, on the Great Southern Railway, occurs the Porongorups, a small group of gneissic hills, which are fringed all round with karri forest. North of the Porongorups is the Stirling Range, the peak of which rises to 3,420 feet, the highest point in the south of the State. Geologically, this range is of great interest, being Protozoic. From a forestry standpoint it is not so interesting, as it carries no timber trees. It has, however, a botanic interest, being the habitat of several species found nowhere else.

From a forestry standpoint the topography of regions inland has been little studied, and while there is little probably to be gained from investigations of the inland portions in the south, there is evidence that an exploration of the tropical region in the north would yield valuable results. Here the country is much broken by large rivers and mountains, and edaphic forest formations occur, which contain species of timber the value of which has already been proved locally for building and general farm purposes on the large pastoral stations. Ebony (*Diospyros nitida*) has been found growing all along the coast from Broome to Parry Harbour. In the same region also occur mangrove forests, consisting of black mangrove (*Bruguiera gymnorrhiza*), red mangrove (*Ceriops candolleana*), white mangrove (*Sp. ind.*), and cork wood (*Sp. ind.*). The first two are rich in tannin.

*Soils.*—Through the length of the jarrah range, the soil, if such it can be called, consists of laterite. It has no value for farming. To this fact and this fact alone the belt of jarrah forests owes its preservation. Even when land settlement policies have alienated areas of jarrah country for agri-

cultural purposes, these areas have sooner or later reverted to the Crown, the settler having failed to effect the necessary improvements or to make a living. In places in the jarrah belt and further south, where the Darling fault country breaks up, dykes of diorite are met with, and the soil disintegrated from this rock forms valuable agricultural land. Except in the valley of the Capel and Blackwood rivers, and around Bridgetown, the areas of diorite soil are very small indeed. In the karri country the soil is of a better quality than in the jarrah belt, and particularly is this the case when the karri and marri are found growing mixed. The soil on which karri grows in a pure or almost pure state is disappointing agriculturally, it being of a light snuffy nature, easily washing away when cleared of timber. The soil on which wandoo grows is, generally speaking, of poor quality. - It is, however, more valuable than jarrah land, and all the best of the forests have been alienated in fee simple. Tuart is entirely confined to the limestone formation along the coast. The rock lies very close to the surface, and is covered by a loose sand. It has a value for grazing purposes, but is poor agriculturally. The savannah forest grows, generally speaking, on excellent heavy soils, and is in consequence necessarily fast disappearing before the wheat farmer in the assured rainfall belt.

*Climate.*—The climate of Swan Land, as Griffith Taylor (Australian Environment) calls the region covered by sclerophyllous forests in the South-West, is probably the best climate in Australia. It has the lowest range of variability in rainfall, 10 per cent., and the cool southerly winds temper the heat of summer, while the winters are very mild. The temperature and rainfall recorded at five of the meteorological stations in the South-West in 1918 were:—

	Shade Temperature.			Rainfall. inches.
	Mean.	Maximum.	Minimum.	
Perth .. ..	65	107	38	40
Bridgetown .. ..	59	104	27	39
Busselton .. ..	62	105	35	38
Karridale .. ..	61	95	29	49
Albany .. ..	62	93	37	41

In this region the rain falls during the winter months—April to September—and the summers are exceedingly dry. As you penetrate inland or go northwards, the rainfall rapidly diminishes (see map of vegetation) and the extremes of heat and cold increase. In the Northern or tropical portion of the State the seasons are reversed, the rainy season occurs from October to April. The following are the meteorological statistics of certain Northern stations:—

	Shade Temperature.			Rainfall. inches.
	Mean.	Maximum.	Minimum.	
Wyndham .. ..	84	105	59	29
Hall's Creek .. ..	77	109	32	20
Derby .. ..	81	108	47	24
Broome .. ..	80	106	47	24

Between the tropical North and the temperate South lies a belt of country where very little rain falls at any time of the year.



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striking feature of the jarrah belt. Here are a few of the species of ground cover to be met with:—

*Hakea amplexicaulis.*  
*Hakea cristata.*  
*Hakea ruscifolia.*  
*Hakea erinacea.*  
*Pimelea sylvestris.*  
*Leucopogon verticillatus.*  
*Kennedyia* and *Hardenbergia.*  
*Marianthus candidus.*  
*Dryandra repens.*  
*Anigozanthos.*  
*Tetralthea.*  
*Boronia*  
*Stylidium diversifolium.*  
*Burchardia.*  
*Stylidium calcaratum.*  
*Poranthera glauca.*  
*Acacia nervosa.*  
*Leucopogon Australis.*  
*Ranunculus lappaceus.*  
*Tremandra.*  
*Haloragis.*  
*Xanthosia.*  
*Gompholobium polymorphum.*  
*Comesperma ciliatum.*  
*Opercularia apiciflora.*  
*Thysanotus patersoni.*  
*Scaevola fasciculata.*  
*Grevillea bipinnatifida.*  
*Trymalium billardieri.*  
*Grevillea glabrata.*  
*Albizzia lophantha.*

## SECTION II.

\*DESCRIPTION OF MAIN TYPES OF  
FOREST GROWTH.

## JARRAH FORESTS.

While jarrah (*Euc. marginata*) is to be found growing over practically the whole of the sclerophyllous forest regions—some 13,000,000 acres—this tree only attains its best development on the laterite-capped Darling Range. Here it is the dominant species, attaining an average height of 100 feet. Associated with it are marri (*Euc. calophylla*), blackbutt (*Euc. patens*), and bullich (*Euc. megacarpa*). It is only in secondary laterite and alluvial soil that marri and blackbutt are predominant. Elsewhere jarrah forms 95 per cent. of the growing stock. Both marri and blackbutt attain the same size as jarrah, but blackbutt establishes itself on the richest pockets of soil, and is at its best in diorite valleys and gullies. Bullich grows in the laterite gullies and forms pure stands. Along the banks of the perennial larger streams and rivers grows river-banksia (*B. verticillata*), a tree attaining a height of 50 to 60 feet. The prime jarrah forests (see map) contain a number of small trees, of which sheoak (*Casuarina Fraseriana*) is the tallest. It attains a height of 45 feet. In the same storey are found banksia grandis, native pear (*Xylomelum occidentale*), *Dryandra floribunda*, Christmas tree (*Nuytsia floribunda*), while emu bush (*Personia elliptica* and *Personia longifolia*) form a still lower storey, attaining about 15 feet. Below these again we find a wealth of shrubs, prickly mimosa (*Acacia pulchella*), Hibertias, blackboys (*Xanthorhoa Preissii* and *X. recurra*), grass tree (*Kingia australis*), zamia (*Macrozamia Fraseri*). several acacias and hakeas, and a number of plants of the order Epaeridaceae. The wealth of ground cover is very great indeed, as the following brief enumeration will show. There is, however, a total absence of graminæ, which, considering the rainfall and the fairly open canopy, is perhaps the most

The forest grows in dense formation, yet the crowns of the jarrahs do not interlock and form a dense cover, but grow in such a manner that the crown of each tree is to some extent clear of the next. Add to this the fact that the leaves of this eucalyptus, as is the case with nearly all of this genus, turn edgeways to the light, and it will be readily seen that the cover is very light indeed. There is an almost complete absence of humus, but this is probably due to the fact that every three or four years the forests are fired and the leaves, twigs, and debris are consumed. It is fortunate that jarrah is naturally very resistant to fire, or the forests of this timber would long since have been destroyed. As it is, the scorching that the large and medium sized trees receive every few years causes a cessation of growth for the time being, and when the fire is so severe as to destroy all the green leaves of the crown, the growth of epicormic branches on the bole results in the formation of kino (gum) pockets which seriously reduce the value of the timber. The damage done to the large trees by these repeated fires is not, however, so serious as the destruction caused to the regrowth. The seedling has not time to get its head above the ground fire before it is burnt back. The majority are killed, though a few throw

\* See map showing the Prime Forest Regions,



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out suckers, and these in turn are burnt back by the next fire. A few in the end survive, growing sufficiently high to escape being burnt back by a ground fire. When the sapling stage is reached the young trees are moderately safe from ground fires, but when a heavy crown fire occurs, they are either killed outright or their leading shoots are burnt off. In the latter case new shoots are made and a twist or kink forms at that height. As the saplings pass to the pole stage they experience these repeated fires, and the severe ones can be counted on the stems by the kinks at various heights. When the tree attains its height-development and develops its crown, it is, generally speaking, safe from actual destruction by fire. In cases, however, where heavy stands of mature timber have been felled and the crowns litter the ground, the subsequent fire is frequently fierce enough to kill large jarrah trees. The repeated fires also have another serious effect: they sooner or later fire the trees at the butt. This is most frequently the case when a dead limb or fallen tree lies close to the base of the trunk and so causes so fierce a fire as to burn off the fire-resisting bark; the wood is then exposed, and it is only a matter of years for the tree to be converted into a chimney.

Fires are responsible for most of the defects that are to be found in jarrah timber, viz., rotten hearts, hollow logs, gum pockets, gum veins, double crowns, crooked and twisted grain. Fires are in 99 cases out of a 100 purposely set by graziers who run cattle in the forests, and by kangaroo hunters who burn the forest to either drive the game or provide feeding grounds where they can be shot at a future season. The Forests Act provides for the taking over by the Forests Department of pastoral leases in State forests and for the control of the fire menace generally.

The growing stock in a virgin jarrah forest varies very much from place to place. Sufficient work has not as yet been done to explain the variations. The mature timber (trees of over 90in. girth at breast height) reaped by the timber companies now operating averages eight loads of timber in the round (quarter girth measurement) per acre. The over-mature timber left by the sawmiller averages the same amount. The 72in. to 90in. girth class averages five loads. No estimate has been made of the average loadage of the smaller girth classes. Chiefly owing to the fires the rate of growth of the cut-over forests is slow, but an additional reason for this slowness is the presence of overmature timber, for which no market can at present be found. It is not possible to give yield tables. Eighteen sample plots have been selected, each five acres in extent, but only two measurements separated by two years have been taken, and the data are therefore not sufficient for the drawing up of tables.

Jarrah is the only timber milled to any extent. The other species making up the forests have been neglected.

*Sheaoak*.—In early days sheaoak was extensively used for roofing shingles, and during the war, when corrugated iron was not procurable, it again came into use. It is also finding a somewhat larger market for furniture and cabinet work generally. This species suffers more from fire than jarrah, and to-day it is difficult to find a tree which has not one side burnt to the heart.

*Bullich*.—This timber is now being sawn in very small quantities and put on the Perth market for furniture work.

*Marri*.—The presence of gum veins in this timber renders it generally unsuitable for sawmilling purposes. Here and there a clean tree is found, and the timber obtained from such is of value, but for the most part the marris of the jarrah belt are too gummy for timber purposes. The gum or kino contains, however, a very high percentage of tannin. Hide powder analysis shows that an average of over 50 per cent. of tannin is absorbed by the hide powder. Unfortunately it has the disadvantage that it colours the leather a red brown, and this has militated against its use as a tannin. The fact that the gum can be tapped from the tree without killing the latter makes it important that chemical investigation in the direction of decolorisation be carried out to render it a more suitable tannage. A large and inexhaustible supply of so strong a tannin material as marri gum is certainly of great potential value, not only to the State and Commonwealth, but to the Empire as a whole. It is to be found growing practically throughout the sclerophyllous forest region. It extends outside the jarrah forest into the karri forest, and is found in a pure state on rich alluvial lands, where it is necessarily being rapidly destroyed to make room for agriculture.

*River banksia* is beginning to be more used for furniture work. It is comparatively rare, confined as it is to half a chain width along river banks. It is fast growing, but is easily killed by high floods; fortunately these are rare. The interval between two high floods enabled a fair estimate to be made of the rate of growth, and it was found that merchantable timber can be expected in 40 years.

*Native pear* only occurs very sparsely, and is entirely absent from a very large area of the jarrah forest. It is not at its best in the jarrah forest, and only grows in a very stunted and gnarled form. Much of its poverty is due to fire. The home of this species is on the plains between the Darling Range and the sea.

*Jarrah*, the dominant species of these forests, is the tree which has yielded the well known timber of that name, which has been the basis of the timber industry of Western Australia from the beginning of the Colony. Of the total output of square sawn or hewn timber during 1918-19, which amounted to



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145,453 loads, 128,747 loads were jarrah. There are in all 50 sawmills in Western Australia, and of these two only are cutting karri, one is cutting jarrah and karri, six are cutting river banksia and sheaoak, and the remaining 41 mills are engaged purely in cutting jarrah. The size of the mills ranges from large concerns with a daily output of 80 loads in the square and employing 120 hands to little mills with an output of eight to 10 loads in the square, employing 10 to 15 men. Over 500 miles of timber tramways (3ft. 6in. gauge) have been laid by one firm alone to enable the logs to be brought to its mills. The rate of cutting is very high, and railway construction plays a very important part in the exploitation of the forest. The selection of timber for felling is left entirely to the sawmiller, who is only restricted in so far that he may not cut trees under 90in. girth. The result is that the exploitation is many times the "possibility" of the forest, and the cut-over country is left in a deplorable condition.

In addition to the sawmiller, there were working exclusively in jarrah forests 157 hewers in 1918-19. These timber workers hew out railway sleepers from the log. Up to 1917 they were practically unrestricted, and carried out destructive hewing in virgin forest. In 1913-14 there were 2,580 operating in this manner. To-day the hewer is restricted to forest where it pays better to take the axe, maul and wedge to the tree than the log to the mill. In time he may become a very useful worker in the forest, but before that can happen the severity of the specification for railway sleepers, both for the Australian and overseas market, must be considerably reduced to enable the working up of overmature and second-grade jarrah generally.

## KARRI FORESTS.

Karri (*Euc. diversicolor*) is restricted in its habitat to the wettest portion of the State, where the average rainfall is 35 inches and over. The northern boundary is a line between Manjimup and Nannup, and from there it spreads south and south-east to Denmark. Except for an isolated area to the north of the Leeuwin to the Margaret River, it does not extend westwards beyond a line drawn from Nannup to a point on the Warren River, six miles above the mouth. Another small and curiously isolated area of karri is to be found growing as a fringe around the slopes of the Porongorup Hills, to the east of Mt. Barker. It is generally separated from the sea by a belt of sand plain country, though at Nornalup it comes down to the edge of the estuary formed by the Deep and Frankland Rivers. The tree attains a great height. The average is 200 feet, and the highest I have measured is 278 feet.

The karri forests, unlike the jarrah, do not extend in a pure state over the whole area described above, but are intersected by belts of jarrah, and by belts of mixed karri and marri, pure marri, and blackbutt and marri. The karri forest soil is of a deeper and richer nature than the jarrah soil, and appears to be composed of disintegrated granite and schists. Agriculturally the soil where the karri grows in pure or almost pure stands appears to be disappointing. Where, however, it is found mixed with marri, it gives good results. Here the soil contains an admixture of disintegrated diorite. With the exception of marri and blackbutt there are no large trees in the karri forest except along the river banks, where we find peppermint (*Agonis flexuosa*) and its sister cedar (*Agonis juniperiana*), river banksia (*Banksia verticillata*); none of these grow to more than 70 feet in height. As an understorey scattered here and there we find karri-oak (*Casuarina decussata*), and again banksia grandis.

The cover afforded by the karri forest is denser than the jarrah, but this is because the tree grows more densely, though its crown, taking into account the size of the tree, is less spreading than jarrah. The undergrowth in karri forest is very different to that of any formation except the tingle-tingle forest. There is a great wealth of small trees up to 25 feet high, belonging largely to the leguminosae, which form dense, almost impenetrable thickets. These cover the ground effectually and make a very fine layer of humus. Here also we find bracken (*Pteridium aquilinum*). Common to both jarrah and karri belts we find blackboy (*Xanthorrhoea*), but the grass tree (*Kingia*), which is somewhat rare in the jarrah forest, is most abundant in the karri forests. The zamia (*Macrozamia*) is very abundant, and in certain parts attains the height of 15 feet. Waterbush (*Bossiaea aquifolium*), also rare in jarrah, forms heavy thickets, as do the two hazels (*Chorilaena hirsuta* and *Trymalium billardieri*). Possibly the closest thickets are formed by karri, wattle (*Acacia, pentadenia*), which attains 25 feet and extends over wide areas. Of the lower shrubs, blue bush (*Hovea arborea*) and two more wattles (*Acacia urophylla* and *Ac. nigricens*) are most common. Banjine (*Pimelia clavata*, *P. spectabilis*, *P. rosea*, and *P. eyrei*), the barks of which yield a bast fibre, are also to be met with. This dense undergrowth only gets dry enough to burn at long intervals—about 10 years. As in the jarrah country the graziers fire it whenever it will burn, with the result that much valuable dead soil covering and humus is destroyed. The young karri as a rule get their heads well above the fires in 10 years, so that they are not burnt back and generally escape losing their leading shoots. The trees, however, suffer a very bad scorching, particularly as the bark is deciduous and there is therefore always a pile of fallen dry bark around the base of each bole. Where the karri wattle grows in high thickets the



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fires are so intense as to burn the trees to the crowns and defoliate them. Here, as in the jarrah country, greedy branches form down the bole, and when they fall off, leave gum pockets. The bark, being thin, offers less protection to the trees, so that after a fierce fire, the trees develop small longitudinal cracks from butt to crown. These act as breeding grounds to fungoid disease, to which karri, unlike jarrah, is prone.

The density of the stocking in the virgin karri is very great. Six hundred loads of merchantable timber have been removed from an acre. The average, however, is much lower than this. The State sawmills operating for three years removed from 2,000 acres 80,000 loads, or 40 loads to the acre. They left behind as much again in what was regarded as unprofitable logs. The girth restriction in karri country is 108in., and, as in the jarrah forests, there is no supervision other than to restrict the feller to trees over this size. If it is possible, the state of the forest after the sawmiller has done with it is worse than the cut-over jarrah forest. In the prime karri country the stand consists of 95 per cent. karri, and the other timbers, of which marri is the largest, are not at present utilised. The cedar is worthy of attention, yielding as it does a remarkably strong long-grained wood similar to ash. The name cedar is an unfortunate one.

## WANDOO FORESTS

(*Euc. redunca* var. *elata*).

As will be seen from the forest map, the prime wandoo forest is confined to a very small area on the north-eastern end of the prime jarrah belt. It is true that it extends all along the eastern edge of this belt and out to the Great Southern Railway, where it becomes very stunted. The variation that this tree shows has led to botanists calling the prime wandoo "*var. elata*" and the stunted form "*Euc. redunca*." It covers a large area in savannah forest formation, but it is not proposed to describe this class of wandoo forest but to confine the description to the merchantable woodlands to the north-east of the jarrah. The rainfall in this region is a few inches less than in the jarrah country, and this is shown by the jarrah adopting a stunted habit of growth, while the wandoo attains a good height and girth. The soil consists in great part, as in the jarrah country, of laterite, but the presence of clay soil is a new feature. The under-

growth is the same as in the jarrah forests but is less rich and luxurious, and the stems are more woody, and thorny bushes and shrubs with reduced leaves become common. The vegetation is more Xerophyllous. Species rare in the jarrah forests, such as the gastro-labiums, become very common, as do compositæ, and grasses help to cover the ground. Wandoo affords so little cover and the vegetation is sufficiently Xerophyllous for this type of forest to be called savannah forest. No information is available as to the stocking of wandoo forests. The timber is used almost exclusively by the Government Railways for truck-building, and it all comes from private property.

## TUART FORESTS

(*Euc. gomphocephala*).

The prime tuart country lies between the Sabina river on the south and Capel river on the north (*see forest map*). From Capel to some 20 miles north of Perth it is to be found scattered all along the limestone fringe of the seaboard, but nowhere does it attain the same size and stocking as on the small area near Capel. The soil consists of sand overlying coastal limestone. In places the rock outcrops. The trees attain an average height of 120 feet and form pure stands of large timber. Associated with it as an understorey is found peppermint (*Agonis flexuosa*) which grows in the tuart country to a much larger diameter than anywhere else and attains a height of 30 feet. In the same storey we find *Banksia grandis*. As ground cover there are a number of grasses and a few small shrubs. In virgin forest the stand of merchantable timber is eight and a half loads per acre and there are 10 loads of faulty mature and over-mature timber. The growth of the timber is fast, averaging for girth classes, between 72in. and 90in., 0.9in. a year. The timber is used for the undercarriages of the trucks of the Government Railways, and the use of this timber instead of steel has reduced the maintenance cost from £3 per annum to 7s. 6d. per annum. It is also used for felloes, naves, and spokes, particularly for the big whims used in hauling karri and jarrah logs from stump to tramline. The cutting has, up to the present, been carried out in a very wasteful manner, and, owing to heavy grazing and fires, there has been little or no regeneration for 50 years.



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### SECTION III.

#### AREA COVERED BY EXISTING FORESTS.

The forest data enumerated in Table I. includes only the sclerophyllous region and does not include the minor forest products, such as mallet bark (*Euc. occidentalis*, var. *astriugens*), sandalwood (*Santalum cygnorum*). The figures are based on a close forest survey of the greater part of the jarrah belt and a portion of the karri belt and the demarkation of the prime tuart country. The wandoo figure is an estimate only. The figures relating to agricultural and other land were obtained from the Surveyor General. It should be remembered that, in all new lands all soils are very naturally regarded as potentially agricultural, and only time and much experimenting will show whether some of the land figuring as fit for the growing of cereals and other farm crops might not better be employed growing timber, at any rate until it is proved beyond dispute that it pays better for farming. In this connection, the report of the Royal Commission on Agriculture which sat in 1919 is of special interest to foresters. For many years a controversy has raged around the question of the suitability of the karri country for agriculture, and to the Hon. J. Mitchell, C.M.G., the present Premier and Minister for Lands, is due the credit of settling the matter by deciding

to reserve for all time the pure karri forests and alienate for farming purposes only the mixed karri, marri, and blackbutt lands. The actual choosing of these mixed lands is to be left to the Forests Department.

The Surveyor General, Mr. H. S. King, has kindly furnished the following explanatory note in regard to the figures he supplied:—

*Agricultural Land.*—These figures represent the total area in the South-West Division, with 1,562 square miles outside that Division in the Eucla Division of the State, which, exclusive of alienated land, land in process of alienation, mineral and reserved land, is available for selection for agricultural and mixed farming purposes. Of the total area, 65,382 square miles is within the safe rainfall limit for cereal growing as at present defined, and a proportion which cannot at present be accurately determined is land of inferior quality, which, under present methods of agriculture, cannot be profitably utilised. There are 34,130 square miles alienated within the South-West Division.

*Other Lands.*—These figures represent the area of the State, exclusive of the South-West Division, and 1,562 square miles in the Eucla Division. Of this area 377,648 square miles are leased for pastoral and mining purposes. It is considered that a large proportion of the balance will eventually be used for pastoral purposes. A proportion consisting of land situated in the vicinity of the Northern Rivers could be used for tropical agriculture under suitable conditions.

TABLE I.

STATEMENT SHOWING THE TOTAL AREA OF FOREST AND THE PERCENTAGE OF THE LAND AREA COVERED BY FOREST.

	Agricultural Land.	Forest.			Other Land.	Total.
		Merchantable.	Unprofitable or inaccessible.	Total.		
Jarrah—Sq. miles ... ..	...	4,200	8,400	12,600	...	...
Percentage of total area ... ..	...	.43	.86	1.29	...	...
Karri—Sq. miles ... ..	...	400	† 400	800	...	...
Percentage of total area ... ..	...	.04	.04	.08	...	...
Wandoo—Sq. miles ... ..	...	160	12,000	12,160	...	...
Percentage of total area ... ..	...	.01	1.20	1.21	...	...
Tuart—Sq. miles ... ..	...	8	200	208	...	...
Percentage of total area ... ..	...	.0008	.02	.02	...	...
Forest Total—Sq. miles ... ..	...	4,768	‡ 21,000	25,768		
Percentage of total area ... ..	...	.48	2.12	2.6		
Totals—sq. miles ... ..	92,826	4,768			878,326	975,920
Percentage of total area ... ..	9.5	.48			90.02	...

† In this is included mixed karri and marri land which may be alienated in the near future but on which it is intended to reserve the karri timber from destruction at the hands of the settler.

‡ The 21,000 acres of unprofitable forest are included in the Surveyor General's estimate of Agricultural land.



## SECTION IV.

\* BRIEF NOTES ON THE MOST  
IMPORTANT TIMBERS AND  
FOREST PRODUCE.

## JARRAH

*(Euc. marginata).*

This tree is the principal timber of the State. In the early days it was called mahogany, owing to the resemblance it has to the Honduras timber. About 1860 the name was altered to jarrah, as it was generally recognised that this was a better timber than mahogany, and that it had so many fine qualities that it deserved a name of its own. Jarrah is the name given to the tree by the aborigines.

The tree grows to a height of about 100 to 120 feet, with a bole of 50 to 60 feet, and a diameter up to 72 inches.

Weight per cubic foot (green)—68lbs.

At 12 per cent. moisture—55lbs.

Transverse strength—15,000lbs. per square inch.

Tensile strength—15,500lbs. per square inch.

A hard wood, but easily worked, and therefore used for almost every purpose. It is strong enough to be used for beams, and its colour and texture are such that it is daily becoming more and more prominent as a cabinet wood. One of its remarkable qualities is its durability when exposed to the worst conditions. The timbering in the first houses built when the Colony was established is still sound to-day, and the post-and-rail fences erected by the earliest settlers are still standing. Its extraordinary durability has, however, rather cheapened it in the eyes of the outside world, where it has commanded a readier sale as sleeper or paving block wood than for the purposes where a more expensive wood is generally used. It is to be regretted that the exploitation of the jarrah forests has been conducted practically solely for the sleeper market. Since 1836, the export of timber from the State amounted to 3,559,954 loads, valued at £14,322,845, the bulk of which consisted of jarrah.

It is on Lloyd's list of shipbuilding woods, and jarrah ships in the early days plied between Western Australia, India, and other parts of the world. Its durability has made it renowned for bridge, wharf, and harbour work, while the telegraph service of the State is dependent upon supplies of jarrah poles.

It is to be found scattered throughout the South-West over some 13,000,000 acres of country within the 25 to 45 inch rainfall belt. The main belt of timber, however, stretches from Childow's Well in the north, along the Darling Range to the extreme south of the State, in the neighbourhood of Albany.

The total area of prime jarrah forests is probably not more than 2,500,000 acres, and is all on this laterite capped range of hills.

It regenerates itself well, but the constant firing of forests has resulted in the destruction of the young growth in many parts of the forests. The recovery in milling operations is from 40 to 50 per cent. of the round log (quarter girth system), or about 33½ per cent. true measurement.

## KARRI

*(Euc. diversicolor).*

The second most important tree of the State; it grows to a great height (trees of 278 feet having been measured), with a bole of 100 to 140 feet, and diameter of 8 to 10 feet.

Weight per cubic foot (green)—72lbs.

At 12 per cent. moisture—58lbs.

Transverse strength—17,300lbs. per square inch.

Tensile strength—18,750lbs. per square inch.

A hard, strong wood. It closely resembles jarrah timber, but the grain is longer, and it is a much stronger wood. It is beyond doubt a splendid super-structural timber, and is strongly to be recommended for heavy beams, roof principals, etc. *It is not durable in the ground, and does not resist white ants.*

It is on Lloyd's list of shipbuilding timbers, and is suitable for all purposes where large sections of great strength are necessary. It has been found very satisfactory for wooden pipes, and it makes a good wagon spoke, but its main use up to now has been for railway wagon-scantling, and telegraph arms. The English Railway Companies and the London Post Office authorities are strong in their praise of the timber for these purposes. It has suffered very much through its being so easily confounded with jarrah. As in all young countries, timber in Western Australia has in the past been valued according to its durability as a fence post or a sleeper, and karri, though immeasurably superior in other respects, has been condemned owing to its failure when put to such uses. It is confined to the wettest portion of the South-West of the State, and its northern limit is Nannup and the upper waters of the Donnelly, whence it spreads southwards and south-eastwards to Denmark. There is then a gap in the belt, and it is to be met with again near the Porongorup Range; another isolated patch occurs on the extreme South-West near the Leeuwin; this was the place whence the first karri was exported from the State, and is more commonly known under the name of Karridale. In all it is doubtful whether more than 250,000 acres of prime karri forest can be reserved. It regenerates

\* See maps showing habitat of each species.



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itself well, and it forms the only forest of the State that carries a dense undergrowth of shade-bearing species.

The sawmiller recovers from 30 to 40 per cent. of the round log (quarter girth system).

### WANDOO

(*Euc. redunca*, var. *elata*).

A tree attaining a height up to 100 feet, with a bole of 30 to 40 feet, and diameter of four feet.

Weight per cubic foot (green)—79lbs.

At 12 per cent. moisture—71lbs.

Transverse strength—16,100lbs. per square inch.

Tensile strength—16,100lbs. per square inch.

This wood is hard, strong, and durable. It is used for bridge construction, wharf planking, wheelwright, millwright, knees of boats and shipbuilding generally. It makes an excellent trenail. It is very satisfactory for all turnery work, such as jute and cotton bobbins, telegraph insulator pins, etc. Its main use, however, is for wagon scantling for the railway stock of the Government Railways of the State. It gives a life of 25 years in under-carriages of trucks. The top plank of the sides of these trucks is always made of wandoo, which stands the wear of the unloading and loading better than steel, also the stanchions of the trucks are of wandoo. A remarkable quality which this timber possesses is that when used in conjunction with steel there is no chemical action between the wood and the metal. Bolts have been taken from under-frames of trucks after 20 years' use and been found to be quite as clean as when put there, while the auger marks were still visible in the holes. The value of this timber is so well recognised by the Government of this State that permits for cutting it can only be obtained if the timber is to be used by State Departments; in other words, the timber may not be exported. (See Tuart.)

It is to be found growing in the South-West portion of the State, on the edges of the jarrah belt. It does not grow in close forests, but in open savannah forests, and is to be found mixed with jarrah and red gum.

### MARRI

(*Euc. calophylla*).

A tree attaining a height of 90 to 150 feet, with a bole of 40 to 120 feet, and diameter of six to seven feet.

Weight per cubic foot (green)—72lbs.

At 12 per cent. moisture—56lbs.

Transverse strength—16,600lbs. per square inch.

Tensile strength—20,200lbs. per square inch.

This tree yields a light-coloured strong wood. It is easily worked, and were it not for the presence of gum veins would be among the most valuable timbers in Western Australia. Unfortunately, the gum or kino occurs in such quantities that it is difficult to find a tree free enough from gum to make it profitable to saw it up. It is used for all purposes where strength and elasticity are required. Timber hewers always take out the hickory shafts from their carts and replace them by marri shafts. Heavy poles used in the large whims which carry the great jarrah and karri logs to the mills are of marri. In the whim itself the fetchels, which are trusses to connect the pole with the axle bed, are also of marri. It makes a good axe and tool handle, and there would seem to be a future for it for all smaller turnery work. The gum or kino yielded by this species contains a heavy percentage of tannin. Hide powder analysis shows that it contains up to 68 per cent. From earliest settlement it has been used by settlers to convert hides into leather, but unfortunately it has not been possible to use it to the extent that it should, owing to the fact that it imparts to the leather a red colour. It is hoped that investigations by leather chemists will discover the means of decolourising this valuable product, the source of which is inexhaustible.

It occurs throughout the jarrah belt, but like blackbutt is to be found generally on the better alluvial soils in the valleys between the laterite capped ridges.

### TUART

(*Euc. gomphocephala*).

A tree attaining a height up to 120 feet, with a bole 35 to 60 feet, and a diameter seven to eight feet.

Weight per cubic foot (green)—78lbs.

At 12 per cent. moisture—68lbs.

Transverse strength—17,900lbs. per square inch.

Tensile strength—16,500lbs. per square inch.

The timber is hard and dense with an interlocked grain, its colour is yellow. It vies with wandoo in strength and toughness. The timber is used for wheelwright work, especially the large naves required for the 9ft. wheels of the timber whims. Its main use, along with wandoo, is for railway wagon and truck construction. The Chief Mechanical Engineer in Western Australia, Mr. E. S. Hume, has reduced the maintenance of his trucks from £3 to 7s. 6d. per year 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, and its export prohibited.

It is confined to the limestone formation, and on this formation it stretches in scattered lines from Lake Pinjar southward along the coast as far as



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Sabina River, 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 Sabina River and Capel, and it is doubtful whether it will be possible to reserve more than 5,000 acres of first-class tuart country. Between Sabina River and Capel River the distance is about 12 miles.

**SANDALWOOD***(Santalum cygnorum).*

A small tree attaining a height of 12 to 16 feet, with a diameter of six to eight inches. Until some few years ago it was used solely by the Chinese for ceremonial purposes. It may be said that the development in Western Australia in the early days was to a large extent dependent on the sandalwood trade. Since 1845 there have been exported 292,367 tons, valued at £2,494,079. The supply close to the seaboard has long since been exhausted, and the source is now away back in the goldfields district. It thrives in as low a rainfall as eight inches per annum. Lately there has been a development in the distillation of sandalwood oil. The yield of oil from the Western Australian wood is not so heavy as that obtained from *Santalum album*, and its essential oil differs from santalol. It is, however, used in Australia and the East for medical purposes, and found to be as efficacious.

**NATIVE PEAR***(Xylomelum occidentale).*

A small tree, attaining a height of 20 to 25 feet, with a short bole, and a diameter of about 12 inches.

Weight per cubic foot (green)—56lbs.

At 12 per cent. moisture—46lbs.

Transverse strength—7,669lbs. per square inch.

Tensile strength—7,000lbs. per square inch.

A tree yielding a most ornamental and dark brown wood, with a beautiful figure. It is light, and makes up into very fine furniture wood; finished with a wax surface it resembles moiré silk.

It is to be found growing all along the sand-plain country, between the Darling Range and the sea coast. Like sheoak, it suffers very badly from fire, and it is therefore very hard to get in sizes greater than 12 inches in diameter. It is important that thorough fire-protection measures be taken in order to prevent the extinction of this beautiful furniture wood.

**SALMON GUM***(Euc. salmonophloia).*

A tree ranging from 80 feet to 100 feet in height, with a bole of 40 to 50 feet, and about 2½ to 3 feet in diameter.

Weight per cubic foot (green)—70lbs.

At 12 per cent. moisture—66lbs.

Transverse strength—17,900lbs. per square inch.

Tensile strength—19,200lbs. per square inch.

An exceedingly dense wood, the second strongest in Australia. It has up to now been used for mining purposes only. It is questionable whether the goldfields of Western Australia, which have up to date yielded £80,000,000 of gold, would have been developed had it not been for this tree and its sister Gimlet (*Euc. salubris*). The region in which it thrives has an average rainfall of 12 inches. Its gleaming salmon-coloured bark makes it the most conspicuous tree of the savannah forest.

**BLACKBUTT***(Euc. patens).*

A tree attaining a height up to 100 feet, with a bole 40 to 50 feet, and up to six feet in diameter.

Weight per cubic foot (green)—69lbs.

At 12 per cent. moisture—54lbs.

Transverse strength—14,200lbs. per square inch.

Tensile strength—15,700lbs. per square inch.

About the same weight and strength as jarrah, but a pale yellow-coloured wood. It is not plentiful, but it is to be found in small patches in the gullies and pockets of alluvial soil, between the laterite crests of the Darling hills. It is useful for many purposes, and particularly for farm implements and railway truck building.

**RASPBERRY JAM***(Acacia acuminata).*

A small tree 15 to 25 feet high, with a short bole, and up to 12 inches in diameter.

Weight per cubic foot (green)—73lbs.

At 12 per cent. moisture—62lbs.

Transverse strength—14,200lbs. per square inch.

Tensile strength—12,000lbs. per square inch.

A fairly heavy wood possessing a remarkably heavy scent, resembling that of pressed raspberries. It is very durable indeed; fence posts 70 years in the ground show no signs of decay. The grain, like its Victorian sister, Blackwood, is very beautiful and it is therefore much prized for cabinet work. It is regarded by farmers as an indication of good wheat-growing and sheep-grazing land, and is being rapidly destroyed.



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**YATE***(Euc. cornuta).*

A tree attaining a height of 50 to 60 feet, with a bole of 25 to 35 feet, and diameter of three feet.

Weight per cubic foot (green)—79lbs.

At 12 per cent. moisture—71lbs.

Transverse strength—16,700lbs. per square inch.

Tensile strength—24,200lbs. per square inch.

This species yields a light-coloured timber of exceptional strength. It is probably one of the strongest timbers in the world, and in one test for tensile strength the breaking load was 17½ tons per square inch, 3½ tons less than that usually specified for wrought iron of ordinary quality. It is used for wheelwright work generally, and is preferred where the strongest shafts or frames of carts are required. It occurs at Busselton, Donnelly River coast, Lake Muir, and Mount Barker district. That it is not used more generally is due to the fact that it is found in open savannah forests at a distance from centres of population.

**RIVER BANKSIA***(Banksia verticillata).*

A tree attaining a height of 50 to 60 feet, with a bole of 15 to 20 feet, and a diameter of two feet six inches.

Weight per cubic foot (green)—59lbs.

At 12 per cent. moisture—35lbs.

Transverse strength—10,300lbs. per square inch.

Tensile strength—8,000lbs. per square inch.

This tree yields a light-coloured timber with a particularly beautiful grain. The medullary rays are wide, so that when cut on the quarter it shows a beautiful oak-like figure, and is much prized for furniture work. It is the lightest of all timbers of the State. It occurs along the side of the larger rivers and streams in the South-West, and is rarely to be found growing far away from running water.

**SHEOAK***(Casuarina Fraseriana).*

A tree attaining a height of 40 to 45 feet, with a bole 10 to 15 feet, and a diameter of two feet six inches.

Weight per cubic foot (green)—60lbs.

At 12 per cent. moisture—52lbs.

Transverse strength—12,000lbs. per square inch.

Tensile strength—9,000lbs. per square inch.

A sound wood with broad medullary rays, which show up and make the timber particularly beautiful when cut on the quarter. It takes a good polish and stands up well, and therefore makes an excellent

cabinet wood. It makes a good ox yoke. It splits well, and was used almost exclusively in the early days of the colony for roofing shingles. A shingle taken from one of the first-erected houses in Perth (after 83 years' use) was found to be in a splendid state of preservation. Bush fires have played havoc with this species, and it will only be by a sound system of fire control that the future supplies of this valuable timber can be assured. It grows scattered through the length and breadth of the jarrah belt, but is not to be found in the drier regions.

**MORRELL***(Euc. longicornis).*

This tree attains a height of 60 to 90 feet, with a bole of 30 to 40 feet, and diameter up to four feet.

Weight per cubic foot (green)—73lbs.

At 12 per cent. moisture—64lbs.

Transverse strength—16,900lbs. per square inch.

Tensile strength—18,000lbs. per square inch.

It is a strong, hard, dense wood, and has an interlocked grain. It is of a dark-brown colour, and is used for wheelwright work, tool handles, etc. It is also used for mining timber. It occurs in the dry country in the rainfall belt of about 10 to 20 inches, and is scattered throughout the length and breadth of country between Three Springs on the north, Kataning on the south, and Southern Cross on the east. It does not grow in dense forest, but occurs in savannah forest formation.

**YORK GUM***(Euc. loxophleba).*

A tree which attains a height of 40 to 60 feet, and a length of bole of 10 to 15 feet, and a diameter of 18 to 24 inches.

Weight per cubic foot (green)—77lbs.

At 12 per cent. moisture—67lbs.

Transverse strength—14,500lbs. per square inch.

Tensile strength—13,000lbs. per square inch.

A dense, hard, heavy wood, with very interlocked grain. The wood is by far the best nave, maul, and mallet wood in Australia, while it may be used very successfully for felloes and other wheelwright and wagon-building purposes. The wood is of a yellow-brown colour, and carries a beautiful figure. It grows in open or savannah forests, and is to be found in the 20-inch rainfall belt. It is most common about Bolgart, Toodyay, Northam, York, Narrogin to Broomehill. Its presence is regarded by farmers as an indication of good agricultural soil for wheat-growing, and also good grazing country for sheep.



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## MALLET

*Brown Mallet (Euc. occidentale var. astringens); Blue Leaf Mallet (Eucalyptus sp. ind.); Silver Mallet (Euc. falcata); Swamp Mallet (Euc. spathulata).*

These four mallets appear chiefly in the savannah country between York and Mount Barker in the South-Eastern District of the State. These trees grow to a height of 50ft. with a diameter of two feet. The bark has been in the past the subject of an extensive export trade, but lack of proper regulation has resulted in its being depleted over very large areas. The bark contains from 36 per cent. to 47 per cent. tannin.

## RED TINGLE TINGLE

*(Euc. Jacksoni).*

A tree which grows up to a height of about 150ft. and has a diameter of 10 to 13 feet. It occurs between the Bow, Frankland, and Deep Rivers, but does not extend inland very far. It grows down to the water's edge at Nornalup Estuary. Elsewhere it is separated from the sea by sand plain formation. It is usually associated with yellow tingle tingle and marri. Owing to the isolated position of the country in which tingle tingle grows, the timber has not yet been put to any use except fence posts. It appears to have all the qualities necessary to make it good structural timber.

Weight per cubic foot (green)—73lbs.

At 12 per cent. moisture—62lbs.

Transverse strength—14,780lbs. per square inch.

Tensile strength—15,680lbs. per square inch.

## YELLOW TINGLE TINGLE

*(Euc. Guilfoylii).*

A tree which grows to the height of about 100 feet, and is 3 to 4 feet in diameter. It grows in the same district as the red tingle tingle, but isolated specimens may also be found near Denmark. It forms a lower storey under the red tingle tingle. The timber has not been tested, but from an examination that has been made it appears to be suitable for all purposes for which karri is now used.

## CEDAR

*(Agonis juniperiana).*

A tree growing to a height of 50ft. with a diameter of 2ft. 6in. It is found growing only in the karri country, alongside the running streams and rivers. It is usually associated with river banksia and peppermint. The wood is light brown or yellow in colour. It is very strong and most suitable for axe handles and other uses where hickory or ash is generally used.

## BLACKBOY

*(Xanthorrhoea Preissii).*

The Western Australian blackboy belongs to the same genus 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 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 off 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 requires scientific investigation with a view to discovering a use to which it may be put. In this connection it is interesting to note that large quantities of the South Australian *Xanthorrhoea*, which is very similar to the Western Australian blackboy, found its way into Germany prior to the war. To what purpose the Germans put the gum is not at present known. Destructive distillation has been carried out in Western Australia, and among the products obtained have been glucose, treacle, scents, alcohol, and certain tar products, and from these latter again two dyes have been obtained.

## GRASS TREE.

*(Kingia australis.)*

This plant, 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. Grass tree 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.



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It is to be met with in abundance on the poorer classes of soil. It attains a height of from 6 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. The trunk, it may be remarked, is almost always a black colour, like that of the "blackboy," caused through the scorching of the layer of pressed leaves by bush fires. At the present time the main commercial value of grass tree lies almost wholly in the 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 piassava. 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. 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.

## ZAMIA PALM

(Macrozamia Fraseri).

A cycad growing to a height of three feet, and in one particular locality 15 feet. The core contains a large amount of starch, which was utilised in the early days as a substitute for tapiaco, but might to-day be utilised for the manufacture of industrial alcohol.

## FORMS OF UTILIZATION.

**Fuel.**—Wood is largely used for fuel, both for industrial establishments and for household use. Coal is used on the railways. While figures are not available regarding the fuel consumption of the smaller towns, those in connection with the capital city, which include one-third of the total population, have been approximately tabulated.

**Fuel consumption of Perth.**—Banksia, 25,000 cords; jarrah, 75,000 cords; total, 100,000 cords, or approximately one cord per head of population. The banksia used is chiefly *Menziesii*, though *Banksia attenuata*, *Banksia illicifolia*, and *Banksia grandis* are also mixed in. Banksia is used mainly for kitchen and general household use.

The largest consumption of wood fuel is on the goldfields. There the whole of the power is raised through this medium (see Tables IV. and V). All the eucalypti mentioned on page 3, except York gum and yate, are used for fuel. The two mulgas are also used, and they make the best producer gas charcoal.

**Pit props and mining timber.**—No record is kept of the quantity of mining timber used as distinct from fuel. In the Collie coalfields split jarrah props are used, and in the goldfields salmon gum and gimlet are the principal timbers used.

**Wheelwright and coachbuilding.**—Naves: York gum (*Euc. loxophleba*) makes a very good nave, and is used in preference to the imported article from America. For large farm carts and drays tuart is used.

Spokes: Imported New South Wales ironbark (*Euc. sideroxylon*) is preferred, and of our own timbers are used yate, York gum, morrell, tuart (heavy carts), karri, wandoo.

Felloes: York gum, tuart. Some bent felloes are coming on the market.

Pole: Yate, karri, marri, tuart.

**Turnery.**—Wandoo and tuart are used for handles.

**Furniture.**—Jarrah, sheoak, banksia.

**Paper pulp.**—In Western Australia investigations have been begun with some local eucalypts for the manufacture of paper pulp. The most promising of these is karri. From laboratory experiments with young karri very satisfactory newsprint has been made. 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:—

Raw Material.	Pulp.	Yield.	Loss of Weight on Bleaching %.	Bleach consumed % 3rd B.P.	Soda consumed % Caustic Soda.	Fibre Dimensions.			Pressure lbs. sq. inch.	Soda strength (concentration) at start.	Time. hours.
	% Unbleached.	% Bleached.				Length L.	Diameter D.	Ratio D L			
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 of the "20-year" material.



## SECTION V. OWNERSHIP OF FORESTS.

Western Australia differs little from other self-governing dominions of the Empire in her attitude towards her forest heritage. She has always recognised the fact that, while the marketable timber grown on the land might with advantage be reaped, the land itself was the property of the Crown to be disposed of as the Government thought best. Thus, while cutting rights over large areas have been granted to timber companies, the land itself was not given to them except in a few isolated instances. Even in the case of the early timber concessions, the concessionaire was not permitted to even cultivate the land. His right related purely to the removal of timber. The isolated instances of alienation occurred, in most cases, through the desire on the part of early governments to encourage the building of railways. So we see a timber company granted the right to remove timber off a given area of land and, in consideration of its building so many miles of railway, it was granted so many thousand acres in fee simple. Again, companies interested purely in railway and land development were granted land alongside the railways they built, and thus the State lost its best areas of wandoo. The total loss, however, of forest country through alienation to timber or other companies is very small indeed.

While, on the one hand, governments of the past safeguarded the forests against alienation to sawmillers, they did not hesitate to alienate forest land to settlers. The sawmiller was regarded as the forerunner of settlement and, when he had removed what he was pleased to regard as marketable timber, the country was thrown open to selection. It is a fortunate fact that the jarrah forests grow on soil so poor as to discourage even the hardiest of land hungry immigrants, and in most instances in this belt the alienated land will in the end revert to the Crown. Land held in the jarrah forests by settlers cannot be termed forest to-day, for the timber has been ringbarked and the settler as a rule holds it under the conditional purchase

clauses of the Land Act, which require him to clear and improve the land in an agricultural sense. This land cannot therefore be termed "forest belonging to private individuals" (see Table II.). Under this heading has been included only land alienated in the very early days to sawmilling and land development companies and, where the forests, though not managed in a forestry sense, are at any rate not destroyed.

In the karri country the alienation for farming purposes has been more serious, having regard to the very small area covered by this valuable timber. Again, none of this land is being worked for the growth of timber, and so cannot be included in Table II. as private forests. Like the pure jarrah country, it is probable that the pure karri land will revert in time to the Crown, and settlement will be confined to the richer gullies.

From what has been written it will be seen that there is some difficulty in drawing up Table No. II. Forest land is now held as agricultural land, and when it reverts to the Crown will swell the area of State forests.

Until the passage of the Forests Act of 1918 there was no direct forest authority, and no permanent forest reserves were made. Reserves as national parks in the forest country were constituted, and in one instance vested in a local governing body. Others were vested in the Minister for Lands.

In the matter of reservations the Forests Act of 1918 provides for the dedication of State forests. Such State forests can only be reduced in area by consent of both Houses of Parliament. It provides also for the reservation as timber reserves of forest country. Such timber reserves may be alienated, but a report from the forest authority must first be obtained. While the forest survey of the whole of the State's major timber assets is nearing completion, it has not as yet been possible to dedicate State forests except in the tuart belt, and these amounting to 3,397 acres alone figure in Table II. Under the heading "Other forest" is included a large area of timber reserves constituted prior to the Act, and fairly safe from alienation. The bulk of the jarrah timber reserves will be shortly dedicated to forestry as State forests, so that the data under "Other forest" will be transferred to the column headed "Dedicated to timber production." In Table II. only merchantable forests are included (see Table I.)

TABLE II.

	Area belonging to—					
	The State.			Corporate Bodies.	Private Individuals.	Total.
	Dedicated to Timber Production.	Other Forest.	Total.			
Jarrah—Square miles ... ..	Nil	4,200	4,200	Nil	150	4,350
Jarrah—Percentage of total forest area	...	16.2	16.2	...	.5	16.7
Karri—Square miles ... ..	Nil	400	400	Nil	Nil	400
Karri—Percentage of total forest area	...	1.5	1.5	...	...	1.5
Wandoo—Square miles ... ..	Nil	Nil	Nil	Nil	160	160
Wandoo—Percentage of total forest area	...	...	...	...	.6	.6
Tuart—Square miles ... ..	5	Nil	5	Nil	3	8
Tuart—Percentage of total forest area	.02	...	.02	...	.01	.03
<b>Total—Square miles ... ..</b>	<b>5</b>	<b>4,600</b>	<b>4,605</b>	<b>...</b>	<b>313</b>	<b>4,918</b>
Percentage of total forest area ...	0.1	93.5	93.6	...	6.4	



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## SECTION VI.

RELATIONSHIP OF THE STATE TO  
THE FORESTS.*A—Brief Summary of Existing Legislation.*

In December, 1918, an Act to provide for the better management and protection of forests was placed on the statute book. The memorandum covering the Bill is of interest:—

## MEMORANDUM.

Before the proclamation of "The Constitution Act, 1889," the waste lands in the Colony were disposed of subject to the Imperial Act, 18 and 19 Viet., c. 56, which enacted that it should be lawful for Her Majesty, by instructions under Her signet and sign manual, or through one of Her principal Secretaries of State, to regulate the sale, letting, disposal, and occupation of the waste lands of the Crown in Western Australia.

Under that authority timber concessions were granted, three of which continue, and cover an aggregate area of 378,139 acres. These expire, as to 82,750 acres in 1924, as to 45,389 acres in 1925, and as to 250,000 acres in 1929.

The Imperial Act, 53 and 54 Viet., c. 26, enabling Her Majesty to assent to the Constitution Act, provided that the entire management and control of the waste lands of the Crown should vest in the legislature of the Colony.

Under "The Land Act, 1898," timber leases were granted of areas not exceeding 75,000 acres, for the term of 25 years, at an annual rent of £20 per square mile.

"The Land Act Amendment Act, 1904," prohibited any further timber leases, and substituted a sawmill permit conferring the sole right of cutting timber over an area proportionate to the horse-power of the mill on the basis of provision for ten years' cutting.

Twenty-three timber leases under the Act of 1898, with an aggregate area of 253,951 acres, are still current; but all these leases will have expired at the end of the year 1927. Thirty-five sawmill permits continue under the Act of 1904, covering an area of 850,028 acres; these expire at varying dates up to 30th June, 1926.

The aggregate area of forest now held under concessions, leases, and sawmill permits is 1,482,123 acres.

The main provisions of the Act are:—

Section 3.—Repeal of old Acts and preservation of existing timber rights.

Section 6.—Extension by the Governor of sawmill permits for a time equal to the temporary cessation of work caused through the war. The same for timber concessions and timber leases, with the proviso that the concessionaire or lessee pay royalty in lieu of rent, or, as an alternative, within 12 months of peace, surrender his concession or lease and take up a permit. In the latter case he will pay royalty and be credited with the rents he paid when closed down during the war.

Section 7.—The control and management of all matters of forest policy is vested in the department of forests.

Section 8.—The Conservator is permanent head, is appointed for seven years, and is directly responsible to the Minister of Forests for the management and control of the forests and the administration of the department.

Section 9.—The Conservator is a body corporate.

Section 14.—No person shall be appointed to the professional division unless he has obtained the degree or diploma of a recognised forest school.

Section 19.—The carrying out by the department of a forest survey classifying the country with a view to demarkating the State Forests and Timber Reserves.

Section 20.—State Forests to be dedicated by the Governor in Council.

Section 21.—And once dedicated can only be revoked in whole or in part by both Houses of Parliament.

Section 25.—Timber reserves to be made by the Governor in Council and these may be revoked, when they can be dealt with under the Lands Act. No revocation to be made until a report from the Conservator is obtained.

Section 27.—The deposit of maps certified by the Surveyor General of State forests and timber reserves.

Section 28.—The exclusion of agricultural land within State forests prior to dedication; such lands to be surveyed and alienated if necessary later.

Section 29.—The surrender of existing pastoral leases within State forests, the lessee to have the option within six months to take up a forest lease at the same rental.

Section 31.—The drawing up of working plans by the Conservator. Such working plans to be approved by the Governor and, when approved, have effect and shall not be altered except on the recommendation of the Conservator.

Section 32.—The granting by the Conservator of permits and licenses to obtain forest produce.

Section 33.—The scope of such permits.

Section 34.—Permits over £10 royalty value can only be granted subject to auction or tender.



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Section 35.—The scope of licenses. A license does not give the holder the exclusive right to remove forest produce from the area of land described on his license. A permit does.

Section 39.—The control of timber on mining leases.

Section 40.—The granting of forest leases, the maximum time to be 20 years.

Section 41.—Three-fifths of the net revenue of the department to be paid into a special fund at the Treasury to be used solely for forestry work.

Section 43.—The making of regulations and prescribing a penalty of £50 for breach of the same.

Section 45.—*Major Offences.*—A penalty of £100 or a year's imprisonment is imposed for the offence of unlawful cutting and removal of forest produce.

Section 46.—A penalty of £100 or a year's imprisonment is imposed for the offence of setting fire to a forest, and also providing a reward of £50 to informers.

Section 47.—That a forest officer may call on persons to help him extinguish fires.

Section 48.—Notice to be given to forester of intention to burn private land adjoining State forests.

Section 49.—The depasturing of cattle, hunting of game, occupation of land, are forest offences.

Section 50.—*Minor Offences.*—That a number of minor offences are punishable by a fine of £50 or six months' imprisonment.

Section 51.—Unlawful possession of timber is an offence; penalty £10.

Section 53.—The minimum fine for all forest offences shall not be less than one-twentieth of the maximum.

Section 66.—The branding of timber before export.

Section 67.—The transfer of the control of timber on catchment areas from the Minister of Water Supply to the Conservator.

Section 68.—The control of cutting of timber on parks and reserves.

Section 69.—The control of cutting of timber on roads.

Section 70.—Ingress and egress for timber tramways, etc., to be provided in all leases and grants of land within State forests or timber reserves.

Section 71.—Private plantations of 10 acres and over to be exempt from local government rates and taxes.

Section 73.—Settlers taking up land under the conditional purchase clauses of the Land Act shall reserve two per cent. of the acreage for the production of timber or other forest produce.

Section 74.—The planting of approved trees to be regarded as an improvement within the meaning of the said Act.

*B—Brief Summary of Administration, and Methods of Forest Development.*

Until 1919 nothing whatever was done in regard to the improvement, regeneration, and fire protection of the natural forests. In that year the preliminary work of drawing up Working Plan No. 1 was begun, and 17 miles of road and firebreak have now been constructed, which is the first step to regenerating the area. The working plan will cover the northern end of the jarrah belt, where the forest is close enough to the main fuel market—Perth—to enable the utilisation of otherwise unmerchantable timber burdening the ground. The green timber only fit for fuel is marked by a forester for felling, and this and the dry wood is being brought to market. The full working plan has not been drawn up and the whole operation is in its infancy. In addition, the preliminary steps towards drawing up Working Plan No. 2 have been initiated. This plan covers the prime tuart country, and includes the fencing and firebreaking of the forests, the granting of grazing leases for a very limited number of head of stock, the regeneration of the tuart by natural means, the establishment of a sawmill to utilise the large over-mature logs for wagon scantling, the establishment of a little mill to utilise the crowns and limbs for turnery work.

*Plantations of Soft Woods.*—The entire absence of merchantable softwoods—Cypress pine (*Callitris robusta*) occurs in the extreme north-west of the State, but from reports received is not merchantable—led the Government some 20 years back to experiment with pine plantations. The only land available within the sufficient rainfall belt for such a plantation was sand plain country, all richer land being required for agriculture. The preliminary experiments were unfortunately carried out at the State Nursery at Hamel, where the soil is somewhat better, and there the growth of Monterey pine (*Pinus insignis*) was satisfactory to begin with. At that time and subsequently the Eastern States embarked on rather heavy planting of this species, and this, together with the experiments at Hamel, led the Government, which was unaided by a forester, to plant 700 acres of Monterey pine in the sand plain. The result was a failure. The site consists of pure silicious sand, only suitable for cluster pine (*Pinus pinaster*), and the work of converting the Monterey pine to cluster pine is now in progress. Direct sowing of seed at the rate of 5lbs. per acre is answering well. The lack of softwoods has helped this work, as a case factory has contracted to clear the pines and prepare the land for the timber it can get out of it.

*Future Pine plantations.*—The 700 acres mentioned above are situated 140 miles from the main market,



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and it was necessary to choose a site for further planting of softwoods nearer Perth. Accordingly an area of 25,000 acres was selected 19 miles north of Perth, and all the preliminary work of the planting plan was executed, that is to say that the survey of a sufficient area to embrace 10 years' planting at the rate of a square mile a year, the survey of a tram-line on a good grade to connect the plantation with Perth, and the selection of forester's quarters, nursery, etc. Unfortunately it was not possible to start work on the area this year, owing to lack of funds. It was argued that the money required for such work should come from the net revenue earmarked under Section 41 of the Forests Act. The amount so earmarked is obviously insufficient to meet the forestry expenditure on the jarrah and karri forests from which the revenue is derived. As a counter argument, it was urged that this was a loan estimate item in that the return, unlike that from the natural forests which will be coming in every year and for ever, would only come in after the present generation ceased to exist. Finally it was decided that plantation of exotics be regarded as a loan estimate item. Everything is now ready, and it is hoped that the work of sowing cluster pine will begin next season.

A State forest nursery has been in existence for 19 years, and up to 1917 trees were distributed free

to settlers and public bodies. The number of plants so distributed was in the neighbourhood of 100,000 annually. For the most part these trees were used for street planting, shade, shelter and wind-breaks on farms. In 1917 it was decided to discontinue the free distribution and issue the trees at cost price. The value of the nursery is great, as it engenders a love of trees and aids the forming of a forest conscience in the country districts. The settler in Western Australia must necessarily destroy much timber to clear his land for farming purposes, and is very apt to develop a feeling of animosity against trees and forests which only the planting of trees will counteract. It has been found that, when one or two settlers plant trees, others quickly follow suit, and so it is that all through the region of assured rainfall the farms contain specimens of trees obtained from the nursery. It is hoped to develop this liking for trees, till the farmers, instead of planting trees for shade and shelter only, take up the planting for profit. The forest nursery is also the training ground for first year forest apprentices, and in this direction is of special value. Seed of useful tannin bearing trees, such as golden wattle (*Acacia pycnatha*) is distributed free to all *bona fide* planters.

The following is a return of the work of the State nursery for 1919-1920:—

No. of Trees distributed, Season 1918.

No. of trees on hand 31-3-18.	No. of trees raised year ended 31-3-19.	Sold to Public.	Distributed free.	Raised for Plantation.	Otherwise disposed of.	Total.	No. of trees on hand 31-3-19.
267,020	33,476	77,489	14,342	20,830	86,359	199,380	101,116

The advice of officers of the Forest Department is at the disposal of private individuals, corporations, and societies. Section 73 of the Forests Act, 1918, provides—

73. (1.) 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.

(2.) The planting of trees, approved by the Conservator, on not less than five acres of any land acquired under the conditional purchase provisions of the Land Act, 1898, shall be deemed an improvement within the meaning of that Act, and the conservation and improvement, to the satisfaction of the Conservator, of indigenous timber already growing on any portion of land acquired under the conditional purchase provisions of the Land Act, 1898, may, with the approval of the Minister for Lands, be deemed an improvement within the meaning of that Act.

From this it will be seen that the policy of the country is to preserve or encourage the planting of a "woodlot" on every holding. Section 71 of the same Act provides—

71. When any area of land of not less than ten acres in extent is planted, after the commencement of this Act, with forest trees approved of by the Conservator as being suitable for commercial purposes, the number of trees not being less than five hundred to the acre, then in computing the value of such area of land as rateable property within the meaning of any Act relating to local government, the increase in the value of such area of land by reason of the trees so planted shall not be taken into consideration.

In other words, plantations are exempt from local rates and taxes.



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## SECTION VII.

## FOREST AUTHORITY.

Up to the end of 1918 when the Forests Department was constituted under the Forest Act, it was a branch first of the Lands Department, then of the Mines Department. For two years it had a professional Conservator, and for 17 years an acting Conservator. The Act of December, 1918, established the department on a sound basis. Its powers are laid down under Section 7:—

7. (1.) There shall be a department of the public service called the Forests Department having, under the direction of the Minister, such powers, authorities, and duties as are provided for by this Act.

(2.) The department shall have the exclusive control and management of—

- (a) all matters of forest policy;
- (b) all State forests and timber reserves, and the forest produce of other Crown lands;
- (c) the planting or thinning of forests, and the making, laying out, and maintaining of plantations and nurseries, and the distribution of trees therefrom;
- (d) the granting of all permits, licenses, and forest leases under this Act;
- (e) the enforcement of the conditions of timber concessions, leases, permits, licenses, and authorities granted under this Act, or any Act hereby repealed, or otherwise;
- (f) the collection and recovery of all rents, fees, royalties, charges, and revenues of the department; and
- (g) the administration of this Act generally.

The Act further establishes, under Section 8 *et seq.*, the position of Conservator for seven years as permanent head of the department. He is a body corporate. His salary is permanently appropriated. He may be suspended for certain prescribed reasons, when he can only be restored to office by a vote of both Houses of Parliament. The Governor may appoint officers to the department after reference to the Conservator.

Only foresters having the degree or diploma of a forest school can be appointed to the professional division.

An examination is necessary before a person can be appointed to the general division.

The Act also provides for the training of forest officers and the employment and training of apprentices for the General division.

Since the Act only came into force in December, 1918, it will be readily understood that its organisation is not far advanced. At present it is divided into seven divisions:—

1. Administration.
2. Working Plans.
3. Ranging.
4. Forest Survey.
5. Timber Inspection.
6. Nursery and Plantation.
7. Research.

**Administration.**—This is established in Perth and consists of conservator, chief clerk, registrar, clerk in charge of accounts, draftsman, record clerk, publicity and exhibition officer. The above have 15 officers to assist them, and three typistes.

**Working Plans.**—This division consists of working plans officer (the appointment is not filled) and assistant working plans officer. The latter combines the position of forestry instructor.

**Ranging.**—This includes the inspecting ranger, district rangers and assistant rangers, as follows:—one inspecting ranger, five rangers, nine assistant rangers.

**Forest Survey (Classification of Forest Land).**—This division consists of three camps of forest rangers, compass men, and apprentices. The work is under the supervision of the inspecting ranger, and includes seven forest rangers and six compass men.\* The draftsman at head office plots the work from the field books.

**Timber Inspection.**—This consists of the chief timber inspector and timber inspectors, as follows:—chief timber inspector and seven timber inspectors.

**Nursery and Plantation.**—This consists of the manager of the nursery, apprentices and plantation superintendent (position not yet filled).

Reviewing these divisions, the **Administrative Division** is at present overburdened with detail work, which should be administered in each district. Lack of technically trained officers has made it impossible to decentralise it up to now, but as soon as trained district forest officers are available, the position will be remedied. The following work is done at head office. All accounts of royalty, inspection fees, etc., are drawn up and sent out. All accounts of revenue are entered and all moneys are lodged at the Treasury.\* All expenditure is segregated and debited to the various votes, and all vouchers for payment passed. All applications for permits, leases, etc., are dealt with, and when granted are registered by the registrar and marked by the draftsman. The

\*The Inspecting Surveyor and the Chief Accountant of the Mines Department superintend the drafting and accounting work until 30th June, 1920, when they both come directly under the Conservator.



## WESTERN AUSTRALIA.

draftsman also does all the plotting of the forest survey work, and the drafting work connected with working plans, demarkation of State forests and forest reserves. All correspondence passes through the records, and is indexed on the card system. Timber workers and the brands they must use to mark the stumps are registered. A publicity campaign is being conducted to form a public opinion regarding forestry, the value of our timbers and forest products, and in addition exhibits are prepared for any local or exhibitions in other States and overseas. Exhibitions have been held in Sydney, Adelaide, one is now on view in London.

The organisation, it will be seen, is not satisfactory, and it is hoped in the near future to introduce a system under which the districts will be under trained District Forest Officers, who will be responsible for the administration of the forests of these districts, and will issue all permits, leases, and other rights.

**Working Plans.**—It is hoped to fill the position of working plans officer very soon. This officer will be entrusted with the preparation of all working plans, and will act as deputy conservator when the conservator is absent. At present preliminary plans are being drawn up with the help of the assistant working plans officer, and a start has been made with working plan No. 1, jarrah country, and working plan No. 2, tuart country.

**Ranging.**—The district ranger is in charge of a district, and, according to the intensity of the exploitation, has one or two assistants. Up to the present the rangers' work has been purely revenue collecting, policing, and the inspection of land within the forest belt applied for by farmers.

**Forest Survey.**—This consists of a close classification of our timber country, with the object of—  
(1) Demarkation of State forests and timber re-

serves; (2) Exclusion of agricultural land; (3) Stock-taking of all timber, both standing and removed.

**Timber Inspection.**—The chief inspector has complete charge of the inspection of timber for export and for local use. The inspection is not only a guarantee that the timber is true to name, but also that it is up to specification. His assistants inspect and send in the returns, which are then forwarded to the accounts branch at head office for the rendering of the accounts. The chief inspector also issues the certificates of inspection to the exporting firm.

**Nursery and Plantation.**—The manager of the State nursery has entire charge of the raising and distribution of all trees, he collects the revenue derived from the sales and banks it. The plantation work is also under his charge until the superintendent is appointed; an assistant forest ranger assists him in his work, while he has two apprentices to train in both the raising and the planting of trees.

**Research** has been conducted in various ways. The department has no established laboratory, and so has sought the help of existing institutions such as Perth Technical School, where Mr. Boas investigated the paper pulping qualities of karri and jarrah timber. In the laboratory of the same institution a research is now in progress into the powellising process. Investigations into essential oils have been carried out by a private chemist, and by the Sydney Technological Museum. Kiln drying of timber and timber testing has been investigated through the co-operation of the University. Botanical research is carried out by the botanist attached to the State Explosives Department. It is hoped that the lack of co-ordination at present existing in research work will soon come to an end, though the establishment of a Federal forest products laboratory which will deal with all problems relating to our major and minor forest products.



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## Revenue and Expenditure.

The revenue since the inception of the department has exceeded the expenditure by £514,289 13s. 8d. Here are the figures:—

Year.	Revenue.	Expenditure.
	£ s. d.	£ s. d.
1st January to 31st December, 1895 ..	3,175 5 2	1,108 5 5
1st January to 31st December, 1896 ..	4,838 11 2	2,020 11 5
1st January to 31st December, 1897 ..	12,320 6 4	3,489 14 4
1st January to 31st December, 1898 ..	30,150 6 3	3,356 5 7
1st January to 31st December, 1899 ..	16,999 11 3	2,438 7 5
1st January to 31st December, 1900 ..	15,525 19 2	2,648 11 10
1st January to 31st December, 1901 ..	18,477 16 2	2,747 6 3
1st January to 31st December, 1902 ..	18,752 11 7	4,301 6 1
1st January to 31st December, 1903 ..	20,478 9 1	3,789 3 4
1st January to 31st December, 1904 ..	20,018 19 4	4,192 16 9
1st January to 31st December, 1905 ..	18,479 18 6	5,089 18 6
6 months, 1st January to 30th June, 1906 ..	10,973 18 4	3,385 1 9
1st July, 1906, to 30th June, 1907 ..	22,783 1 5	6,207 15 2
1st July, 1907, to 30th June, 1908 ..	23,498 13 3	8,801 14 3
1st July, 1908, to 30th June, 1909 ..	29,484 3 8	9,030 12 6
1st July, 1909, to 30th June, 1910 ..	31,549 6 11	8,531 0 9
1st July, 1910, to 30th June, 1911 ..	37,477 3 5	8,862 16 8
1st July, 1911, to 30th June, 1912 ..	44,560 10 10	10,469 4 10
1st July, 1912, to 30th June, 1913 ..	48,236 14 0	11,463 2 11
1st July, 1913, to 30th June, 1914 ..	53,038 16 0	12,092 15 3
6 months, 30th June to 31st December, 1914 ..	22,906 0 0	5,468 14 0
1st January to 31st December, 1915 ..	45,725 13 9	8,869 15 11
1st January to 31st December, 1916 ..	29,820 12 10	9,575 3 2
1st January to 31st December, 1917 ..	36,128 17 11	10,263 2 5
6 months, 1st January to 30th June, 1918 ..	22,113 1 8	6,199 1 11
1st July, 1918, to 30th June, 1919 ..	42,050 12 4	10,872 18 3
	£679,565 0 4	£165,275 6 8

The income and expenditure of the Department for the year ended 30th June, 1919, are given hereunder:—

Revenue for Year ended 30th June, 1919.			
<i>Licenses—</i>	£ s. d.	£ s. d.	
Woodcutters .. ..	544 2 0		
Sandalwood .. ..	25 3 0		
Timber .. ..	36 4 6		
Mallet Bark .. ..	24 15 0		
Pile and Balk .. ..	0 15 0		
		630 19 6	
<i>Royalty on Logs—</i>			
Jarrah .. ..	18,748 7 7		
Karri .. ..	5,905 6 7		
Banksia .. ..	58 6 8		
Sheaoak .. ..	4 4 2		
Pine Thinnings .. ..	178 15 0		
		24,895 0 0	
<i>Royalty on Hewn Jarrah Sleepers—</i>			
At 4s. 2d. per load ..	63 7 1		
" 4s. " ..	552 7 6		
" 3s. 9d. " ..	90 8 4		
" 3s. 7d. " ..	32 19 6		
" 3s. 6d. " ..	49 9 11		
" 3s. 3d. " ..	22 3 11		
" 3s. 1d. " ..	30 3 9		
" 3s. " ..	133 10 6		
" 2s. 6d. " ..	229 10 1		
" 2s. 1d. " ..	27 6 10		
" 2s. " ..	10 18 2		
		1,242 5 7	
<i>Royalty on—</i>			
Piles and Poles .. ..	1,023 12 0		
Beams .. ..	165 16 1		
Sandalwood .. ..	1,605 11 7		
Firewood .. ..	66 14 11		
Split Posts .. ..	1 16 3		
Shingles .. ..	11 11 10		
Blackboy .. ..	13 5 0		
Bark .. ..	5 0 0		
Extra 10 per cent. charge on overdue accounts .. ..	56 1 1		
		2,949 8 9	
Carried forward .. ..			

		£ s. d.
Brought forward .. ..		
<i>Inspection Fees on—</i>		
Hewn Sleepers, Crown Lands	398 4 4	
Sawn Sleepers, Crown Lands	270 11 6	
Sawn Timber, Crown Lands	92 10 5	
Hewn Sleepers, private property .. ..	470 11 3	
Sawn Sleepers, private property .. ..	124 6 11	
Sawn Timber, private property .. ..	13 14 9	
Piles and Poles .. ..	33 19 0	
Beams .. ..	80 11 10	
Miscellaneous .. ..	109 2 6	1,484 10 0
Tree Freight .. ..	34 13 9	109 2 6
Branding Hammer Registration Fees .. ..	36 0 0	34 13 9
Timber Workers' Registration Fees .. ..	21 5 0	36 0 0
		21 5 0
<i>Sales—</i>		
Branding Hammers .. ..	82 10 6	
Trees .. ..	349 11 0	
Publications .. ..	20 16 3	
		452 17 9
<i>Rents—</i>		
Timber Leases .. ..	8,290 0 0	
Concessions .. ..	678 0 0	
Tramlines .. ..	1,187 9 6	
Saw Mill Sites .. ..	20 0 0	
Tuart Reserve .. ..	19 0 0	
		10,194 9 6
Total Revenue for year ended 30/6/1919		£42,050 12 4

## Trust Fund.

Miscellaneous Refunds .. ..	£ s. d.
	479 7 11



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*Expenditure for Year ended 30th June, 1919.*

	£	s.	d.	£	s.	d.
Salaries .. .. .	4,741	2	10			
Wages .. .. .	2,394	11	8			
Forage Allowances .. .. .	2,105	19	7			
Travelling Allowances .. .. .	387	4	1			
Maintaining State Nursery .. .. .	241	0	5			
Ludlow Pine Plantation .. .. .	137	6	3			
Workers' Compensation .. .. .	33	8	0			
Interest on Tuart Reserve .. .. .	50	0	0			
Incidentals .. .. .	782	5	5			
				10,872	18	3

*Loan Expenditure for Year ended 30th June, 1919.*

	£	s.	d.
Classification .. .. .	1,873	18	7
Pine Planting .. .. .	1,206	12	0
Land Purchase for Tuart Timber .. .. .	329	17	6
Purchase of Locke Estate, Tuart Country .. .. .	6,751	12	6
Purchase of Tuart Reserve from Lands Department .. .. .	2,000	0	0
Advertising generally .. .. .	428	19	11
	£12,591	0	6

**Under Section 41 of the Forests Act money is provided for forest work.**

41. (1) All revenue of the department shall be paid into the Treasury.

(2) Three-fifths of the net revenue of the department, to be certified by the Under Treasurer, shall in every financial year be placed to the credit of a special account at the Treasury, and shall form a fund for the improvement and re-forestation of State forests and the development of forestry, and such fund may be expended by the Conservator with the approval of the Minister without any other authority than this Act.

Provided that a scheme for such expenditure shall be submitted annually to and shall be subject to the approval of Parliament.

(3) The balance of the revenue of the department shall be paid into the consolidated revenue fund.

(4) All moneys appropriated annually by Parliament for the purposes of this Act shall be expended under the control and management of the Conservator, with the approval of the Minister.

(5.) The revenue of the department shall include all royalties and proceeds of the sale of forest produce, license fees, rents, and damages awarded for offences against this Act, and all rents and royalties payable under leases, licenses, and permits granted under any Act hereby repealed, or payable under any other existing timber leases or concessions.

The Crown Law authority has laid down the net revenue as being the revenue after deducting all expenditure incurred in collecting the revenue, all services rendered by other departments of the State, and the interest and sinking fund on loan moneys expended to date. Thus in the first half year under the

Act the revenue was £22,169 14s. 2d., and the expenditure under the various headings was:—

	£	s.	d.
Administrative expenditure from Consolidated Revenue Fund .. .. .	5,978	10	3
Printing .. .. .	192	18	3
Lithographing .. .. .	56	18	4
Advertising .. .. .	485	10	2
Services—Mines Department .. .. .	307	10	0
Classification of Timber Lands .. .. .	1,231	0	0
Interest on Loan Funds—6 months at 4½ per cent. per annum .. .. .	804	14	3
Sinking Fund on General Loan Fund—6 months at ½ per cent. per annum .. .. .	55	14	8
	£9,112	15	11

The scheme of expenditure for 1919-1920 assented to by Parliament was:—

*Funds available.*

Funds under Section 41 of the Act accumulated since the 3rd January, 1919, the date on which the Forests Act was assented to—£14,000.

	£	£
Estimated Revenue, 1919-1920 .. .. .	47,000	14,000
Estimated Expenditure, 1919-20 .. .. .	12,000	
Net Revenue .. .. .	35,000	
Proportion under the Act .. .. .		21,000
Total Funds available, 1919-1920 .. .. .	£35,000	

*Allocation of Funds.*

	£
Working Plan No. 1 .. .. .	18,800
Working Plan No. 2 .. .. .	6,000
Forests Products Laboratory .. .. .	5,000
Research Work .. .. .	5,000
Publicity .. .. .	200
	£35,000

In addition to money provided from consolidated revenue on the Estimates to meet cost of collecting the revenue and money provided under Section 41 of the Act, loan moneys are provided for the following purposes:—Pine planting and purchase of land.

**Forest Training.**—There is no provision within the State for the education of superior staff (Professional Division). The consensus of opinion is that there is only room for one good forest school for the whole Commonwealth and that Western Australia is not the best site for such an institution. I hope that co-operation between the States will be established and this object achieved. In the meantime, students desiring to take the professional course go to Adelaide University where there is a lecturer in forestry. Two students for Western Australia are now taking this course. Every State of the Commonwealth is in the same serious predicament; all the forestry departments are crying out for trained foresters and none is available owing to the lack of a good forestry school.



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The subordinate staff is being trained on the apprentice system. Youths of 14-15 years are selected and bound to the Conservator for four years, during which time they receive a training in the theory and practice of forestry. The older hands who were in the department prior to the inauguration of the apprentice system and men who have been appointed temporarily as Assistant Rangers to cope with the growing work are being trained by correspondence, mimeographed lectures are sent out weekly to all these men. As explained above, it will be necessary for these officers to pass examinations in the work before they can be appointed or promoted to positions on the subordinate staff.

**Publications and Reports.**—In addition to the annual report, general propaganda work has been inaugurated through the columns of the metropolitan and country press and pamphlets. It will be necessary also to publish official bulletins on various forest subjects. Up to the present one has been issued, viz., "Kiln Drying of Jarrah."

## SECTION VIII.

FORESTRY ACTIVITIES, MUNICIPAL,  
ETC.

As explained in connection with the nursery work, the planting done up to date has been mainly the making of shelter or wind breaks and the planting of trees for ornament.

## SECTION IX.

## FORESTRY SOCIETIES.

The only society in Western Australia founded with the avowed object of assisting in the preservation of the nation's forest land is the W.A. Branch of the Australian Forest League, with office at West Australian Chambers, St. George's Terrace, Perth. The league issues a quarterly journal called "Jarrah."

## SECTION X.

EDUCATIONAL, RESEARCH, AND  
EXPERIMENTAL WORK.

Under Section VII. I dealt with Educational and Research to a certain extent.

**Education.**—There is no school of forestry for training higher forest officers in Western Australia.

**Research.**—There is no forest products laboratory in Western Australia, and research that has been required by the department has been done by outside chemists. The importance of establishing a forest products laboratory under Federal control to investigate all the forest produce problems of the Commonwealth is now well recognised, and there seems some hope of the laboratory being established in Western Australia. The State Government is providing a site and £5,000 towards the cost of the institution. The Federal Government have appointed Mr. I. H. Boas to take charge of forest products investigations, and it is expected that the necessary legislative enactment will pass the Federal Parliament giving authority to establish the laboratory. The following research has been carried out:—Value of certain eucalyptus oils derived from local trees. Kiln-drying of eucalypt timber (Tiemann process). Testing of physical properties of certain of our timbers not investigated by Julius. Paper pulping qualities of karri and jarrah. The penetration of the arsenic into timber subjected to Powell's process of impregnation, also research into the problem of the apparent chemical combination of the sugar with the timber in the same process (still in progress). Seasoning of sleepers (jarrah, karri, Powellised jarrah and Powellised karri) by air drying, the determination of moisture content when the timber ceases to lose weight—three years, its hygroscopicity and its shrinkage. Collection of a forest herbarium and the determination by the botanist attached to the State Explosives Department of the species. Collection of tan barks and the analysis by the Government Analyst of their tannin contents.

**Experimental Work.**—Twenty-five sample plots of five acres each have been selected in the main forest belt—jarrah, karri, and tuart—and all trees growing on them have been measured twice. The collection of botanical and entomological material. Experiments in the tuart forests with a view to ascertaining the best method of securing a regeneration of the species.



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## SECTION XI.

## ANNUAL INCREMENT AND UTILISATION OF HOME-GROWN TIMBER.

A. The small areas of virgin jarrah, karri, and tuart country still remaining are naturally only growing at the rate that they are dying. In other words, there is no increment. In the cut over country, that is country over which the large sawmills have worked, only the best timber has been removed, while all over-mature and faulty timber has been

left. Here the growth of the undersized timber is retarded by the older trees and by fires, so that the increment is very low. The figures collected from measurements of 25 sample plots are not sufficient to enable anything but an estimate to be made. There are many areas which have been so damaged by fire as to make no growth at all.

TABLE III.  
ANNUAL INCREMENT.

	Area, sq. miles.	Estimated Increment per sq. mile.	Total Gross Increment.	Loss.			Net Increment.
				Fire.	Waste, De- cay, etc.	Total.	
Under State Control ... ..	4,605	?	?	?	?	?	Loads. 266,300
Other ... ..	...	...	...	...	...	...	...
Total ... ..	4,605	...	...	...	...	...	266,300

B. Table IV. includes all timber cut and removed, whether in the round or sawn or hewn, but does not include firewood and mining timber, of which in 1918-19 the consumption was as follows:—

	Tons.	Pumping Stations, Goldfields Water Supply, Nos. 5, 6, 7, 8, plus other small pumping plants	Tons.
Wood fuel consumed on Greenbushes Mining Fields .. .. .	15,120	Household wood, Goldfields .. .. .	7,599
Mining Timber consumed on Collie Coal Fields	3,464	Bakers' wood, Goldfields .. .. .	35,059
Wood fuel consumed in Metropolitan Area ..	154,500	Breweries, Cordial Factories, Electric Light Plants, Batteries (State and Private out- side Golden Mile Batteries) .. .. .	16,181
Wood fuel consumed on Golden Mile, Cool- gardie, and Norseman Mines .. .. .	333,565	Engine wood consumed on Tramways .. .. .	6,781
Mining timber consumed on Golden Mile, Cool- gardie, and Norseman Mines .. .. .	8,700	Electric Power and Light .. .. .	14,909
Wood fuel consumed on Northern Goldfields, Lancefield, Gwalia, Menzies, and Ora Banda .. .. .	76,605	Wood fuel used as charcoal on Eastern Gold- fields .. .. .	50,976
Mining timber consumed on Northern Gold- fields .. .. .	2,072	Sleepers .. .. .	300
Wood fuel consumed in Southern Cross Areas, Westonia, Bullfinch, and Golden Valley	35,779		3,300
Mining timber consumed in Southern Cross Areas .. .. .	18,087		
			*782,997

Nor does the table include sandalwood and mallet bark, since these two products are measured by the ton.

	Tons.	£
Sandalwood .. .. .	6,661	66,308
Mallet .. .. .	4,310	36,293

The quantity of timber cut under private or municipal control forms so small a percentage of the total cut as to be negligible.



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TABLE IV.  
ANNUAL UTILISATION.

Type of Product.	Quantity.	Value at the place of preparation.
	Loads.	£
Jarrah ... ..	251,353	} 930,884
Karri ... ..	14,281	
Tuart ... ..	819	
Wandoo ... ..	793	
York Gum, Morrell, Yate, Jam	1,581	
	268,827	930,884

NOTE.—These figures represent for the most part square sawn, or hewn timber, and to arrive at the utilisation in the round for comparison with the increment, it is necessary to take into account the recovery by the Saw-mills, which amounts to (averaging all timber) 33-1/3rd per cent. 268,827 loads therefore represent 806,481 loads in the round.

## SECTION XII.

## FOREST INDUSTRIES.

Table V. hereunder does not include a number of minor industries which employ less than four persons and so escape the State Statistician's net.

TABLE V.

Industry.	Volume of Timber turned out or consumed.	Value of Product at the place of preparation.	No. of persons employed.
	Loads.	£	
Forest Sawmills and Timber Hewers ... ..	268,723	930,884	5,360
Town Sawmills and Joinery Works ... ..	Not obtainable	175,026	445
Box and Packing Case Making and Cooperage ... ..	do.	6,884	34
Chair Making ... ..	do.	5,529	26
Coach and Motor Body Building ... ..	do.	8,915	296
Boat Building ... ..	do.	9,494	32
Billiard Table Making ... ..	do.	455	2
Furniture ... ..	do.	112,094	33
Picture Frame Making ... ..	do.	8,148	22
Perth Firewood Yards ... ..	do.	62,606	165
Mining Timber and Firewood ... ..	782,997 tons	548,097	1,469
West Australian Government Railways and Tramways ... ..	21,956 loads	68,306	143
	* 290,679 loads	1,936,438	8,027

\* Sawn and hewn timber only.



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SECTION XIII.  
IMPORTS AND EXPORTS.TABLE VI.  
AVERAGE ANNUAL IMPORTS AND EXPORTS OF TIMBER.—(AVERAGE FOR 11 YEARS, 1909-1919).

Country of— A. Destination ; B. Origin.	A.—Exports.		B.—Imports.		Balance—Plus or Minus.	
	Quantity in Loads.	Value, £.	Quantity in Loads.	Value, £.	Quantity in Loads.	Value, £.
United Kingdom ... ..	14,362	56,930	205	1,163	+ 14,157	+ 55,767
Ceylon ... ..	2,506	8,473	...	2	+ 2,506	+ 8,471
India ... ..	35,968	114,722	335	1,899	+ 35,633	+ 112,823
Mauritius ... ..	500	2,001	...	...	+ 500	+ 2,001
Natal (to 1914) ... ..	9,079	25,659	...	...	+ 9,079	+ 25,659
New Zealand ... ..	13,932	59,348	1,008	5,678	+ 12,924	+ 53,670
Singapore ... ..	132	518	...	...	+ 132	+ 518
Argentine ... ..	1,365	5,438	...	...	+ 1,365	+ 5,438
Belgium ... ..	2,173	8,772	4	18	+ 2,169	+ 8,754
Egypt ... ..	5,671	22,930	...	...	+ 5,671	+ 22,930
France ... ..	5	18	1	5	+ 4	+ 13
Germany ... ..	351	1,473	164	939	+ 177	+ 534
Holland ... ..	11	43	9	44	+ 2	— 1
Java ... ..	21	83	3	14	+ 18	+ 69
Philippine Islands ... ..	936	3,748	14	18	+ 922	+ 3,730
Portuguese East Africa ... ..	2,107	8,289	...	...	+ 2,107	+ 8,289
Uruguay ... ..	2,666	10,662	...	...	+ 2,666	+ 10,662
Cape Colony (to 1914) ... ..	11,228	45,336	...	...	+ 11,228	+ 45,336
China ... ..	770	3,143	4	22	+ 764	+ 3,121
Straits Settlements ... ..	7	28	331	1,411	— 224	— 1,393
Brazil ... ..	335	1,338	...	...	+ 335	+ 1,338
Italy ... ..	7	31	3	17	+ 4	+ 14
Hong Kong ... ..	4	15	...	...	+ 4	+ 15
U.S. of America ... ..	...	3	9,407	50,215	— 9,407	— 50,212
South Africa (since 1914) ... ..	12,987	53,473	...	2	+ 12,987	+ 53,471
Ocean Island ... ..	6	23	...	...	+ 6	+ 23
Tonga, Pacific Islands ... ..	1	4	...	...	+ 1	+ 4
Canada ... ..	...	...	37	184	— 37	— 184
Russia ... ..	...	...	172	1,088	— 172	— 1,088
Switzerland ... ..	...	...	...	1	— ...	— 1
Sweden ... ..	...	...	2,352	12,667	— 2,352	— 12,667
Norway ... ..	...	...	826	4,539	— 826	— 4,539
Austria ... ..	...	...	...	1	— ...	— 1
Japan ... ..	...	...	449	2,474	— 449	— 2,474
Siam ... ..	...	...	20	102	— 20	— 102
East Indies ... ..	...	...	4	21	— 4	— 21
Borneo ... ..	...	...	...	1	— ...	— 1
Commonwealth of Australia— Eastern States ... ..	64,849	258,997	2,873	15,278	+ 61,976	+ 243,719
Grand Total ... ..	181,329	689,104	18,221	97,803	+ 163,108	+ 591,301

During the above period an average of 6,661 tons of sandalwood, valued at £66,308, were exported annually to China, and during the same period an average of 4,627 tons of mallet bark, valued at £39,324, were exported annually.



SECTION XIV.

SUMMARY AND OUTLOOK.

A. There is no doubt that Table VII. is the most important table in the report which has been asked for. To all intents and purposes it sets out the forest budget of the State. For such an important table it is necessary that there should be some explanation of the figures that are given. In the first place, the net increment, which is taken from Table III., is given in the round, that is to say it is the net increment in round timber growing in the forest, not the sawn timber that will be obtained by the converter. The other figures—of utilisation, export, home consumption, and import—are measured in the square. It is necessary, therefore, in order to compare the two, to convert the square timber into round. The average recovery in this State by the sawmiller is 33 $\frac{1}{3}$  per cent. It is necessary, therefore, to multiply the figures in the square by 3 to arrive at the number of loads of round timber

utilised. I have, therefore, added a second line giving the figures measured in the round.

Following the printed instructions received from the Forestry Commissioners regarding this table, I have deducted the net increment from the total home consumption to arrive at the debit balance. The figure thus obtained, 50,857 loads, is undoubtedly of great interest. At the same time, I would point out that, in a young country with a small population such as Western Australia, which boasts at the same time a comparatively large export trade, a comparison between the net increment and the total utilisation is a figure which is more important from a forestry standpoint. This comparison leaves a debit balance of 540,181 loads. In other words, *Western Australia is going to leeward at the rate of 500,000 loads a year over the rate of growth of her forests.*

A.

TABLE VII.

Type of Product.	Utilisation.	Exports.	Home Consumption of home-grown Timber.	Imports.	Total Home Consumption of Home and Imported Timber.	Net Increment.	Debit Balance.
1	2	3	4	5	6	7	8
	loads.	loads.	loads.	loads.	loads.	loads.	loads.
Squared Timber (sawn or hewn) ...	268,827	181,329	87,498	18,221	105,719	...	...
Timber measured in the round ...	806,481	...	...	...	317,157	266,300	— 50,857
Total Consumption of Sawn Timber per head of population—(331,660 inhabitants)	45 cubic feet.	27 cubic feet.	13 cubic feet.	2.7 cubic feet.	16 cubic feet.	...	...

B.—Duration of Supplies.

It is quite impossible to estimate the duration of supplies, owing to the lack of full information regarding the present stocking and the rate of growth. One thing is certain, and that is, that there is to-day no area of virgin jarrah forest not already held under sawmilling tenure of sufficient size to keep a large mill going for 10 years. Fifteen years will see the exhaustion of the large mills, but over the same country which these timber butcheries have operated there will then work a large number of small mills which will utilise the mature trees which the big miller left behind him as valueless. With the start of silvicultural work we may

expect to see an increment per annum exceeding European figures. The control or suppression of fire alone will have a tremendous effect on the general growth of the timber and the density of the stocking. With proper forest management and sound silvicultural treatment there is no reason why there should not be built up on the wreckage of the once splendid forests of Western Australia tended forests which will yield for all time 100 cubic feet of timber per acre per year. The forest survey at present in progress is yielding the necessary data regarding the condition of the forests throughout the whole of the South-West, and figures



## WESTERN AUSTRALIA.

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will be available next year as to the total area of virgin forest and the area of cut-over country and the stocking on each. In three years' time our sample areas will yield figures which I trust will enable yield tables to be drawn up fixing the rotation and increment of the various types of forest.

In estimating the probable duration of supplies there is a factor which is not at present known, and that is the degree of profitableness of areas of country outside the prime jarrah, karri, wandoo, and tuart belts. There are indications at present that, with the rise of the price of timber and the cutting out of the larger prime timber, sawmillers will find a use for the second class timber, which, as will be seen from Table I., extends over an area of 21,000 square miles, or 16,000 square miles in excess of the area of merchantable forest.

### C. Short Summary of steps which should be taken to protect and develop the Forest Resources of the Country.

The first step to be taken is the provision of *an adequate system of Forestry Education*. The area of forests in Western Australia is inadequate to absorb a sufficient number of foresters to warrant the establishment of a first class forestry school in the State. The alternative of establishing a lectureship in forestry at the Western Australian University is a "pis aller." All other States of the Commonwealth are in precisely the same position. The number of qualified foresters in Australia at present is eight:—

Each State is desirous of obtaining the services of trained Working Plans Officers, Assistant Conservators, and District Officers. At present there is only the Adelaide University Forestry course, and this is, in the writer's opinion, inadequate for the training of foresters for the whole Commonwealth. It is eminently desirable that co-operation between all the States be effected and one first class forestry school be established to train all foresters for the Commonwealth. Such a school should be situated in the State which has the widest range of forest conditions, and the conditions indicate that New South Wales is the State which should be selected. In that State a forest student could study every form of Australian forest conditions, from the savannah forests through the sclerophyllous to the hygrophyllous forests of the Northern rivers. Such a school should receive only students who hold a University degree of science or have at least two years' on the science side of a University, with qualifying certificates of class examinations. The teaching staff should consist of foresters who have specialised in the various branches of their profession. It would be desirable to provide scholarships for men who have shown special abilities in the Australian

school to enable them to visit Europe and study the systems of forestry in countries where forestry has been practised for 300 years. It would be of material assistance were an Imperial forestry school established in England where these men could complete their training.

In the second place, a sustained yield of timber must be achieved. A glance at the last table will convince anyone that, if we are to avoid a long period of lean years, we must immediately curtail the rate of cutting. We have been mining our forests and have cut capital as well as interest. The sawmillers hold cutting rights, and these are protected under the Forests Act of 1918, but such rights are held subject to regulations which may be made from time to time for the perpetuation of the forests and the timber industry, and it behoves the country to see to it that such regulations are promulgated. It will be necessary also to reduce the export of first class timber cut into sleepers. The bulk of our pre-war export consisted of jarrah sleepers, and the use of the highest grade of so fine a structural and furniture timber for so degraded a purpose is sheer prostitution. By establishing a low specification for sleepers and only permitting the cutting of sleepers from faulty timber, this object could be achieved. If buyers overseas still persist in requiring furniture grade timber for their sleepers, then the export of such sleepers should be prohibited.

Hand in hand with the cessation of the sleeper trade as we have seen it up to date must come the utilisation of the first grade jarrah and karri for purposes for which it is best suited. Jarrah was known as "mahogany" in the early days of the colony, and certainly deserves that name as much as the twenty odd species of wood commonly sold as mahogany, as anyone will vouch for who has seen furniture made of it. Past governments encouraged all and sundry to take up our forests under sawmilling tenure, and the competition and overcutting has resulted in the timber being sold for the worst possible uses. It is necessary to set to work and find markets for it for such purposes as cabinet-making, joinery, parquet flooring, panelling, flooring, joists, and all building purposes. What applies to jarrah applies still more to karri. Here we have been degrading a queen of superstructural timbers by selling it for sleepers, and since it, like many other timbers which cannot boast the same physical qualities of strength, is not durable, we have established large works to impregnate the timber to make it durable as a sleeper in the ground.

The radical step of closing down a sufficient number of mills to reduce the annual out-turn to the increment of the forest is the obvious one, and would effect the whole of the object in view; but the de-



## WESTERN AUSTRALIA.

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moeracy of Western Australia is not likely to take such a course, not even to the extent of closing down its own State sawmills,\* for the very easily understood reason that trees have at present no votes. The country has taken the first step towards sound forest working by passing a Forests Act and establishing some continuity of forest policy. Also, it fully realises the situation as is shown by the fact that all applications for virgin forest—small areas of these are still to be found around existing sawmilling holdings held by large sawmillers—have been refused. Realising the political situation, I therefore advocate the milder course of making a better market for our timber and so reducing the waste and extending the life of our forests. In the matter of waste, the jarrah sawmiller recovers 40 per cent. to 50 per cent. of the round log measured on the quarter girth system, that is to say, about  $33\frac{1}{3}$  per cent. of the true contents; the rest of the log goes over the mechanical elevator into the fire, which is lit when the mill starts and goes out when there is no more timber to butcher. The karri sawmiller recovers 33 per cent. on the quarter girth measured log. He therefore destroys 74 per cent. of the log. In a normal year Western Australian sawmillers burn 500,000 tons of marketable timber, that is exclusive of rotten hearts, sawdust, and timber destroyed by sleeper hewers, which I am glad to say has been somewhat reduced of recent years, nor does this take into account crown, limb, and stump timber left in the forest. Such destruction of national wealth needs to be seen to be realised. If hand in hand with the reduction of waste and consequent prolongation of the cut of our visible supplies sound sylvicultural work is undertaken for the improvement of the cut-over forests, a position will be gradually reached when the annual increment equals the annual out-turn of timber, and a sustained yield from our forests will be achieved.

In the third place, a forest products laboratory is required to investigate the various problems confronting the forester in the utilisation of his major and minor forest produce. When the area of forest country is considered, and also the fact that up to date Western Australia has done nothing but cut timber and strip tan barks, it will, I think, be admitted that there is a vast field for thorough forest research. The immediate problems for solution are:—

1. Timber Utilisation.—Research in the direction of discovering new uses for jarrah and karri and uses for timbers which to-day are either little used or not used at all, such as sheoak, banksia, bullich, marri, etc.

2. Timber Physics.—Research into the physical properties of the various timbers. Without this research work, No. 1 cannot well be carried out.

3. Research into Essential Oils.—Up to date the only oil that has been investigated to any extent is the oil derived from sandalwood (*santalum cyg-*

*norum*). A thorough research into the essential oils derived from the leaves, fruits, and woods of all our forest species would doubtless yield valuable results.

4. Research into Gums.—The blackboy (*Xanthorrhoea Preissii*) has already been referred to. Prior to the war large quantities of the South Australian variety of this gum were exported to Europe for industrial purposes.

5. Wood Distillation.—Little or no work has been done in connection with wood distillation. The group of gold mines at Kalgoorlie known as the "Golden Mile" absorb close on half a million tons of firewood per annum. This wood is hauled 100 miles, and over two square miles of savannah forest are cut out daily to meet the fuel requirements of the mines. A research having for its object the better utilisation of this wood fuel by conversion of it into charcoal and chemical by-products would mean the saving of a vast amount of valuable forest products and the opening of a new business in the distillates.

6. Timber Impregnation.—Though large sums have been spent by the State on a process for rendering a queen of superstructural timbers, viz., karri, immune from white ants and from dry rot, very little research has been conducted towards standardising a method or determining the chemical processes involved in the operation, nor has the matter received thorough investigation from the commercial standpoint, so far as the question of cost is concerned. With the systematic cutting out of the virgin jarrah country there will be a shortage in the near future of long timbers for piles for jetties and harbour works, and it will be necessary to impregnate timbers which up till now have been regarded as useless for the purpose. The use of marri for piles would effect a great saving in the forest budget, for at present the very best of the future milling timber is being taken out to supply piles for harbour works within the State.

7. Paper Making.—Australia imports practically the whole of her paper requirements, and research is very necessary in the direction of finding a local wood which can be used for the manufacture of paper pulp. A certain amount of research has already been carried out in this direction with very encouraging results, but the range of the investigation was too small to enable any definite commercial conclusions to be arrived at.

8. Tanbarks.—Mention has been made of the very high tannin content of the kino derived from marri (*Euc. calopylla*), and the fact that this species can be tapped again and again of its kino without killing the trees. There is in the forests of this species, therefore, a large and inexhaustible supply of tannin material of great potential value. The difficulty up to the present has been that the leather tanned with this material is all of a dark red colour and is, in consequence, unsaleable on the English market. It has been possible to decolourise the solution of marri, but the resulting liquor has only proved efficacious for

\*These sawmills consist of the State sawmills and the Railway mills, which do not come under the control of the Forests Department, but are controlled, in the one case, by the Minister for Works, and in the other by the Commissioner of Railways. The former are purely commercial mills, the latter supply timber for railway purposes.



## WESTERN AUSTRALIA.

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light hides, such as kangaroo, wallaby, kid, etc., and has failed with heavy hides such as are used for the manufacture of sole and harness leather. Research into the marri kino is one which, if it attains the object of solving the problem of decolourising the tannage, will prove of the highest value to the State, Commonwealth, and Empire.

There are also a number of barks carrying percentages of tannin varying between 15 and 30 per cent. These up to date have proved unprofitable for export; freight on the railways and freight overseas have eaten the profits, but research is now needed into the manufacture of tannin extracts from these relatively lower tannin bearing materials, with a view to the erection of tannin extract works and the export of the manufactured extract overseas.

As in the case of the forest school for the training of the professional division, I am strongly of opinion that there should only be one forest products laboratory for the whole of Australia. The desirableness of establishing such a laboratory has already been considered by the Federal authorities, and a tentative agreement has been arrived at under which a Federal forest products laboratory may be established in Western Australia. The State has agreed to find the site, and a sum of £5,000 towards the cost of the buildings. The Federal Government has agreed to erect the buildings and equip them and pay all salaries and maintenance charges. The establishment of this institution must, however, await the legislative enactment entitled "The Science and Industry Bill," which is, I am given to understand, to be considered by the Federal House this session.

In the fourth place, two wide publicity campaigns are required.

(a) A publicity campaign in Western Australia, the object of which would be to form a strong public opinion regarding the proper management and util-

isation of the forest heritage of the State. Some foresters who have visited this State have been so disheartened by the condition of affairs they have found that they have said that there will be no forestry in Western Australia until the last tree has been cut down. I do not hold this pessimistic view, but consider that, by a publicity campaign, the democracy will realise the wealth that the forests represent. It is true that trees to-day have no votes, but when the people develop a forest conscienceness the position will be entirely altered, and they themselves will see to it that the forest policy is maintained and the forests are used for the benefit of the community as a whole for ever, and not for the benefit of the few sawmillers, timber hewers, and timber merchants of to-day.

(b) A publicity campaign in Europe.—We have now reached a stage when it is essential, in order to extend the life of our forests, that we should use a far larger percentage of the trees that we cut down, and the only way by which this can be done is to develop markets in the heavy wood-using countries—England, France, and other countries of the Continent of Europe. There is no doubt that once jarrah and karri come to be used for their proper purposes for structural work—flooring, furniture, and cabinet work—a very large market will be opened up for them; and to advertise the qualities and uses of these timbers a publicity campaign is indispensable.

The publicity campaign in Western Australia can be conducted by the Forests Department and by the Western Australian Branch of the Australian Forest League.

The European campaign should also be conducted through the agency of the Government of Western Australia, but it would be of material assistance if there were some Imperial organisation to assist such a campaign.

Perth, W.A.,  
15th May, 1920.

C. E. LANE-POOLE,  
Conservator of Forests.



## WESTERN AUSTRALIA.

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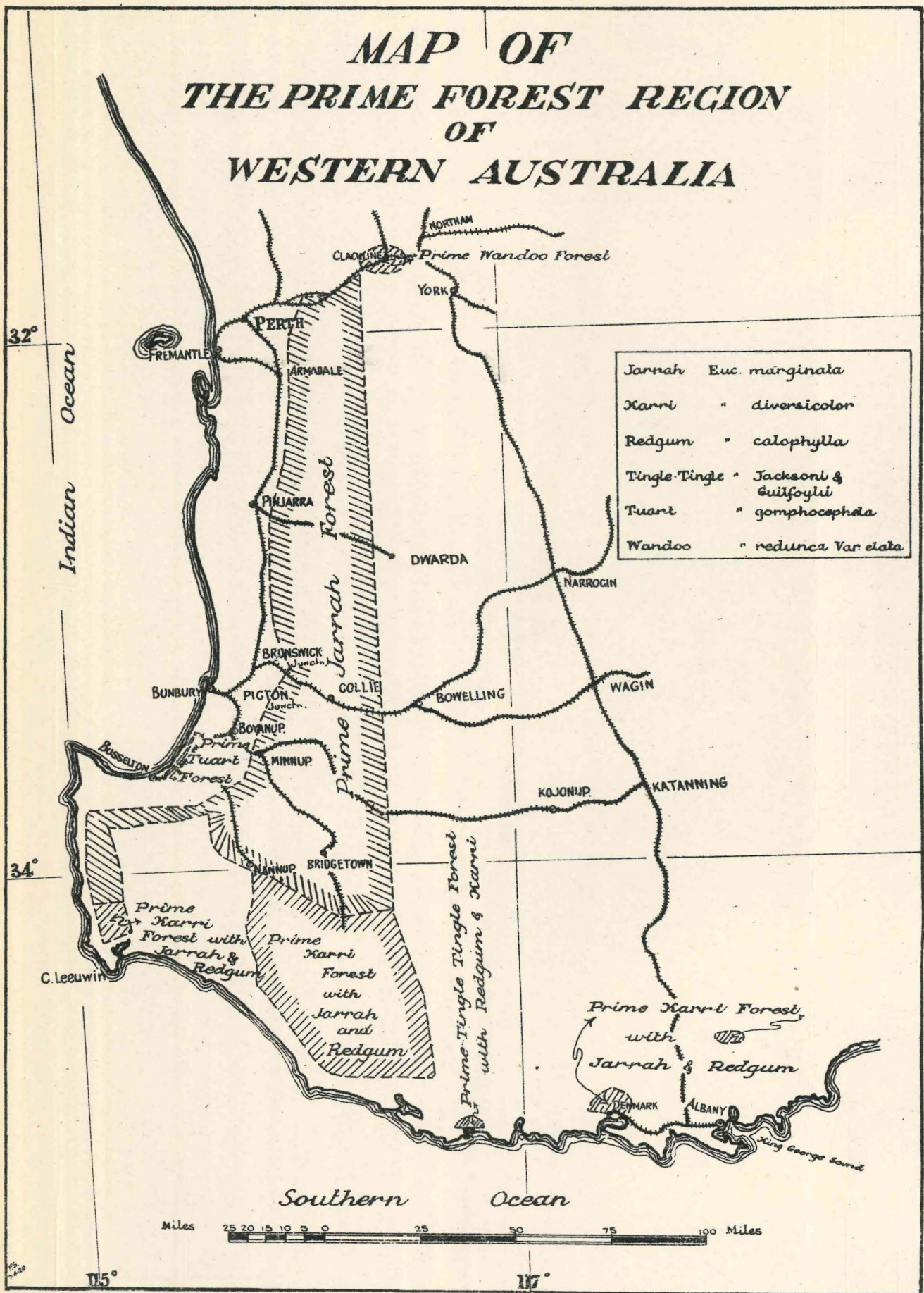
## APPENDICES.

- A.—Report of a Select Committee on the Protection of Sandalwood of Immature Growth, 1881.  
 Report of a Commission on the Relative Values of Karri and Jarrah Timbers for Construction Works, particularly for Submarine Operations, 1887.  
 Report of Select Committee on the Export Timber Branding Bill, 1892.  
 Report of Royal Commission on Forestry, 1903.  
 Final Report of Royal Commission on Forestry, 1904.  
 Report of Board of Inquiry into Timber Industry, 1906.  
 Report of Select Committee of the Legislative Council on Kingia Grass Tree Concession Bill, 1917.  
 Report of Royal Commission on Agriculture, 1919.
- B.—Land Act, 1898, Part XI.  
 Land Act Amendment Act, 1904.  
 The Forests Act, 1918.
- C.—“The Forests of Western Australia and their Development,” by J. Ednie Brown, Conservator of Forests for Western Australia, 1899.  
 “The Physical Properties of Hardwoods of Western Australia,” by C. A. Julius, B.Sc., M.E., 1906, and abridged edition, 1918.  
 “Notes on the Timbers of Western Australia suitable for Railways, Engineering Works, and Constructional Purposes Generally,” 1906.
- “The Physical Properties of the Hardwoods of Australia,” by C. A. Julius, B.Sc., M.E., 1907.  
 “Reports on portions of Kimberleys,” W. V. Fitzgerald.  
 “Botany of Kimberleys,” W. V. Fitzgerald.  
 “The Plants around Sharks Bay,” Von Mueller.  
 Plants of North-Western Australia, Von Mueller.  
 Forests and Timber Trade of Western Australia, Von Mueller.  
 “A Discussion of Australian Forestry, with Special References to Forestry in Western Australia,” 1916, by D. E. Hutchins.  
 Bulletin No. 1 of the Forests Department, “The Kiln Drying of Jarrah,” by C. E. Lane-Poole, Conservator of Forests, Western Australia, 1919.  
 A series of popular illustrated pamphlets descriptive of the forests and the trees in them.  
 A graph showing the relative strengths of seven Western Australian timbers and oregon.
- D.—“Pflanzenwelt von West-Australien,” Dr. L. Diels.  
 “Fragmenta Phytographiae Australiae occidentalis,” L. Diels and E. Pritzel, Leipzig, 1905.  
 “Jarrah,” a quarterly issued by the Australian Forest League.  
 “On the Rapid Seasoning of Jarrah,” by Alfred Tomlinson, M.Sc., Assoc.M.I.C.E., M.C.I., London.  
 “Our Forests,” pamphlet published by the Australian Forest League.



Vegetation.

# MAP OF THE PRIME FOREST REGION OF WESTERN AUSTRALIA

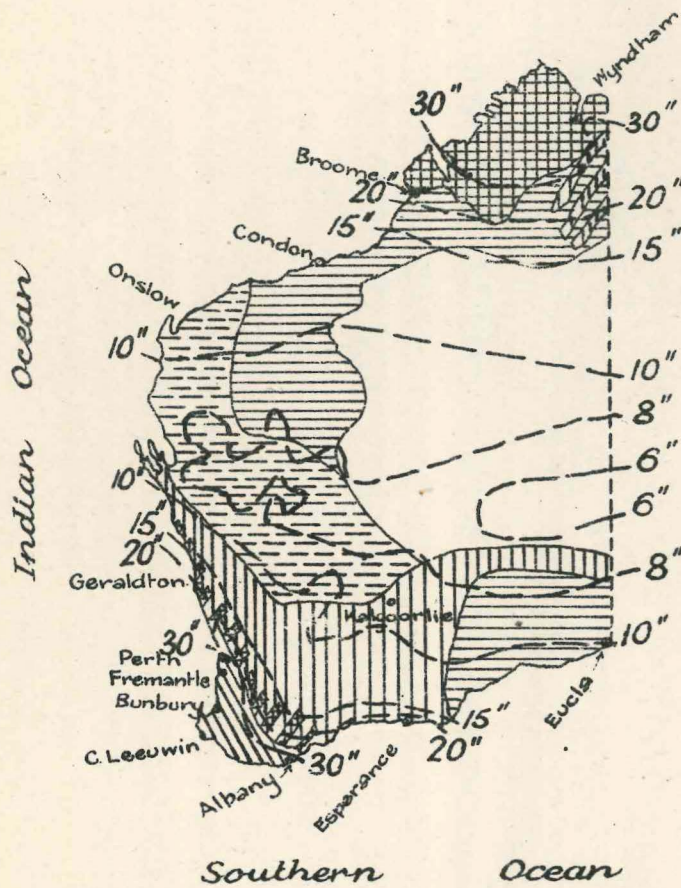








By Authority: FRED. WM. STIMPSON, Government Printer, Perth.



# VEGETATION MAP OF WESTERN AUSTRALIA

(after Diels)



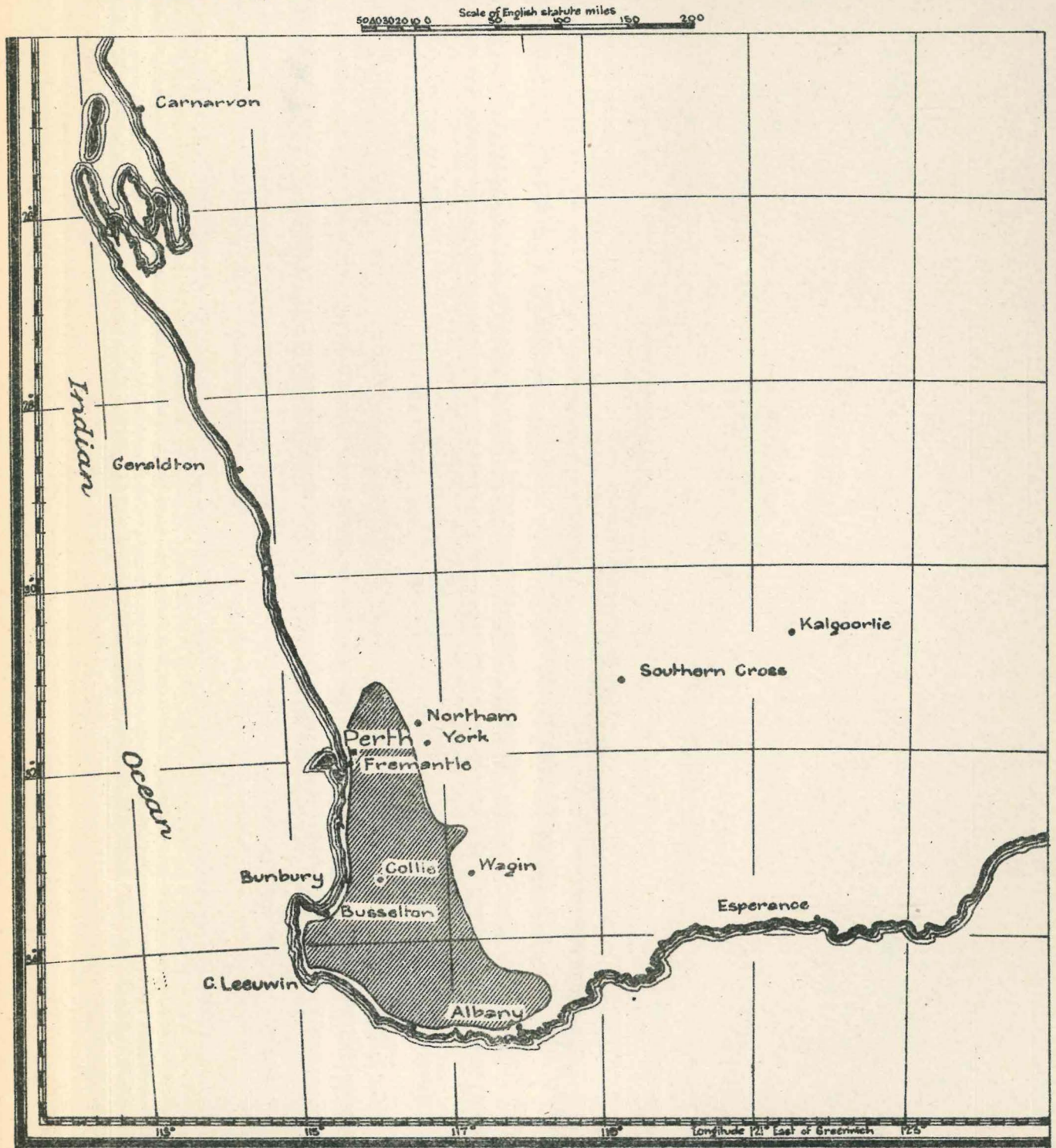
- |   |                                   |   |                                       |
|---|-----------------------------------|---|---------------------------------------|
|  | <i>Sclerophyll<br/>Wood Lands</i> |  | <i>Mulga-Scrub</i>                    |
|  | <i>Savannah<br/>Wood Lands</i>    |  | <i>Mallee-Scrub<br/>Sand-Plain</i>    |
|  | <i>Savannah</i>                   |  | <i>Sand-Plain<br/>&amp; Spinifex.</i> |

Scale: 0 50 100 200 Miles

15.20  
1.1.20



# MAP OF PORTION OF WESTERN AUSTRALIA Showing the Habitat of Jarrah (*Euc. Marginata*)

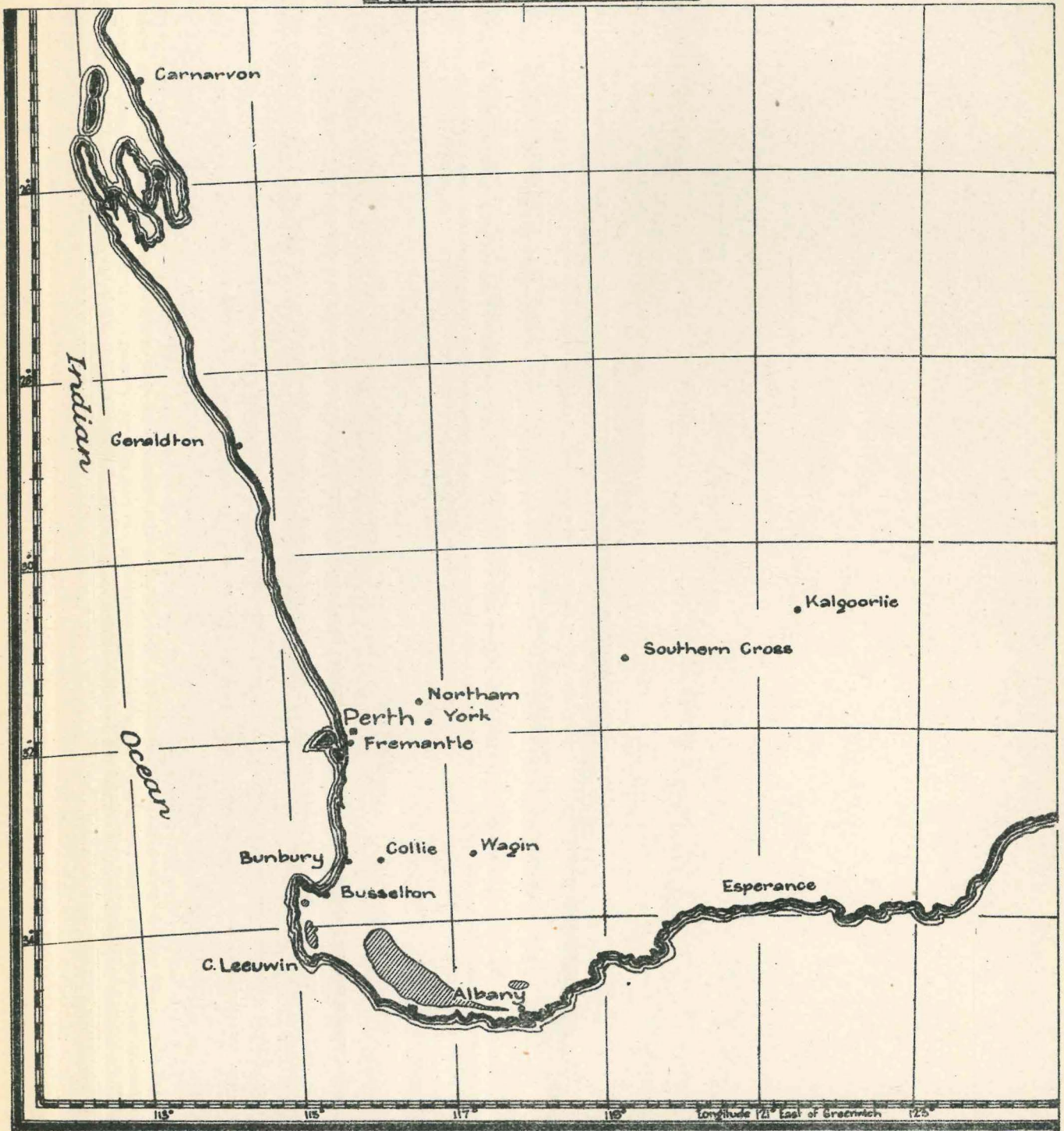


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**MAP OF PORTION OF WESTERN AUSTRALIA**  
**Showing the Habitat of Karri (*Euc. Diversicolor*)**

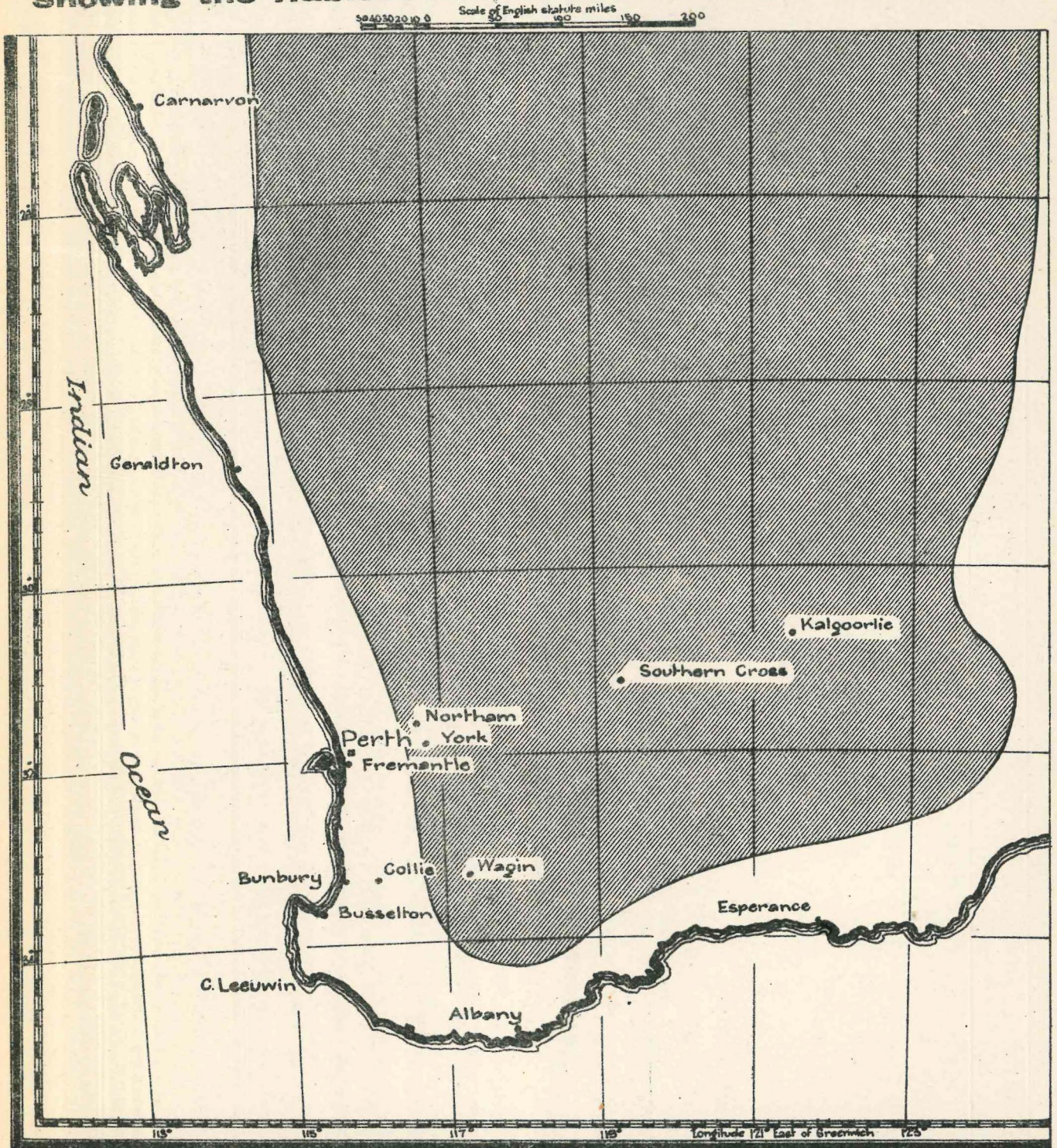
5040302010 0 Scale of English statute miles 50 100 150 200



By Authority: FRANK W. SIMPSON, Government Printer, Perth.



**MAP OF PORTION OF WESTERN AUSTRALIA**  
**Showing the Habitat of Sandalwood (*Santalum Cygnorum*)**

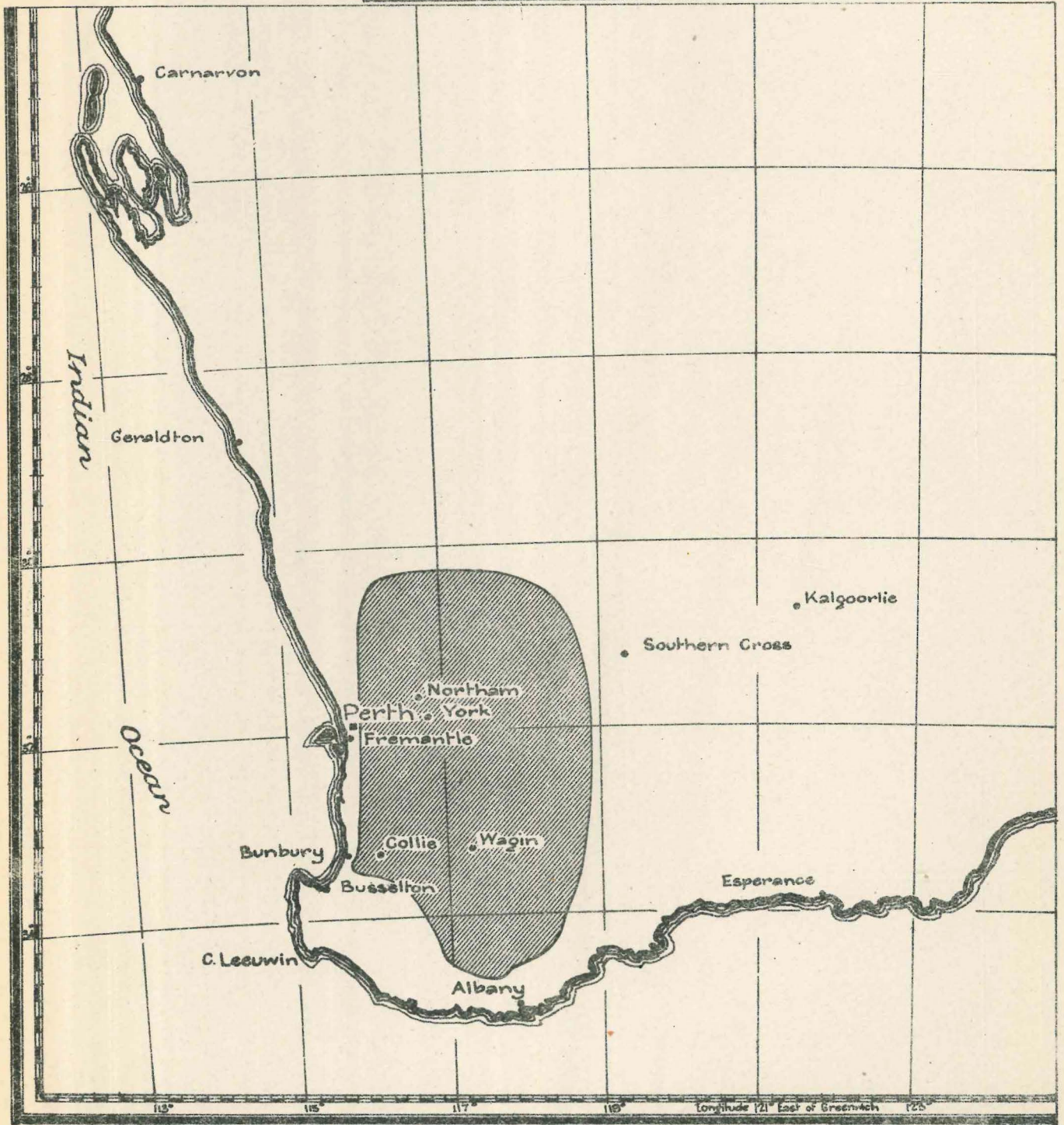


By Authority: FRASER, WM. SIMPSON, Government Printer, Perth.



**MAP OF PORTION OF WESTERN AUSTRALIA**  
**Showing the Habitat of Wandoo (*Euc. redunca* var. *elata*)**

Scale of English statute miles  
0 50 100 150 200

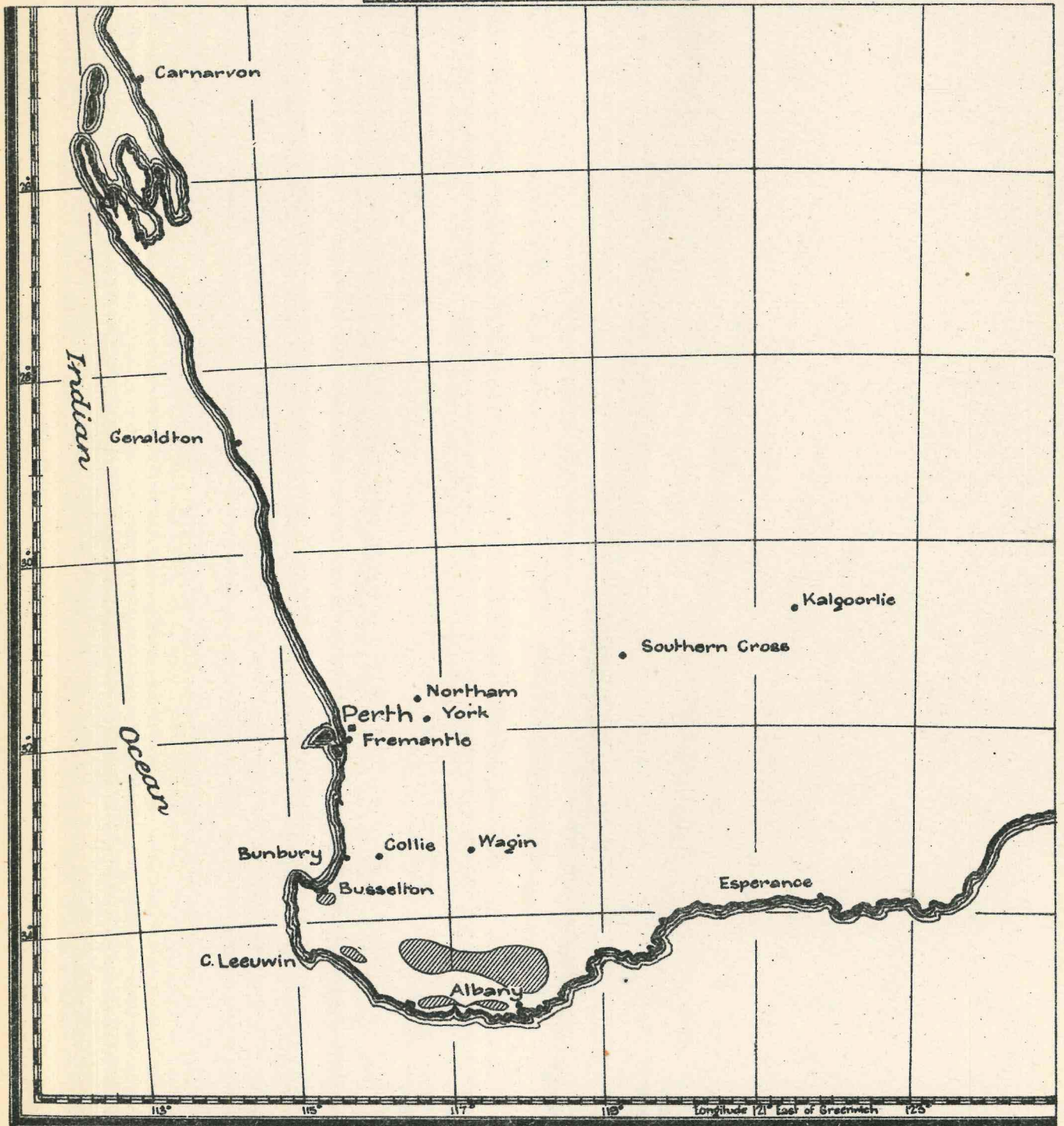


By Authority: FRANK WAT SIMPSON, Government Printer, Perth.



**MAP OF PORTION OF WESTERN AUSTRALIA**  
**Showing the Habitat of Yate Gum (*Euc. cornuta*)**

Scale of English statute miles 0 50 100 150 200

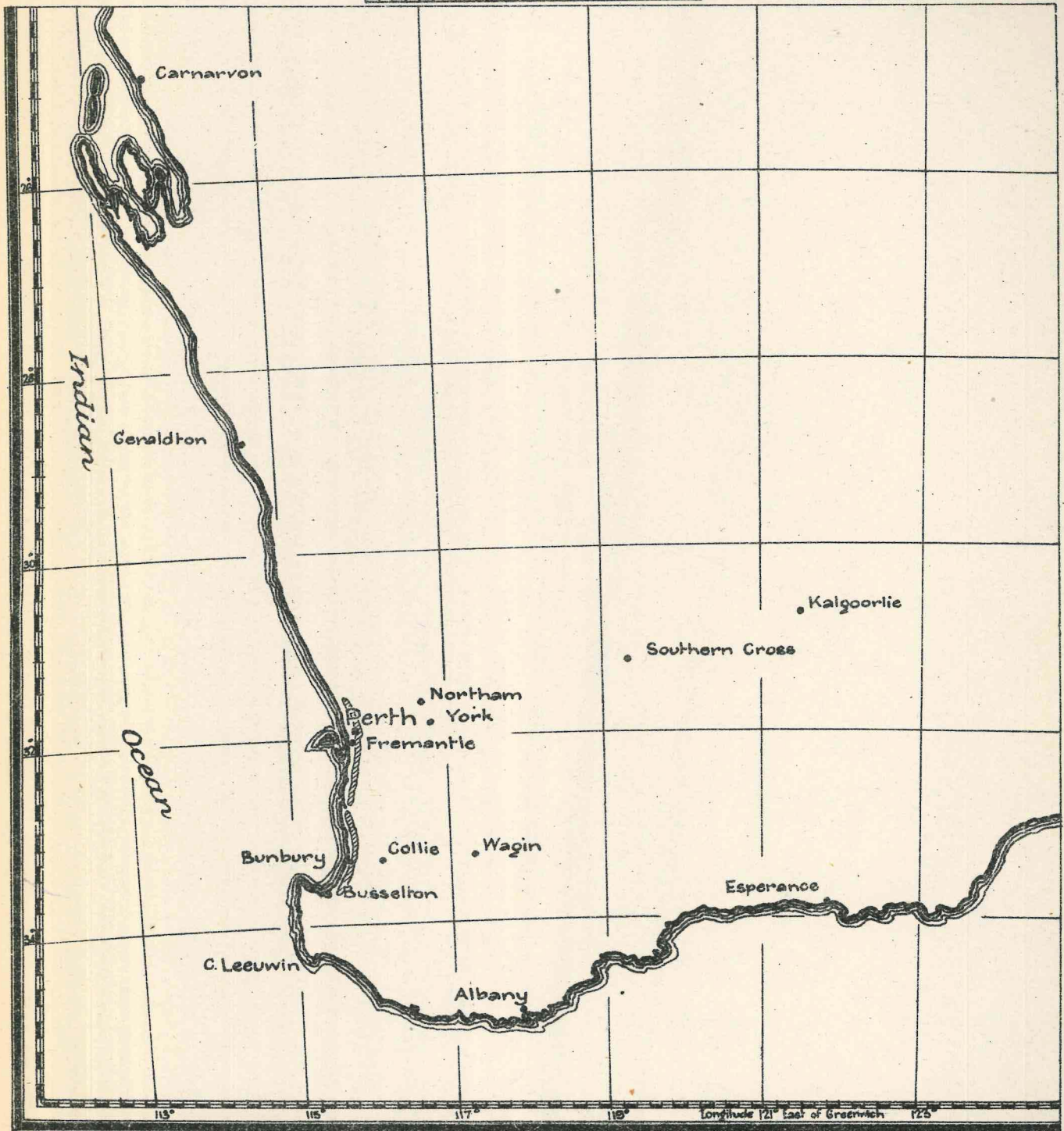


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**MAP OF PORTION OF WESTERN AUSTRALIA**  
**Showing the Habitat of Tuart (*Euc. gomphocephala*)**

Scale of English statute miles 50 100 150 200

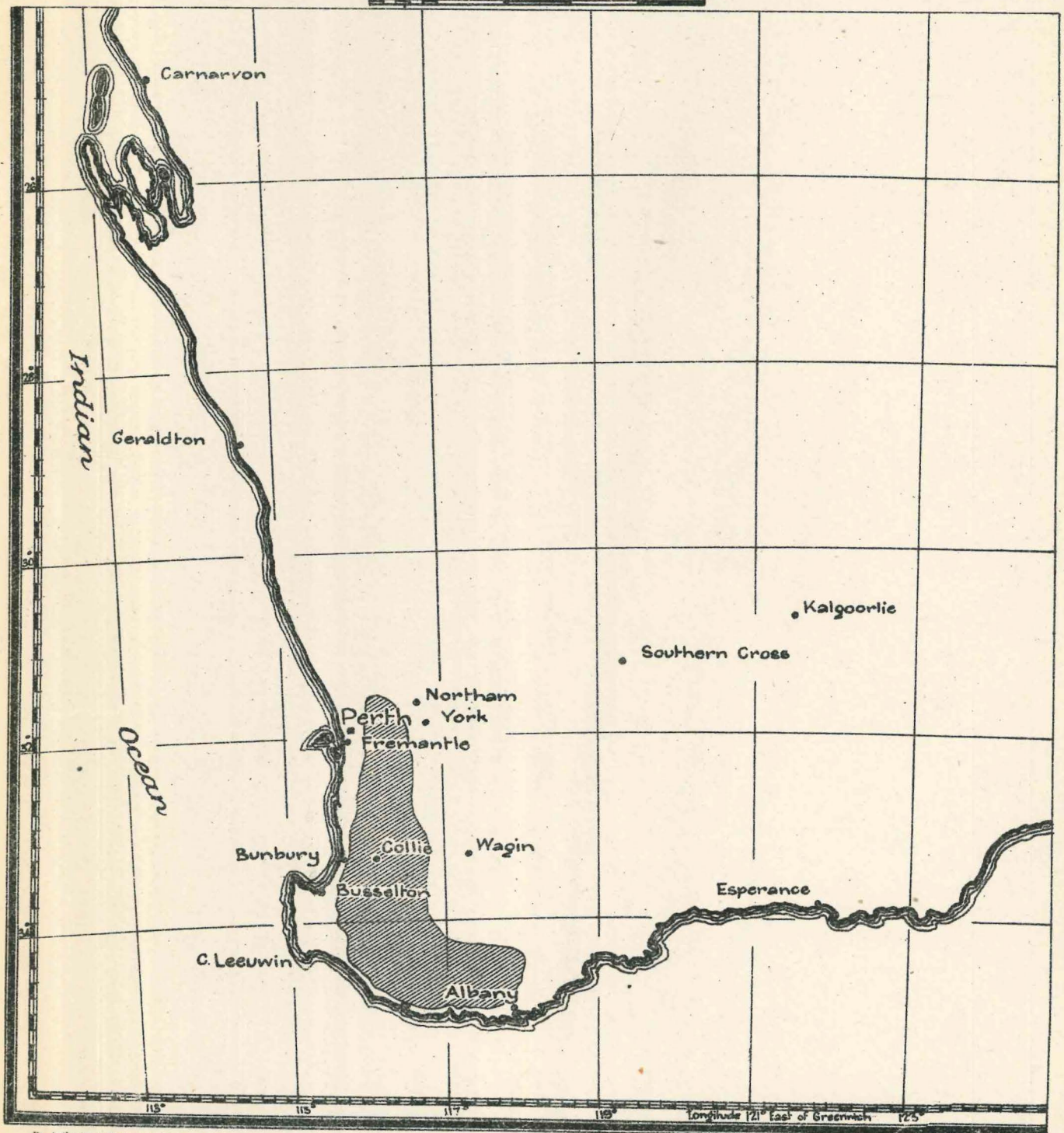


By Authority: FRASER, WM. SIMPSON, Government Printer, Perth.



**MAP OF PORTION OF WESTERN AUSTRALIA**  
**Showing the Habitat of Blackbutt (*Euc. patens*)**

Scale of English statute miles  
0 50 100 150 200

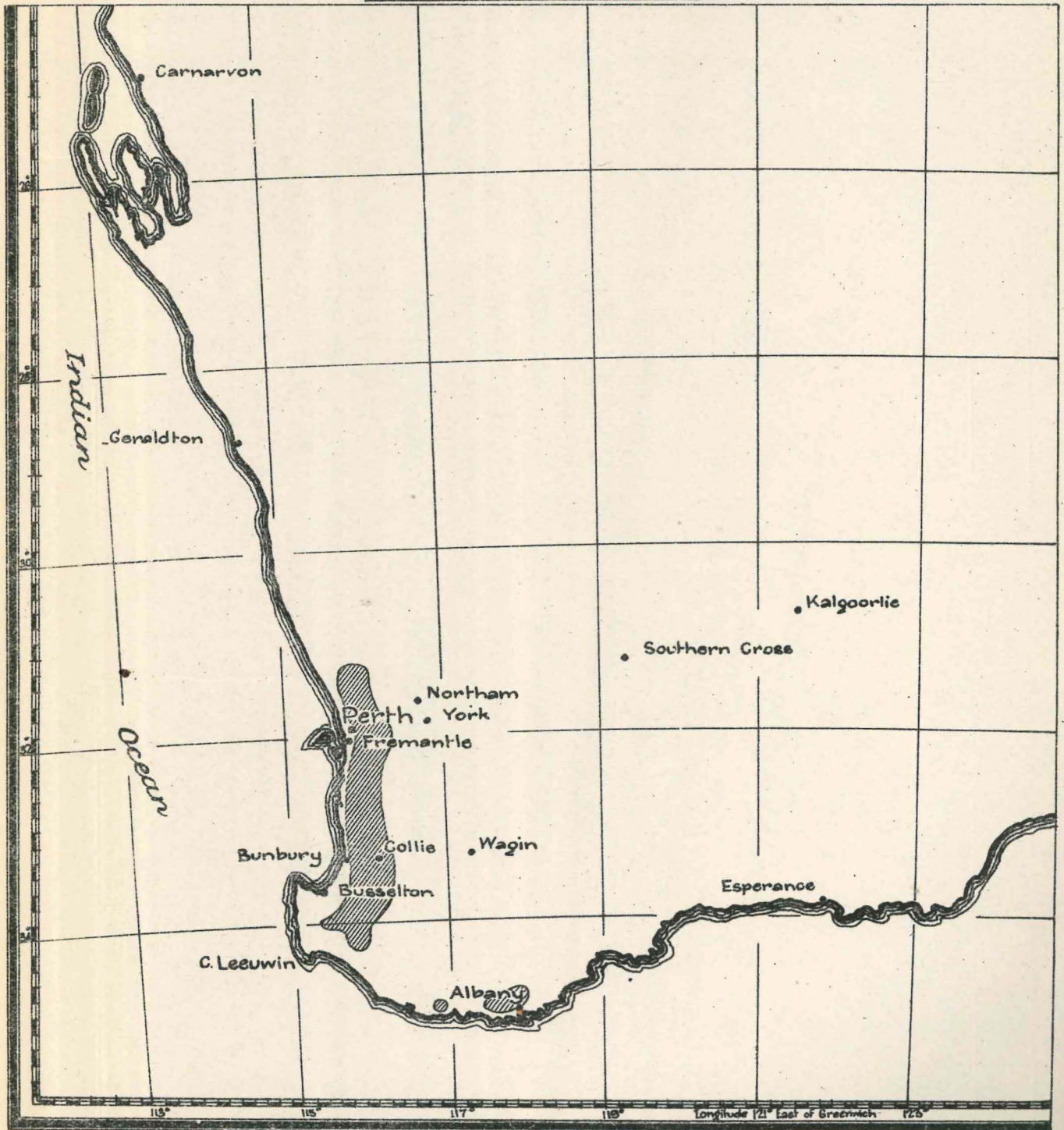


By Authority: FRANK WM SIMPSON, Government Printer, Perth.



**MAP OF PORTION OF WESTERN AUSTRALIA**  
**Showing the Habitat of Sheoak (*Casuarina Fraseriana*)**

Scale of English statute miles 0 50 100 150 200

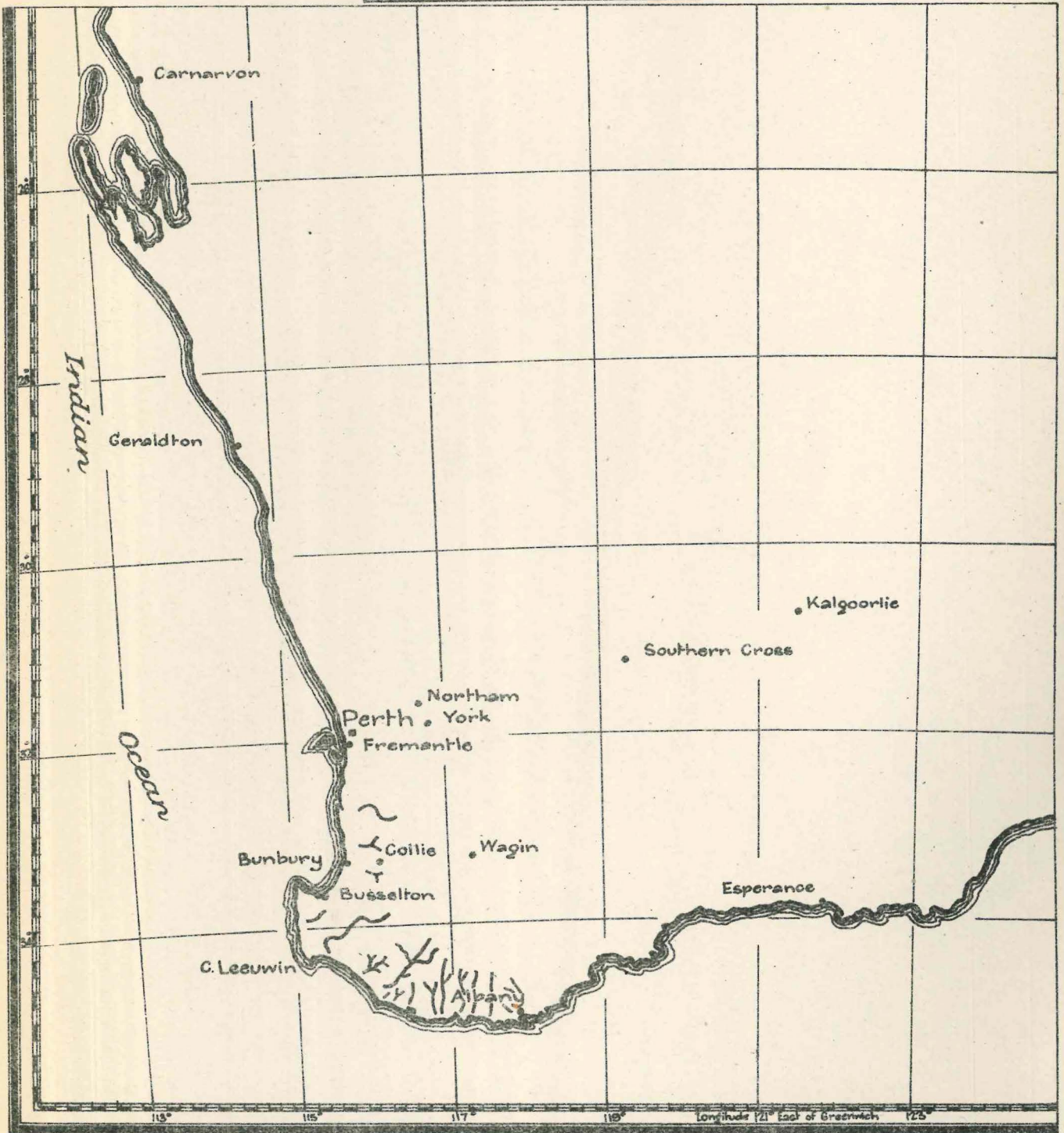


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**MAP OF PORTION OF WESTERN AUSTRALIA**  
**Showing the Habitat of River Banksia (*Banksia verticillata*)**

Scale of English statute miles 0 50 100 150 200

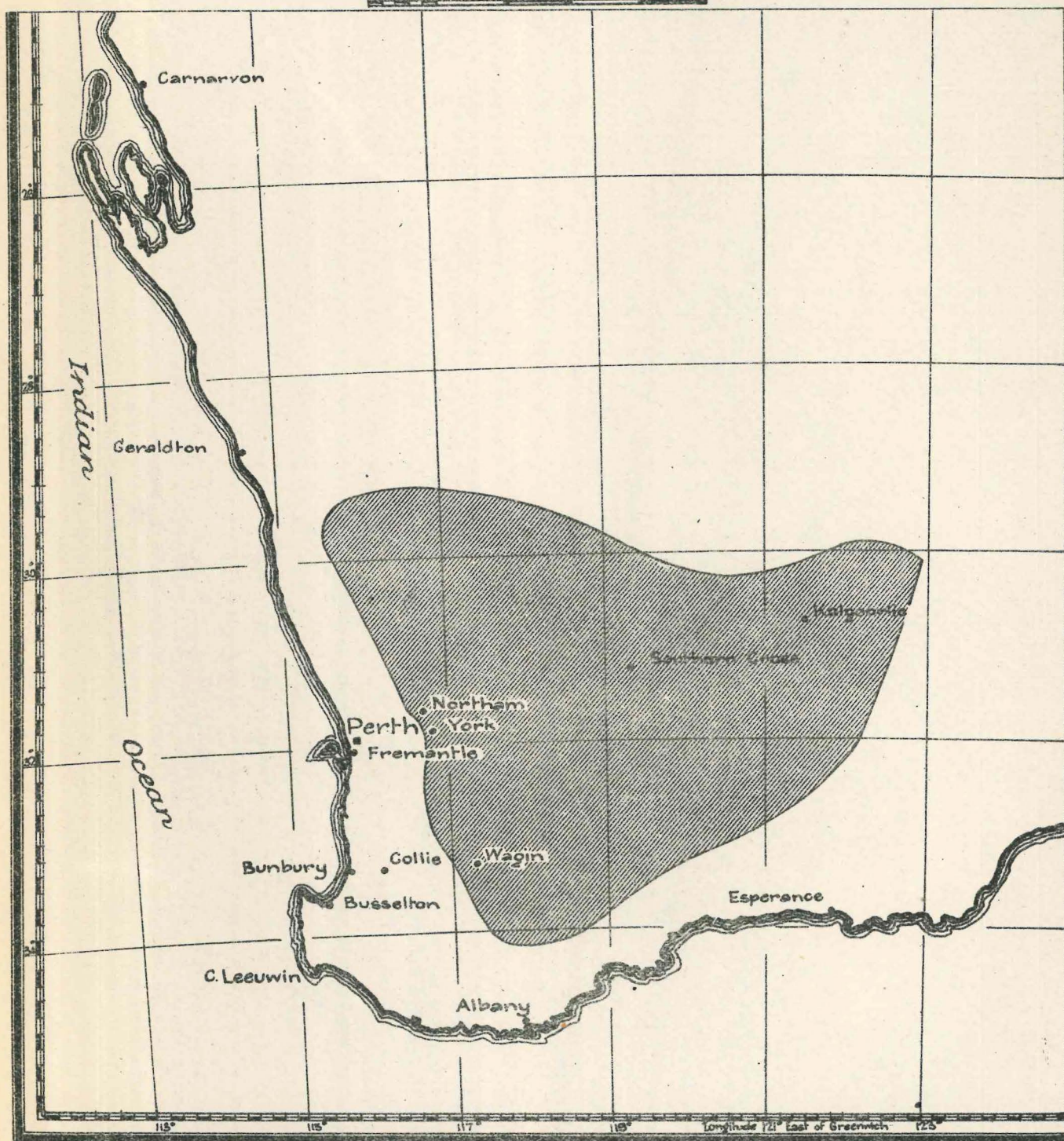


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# MAP OF PORTION OF WESTERN AUSTRALIA Showing the Habitat of Salmon Gum (*Euc. salmonophloia*)

Scale of English statute miles 0 50 100 150 200

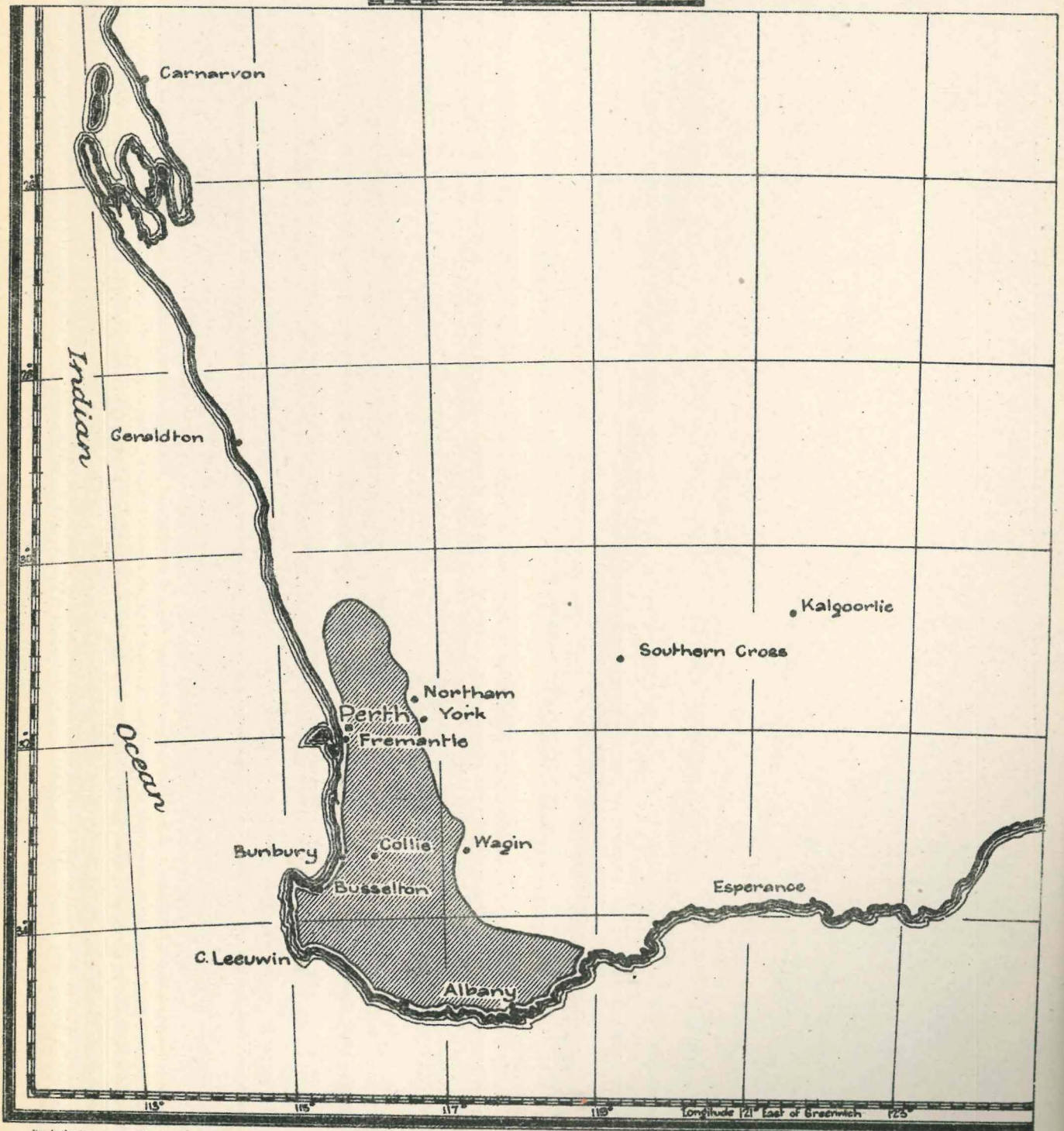


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**MAP OF PORTION OF WESTERN AUSTRALIA**  
**Showing the Habitat of Marri (*Euc. calophylla*)**

Scale of English statute miles 100 150 200

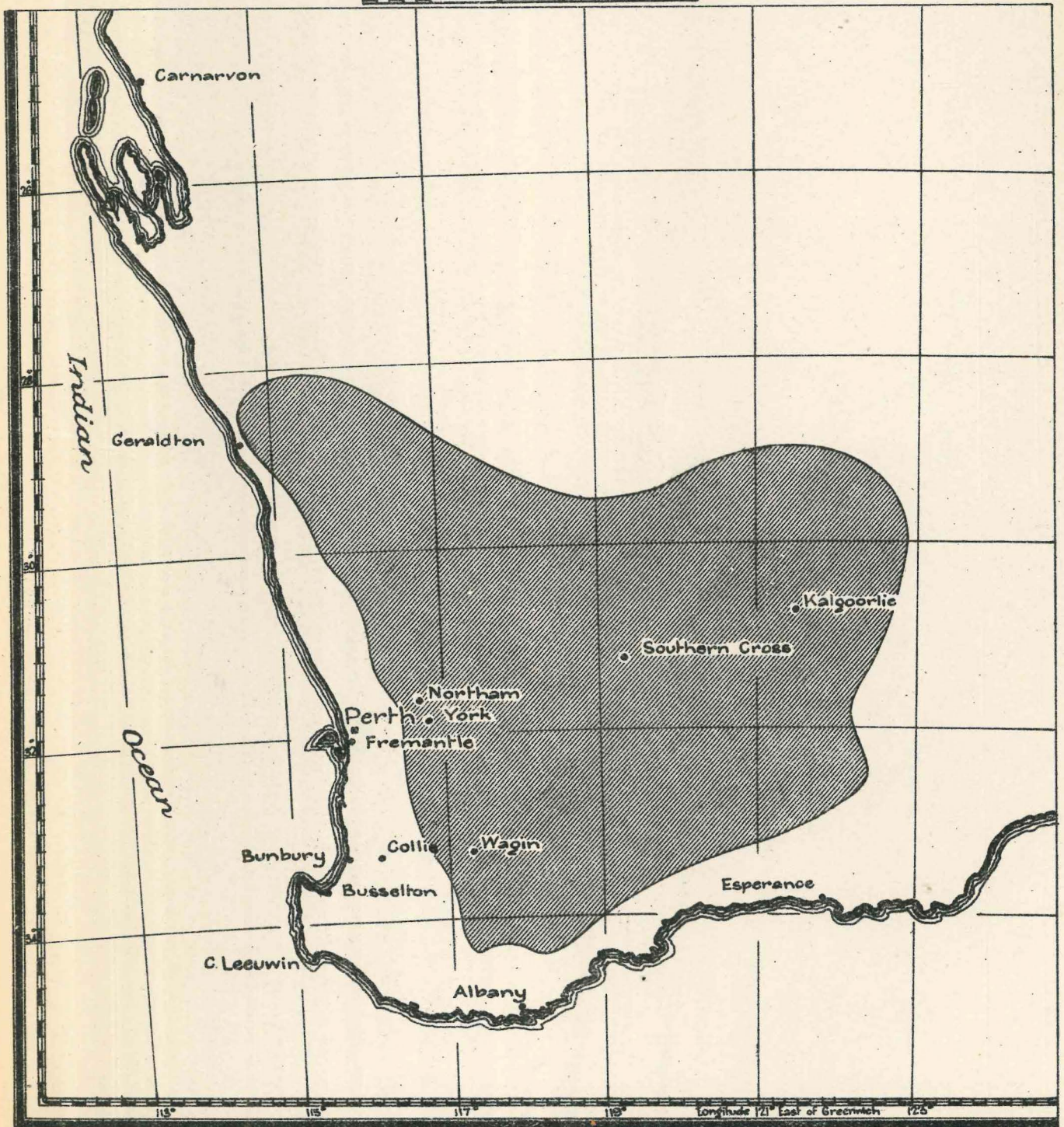


By Authority: FRANK W.M. SIMPSON, Government Printer, Perth.



**MAP OF PORTION OF WESTERN AUSTRALIA**  
**Showing the Habitat of Jam (*Ac. acuminata*)**

Scale of English statute miles  
0 50 100 150 200

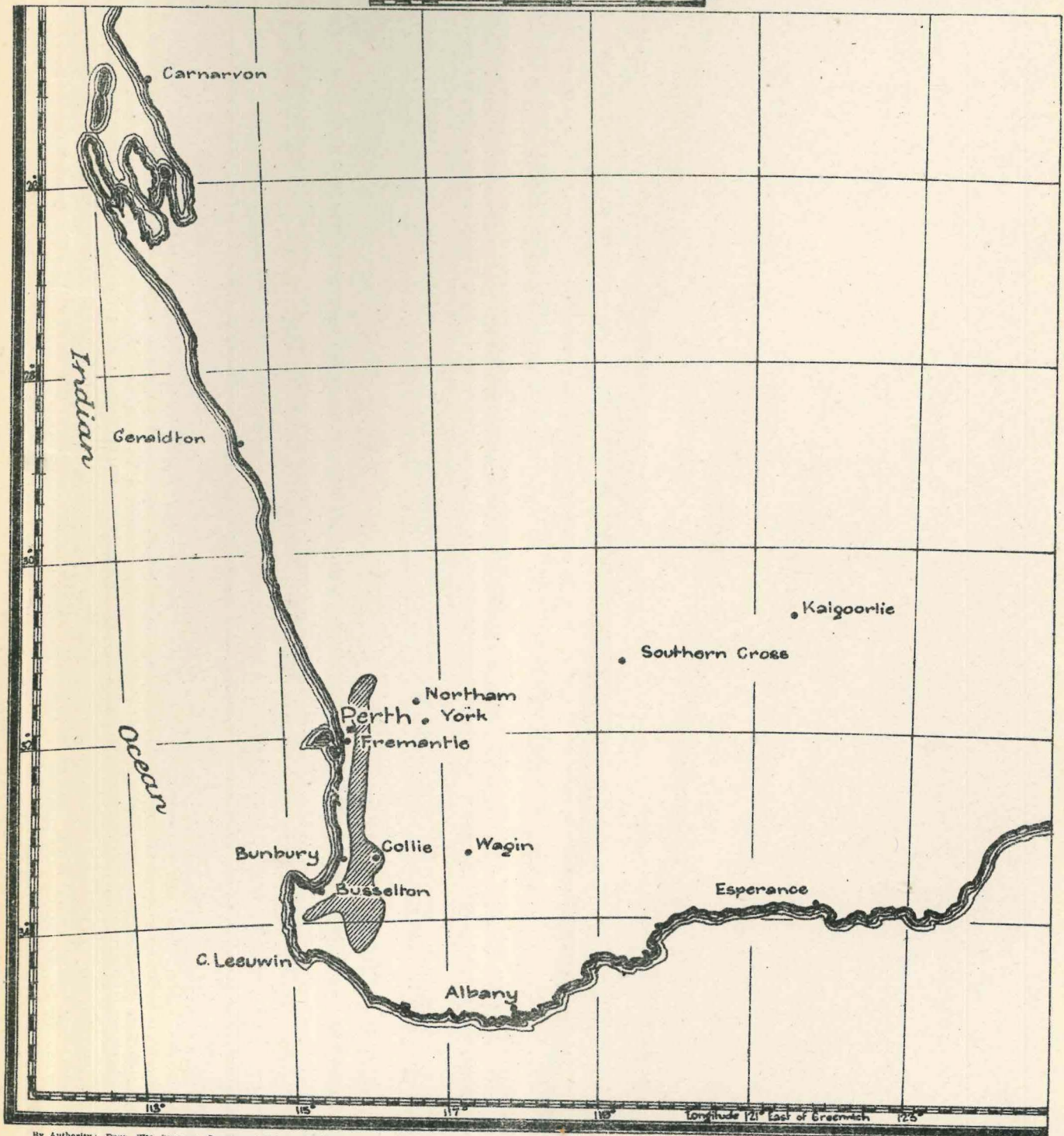


By Authority: FRASER, WM. SIMPSON, Government Printer, Perth.



**MAP OF PORTION OF WESTERN AUSTRALIA**  
**Showing the Habitat of Native Pear (*Xylomelum occidentale*)**

50403020 10 0 Scale of English statute miles 50 100 150 200

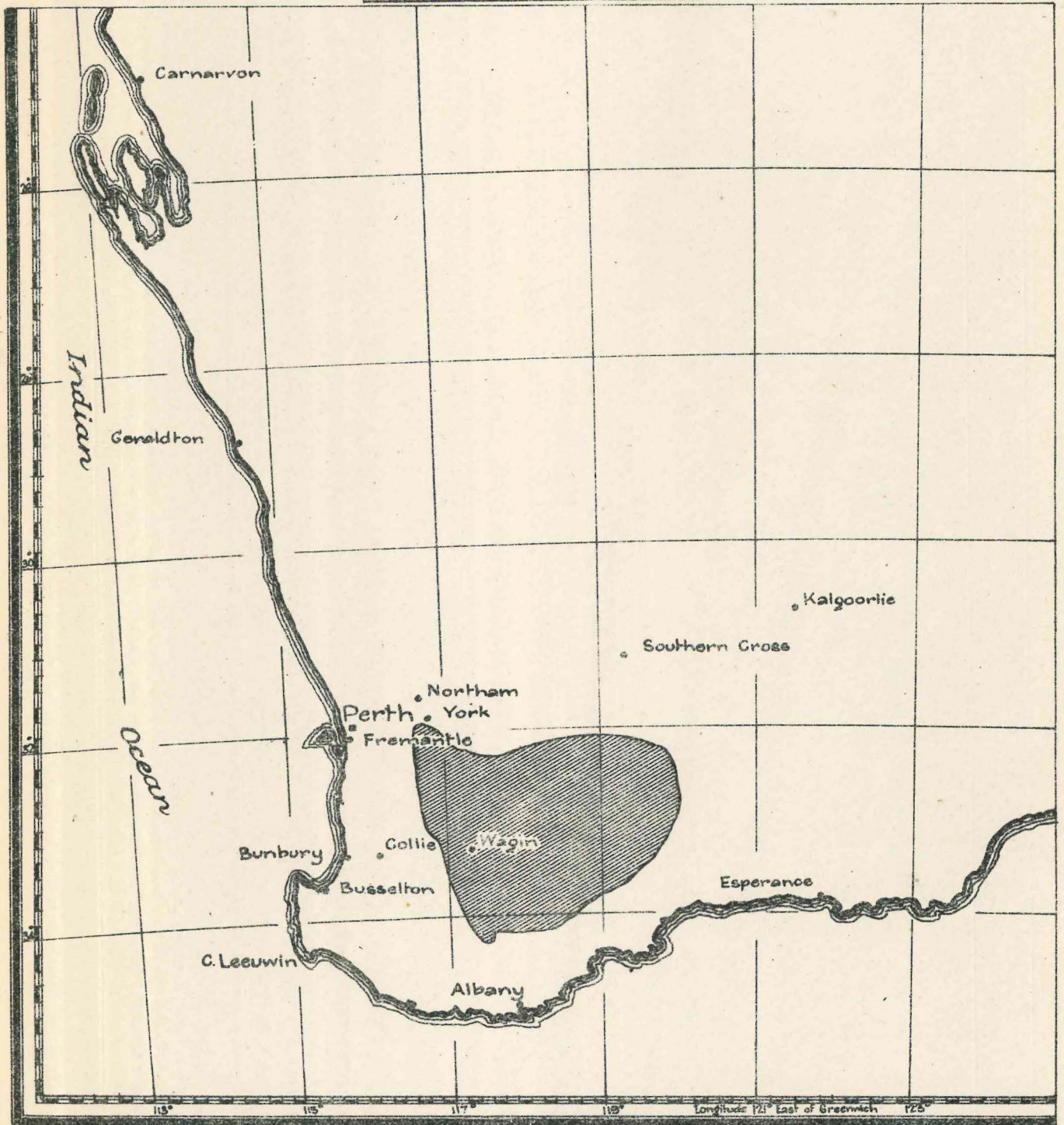


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**MAP OF PORTION OF WESTERN AUSTRALIA**  
**Showing the Habitat of Mallets (*Euc. longicornis*)**

Scale of English statute miles 0 50 100 150 200

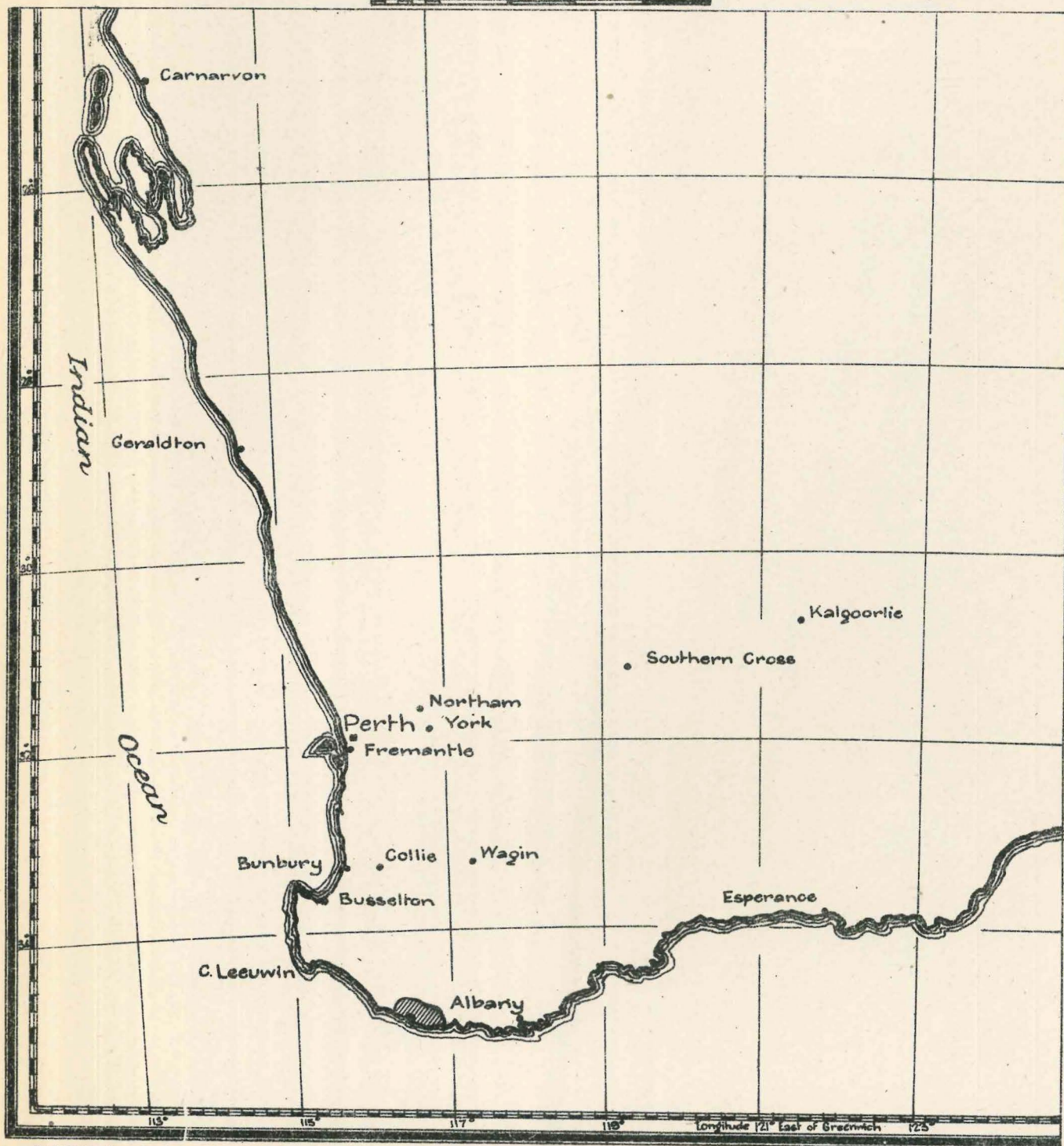


By Authority: FRAS. WM. SIMPSON, Government Printer, Perth.



**MAP OF PORTION OF WESTERN AUSTRALIA**  
**Showing the Habitat of Tingle Tingle (*Euc. Jacksonii* & *Euc. Guilfoyii*)**

50403020 10 0 Scale of English statute miles 50 100 150 200

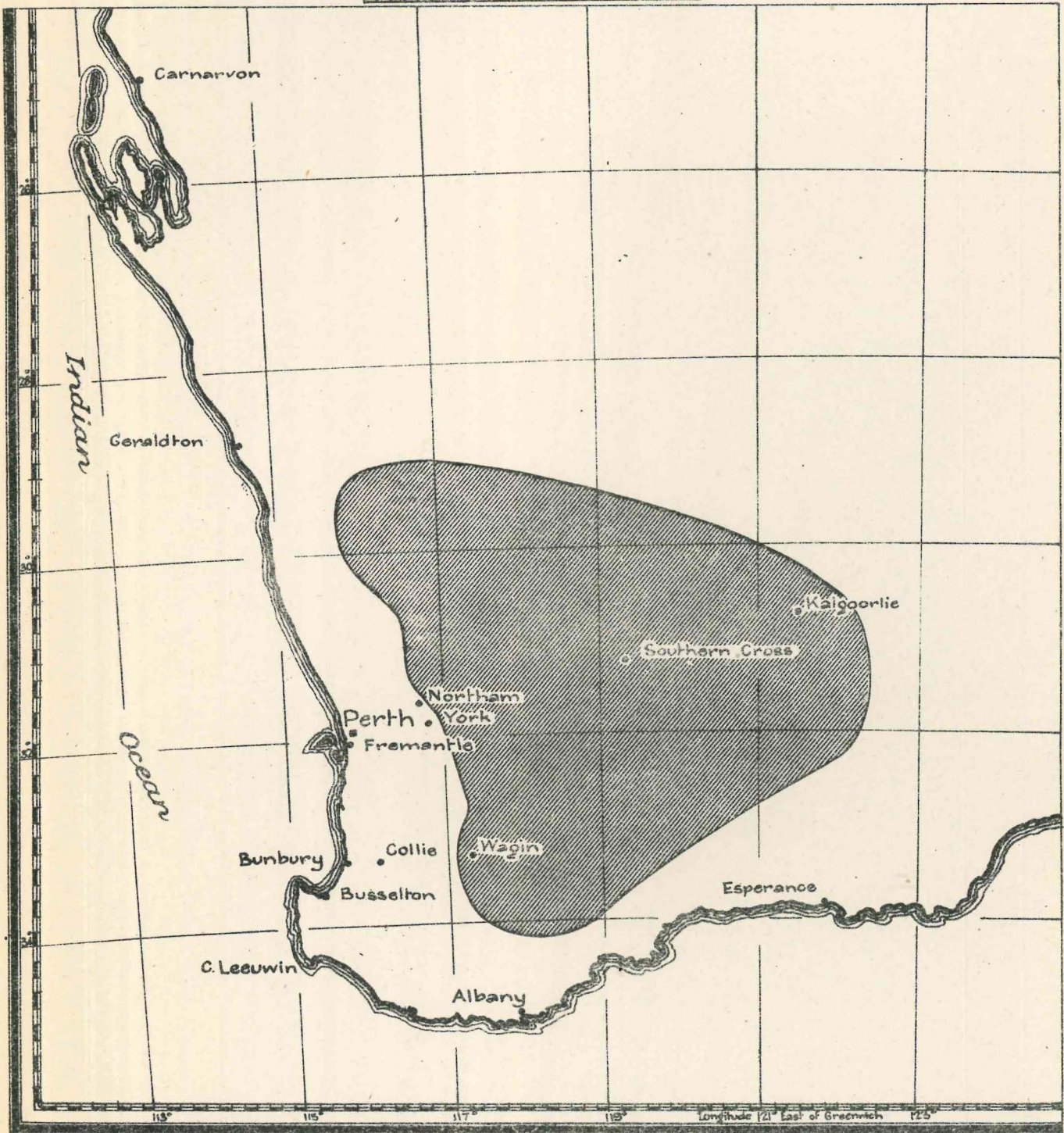


By Authority: Fred. WM. Stott & Co., Government Printer, Perth.



**MAP OF PORTION OF WESTERN AUSTRALIA**  
**Showing the Habitat of Morrell (*Euc. oleosa*, var. *longicornis*)**

Scale of English statute miles 50 100 150 200

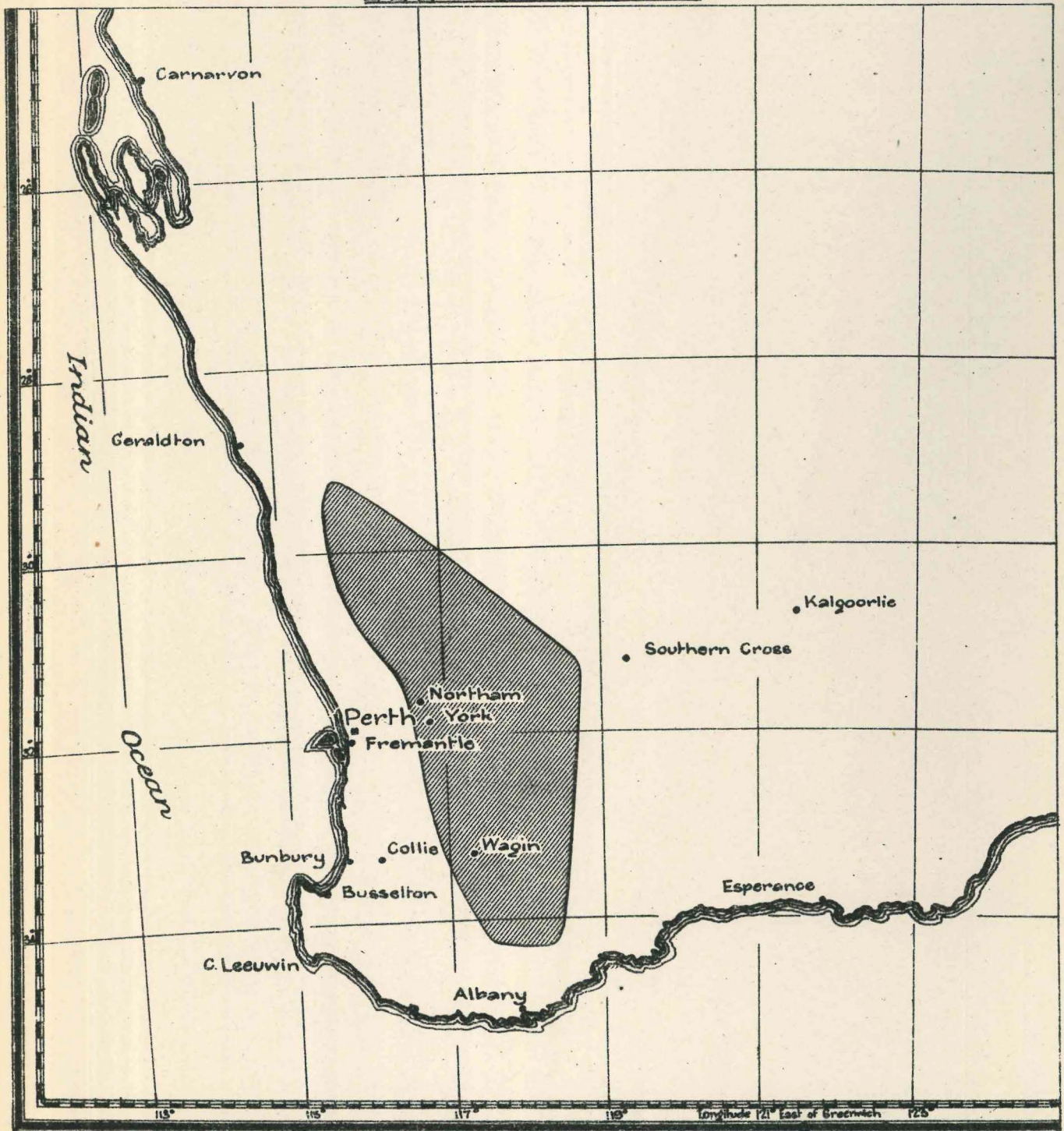


By Authority: FRED. WM. SIMPSON, Government Printer, Perth.



# MAP OF PORTION OF WESTERN AUSTRALIA Showing the Habitat of York Gum (*Euc. loxophleba*)

Scale of English statute miles 0 50 100 150 200



By Authority: FRANK W.M. STAMPSON, Government Printer, Perth.





# GEOLOGICAL SKETCH MAP OF WESTERN AUSTRALIA.

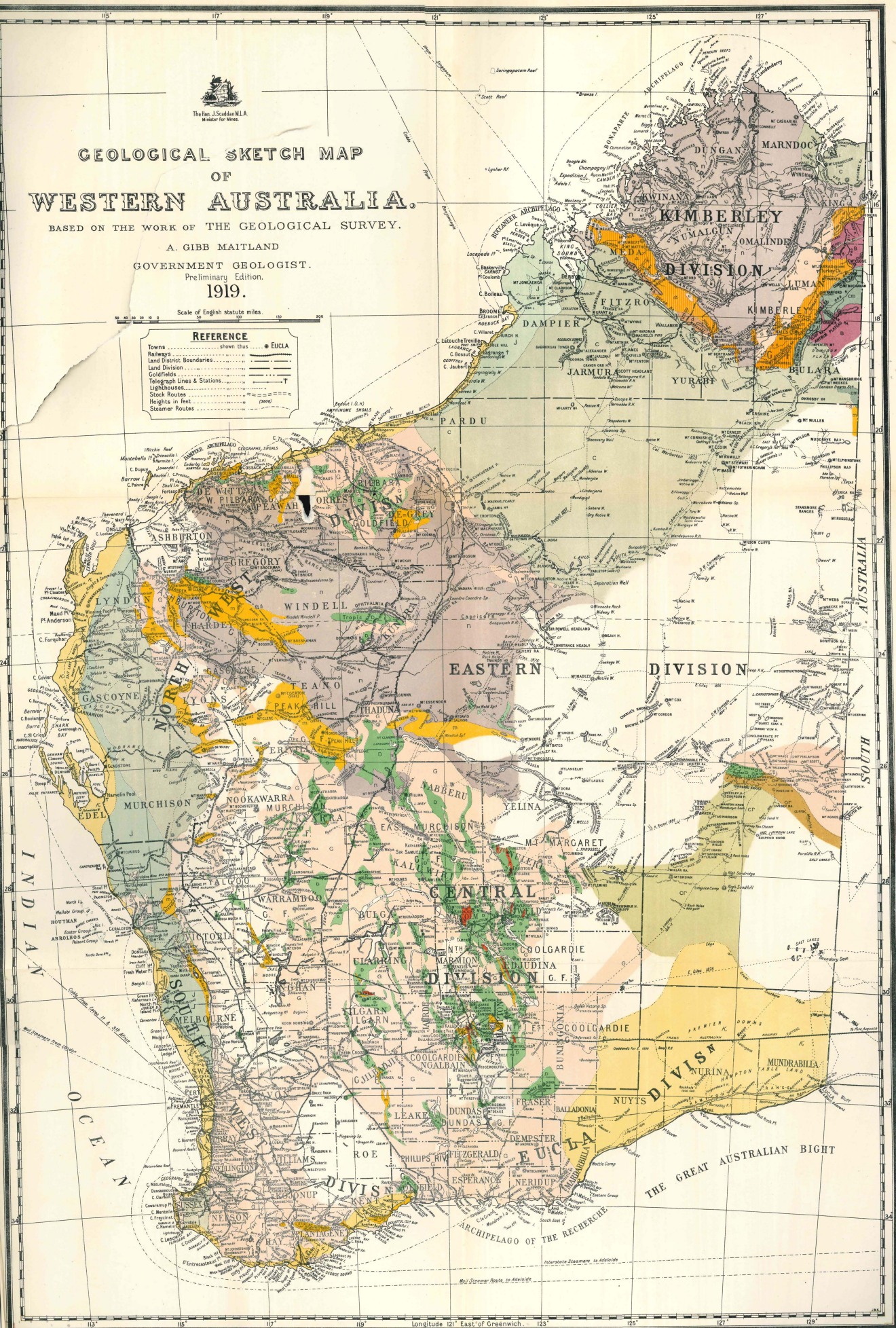
BASED ON THE WORK OF THE GEOLOGICAL SURVEY.

A. GIBB MAITLAND  
GOVERNMENT GEOLOGIST.  
Preliminary Edition.  
1919.

Scale of English statute miles  
0 10 20 30 40

**REFERENCE**

Towns	.....	EUCLA
Railways	.....	
Land District boundaries	.....	
Land Division boundaries	.....	
Telegraph Lines & Stations	.....	
Goldfields	.....	
Lighthouses	.....	
Stock Routes	.....	
Heights in feet	.....	
Steamer Routes	.....	



Geology compiled by F.R. Edleston.

CAINOZOIC			MESOZOIC			PALÆZOIC			PROTEROZOIC			ARCHÆZOIC			IGNEOUS.		
<b>K</b>	<b>CR</b>	<b>J</b>	<b>C</b>	<b>D</b>	<b>O</b>	<b>OR</b>	<b>CM</b>	<b>n</b>	<b>m</b>	<b>h</b>	<b>G</b>	<b>P</b>	<b>B</b>	<b>D</b>	<b>D</b>		
Tertiary and Post-Tertiary Cenozoic, Eocene, normal, subduction, etc.	Cretaceous	Jurassic and undifferentiated Cretaceous.	Permian-Carboniferous and Carboniferous	Devonian	Ordovician	Cambrian.	Nullage. (Archaean conglomerates in places)	Mosquito Creek and Stirling Range Beds (Archaean rocks in places)	Undifferentiated metamorphic rocks.	Granite and gneiss.	Porphyries and porphyrites.	Basalt.	Dolerite dykes and sills (Post-gold granites?) (Pre-gold granites?)	Gabbro dolerite, epidiorites, etc. (Pre-gold granites?)			

By Authority: F.R. Edleston, Government Printer, Perth.