

# FORESTS DEPARTMENT, WESTERN AUSTRALIA

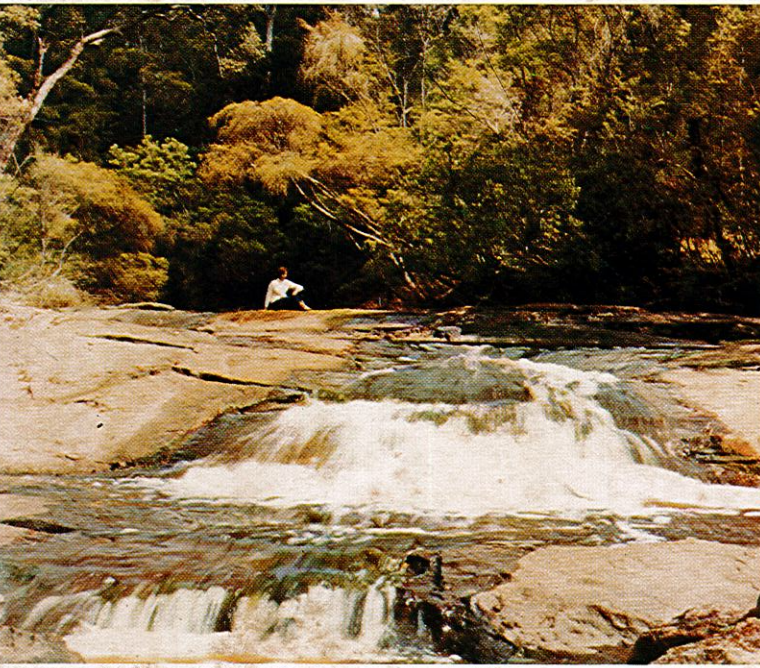
ANNUAL  
REPORT  
1970



Rocky crossing where Heartbreak Trail meets the Warren River.



The Cascades Trail, a scenic walking path by the banks of the Lefroy Brook.



White summer at the Cascades.

Dense young karri and undergrowth border a side track.



Barbecue-time at Karri Oak picnic spot.



The wrap-around cover shows picnic grounds, walking trails and other scenic views along and near to the Rainbow Trail in the karri forest region near Pemberton. This is an example of the type of forest recreation improvement work carried out by the Department for the benefit of tourists and the general public.

# REPORT

*on the operations of the*

# FORESTS DEPARTMENT

WESTERN AUSTRALIA

*for the year ended*

30th JUNE, 1970

*by*

W. R. WALLACE, Dip. For. (Canb.)

*Conservator of Forests*



PRESENTED TO BOTH HOUSES OF PARLIAMENT

Forests Department,  
PERTH,  
30th September, 1970

TO THE HONOURABLE THE MINISTER FOR FORESTS

Sir,

*I have the honour to transmit herewith my report on the operations of the Department for the year ended 30th June, 1970.*

Yours faithfully,

W. R. WALLACE,

Conservator of Forests.





Managed native forests have done more for conservation than any other form of land use in Australia. Here the Collie River flows through State Forest on its way to the Wellington Dam. A small wild-flower reserve is situated along the right bank (foreground).



# CONTENTS

SECTIONS	Page
<b>1. Statistical Summary of Major Operations</b> .....	8
<b>2. Revenue and Expenditure</b> .....	10
<b>3. The Forest Area—</b>	
State Forests .....	10
Timber Reserves under Forests Act .....	10
Land Released .....	10
Mining in State Forest .....	10
<b>4. Sawmilling Timber Inspection and Forest Produce—</b>	
Timber Production and Distribution .....	14
Sandalwood .....	16
Firewood Production .....	16
Other Forest Produce .....	16
<b>5. Forest Management and Conservation—</b>	
Forest Conservation .....	17
Forest Recreation .....	18
Working Plans .....	19
Mapping & Surveys .....	19
Forest Engineering .....	20
Departmental Buildings .....	20
Communications .....	20
<b>6. Reforestation</b> .....	22
<b>7. Afforestation</b> .....	23
Blackwood Valley Plantations .....	23
Establishment and Production .....	25
<b>8. Protection—</b>	
Fire Protection .....	30
<b>9. Research—</b>	
Pine Silviculture .....	33
Jarrah Silviculture .....	37
Karri Silviculture .....	38
Soils and Nutrition .....	40
Fire Research .....	40
<b>10. Utilization</b> .....	43
<b>11. Library</b> .....	44
<b>12. Education and Publicity</b> .....	44
<b>13. Timber Industry Regulation Act</b> .....	45
<b>14. Forest Offences</b> .....	45
<b>15. Employment in Forestry and Timber Industry</b> .....	45
<b>16. Staff Matters</b> .....	46
 <b>APPENDICES</b>	
<b>1. Revenue and Expenditure Statements for the year ended 30th June, 1970—</b>	
(a) Consolidated Revenue Fund .....	47
(b) Forest Improvement and Reforestation Fund .....	47
(c) Afforestation Expenditure .....	48
(d) Distribution of Expenditure .....	48
<b>2. Exports and Imports for the year ended 30th June, 1970—</b>	
(a) Exports of Timber, Tanning Substances and Essential Oils .....	49
(b) Imports of Timber, Tanning Substances and Essential Oils .....	51
<b>3. Summary of Exports of Forest Produce since 1836</b> .....	53
<b>4. Summary of Imports of Timber, Tanning Materials and Essential Oils since 1848</b> .....	54
<b>5. Summary of Log Production</b> .....	55



## PRINCIPAL OFFICERS

Conservator of Forests	.....	.....	.....	.....	.....	W. R. WALLACE, Dip. For. (Canb.).
Deputy Conservator of Forests	.....	.....	.....	.....	.....	D. W. R. STEWART, B.Sc. (For.) Dip. For. (Canb.) Dip. For. (Oxon).
Chief of Division	.....	.....	.....	.....	.....	W. H. EASTMAN, B.Sc. (For.) Dip. For. (Canb.) Dip. For. (Oxon.).
Chief of Division	.....	.....	.....	.....	.....	J. C. MEACHEM, D.F.C., B.Sc., (For.) Dip. For. (Canb.).
Chief of Division	.....	.....	.....	.....	.....	B. J. BEGGS, B.Sc. (For.) Dip. For. (Canb.).
Chief of Division	.....	.....	.....	.....	.....	P. J. McNAMARA, M.A. (Oxon).
Utilization Officer	.....	.....	.....	.....	.....	H. C. WICKETT, M.Sc. (Adel.) B. For. Sc. (N.Z.), M.I.E. (Aust.), Dip. For. (Canb.).
Superintendent	.....	.....	.....	.....	.....	D. E. GRACE, B.Sc. (For.), Dip. For. (Canb.).
Superintendent (Research)	.....	.....	.....	.....	.....	E. R. HOPKINS, B.Sc. (W.A.) Dip. For. (Canb.) Ph.D. (Melb.).
Superintendent (Fire Control)	.....	.....	.....	.....	.....	F. J. CAMPBELL, B.Sc. (For.) Dip. For. (Canb.)
Superintendent	.....	.....	.....	.....	.....	J. B. CAMPBELL, B.Sc. (For.) Dip. For. (Canb.).
Chief Draftsman	.....	.....	.....	.....	.....	R. M. DAVIS, E.D.
Secretary	.....	.....	.....	.....	.....	E. S. BUDD.
Accountant	.....	.....	.....	.....	.....	E. G. BAKER, A.A.S.A.
Registrar	.....	.....	.....	.....	.....	R. K. REID.



## LIST OF COMMON AND BOTANICAL NAMES OF TREES USED IN THIS REPORT

### EUCALYPTS

Bald Island Marlock	.....	.....	.....	.....	.....	<i>Euc. lehmannii</i>
Brown Mallet	.....	.....	.....	.....	.....	<i>Euc. astringens</i>
Coral-flowered Gum	.....	.....	.....	.....	.....	<i>Euc. torquata</i>
Dwarf Sugar Gum	.....	.....	.....	.....	.....	<i>Euc. cladocalyx var. nana</i>
Jarra	.....	.....	.....	.....	.....	<i>Euc. marginata</i>
Karri	.....	.....	.....	.....	.....	<i>Euc. diversicolor</i>
Marri	.....	.....	.....	.....	.....	<i>Euc. calophylla</i>
River Gum	.....	.....	.....	.....	.....	<i>Euc. camaldulensis</i>
Tallowwood	.....	.....	.....	.....	.....	<i>Euc. microcorys</i>
Tasmanian Blue Gum	.....	.....	.....	.....	.....	<i>Euc. globulus</i>
Tingle (Red)	.....	.....	.....	.....	.....	<i>Euc. jacksonii</i>
Tingle (Yellow)	.....	.....	.....	.....	.....	<i>Euc. guilfoylei</i>
Tuart	.....	.....	.....	.....	.....	<i>Euc. gomphocephala</i>
W.A. Blackbutt (Yarri)	.....	.....	.....	.....	.....	<i>Euc. patens</i>
Wandoo	.....	.....	.....	.....	.....	<i>Euc. wandoo</i>

### CONIFERS

Maritime Pine (Pinaster Pine)	.....	.....	.....	.....	.....	<i>Pinus pinaster</i>
Monterey Pine (Radiata Pine)	.....	.....	.....	.....	.....	<i>Pinus radiata</i>

### OTHER

Sandalwood	.....	.....	.....	.....	.....	<i>Santalum spicatum</i>
Sheoak	.....	.....	.....	.....	.....	<i>Casuarina fraseriana</i>



In view of the forthcoming changeover to the metric system of measurement, figures in this Report are given both in standard units and their metric equivalents.

### CONVERSION FACTORS USED IN THIS REPORT

LENGTH	1 centimetre = 0.3937 in. 1 metre = 3.281 ft. 1 metre = 1.094 yd. 1 kilometre = 0.621 mile 1 yard = 3 feet = 36 inches	1 inch = 2.540 cm. 1 foot = 0.3048 m. 1 yard = 0.9144 m. 1 mile = 1.609 km. 1 mile = 1,760 yards = 5,280 ft.
AREA	1 cm <sup>2</sup> = 0.155 sq. in. 1 m <sup>2</sup> = 10.76 sq. ft. 1 km <sup>2</sup> = 0.3861 sq. mile 1 hectare = 0.003861 sq. mile 1 hectare = 2.471 acres 1 sq. kilometre = 100 hectares	1 sq. in. = 6.452 cm <sup>2</sup> 1 sq. ft. = 0.0929 m <sup>2</sup> 1 sq. mile = 2.59 km <sup>2</sup> 1 sq. mile = 259 ha. 1 acre = 0.4047 ha. 1 sq. mile = 640 acres
VOLUME	1 cm <sup>3</sup> = 0.061 cu. in. 1 m <sup>3</sup> = 35.31 cu. ft. 1 m <sup>3</sup> = 0.706 loads 1 litre = 61 cu. in. 1 litre = 0.2642 gal. (U.S.) 1 litre = 0.2200 gal. (Imp.) 1 litre = 1,000 cm <sup>3</sup>	1 cu. in. = 16.39 cm <sup>3</sup> 1 cu. ft. = 0.02832 m <sup>3</sup> *1 load = 1.416 m <sup>3</sup> 1 cu. in. = 0.01639 litre 1 gal. (U.S.) = 3.785 litres 1 gal. (Imp.) = 4.546 litres 1 gallon = 4 quarts
MASS	1 kilogramme = 2.205 pounds 1 metric ton = 1.102 short tons 1 metric ton = 0.9842 long tons	1 pound = 0.4536 kg. 1 short ton = 0.9072 metric ton 1 long ton = 1.016 metric tons
PRESSURE	1 kg. per m <sup>2</sup> = 0.2048 lb. per sq. ft. 1 gr. per cm <sup>2</sup> = 0.0142 lb. per sq. in.	1 lb. per sq. ft. = 4.882 kg. per m <sup>2</sup> 1 lb. per sq. in. = 70.31 gr. per cm <sup>2</sup> .
DENSITY	1 kg. per m <sup>3</sup> = 0.06243 lb. per cu. ft.	1 lb. per cu. ft. = 16.02 kg. per m <sup>3</sup>
OTHER	1 m <sup>2</sup> /ha. = 4.356 sq. ft./acre 1 m <sup>3</sup> /ha. = 14.29 cu. ft./acre	1 sq. ft./acre = 0.2296 m <sup>2</sup> /ha. 1 cu. ft./acre = 0.07 m <sup>3</sup> /ha.

\* This measure (1 load = 50 cu. ft.) is commonly used in the W.A. timber industry.

## I. STATISTICAL SUMMARY OF MAJOR OPERATIONS

### Timber Production

	Cubic Feet	M <sup>3</sup>	
Total Production of Sawn Timber	15,614,003	442,188	
Exports—Interstate	2,077,349	58,830	(13.3 per cent)
Exports—Overseas	1,322,185	37,444	(8.5 per cent)
Local Consumption	12,214,469	345,914	(78.2 per cent)

### Trends in Production and Consumption

Year Ended 30 June		Production			Total Export	Local Consumption	Sawmills (No.)	Employees Monthly Average (No.)
		Sawn	Hewn	Total				
1926	cub. ft.	14,522,733	6,277,952	20,800,685	12,001,384	8,799,301	....	....
"	m <sup>3</sup>	411,283	177,792	589,075	339,879	249,196	....	....
1938	cub. ft.	11,720,642	2,573,540	14,294,192	7,545,744	6,748,448	134	3,112
"	m <sup>3</sup>	331,928	72,883	404,811	213,695	191,116	....	....
1946	cub. ft.	8,869,847	14,041	8,883,888	3,373,025	5,510,863	128	2,876
"	m <sup>3</sup>	251,194	398	251,592	95,524	156,068	....	....
1951	cub. ft.	12,571,635	1,183	12,572,818	2,342,492	10,230,326	256	4,047
"	m <sup>3</sup>	356,029	33	356,062	66,339	289,723	....	....
1956	cub. ft.	19,213,771	5,308	19,219,079	4,568,034	14,651,045	274	5,804
"	m <sup>3</sup>	544,134	150	544,284	129,367	414,917	....	....
1960	cub. ft.	16,625,475	....	16,625,475	6,167,132	10,458,343	265	5,037
"	m <sup>3</sup>	470,833	....	470,833	174,653	296,180	....	....
1961	cub. ft.	15,783,370	....	15,783,370	5,212,532	10,570,838	238	4,790
"	m <sup>3</sup>	446,985	....	446,985	147,619	299,366	....	....
1962	cub. ft.	15,801,067	....	15,801,067	5,660,639	10,140,428	236	4,906
"	m <sup>3</sup>	447,486	....	447,486	160,309	287,177	....	....
1963	cub. ft.	15,593,099	....	15,593,099	5,482,513	10,110,586	221	4,725
"	m <sup>3</sup>	441,596	....	441,596	155,265	286,332	....	....
1964	cub. ft.	16,088,169	....	16,088,169	5,266,328	10,821,841	214	3,448*
"	m <sup>3</sup>	455,617	....	455,617	149,142	306,474	....	....
1965	cub. ft.	17,052,025	....	17,052,025	4,716,296	12,335,729	206	3,615
"	m <sup>3</sup>	482,913	....	482,913	133,565	349,348	....	....
1966	cub. ft.	17,377,858	....	17,377,858	2,432,378	14,945,480	203	3,518
"	m <sup>3</sup>	492,141	....	492,141	68,885	423,256	....	....
1967	cub. ft.	16,887,742	....	16,887,742	4,898,421	11,889,321	202	3,173
"	m <sup>3</sup>	478,261	....	478,261	138,723	339,537	....	....
1968	cub. ft.	17,173,335	....	17,173,335	2,986,212	14,187,123	188	3,209
"	m <sup>3</sup>	486,349	....	486,349	84,569	401,779	....	....
1969	cub. ft.	15,300,480	....	15,300,480	3,052,797	12,247,683	191	3,233
"	m <sup>3</sup>	433,309	....	433,309	86,455	346,854	....	....
1970	cub. ft.	15,614,003	....	15,614,003	3,399,534	12,214,469	163	2,869
"	m <sup>3</sup>	442,188	....	442,188	96,275	345,914	....	....

\* As from and including 1964 these figures exclude persons employed in associated timber yards in the Metropolitan Area.

### Total Cut (Log Volumes)

	1970		1969	
	cub. ft.	m <sup>3</sup>	cub. ft.	m <sup>3</sup>
Jarrah	31,766,669	899,632	32,999,182	934,537
Karri	8,654,377	245,092	7,896,260	223,622
Wandoo	1,354,097	38,348	1,161,619	32,897
Pine	2,923,644	82,797	2,874,346	81,401
Other	1,102,155	31,213	1,130,587	32,018
	<hr/> 45,800,942	<hr/> 1,297,082	<hr/> 46,061,994	<hr/> 1,304,475

Made up as follows—

From State Forests and Crown Land — 39,597,323 cu. ft. (1,121,396 m<sup>3</sup>) — 86.4 per cent.  
From Private Property — 6,203,619 cu. ft. (175,686 m<sup>3</sup>) — 13.6 per cent.

### Value of Production

	1970	1969
Total Value of Sawn Timber (on mill skids)	\$25,143,600	\$23,906,000
Total Value of Other Forest Products	\$5,852,770	\$6,195,250



## Forest Area

	acres	hectares
Additions to State Forest	4,534	1,835
Excisions from State Forest	276	112
Land Purchased for Pine Planting	3,357	1,358
Total Area of State Forest	4,460,584	1,805,198

## Reforestation

Cut-over area treated for regeneration	126,381	51,146
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## Afforestation

Area planted with pines, 1969	7,674 ac.	3,106 ha.
<i>Pinus radiata</i>	2,551 ac.	1,032 ha.
<i>Pinus pinaster</i>	5,027 ac.	2,033 ha.
Other species	96 ac.	39 ha.
Total area of pine plantation established	65,215 ac.	26,392 ha.
<i>Pinus radiata</i>	26,114 ac.	10,568 ha.
<i>Pinus pinaster</i>	38,581 ac.	15,614 ha.
Other species	520 ac.	210 ha.
Total experiment areas (additional)	1,833 ac.	742 ha.

## Management

Survey—		
Theodolite surveys (control points)	19 (No.)	
Other surveys	4 miles	6 km.
Topographical mapping	1,931,220 acres	781,565 ha.
Assessment—		
Area covered	693,000 acres	280,457 ha.
Engineering, new works—		
Roads and tracks	345 miles	555 km.
Telephone lines	10 miles	16 km.
Houses and buildings	6 (No.)	

## Protection

Controlled burning	1,118,223 ac.	452,545 ha.
Fire Outbreaks—		
Number	294 (No.)	
Area burnt	13,838 ac.	5,600 ha.

## Nurseries (Hamel and Dryandra)

Trees produced for—		
Private buyers	274,354 (No.)	
Forests Department	436,128 (No.)	

## Sandalwood

Quantity exported	859 tons	873 m. tons
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## SOURCE AND USE OF FUNDS

Source—	1969/70	1968/69
Royalty on Timber etc.	2,909,632	3,077,704
Departmental Sales of Logs etc.	1,699,214	1,576,702
	<u>4,608,846</u>	<u>4,654,406</u>
General Loan Fund	400,000	400,000
Federal Road Grant	210,000	210,000
Commonwealth Government Softwood Forestry Agreement	600,000	600,000
	<u>5,818,846</u>	<u>5,864,406</u>
Use—		
Consolidated Revenue Fund	1,576,369	1,599,907
Reforestation Fund	3,192,550	3,054,678
Commonwealth Government Softwood Forestry Agreement	600,000	600,000
General Loan Fund	400,000	400,000
	<u>5,768,919</u>	<u>5,654,585</u>

## 2. REVENUE AND EXPENDITURE

Revenue from all sources was \$4,608,846 compared with \$4,654,406 the previous year.

In the following, figures in brackets refer to 1968/69. Of the net revenue, \$2,713,126 (\$2,761,178) was transferred to the Forests Improvement and Reforestation Fund. Expenditure charged against this fund was \$3,192,550 (\$3,054,678) and the balance in the fund at the 30th June, 1970, was \$257,430 (\$456,929) which includes a reserve for Fire Control, \$201,000, the balance being working account of \$56,430. The return from thinning operations in Departmental pine plantations was \$365,765 (\$255,305).

## 3. THE FOREST AREA

### State Forests (Forests Act, 1918-1969)

The total area of State Forest at 30th June, 1970, was 4,460,584 acres (1,805,198 ha.) which is an increase of 4,258 acres (1,723 ha.) compared with the total area at 30th June, 1970.

During the year, additions totalling 4,354 acres (1,835 ha.) were made to State Forest and 276 acres (112 ha.) were excised and reverted to the Lands Department.

	June, 1970		June, 1969	
	Acres	Hectares	Acres	Hectares
Jarrah	3,198,597	1,294,472	3,196,242	1,293,519
Karri	172,797	69,931	171,441	69,382
Jarrah and Karri (mixed)	656,082	265,516	656,039	265,499
Jarrah and Wandoo (mixed)	163,785	66,284	163,785	66,284
Tuart	6,435	2,604	6,471	2,619
Tingle Tingle	10,697	4,329	10,697	4,329
Karri and Tingle (mixed)	13,885	5,619	13,885	5,619
Sandalwood	1,930	781	1,930	781
Pine Planting Area	181,296	73,370	180,756	73,152
Mallet	54,928	22,229	54,928	22,229
Miscellaneous	152	61	152	61
	4,460,584	1,805,196	4,456,326	1,803,474

### Timber Reserves (Forests Act, 1918-1969)

The area held under Timber Reserve at 30th June, 1970, was 1,862,884 acres (753,909 ha.) which is a decrease of 2,992 acres (1,211 ha.) on the area at 30th June, 1969.

	June, 1970		June, 1969	
	Acres	Hectares	Acres	Hectares
Jarrah	96,476	39,044	98,320	39,790
Wandoo and Jarrah	71,682	29,010	71,682	29,010
Jarrah and Karri	465	188	465	188
Pine Planting	4,584	1,855	5,732	2,320
Mallet	475	192	475	192
Sandalwood	23,100	9,348	23,100	9,348
Mining Timber, Firewood etc.	1,666,102	674,271	1,666,102	674,271
	1,862,884	753,908	1,865,876	755,119

### Land Alienations, etc.

During the year ended 30th June, 1970, 134 applications for land, and for road provisions and closures, were received covering a total of 136,022 acres (55,048 ha.).

The Department agreed to the release as follows—

Alienations			Mineral Claims and Leases (Pastoral-Grazing)		
Timber Zone		Outside Timber Zone	Timber Zone		Outside Timber Zone
State Forest	Crown Land		State Forest	Crown Land	
acres	acres	acres	acres	acres	acres
68 (27 ha.)	8,819 (3,569 ha.)	.....	187 (76 ha.)	5,194 (2,102 ha.)	.....

No. of alienations approved 24

No. of leases approved 20

The total of freehold land held at 30th June, 1970, in the name of The Conservator of Forests was 51,208 acres (20,724 ha.), an increase of 3,354 acres (1,357 ha.).



### Mining in State Forests

The current level of mining activity in forest areas is of major concern. The over-riding powers of the Mining Act in respect of State Forests and timber reserves which date from the early days of gold mining coupled with the marked increase of mining activity, has given rise to the greatest threat the forest estate has experienced.



Mining for bauxite in State Forest near Jarrahdale. Since 1965 some 1,200 acres (486 ha.) of jarrah forest have been cleared but only about 300 acres (121 ha.) actually mined.

The position changes daily as new claims come to hand and the recording and plotting is completed. As at the 16th March, 1970, the position was as follows—

Area of State forest and timber reserves located in the south-west of the State .....	4,635,643 acres (1,876,045 ha.)
Area under mineral lease .....	Approx. 1,650,000 acres (667,755 ha.)
Area under mineral claims .....	Approx. 132,000 acres (53,420 ha.)
Area under temporary reserves .....	Approx. 734,000 acres (297,050 ha.)

It is readily seen that more than half the area of State Forest is subject to some form of mining claim or tenement.

The Forests Department has always supported the multiple use concept with relation to forest land and apart from normal forest produce aspects, has given attention to the needs of the Water Supply authorities, the naturalist, the tourist and the public recreational requirements.

Throughout the 52 years of forest management under the Forests Act of 1918, mining has been practised at Collie for coal and there has been intermittent activity at the Greenbushes tin field. Interest in mineral sands mining on the coastal strip in the past 20 years has been followed by the large scale operations for bauxite in the prime jarrah forests. At the present time, interest is being shown in a wide variety of minerals.

When the bauxite operations were first proposed, it was predicted that this would result in a loss of 35 acres (14 ha.) of forest per annum. In 10 years the Jarrahdale mining has grown to 300 acres (121 ha.) per annum and Pinjarra will have greater demands.

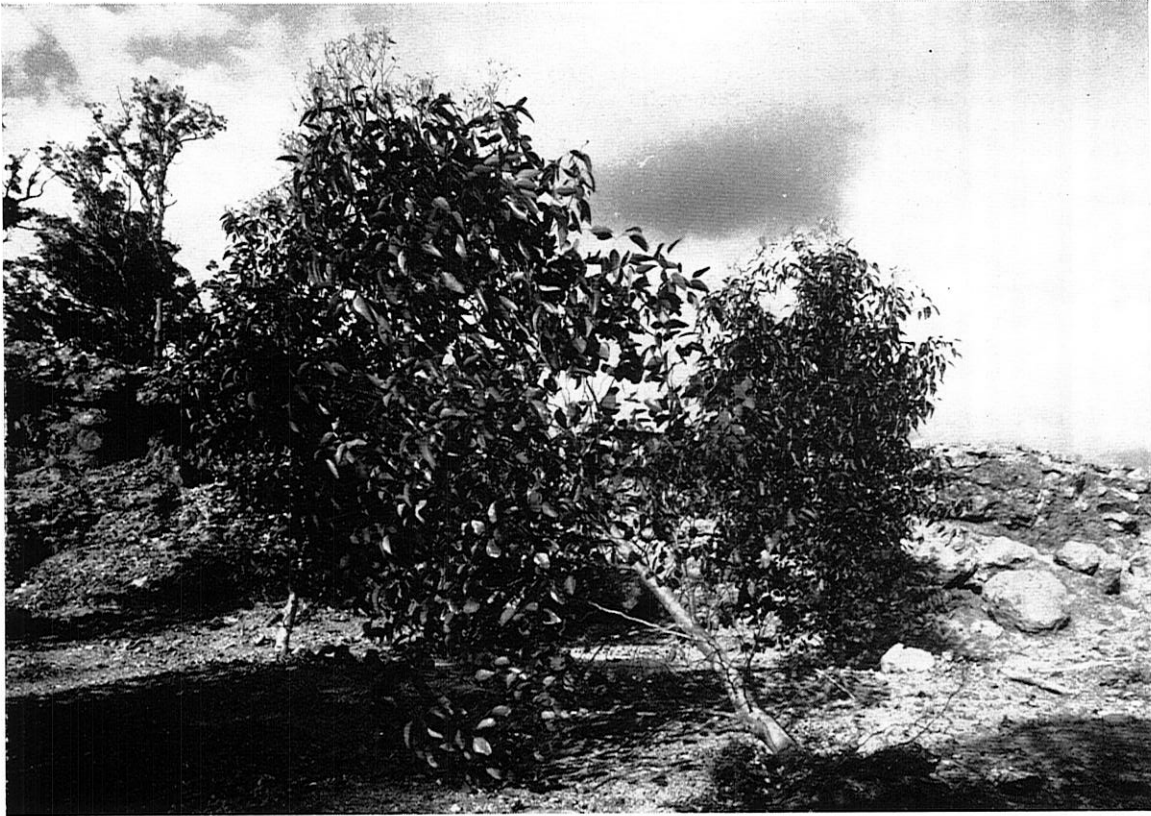
The established operations and the possibility of further major extensions must be viewed in the light of the State's current and future timber needs. State forests have been afforded protection for over half a century by requiring a resolution of both Houses of Parliament before the dedication can be revoked and the land directed to any other purposes. It is desirable that similar protection be given to areas proposed for open cut mining. The over-riding provisions of the Mining Act which still apply, were drawn up in the days of deep mining for rare minerals.



The photograph indicates the depth of mining and the type of regrowth jarrah forest which is being destroyed. In the foreground are five well-grown young Sugar Gums planted three years earlier in the overburden returned to the pit.

The restoration and rehabilitation of areas covered by mining is provided under agreements with the companies in the bauxite open cut areas. The seedlings established have shown vigour but it is too early to suggest that a successful forest crop will result. Some windthrow in 4 year old seedlings of various species serves to support earlier doubts expressed on the inadequacy of the soil depth to support a forest crop.





Recent windthrow in the oldest (4 years) planting. Where the depth of surface soil is shallow, the tree roots have failed to penetrate the underlying "hard pan" to gain the required anchorage.

Above : Sugar Gum (*Eucalyptus cladocalyx*) tipped over by strong winds.

Below : Pines too, suffer windthrow. Here a Pinaster Pine (*P. pinaster*) has struggled to gain a firm footing—and lost.



Action is being taken to oppose the establishment of further mining operations.

Apart from the loss of forest estate through mining, an annual average of 1,000 acres (405 ha.) has been rendered unproductive over the last 20 years by necessary public requirements for such uses as power-line clearing, water reservoirs and roads. Western Australia has only 0.7 per cent of its area set aside for production of its forest resource and there is little prospect of increasing this within the zone which receives suitable rainfall for forest establishment. Further erosion of prime forest by mining operations should not be undertaken without critical appraisal of all the factors involved in each case.

#### 4. SAWMILLING, TIMBER INSPECTION AND FOREST PRODUCE

##### Timber Production

The production of 15,614,003 cubic feet (442,188 m<sup>3</sup>) of sawn timber was an increase of 313,523 cubic feet (8,879 m<sup>3</sup>) on last year's figure. Of the total output 2,107,890 cubic feet (59,695 m<sup>3</sup>) came from private property, an increase of 222,182 cubic feet (6,292 m<sup>3</sup>) on the 1968-69 figure.

At December 31, 1969, there were 163 sawmills registered, of which 104 operated on Crown land and 59 on private property. This represents a total reduction of 28 on last year's registration being 11 for Crown land and 17 for private property mills. Details of the annual intake of mill logs and production of sawn timber are given in accompanying tables.

The annual intake of logs (1829-1970) is given in Appendix 5.

Roundwood production from Departmental pine plantations totalled 2,870,170 cubic feet (81,281 m<sup>3</sup>) an increase of 59,666 cubic feet (1,688 m<sup>3</sup>) on the figure for 1968-69 (See Afforestation).

Local plywood factories obtained the following quantities of peeler logs—

	Cub. ft.	m <sup>3</sup>
Karri	137,030	3,881
Jarrah and Other Hardwoods	32,110	909
Pine	220,458	6,243
	<u>389,598</u>	<u>11,033</u>

##### Timber Inspection

The total quantity of timber inspected during the year was 3,699,190 cubic feet (104,761 m<sup>3</sup>) made up as follows—

Railway Sleepers	2,715,621 cub. ft. (76,906 m <sup>3</sup> )
Ex Crown Land	1,854,321 cub. ft. (52,514 m <sup>3</sup> )
Ex Private Property	833,638 cub. ft. (23,609 m <sup>3</sup> )
Re-inspected	27,662 cub. ft. (783 m <sup>3</sup> )
Other Sawn Timber	983,569 cub. ft. (27,855 m <sup>3</sup> )

All railway sleepers produced were inspected.

#### TIMBER PRODUCTION PRODUCTION OF TIMBER FOR YEAR ENDED 30th JUNE, 1970 (EXCLUSIVE OF MINING TIMBER, FIREWOOD, POLES AND PILES)

Tenure	Volume of Mill Logs by Species								Totals	
	Jarrah	Karri	Wandoo	Yarri	Sheoak	Marri	Pine	Other	In Log	Recovery of Sawn Timber
Crown lands— cub. ft. ....	27,216,271	8,143,628	506,998	125,185	9,182	628,488	2,870,170	97,401	39,597,323	13,506,113
m <sup>3</sup> ....	770,765	230,628	14,358	3,545	260	17,799	81,283	2,758	1,121,396	382,493
Private Property cub. ft. ....	4,550,398	510,749	847,099	79,110	283	160,255	53,474	2,251	6,203,619	2,107,890
m <sup>3</sup> ....	128,868	14,464	23,990	2,240	8	4,538	1,514	64	175,686	59,695
Total cub. ft. ....	31,766,669	8,654,377	1,354,097	204,295	9,465	788,743	2,923,644	99,652	45,800,942	15,614,003
m <sup>3</sup> ....	899,632	245,092	38,348	5,786	268	22,337	82,797	2,822	1,297,082	442,188

In addition to the above 44,687 tons (45,402 metric tons) of wandoo logs were treated for tannin extract.



QUANTITY OF SAWN TIMBER PRODUCED FROM CROWN LANDS AND PRIVATE PROPERTY FOR THE PAST TWO YEARS

Year Ended 30 June	From Crown Lands		From Private Property		Total Quantity	Estimated Value at Mill Skids of Timber Obtained	
	Sawn Timber other than Sleepers	Sawn Sleepers	Sawn Timber other than Sleepers	Sawn Sleepers			
1969	cub. ft. ....	11,737,213	1,677,559	1,232,745	652,963	15,300,480	\$ 23,906,000
	m <sup>3</sup> ....	332,398	47,508	34,911	18,492	433,309	
1970	cub. ft. ....	11,651,792	1,854,321	1,274,252	833,638	15,614,003	25,143,600
	m <sup>3</sup> ....	329,979	52,514	36,087	23,609	442,189	

DISTRIBUTION OF SAWN TIMBER

Distribution		Sleepers	Other Sawn Timber		Total
		All Species	Karri	Jarrah and Other Species	
Interstate	cub. ft. ....	619,242	649,575	808,532	2,077,349
	m <sup>3</sup> ....	17,537	18,396	22,898	58,831
Overseas	cub. ft. ....	501,097	184,089	636,999	1,322,185
	m <sup>3</sup> ....	14,191	5,213	18,040	37,444
Local	cub. ft. ....	1,567,620	2,630,410	8,016,439	12,214,469
	m <sup>3</sup> ....	44,395	74,493	227,026	345,914
Total	cub. ft. ....	2,687,959	3,464,074	9,461,970	15,614,003
	m <sup>3</sup> ....	76,123	98,103	267,963	442,189

**Distribution of Timber**

The overall increase of 313,523 cubic feet (8,879 m<sup>3</sup>) in the production of sawn timber, when compared with 1968-69, was absorbed by a rise in total exports of 346,737 cubic feet (9,819 m<sup>3</sup>). There was little change in the State's consumption of its local production, but total imports, both in quantity and value, continued to rise.

Some of the highlights of the movement of timber during the year when compared with 1968-69, were—

*Exports.* The overseas market for railway sleepers improved to the extent of 421,000 cubic feet (11,923 m<sup>3</sup>) with United Kingdom increasing its intake by 344,000 cubic feet (9,742 m<sup>3</sup>). Supplies to South Africa fell by 45,000 cubic feet (1,274 m<sup>3</sup>) but new markets totalling 159,000 (4,503 m<sup>3</sup>) were found in Kenya, Tanzania and Israel.

Overseas exports of other sawn jarrah fell by 96,000 cubic feet (2,719 m<sup>3</sup>) mainly as a result of a reduction in supplies to Kenya. There was little change in the overseas demand for karri.

There was a small gain in total interstate exports, the decrease of 99,000 cubic feet (2,804 m<sup>3</sup>) being more than balanced by increases of 60,000 cubic feet (1,699 m<sup>3</sup>) each for jarrah and karri.

*Imports.* Significant rises in the value of overseas imports when compared with 1968-69, were—

Sawn hardwoods, \$457,000, of which Malaysia accounted for \$426,000 and dressed and moulded timbers, \$26,000 with Malaysia trebling its contribution.

The outstanding feature of interstate imports was the dramatic rise of \$744,000 to \$1,123,000 in the value of reconstituted wood (particle board etc.). However it should be noted that the import bill for this product in 1967-68 was \$1,223,238. Although the quantity of plywood and veneer imported was less, the value rose by \$190,000. Of the \$47,000 worth of rough sawn conifers imported—nearly five times the value for 1968-69—South Australia provided approximately one-half and New South Wales one-third. It is noteworthy that the value of rough-sawn hardwoods from interstate sources rose from \$5,738 in 1968-69 to \$91,964 this year.

*Local Consumption.* Once again local consumption of the State's sawn production was lower than one would expect for a "State on the move" and was slightly less than last year's figure. Although there were increases in the local use of karri—782,000 cubic feet (22,146 m<sup>3</sup>)—and railway sleepers—64,000 cubic feet (1,812 m<sup>3</sup>)—these were more than offset by a drop in jarrah and other species of 879,000 cubic feet (24,893 m<sup>3</sup>).

Currently the timber industry is facing stiff competition from substitute materials—in particular, concrete for flooring, and aluminium for door and window frames, and now, house framing. The rapidly expanding building development in the North-West mining centres has not helped the industry to the extent hoped for, in that the lower freight on timber imported from overseas through North-West ports, means that the landed cost is so low that West Australian firms find it most difficult to compete on a contract basis.

In addition there has been a marked decline in house building activity in the Metropolitan Area where the tendency is to build more and more flats which have little timber content. For the first six months of 1969, the number of housing approvals averaged 1,000 per month, but for the corresponding period of 1970 the average was only 609 per month.

It will be appreciated that reduced activity in the timber industry means a drop in royalties for log timber and a consequent decline in the income of the Department.

### Sandalwood

The demand for sandalwood continued and 859 tons (873 m. tons) were exported compared with 614 tons (624 m. tons) for the previous year. To increase supplies of sandalwood, it was agreed to raise the price paid for logwood received after the 30th November, 1969, from \$76 to \$98 per ton cleaned of bark and sapwood and to accept sandalwood logs cleaned of bark only at a price of \$76 per ton.

Sandalwood received at Fremantle during the year totalled 749 tons (761 m. tons) compared with 628 tons (638 m. tons) for the year ended 30th June, 1969, and this quantity was made up as follows—

<i>Crown Land</i>		Tons	Metric Tons
Logwood (including roots and butts)	....	650	660
Pieces	....	99	101
<i>Private Property</i>	....	Nil	....
		<u>749</u>	<u>761</u>

No orders for logwood were placed by distillers but 49 tons (50 m. tons) of roots and butts were delivered to them for oil distillation purposes.

A total of 3,136 lb. (1,422 kilos) of W.A. sandalwood oil was exported interstate and overseas.

The Conservator was elected Chairman of the Sandalwood Export Committee following his appointment to the Committee as W.A. Government representative.

### Firewood Production

The following table shows the quantity of firewood produced according to returns received. A large quantity is also obtained from private property for which returns are not received.

	Crown Land (Tons)	(Metric Tons)	Private Property (Tons)	(Metric Tons)	Total (Tons)	(Metric Tons)
<i>Sawmills—</i>						
For Sale	85,543	86,912	7,529	7,649	93,072	94,561
Own Use	34,277	34,825	122	124	34,399	34,949
<i>Permits and Licenses—</i>						
South-West	53,826	54,687			53,826	54,687
<i>Permits and Licenses—</i>						
Goldfields	25,686	26,097			25,686	26,097
<i>Other Permits and Licenses—</i>						
Wundowie	95,373	96,899			95,373	96,899
Kalgoorlie-Mines	1,957	1,988			1,957	1,988
Kalgoorlie-Pumps	10,704	10,875			10,704	10,875

### Other Forest Produce

Poles and piles obtained from Crown land during the year amounted to 1,520,949 lineal feet (463,585 m.) compared with 2,252,874 lineal feet (686,676 m.) for the previous year. Of the total, 625 lineal feet (190 m.) were produced from Departmental operations while returns for private property showed 81,638 lineal feet (24,883 m.) as compared with 261,395 lineal feet (79,673 m.) for the year 1968-69.

Posts and strainers cut from Crown lands totalled 342,526 of which 5,732 were produced by the Department. Records received show that 15,609 posts and strainers were obtained from private property, but this is only a small percentage of the total production from this source.

Apart from sawn timber supplied by sawmills, 11,667 tons (11,854 metric tons) of mining timber were used. All of this was obtained from Crown lands, 7,011 tons (7,123 metric tons) being from inland forests.

The number of Christmas trees sold was 8,384, compared with 10,228 the previous year. Revenue from sales amounted to \$4,381.

FOREST PRODUCE NOT ELSEWHERE INCLUDED IN PRODUCTION TABLES

Description of Forest Produce	South-West Division and Agricultural Areas			Goldfields Areas	Total
	Supplied by Department	Other Crown Lands	Private Property		
Mining Timber	Tons	4,656	....	7,011	11,667
	Metric Tons	4,731	....	7,123	11,854
Charcoal	Tons	39,941	....	....	39,941
	Metric Tons	40,580	....	....	40,580
Poles, Piles and Bridge Timbers	Lin. ft.	625	1,437,996	81,638	690
	Metres	191	438,301	24,883	210
Fence Posts and Rails	No.	5,655	156,389	15,609	150,920
Strainer Posts	No.	77	13,876	....	13,953
Wandoo Timber for Tannin Extract	Tons	....	8,575	36,112	....
	Metric Tons	....	8,712	36,690	....
Beansticks etc.	No.	....	10,000	....	5,500
Boronia Blossom	lb.	....	2,381	911	....
	Kilos.	....	1,080	413	....
Gravel and Stone	cu. yds	....	147,005	....	147,005
	m <sup>3</sup>	....	112,217	....	112,217
Sand	cu. yds.	....	4,006	....	4,006
	m <sup>3</sup>	....	3,058	....	3,058
Scout Staves	No.	700	....	....	700
Sawdust consumed as Fuel	Tons	....	126,868	....	126,868
	Metric Tons	....	128,899	....	128,899

**Boronia Resource Survey**

Within recent years public concern has been expressed that increased exploitation by pickers, and perhaps fire, may be threatening Western Australia's resources of brown boronia (*Boronia Megastigma*)—one of our most popular indigenous wildflowers, being renowned for its delightful perfume.

Since the beginning of the century, this species, which occurs naturally in the wetter areas of the extreme South-west of the State, has been picked to supply a demand for decorative sprays, flowers for the perfumery trade and seed for propagation. It ranges sparsely over an area of about 10,000 square miles.

In 1969, the Department arranged for a survey to assess the current boronia resource situation.

All the evidence indicates that rational picking does not appear to threaten survival, but without burning, boronia has a life span of only seven to ten years before it is suppressed by longer-lived and more vigorous scrub. Periodic burning seems essential for the continued reproduction of the species.

Although many hundreds of acres have been lost in clearing land alienated for agriculture, there are 250 known locations of boronia totalling 1,000 acres, within State Forest and these will continue as a permanent asset under protection, as long as the land remains State Forest.

**5. FOREST MANAGEMENT AND CONSERVATION**

**FOREST CONSERVATION**

For nearly 90 years the forests of Western Australia were exploited for their timber without any serious effort being made for replacement of the resource. Fortunately a small group of enlightened, far-sighted citizens realised that the resource was not in fact "inexhaustible" and objected strongly to "mining" of the forest. It was through their efforts that the Forests Act, which aims at the conservation and regeneration of our native forests, was passed in 1918 and gazetted early in 1919.

Since the passing of the Act, conservation as practised by the Department, has not been the narrow concept of preservation, but rather the planned use and management of land, water, and their associated resources, for the provision of optimum social and economic returns.

The first step taken by the Department was the acquisition of prime forest for dedication as permanent State Forest. This was followed by measures to control exploitation so that only the forest increment was removed. Regeneration of cut-over areas then ensured that our forest resource would be with us in perpetuity.

Protection of the forest from fire was obviously necessary and an efficient fire control organisation has been developed. Not only are State Forests and timber reserves protected but a further two million acres of other Crown land and private property are given indirect protection, due either to their strategic significance in relation to State Forest or to their forest value.

Forest maps produced from aerial photographs, are of considerable value to Departmental research officers, C.S.I.R.O. and University staff, and amateur conservation groups, studying ecology. In fact, these maps are the most suitable available basis for conservation studies in the high rainfall areas of the State. More recently, ecological site surveys linking vegetation with climate, topography and soil, provide a ready-made reference system for intensive studies of fauna and flora.

The Department has undertaken a number of major projects some of which are, or were, not revenue producing. These include—

Sand dune reclamation on areas along the South coast.

The establishment and maintenance of 56 arboreta scattered throughout the wheatbelt and the raising of tree seedlings for supply to farmers, Local Government authorities and other Government departments for shade, shelterbelt and ornamental purposes.

The protection of Dryandra State Forest north-west of Narrogin, which has long ceased to be a commercial proposition following the collapse of the mallet bark market. The forest is now one of the largest and finest fauna reserves in the Great Southern region.

The Native Flora Protection Act is administered by the Department and the Conservator is Chairman of the recently formed "Committee for Conservation of Road Verges".

Departmental officers have played and continue to play an active role on various bodies which are concerned with the conservation of natural resources. Some of these are—

Western Australian Wild Life Authority  
Reserves Advisory Council  
Water Purity Advisory Committee  
Soil Conservation Advisory Committee  
Water Research Foundation of Australia.

Unfortunately the present over-riding powers of the Mining Act and the major upsurge of open-cut mining activities can seriously threaten the conservation of our valuable and unique indigenous forests. It is intended to give evidence to the Committee of Inquiry Into the Mining Act with a view to having the position rectified.

### Forest Recreation

The valuable contribution forests make to national welfare as recreation grounds is being increasingly appreciated by the community at large.

The need for these recreation grounds in Western Australia is indicated by the popularity of developed and undeveloped picnic areas throughout State Forests, the present public use of forest areas and tourist roads developed with the aid of Treasury grants, and the demand for nature reserves and national parks.

To gauge public activity in forest areas, a pilot survey was carried out by Departmental officers in the divisions of Mundaring and Kelmscott. Based on limited data, it was estimated that in 1969 some 237,000 people visited State Forest areas within 35 miles of Perth.

The survey was designed to obtain information on—

- (a) The number of people using State Forests for picnics, sightseeing and other weekend activities;
- (b) Some indication of the habits, preferences and opinions of forest visitors; and
- (c) The proportion of people observed in certain locations within the forest, such as water catchments and areas affected by *Phytophthora cinnamomi* root rot fungus.

The pilot survey has paved the way for more precise surveys which should provide useful information in future planning for recreational use of State Forests both for developed and undeveloped sites, sightseeing and nature reserves.

One of the more popular picnic and touring spots made readily accessible with the aid of Treasury grants, is the "Rainbow Trail" which commences about a mile west of Pemberton in the karri forest region. (See cover.)

Old timber tramway formations and connecting tracks were up-graded to make safe all-weather roads suitable for tourist traffic. Signposts and information boards were erected, parking areas cleared and provided with barbecue facilities, rustic tables and seats, and playground areas. Rubbish bins and disposal services were also provided.

An information folder produced for the Rainbow Trail includes a map of the area and surrounding points of interest.

Other projects carried out in the karri forest region were, briefly—

Pemberton: Gloucester Tree picnic spot and facilities and the Cascades walking trail.

Manjimup: Walking lanes and a picnic spot at One-Tree Bridge on the Donnelly River. The famous group of fine karri trees, "The Four Aces" is barely half-a-mile from this spot.

A noticeable trend is the increasing public use of abandoned forest settlements for picnic grounds. Factors in favour of this appear to be the open areas once occupied by houses, a variety of exotic and indigenous trees—most of which were planted by the Department around the houses followed by others after cleaning-up operations—and the existence of good access tracks for walkers. One of the most popular of these is Glencagle, 33 miles (53 km.) from Perth on the Albany Highway.

There are a number of other picnic spots in such widely separated places as Inglehope, nine miles east of Dwellingup on the road to Boddington; and Willow Springs, an abandoned sawmill and forest settlement in karri forest country some 11 miles east of Nannup and south of the Bridgetown road.





Part of the Gleneagle picnic ground on the Albany Highway 33 miles (53 km.) from Perth. Note the rustic tables, seats and litter bin and the stone fireplace.

## MANAGEMENT

### Working Plans

*Hardwood Inventory.* Information on the stocking of 697,000 acres (282,076 ha.) of hardwood forest in parts of the Shannon, Pemberton, Nannup, Busselton and Collie division was obtained by the measurement of 1,474 sample plots covering 2,081 acres (842 ha.). The data was processed by computer.

*Softwood Inventory.* Measurements were made of 1,100 temporary and 465 permanent angle-count plots in plantations at Margaret River, Grimwade, Collie and Harvey. The data was processed by computer and the results show that top height is a better indicator of the condition of the stand than is density stratification.

*Projects.* Re-interpretation of dieback areas in the northern jarrah forests indicates that the average annual rate of spread since 1965 is generally less than four per cent of the then infected area.

The value of both colour and black and white aerial photographs in locating areas of dieback in the southern jarrah forests was investigated. To date the use of 70 m.m. colour strips at scale 1:3168 and 9 in. x 9 in. black and white prints at scale 1:40,000 has given best results.

A technique for checking the effectiveness of aerial controlled burns was developed using 70 m.m. Ektachrome infra-red film at 1 in. = 40 chains scale.

A map showing all known occurrences of karri outside the main belt has been prepared from small and medium scale air photos. Doubtful occurrences will be field checked before the map is finally published.

To provide basic data needed to revise pine marketing policy an estimate was made of the annual yield of chip, case, and sawlog materials to be expected for the next 25 years from pine plantations to be established, as well as from those already established.

### Mapping and Surveys

Re-mapping plantations, using co-ordinated photo-control, continued with the completion of contoured 10 chain scale plans of Harvey Division plantations Myalup and McLarty. The project covering Wanneroo plantations was commenced and five map sheets have been published. In addition, existing maps were revised to include new clearing and planting as shown on recent aerial photographs.

The medium scale maps Dwellingup 80 and Harvey 80 were completed and are awaiting printing. Preparation of maps Busselton 80 and Kirup 80 is proceeding. Aerial photographs were obtained for the revision of maps in the Southern Region and this is in progress with sheets Manjimup 80 and Pemberton 80 being prepared for republishing.

Project mapping included contouring about 1,000 acres (405 ha.) of Iffley dieback research area, planimetric 20 chain scale mapping totalling 150,000 acres (60,705 ha.) and mapping the 1969 interpretation of areas affected by jarrah die-back. Large scale mapping was completed of Departmental settlements Gngangara and Pemberton.

The policy was adopted that all co-ordinating and tower plans would be prepared at Head Office and plans required for the 1970/1971 fire season are now in course of preparation.

Theodolite surveys were effected to provide co-ordinated control for stereoplotting and 19 points were fixed for mapping control. Height control was established at 43 stations.

### **Forest Engineering**

Engineering projects during the year included the construction of 345 miles (555 km.) of roads, tracks and firelines and the regrading of 4,610 miles (7,417 km.) of existing roads.

A further 10½ miles (16½ km.) of telephone line were erected.

### **Plant and Equipment**

A total of 60 workshop wages employees, two less than last year, maintained all items of plant and equipment.

Eight apprentices completed their training during the year, one resigned and six were engaged, bringing the total employed to seventeen. Of the six apprentices engaged, four qualified for four year terms and the remainder for five year terms.

Major items of fabrication completed during the year included three workshop gantries, one pine seedling transporter, one nursery trailer, one pine lifter, one portable compressor, four tractor canopies, one boom spray, three bulldozer blades and other small items for field and research use.

### **Departmental Buildings**

During the year six houses were erected bringing the total owned by the Department to 505.

The Lindsay tower south of Nannup and the Hampden tower north of Myalup were the two new fire lookouts constructed. Each will improve fire detection in nearby pine plantations.

A small sawmill was built at Pemberton to cut pine thinnings from nearby plantations. This replaces the old Pimelea sawmill.

Other new buildings included two glasshouses, three shadehouses, a laboratory and storage shed and two ablution blocks.

### **Communications**

*Radio.* The installation of High Frequency (H.F.) and Very High Frequency (V.H.F.) radio at Narrogin was completed and included the equipping of two mobiles.

The new Hampden fire lookout tower was equipped with V.H.F. radio and is now linked to Mt. William fire lookout tower and Harvey headquarters for transmission and receipt of reports of sightings of smoke.

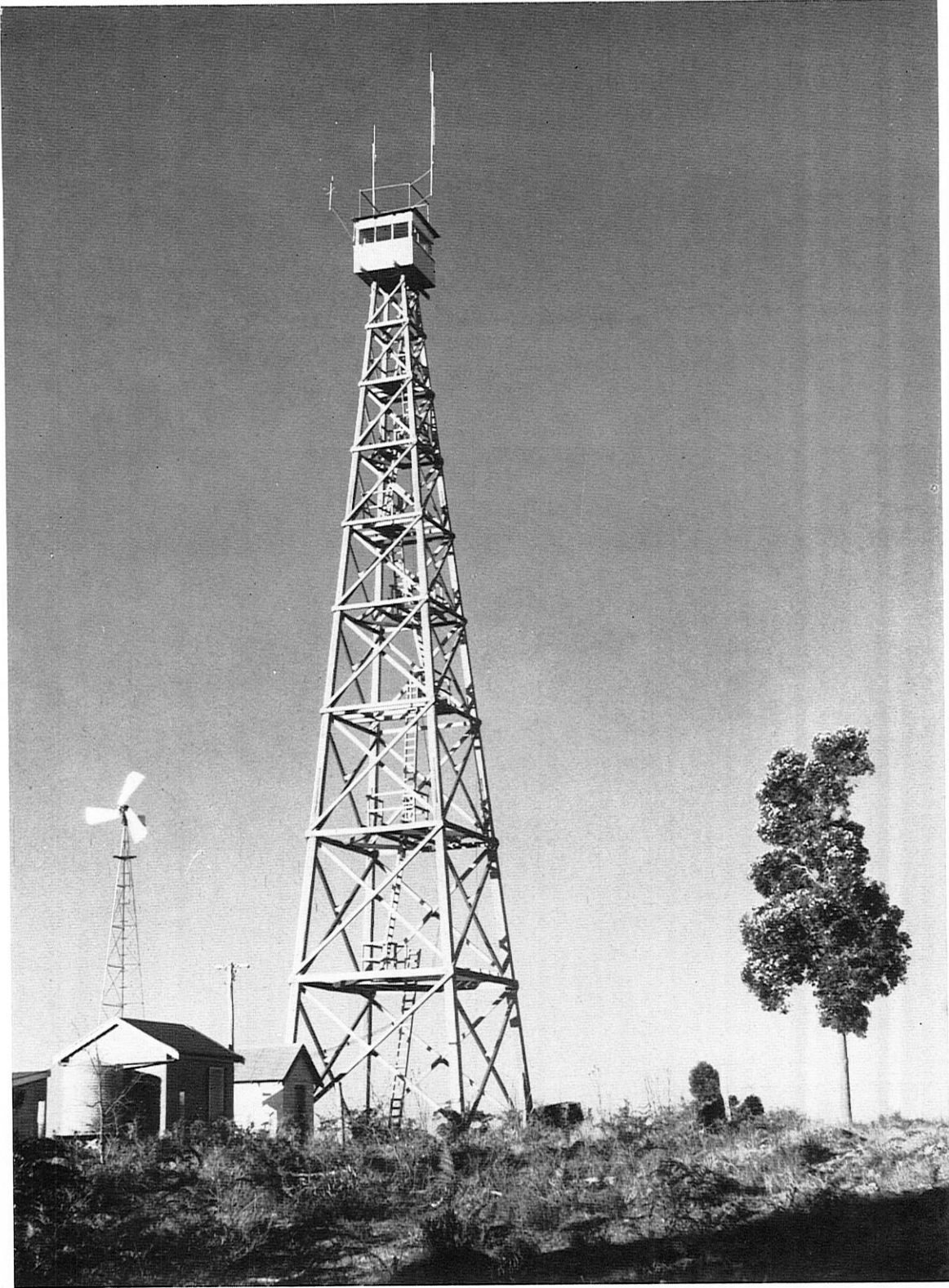
Modifications were made to the wind generator system of the East Kirup repeater station.

Improved ground to air communication was achieved by fitting 10 watt radio telephones with foot control to aircraft used in controlled burning.

*Radio Telephones.* Arrangements to modify the selective call radio-telephone at Kelmscott so that it can communicate with Mt. Solus tower and Jarrahdale as well as Mt. Dale tower, are complete. This will be done by moving the equipment to Roleystone with control to Kelmscott office through P.M.G. telephone lines.

Twenty vehicles were wired and equipped ready for the installation of radio.

*Telephones.* The installation of a major telephone inter-office communication system at Manjimup, commenced last year, was completed on schedule, and telephone connection made to the new Divisional Forest Officer's residence at Pemberton.



Early detection and rapid communication are basic requirements in controlling outbreaks of fire. Milward fire lookout tower, overlooking native forests and pine plantations in the Nannup Division, combines these two requirements, being equipped for Very High Frequency (V.H.F.) radio transmission. The tower acts as a repeater station in the overall communications network.

## 6. REFORESTATION

Concentrated logging in the northern jarrah forest areas and integration of logging with other forms of utilization such as pole and pile getting has substantially reduced the total area of forest worked over in the year. This has achieved the first objective of the logging hygiene programme which has now been introduced into all operations throughout the jarrah forest with complete co-operation from the timber industry.

Re-establishment of resistant species upon dieback sites continued on a field trial basis in all Divisions but was extended into a full scale plantation project which covered 227 acres (92 ha.) in the, Kelmscott division.

Special techniques for rehabilitating the less favourable dieback sites with *P. pinaster* are being developed. This treatment involves deep ripping and spot sowing or planting in the ripped lines after minimal clearing, because the cost of such operations must be closely related to predicted returns. Field trials covered 200 acres (81 ha.) during the year and this technique will be further tested before being introduced on an operational basis.

"Clear cutting" with seed trees has been continued in the karri forest and has resulted in the complete regeneration of cut over stands with a full stocking of regrowth from natural seed fall. This system has also demonstrated the ancillary advantages of reducing the amount of road construction needed to service each years cutting coupe and of reducing the total area requiring intensive fire protection after regeneration.



A "wheatfield" crop of young karri in the Pemberton Division following a successful prescribed "regeneration burn".



Field trials of replanting cut over areas with karri wildlings are being costed to determine the economics of using this technique to keep reforestation with karri up to date in the event of lengthy gaps in the cycle of natural seed production.

During the year 89,138 acres (36,074 ha.) of virgin State Forest were cut over, made up of jarrah forest 78,708 acres (31,853 ha.), karri 5,517 acres (2,233 ha.), wandoo 9,342 acres (2,781 ha.) and other species 1,571 acres (636 ha.).

In addition 68,641 acres (27,779 ha.) of State Forest cut over in the past were logged again.

Timber stand improvement operations involving the removal of trees surplus to crop requirements continued on a limited scale as the majority of the stands likely to show a substantial economic return from this treatment have already received attention.

Experimental rehabilitation of areas cleared for bauxite mining near Jarrahdale has been continued and a total of 470 acres (190 ha.) of replanting has been completed to date. On about half of this area replanting was on areas cleared for mining but not subsequently excavated and it is hoped that improved exploratory techniques will substantially reduce the area of unnecessary clearing.

Results of the earliest plantings in 1965 show some early promise, but as the trees increase in height they are becoming susceptible to windthrow because their roots are mainly confined to the shallow layer of replaced top soil and are unable to penetrate the compacted surface of the underlying pit bottoms. Results of earlier trials indicate that moisture retention and root penetration are improved by deep ripping and the need for this treatment is becoming increasingly apparent.

It must again be stated that the commercial potential of these rehabilitated areas cannot be fully evaluated for many years. Tentative conclusions may be available by 1975 at the earliest, but because of the nutritional and physical problems associated with these extremely refractory sites, firm conclusions cannot be drawn until the trees have formed stands of commercial size.

On present information approximately 240 acres (97 ha.) will be mined each year in the Jarrahdale area together with a further 480 acres (194 ha.) near Dwellingup when the Pinjarra plant comes into operation. Rehabilitation of these areas will constitute a major task, the success of which depends upon very fragmentary information at present.

## 7. AFFORESTATION

### Blackwood Valley Plantations

Originally the south-west of the State within the 30 in. (76 cm.) and over rainfall zone, contained some 16 million acres (6.5 million ha.) of hardwood forest, but much of this has been alienated and either cleared for agriculture or heavily exploited for its timber. The State now has barely  $4\frac{1}{2}$  million acres (1.8 million ha.) permanently dedicated for forest production, of which, more than  $3\frac{1}{2}$  million acres (1.4 million ha.) have been cut over with varying degrees of intensity.



An example of some of the degraded farmlands on the upper slopes of the Blackwood Valley which have been re-purchased for afforestation with *P. radiata*.

The permanently dedicated native hardwood forests are quite inadequate to support a population of more than one million persons at the past and probable future levels of wood and wood product usage.

This leaves a choice of two alternatives for the future : Either import our forest product requirements at prices which will continue to rise in a world where rapidly increasing population makes increasing demands on the world's forest resources ; or : Create a new and diversified timber industry complex in the south-west of Western Australia to supply the demand for sawn and processed forest products, based on a rapidly expanded softwood planting programme and the State's continuously regenerated hardwood forests.

The current forest products import bill for Australia is well in excess of \$200 million, and will soon exceed that for petroleum products as the nation's major import expenditure item.

To provide an expanded programme of softwood planting, basic requirements are, suitable species and adequate areas of land with the required climatic and soil condition.

Despite trials over a period of 50 years of many softwoods, only two species have so far proved suitable for the economic production of wood on a commercial scale. The best species, with three times the yield potential of the other, and some twenty times the yield potential of jarrah, is *Pinus radiata*, but it is extremely demanding as to site.

Soils suitable for *P. radiata* plantations are very limited and most of such areas have long since been alienated from the Crown. The valley of the Blackwood River and its tributaries, between Nannup and Boyup Brook, is the largest and best example of such an area.

Soils in State Forest suitable for *P. radiata* have either been planted or are listed for conversion to this species. For expansion of large scale planting, purchase of privately owned land is essential.

Since 1955 some 26,000 acres (10,522 ha.) of suitable land has been purchased in the Blackwood Valley and plantations are being established at an increasing rate.

To maintain continuity of plantings and achieve the accepted afforestation target by the year 2000, the purchase of further suitable land is an urgent requirement with the aim of acquiring at least 40,000 acres (16,188 ha.). Some 14,000 acres (5,666 ha.) were recently on offer, of which 13,000 acres (5,261 ha.) would be suitable for *P. radiata* and it is understood further properties are in the hands of agents for sale.



Multiple land use in the Blackwood Valley. Orchards and pasture are found in the valley floor and on the lower slopes, while the upper slopes are devoted to plantations of Radiata Pine.

It is estimated that 40,000 acres (16,188 ha.) of *P. radiata* progressively planted at the rate of 1,000 acres (405 ha.) a year for 40 years would provide steadily increasing employment for an ultimate work force of 1,600 and an annual product output of \$12 million to \$15 million. At a planting rate of 1,500 acres (607 ha.) a year, employment could rise to 2,400, and the annual value of the product output increase to \$18 million to \$23.5 million.

Industries likely to develop in utilizing plantation-grown pine as a raw material are : particle board, pulp, wood preservation, sawmilling, plywood and veneer, transport (from forest to plant, to market), and engineering services.

The employment of some 1,600 persons in the establishment, tending, harvesting and processing of forest produce would imply some 1,200 families, with the necessary facilities such as housing, schools, power, water supplies, transport, shops and other services.



A fine young stand of Radiata Pine established 10½ years earlier on high ground overlooking the Blackwood Valley.

This would involve considerable expansion of the townships concerned with a great increase in housing and the essential services normally associated with a population of 4,000 to 5,000 people.

The scheme would also provide a local market for farm produce and provide a source of employment for the families of farmers established in the district.

From full consideration of all factors involved, it is recommended that :

1. A firm policy of land acquisition be adopted for the Blackwood Valley to facilitate the purchase of suitable properties as and when they become available.
2. That financial provision be made to support this policy.

### **Pine Plantations**

During the winter of 1969 a total of 7,674 acres (3,105 ha.) of pines, a new record, were planted of which 853 acres (345 ha.) were for experimental purposes.

Allowing for the clear felling of 142 acres, the total area planted to pine at 31st December, 1969 was 67,048 acres (27,134 ha.) of which 1,833 acres (742 ha.) were for experimental purposes.



The distribution of these plantations, by Divisions was as follows :—

Division	<i>P. radiata</i>		<i>P. pinaster</i>		Other Species		Total	
	ac.	ha.	ac.	ha.	ac.	ha.	ac.	ha.
Wanneroo	53	21	24,482	9,908	154	62	24,689	9,992
Metropolitan	41	17	2,040	826	30	12	2,111	854
Mundaring	2,386	966	1,732	701	148	60	4,266	1,726
Kelmscott	181	73	1,960	793	24	10	2,165	876
Dwellingup	206	83	89	36	16	6	311	126
Harvey	3,984	1,612	4,423	1,790	31	13	8,438	3,415
Collie	3,966	1,605	9	4	.....	.....	3,975	1,609
Kirup	6,097	2,468	193	78	.....	.....	6,290	2,545
Nannup	6,378	2,581	141	57	21	8	6,540	2,647
Busselton	1,409	570	3,454	1,398	59	24	4,922	1,992
Manjimup	524	212	.....	.....	.....	.....	524	212
Pemberton	889	360	58	23	37	15	984	398
Plantation Totals	26,114	10,568	38,581	15,614	520	210	65,215	26,392
Experimental Areas	299	121	1,390	562	144	58	1,833	742
Totals	26,413	10,689	39,971	16,176	664	268	67,048	27,134

The 1969 plantings were spread over the following Divisions :—

Division	<i>P. radiata</i>		<i>P. pinaster</i>		Other Species		Total	
	ac.	ha.	ac.	ha.	ac.	ha.	ac.	ha.
Wanneroo	.....	.....	2,997	1,213	.....	.....	2,997	1,213
Mundaring	32	13	248	100	.....	.....	280	113
Kelmscott	.....	.....	455	184	.....	.....	455	184
Dwellingup	206	83	5	2	16	6	227	92
Harvey	643	260	334	135	.....	.....	977	396
Collie	452	183	5	2	.....	.....	457	185
Kirup	483	195	.....	.....	.....	.....	483	195
Nannup	652	264	110	45	.....	.....	762	308
Busselton	17	7	161	65	5	2	183	74
Plantation Totals	2,485	1,005	4,315	1,746	21	8	6,821	2,760
Experimental Areas	66	27	712	288	75	30	853	345
Totals	2,551	1,032	5,027	2,034	96	38	7,674	3,105

### Roundwood Production

Roundwood production from Departmental plantations, mainly in the form of thinnings, amounted to 2,870,170 cubic feet (81,281 m<sup>3</sup>) which was only a small increase of 59,666 cubic feet (1,688 m<sup>3</sup>) or 2.1 per cent over the previous year's production. The following figures show the trend in pine log removals in recent years—

Year Ended June 30	Cubic ft. (U.B.)	m <sup>3</sup> (U.B.)
1950	298,010	8,440
1955	710,845	20,131
1960	1,002,619	28,394
1965	1,721,951	48,766
1966	1,958,345	55,460
1967	2,007,325	56,847
1968	2,393,413	67,781
1969	2,810,504	79,593
1970	2,870,170	81,281

Removals by category and by species were as follows—

Category	<i>P. radiata</i>		<i>P. pinaster</i>		Total	
	cu. ft.	m <sup>3</sup>	cu. ft.	m <sup>3</sup>	cu. ft.	m <sup>3</sup>
Sawlogs	942,488	26,691	314,768	8,914	1,257,256	35,605
Chipwood	199,539	5,651	1,099,513	31,138	1,299,052	36,789
Peeler Logs	215,152	6,093	5,360	150	220,458	6,243
Fence Posts and Rails	54,083	1,532	10,044	284	64,127	1,816
Woodwool Logs	743	21	13,041	369	13,784	390
Miscellaneous Poles	5,165	146	10,328	292	15,493	438
Total	1,417,170	40,134	1,453,000	41,147	2,870,170	81,281

A feature of the year's production was the 27 per cent drop—472,260 cubic feet (13,374 m<sup>3</sup>)—in the demand for sawlogs, when compared with last year's figure. This was mainly due to a reduction in the wooden case trade as a result of competition from cartons. On the other hand, the demand for chipwood logs for the manufacture of particle board rose by 426,388 cubic feet (12,075 m<sup>3</sup>) or 49 per cent.

Peeler log production doubled when compared with the 1968-69 figure and the volume of 220,458 cubic feet (6,243 m<sup>3</sup>) was a record. Supplies of pine fencing material in the form of posts, strainers and struts or rails, as well as "woodwool" logs fell by 24 per cent and nine per cent respectively. However, sales of miscellaneous poles nearly quadrupled when compared with last year. Included in this category were 4,676 cubic feet (132 m<sup>3</sup>) of poles for the construction of rafts for the pearl culture industry at Kuri Bay in the north of the State.

Roundwood removals from the various plantations were as follows—

	cub. ft.	m <sup>3</sup>	cub. ft.	m <sup>3</sup>
Wanneroo (Gnangara)			517,502	14,655
Metropolitan			373,583	10,580
Collier	75,889	2,149		
Somerville	297,694	8,431		
Mundaring			667,683	18,909
Kelmscott (Gleneagle)			36,589	1,036
Harvey			410,274	11,619
Harvey Hills	310,396	8,790		
Myalup-McLarty	99,878	2,828		
Collie			103,795	2,939
Kirup (Grimwade)			336,594	9,532
Nannup			8,000	226
Busselton			354,436	10,037
Ludlow	184,481	5,224		
Keenan	169,955	4,813		
Manjimup			5,793	164
Pemberton			55,741	1,578
			<u>2,870,170</u>	<u>81,280</u>

### Sawn Production

The total sawn production from all sources was 596,510 cubic feet (16,893 m<sup>3</sup>) a decrease of 97,066 cubic feet (2,749 m<sup>3</sup>) or 14 per cent on last year's figures. As previously indicated the reduction was caused by a drop in the case trade. Squared baulks represented thirty per cent of the total sawn production.

Sawn production by species was—

*P. radiata*—461,303 cub. ft. (13,064 m<sup>3</sup>)  
*P. pinaster*—135,207 cub. ft. (3,829 m<sup>3</sup>)

### Mallet Plantations

No mallet bark was produced during the year and no extensions were made to the plantation which remains at 19,111 acres (7,734 ha.).

### Tree Establishment on Areas Mined for Bauxite

Since 1965 some 1,200 acres (486 ha.) of jarrah forest in the Jarrahdale division have been cleared by Alcoa of Australia Ltd. of which 300 acres (121 ha.) have been mined for bauxite.

Two hundred and thirty-four acres (95 ha.) of the mined area and 240 acres (97 ha.) of the unmined area have been replanted with a range of eucalypts and pines.

After mining, the company returns the overburden to the area and where this has some depth, results are reasonably encouraging. However, recent windthrow in the oldest (4 year old) plantings is causing some concern, as it is found that the roots are spread wide horizontally in the surface soil but have failed to penetrate and gain anchorage in the hard clay below.

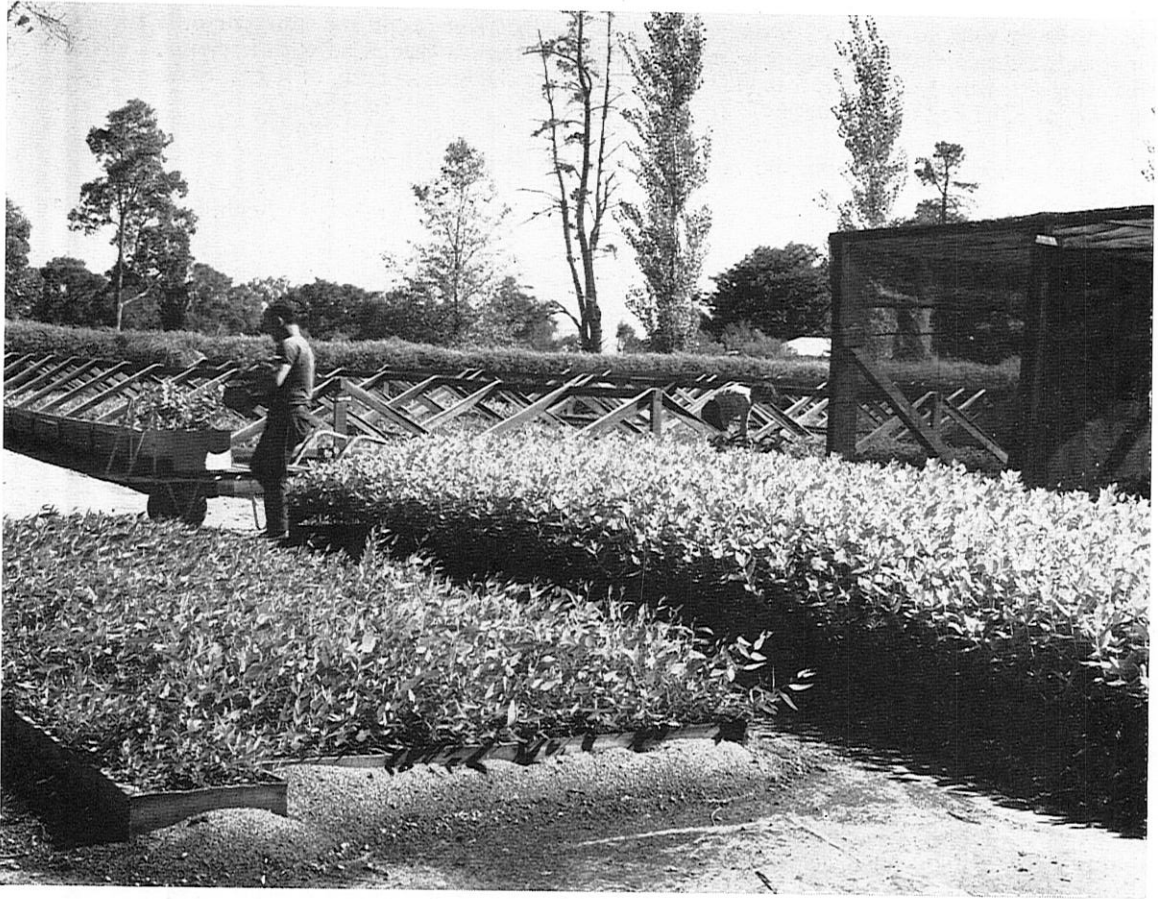
Various establishment methods and fertiliser trials are being attempted. The standard treatment for eucalypt planting is to use jiffy pot stock and to apply 2 oz. (57 gm.) each of blood and bone and potato E manure at the time of planting. Pines receive 2 oz. (58 gm.) per tree of zinc-super. The species in each group showing greatest promise are *Eucalyptus microcorys* (Tallowwood) and *Pinus pinaster*.

A small trial of deep ripping indicates that this method should become standard treatment for the future as not only do the plants receive a better start, but soil erosion is also minimised.

It is too early to predict the success or otherwise of these plantings and it will not be possible to obtain a reasonable idea until the best of the treatments are at least 10 years old.

### Inland Arboreta

The 56 arboreta, established over a period of 20 years, cover a wide range of sites throughout the farming areas of the State. The severe drought to which the trees were subjected during the year provided a real test of their drought resistance. Results of a recent assessment have been very encouraging, in that almost without exception, well established trees have survived.



Trays of young eucalypt seedlings raised at Hamel Forest Nursery, soon to be despatched to buyers in country districts.

### Tree Nurseries

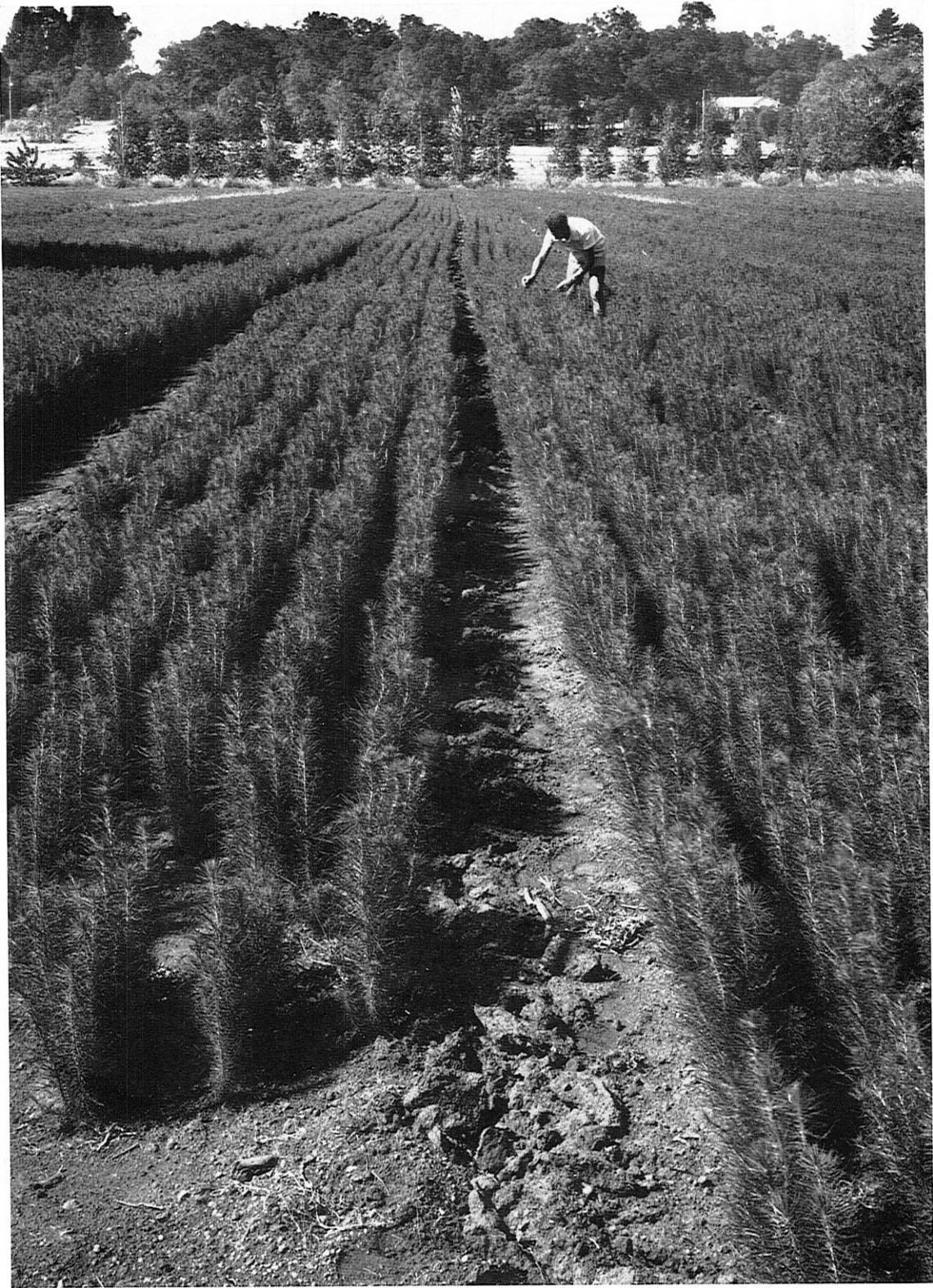
The performance of the various species in the arboreta has influenced the revision of the list of trees recommended for planting. The Price List of Trees ex Hamel and Narrogin Nurseries has been rewritten and reprinted under the title "Catalogue of Trees for Growing Under Western Australian Conditions".

In 1969, Hamel and Narrogin nurseries sold 274,354 young trees for planting in country districts. The plants were distributed from the nurseries as follows—

Nursery	Number of Plants Sold				Departmental Use			Number of Species
	Potted Stock	Tray Stock	Open Rooted	Total	Pines	Other	Total	
Hamel	41,593	23,779	122,491	187,863	360,897	63,108	424,005	218
Narrogin	79,391	7,100	.....	86,491	606	11,517	12,123	97
Total	120,984	30,879	122,491	274,354	361,503	74,625	436,128	

The most popular eucalypts sold were—

River gum	.....	<i>E. camaldulensis</i>
Tuart	.....	<i>E. gomphocephala</i>
Dwarf Sugar Gum	.....	<i>E. clodocalyx</i> var. <i>nana</i>
Bald Island Marlock	.....	<i>E. lehmannii</i>
Salt River Gum	.....	<i>E. sargentii</i>
Coral-flowered Gum	.....	<i>E. torquata</i>
Sugar Gum	.....	<i>E. cladocalyx</i>
Tasmanian Blue Gum	.....	<i>E. globulus</i>



Over seven million pine seedlings were distributed by Departmental nurseries in 1969. These healthy young plants, growing in the Hamel Forest Nursery, are typical of the stock raised.

A total of over seven million young plants were distributed by all Departmental nurseries. These were mainly pines for the afforestation programme.

An increasing demand for pine seedlings for private plantation projects resulted in the sale of 184,000 plants.



## 8. PROTECTION

### Fire Protection

#### State Forests Under Protection

Indigenous Forest	.....	.....	.....	4,393,536 acres (1,778,064 ha.)
Pine Plantations	.....	.....	.....	67,048 acres (27,134 ha.)
Mallet Plantations	.....	.....	.....	19,111 acres (7,734 ha.)

A further two million acres of Crown Land and private land are indirectly protected due either to their strategic significance in relation to State Forest or to their forest value.

### The Fire Season

Extreme drought was the most significant weather feature effecting fire control in the forest belt. Below average winter rains were followed by an abnormally dry spring and early summer. Tropical cyclones resulted in dangerous fire weather during February but were fortunately followed by heavy rain which eased the fire hazard.

A secondary peak in fire weather developed in March but heavy rains in April caused an early close to the fire season.

The figures below are for the Forest Weather Stations at Dwellingup (Jarrah) and Pemberton (Karri).

	Jarrah		Karri		
	Average	1969/70	Average	1969/70	
<b>RAINFALL</b>					
Annual	ins.	50.50	40.15	51.05	35.59
"	cms.	128	102	130	90
No. of Wet Days		100	99	177	145
<b>TEMPERATURE</b>					
Mean Maximum		77.2°F	79.6°F	73.0°F	74.8°F
Days of 100°F or over (No.)		4	2	2	Nil
Days of 90°F or over (No.)		27	29	14	14
<b>RELATIVE HUMIDITY</b>					
Days of 10% or less (No.)		3	Nil	<1	Nil
Days between 11 and 15% (No.)		7	8	3	3
Days between 16 and 25% (No.)		35	49	8	13
<b>FIRE HAZARD</b>					
No. of Dangerous days		12	10	1	5
No. of Severe days		22	25	6	5
Mean Hazard		5.4	6.5	4.4	5.1

### Controlled Burning

Dry spring weather favoured the controlled burning programme. Aerial ignition methods again allowed full advantage to be taken of suitable weather and except for some karri areas, programmes were completed much earlier than usual. For the first time, the area on which aerial ignition was used exceeded that lit from the ground.

Protection of plantations by controlled burning of internal buffer strips was extended in both *P. pinaster* and *P. radiata* plantations.

Prescribed Burning	Acres	Hectares
Indigenous forest—hand burning	498,852	201,885
Indigenous forest—aircraft burning	603,945	244,417
	1,102,797	446,302
Advance and Tops Disposal burning	12,514	5,064
	1,115,311	451,366
Plantations—hand burning	2,912	1,179
	1,118,223	452,545



The famous Diamond Tree fire lookout. To obtain a clear view over the surrounding forest, a 20 feet wooden tower was built 160 feet above ground level in the branches of a karri tree—note the karri regrowth nearby. First manned in 1942 the lookout is situated only a few chains off the South-West Highway about six miles south of Manjimup.

## Detection

Thirty four fire lookout towers were manned continuously during the season.

Manning of Towers				Karri	Jarrah	Plantations
First Watch	....	....	....	15/10/69	22/9/69	16/9/69
Last Watch	....	....	....	15/4/70	19/4/70	5/5/70

## Communications

P.M.G. telephones are the major link between divisions for general traffic. This is supplemented by High Frequency radio for long distance fire control communications.

Where P.M.G. telephone services are not available, short distance communications between fixed points such as fire lookouts and their headquarters are provided by "earth return" telephones. The replacement of this system with modern radio telephones has commenced.

Contact is maintained with mobile fire fighting teams through a reliable system of Very High Frequency radios and repeater beacons.

## Fires and Fire Damage

Departmental gangs attended 294 fires during the season compared with an average of 350. Of these, 202 burned on forest land, and covered an area of 13,838 acres (5,600 ha.) as follows—

Pines	....	....	....	....	....	3 acres (one ha.)
Indigenous Forest	....	....	....	....	....	13,835 acres (5,599 ha.)

The three acres (one ha.) of pines burnt resulted from 30 fires of which the majority occurred in Somerville plantation near Perth. The extremely low area per fire is a direct result of fuel reduction by controlled burning at Somerville and of efficient detection and suppression. This is again reflected in the small area affected by the 172 wildfires which occurred in indigenous forest. This is particularly creditable in a season when suppression was exceptionally difficult due to prolonged drought.

The following table lists fire causes—

Escapes from settlers burning	....	....	....	....	....	73
Deliberately lit	....	....	....	....	....	49
Escapes from prescribed burning	....	....	....	....	....	41
Travellers	....	....	....	....	....	12
Bush workers	....	....	....	....	....	12
Mill surroundings	....	....	....	....	....	11
Hunters and fishermen	....	....	....	....	....	10
Children	....	....	....	....	....	10
Lightning	....	....	....	....	....	7
Burning vehicles	....	....	....	....	....	5
Householders	....	....	....	....	....	3
Other Government employees	....	....	....	....	....	3
Mine surroundings	....	....	....	....	....	3
S.E.C. mains	....	....	....	....	....	3
W.A.G.R. locomotives	....	....	....	....	....	2
Rubbish dumps	....	....	....	....	....	2
Spontaneous combustion	....	....	....	....	....	1
Welding plant	....	....	....	....	....	1
Unknown	....	....	....	....	....	46
						<hr/>
						294
						<hr/>

The number of escapes from settlers burns rose sharply compared with the previous two seasons. It is considered this was largely due to underestimation of the increased risk of escapes caused by abnormally dry fuel conditions brought about by drought.

Departmental gangs were again sent on a number of occasions to protect public and private dwellings and property from fire damage.

Due to the high labour turnover it has been necessary to maintain emphasis on gang training in various aspects of fire control. Competition between gangs is proving a continued success both as a morale booster and as a measure of efficiency before the height of the fire season is reached.

Public relations were generally good. As far as possible all meetings of bush fire control organisations were attended by officers of the Department and several public demonstrations of fire fighting equipment and methods were held.

## F.A.O. Fire Study Tour

Australia was the host country for the Third Fire Study Tour organised for developing countries by the Food and Agriculture Organisation of the United Nations. In January 1970, 32 representatives from 23 countries were shown the methods and results of Western Australian fire control practice. The tourists visited jarrah, karri, tuart and pine forests over a period of one week and saw controlled burning results, detection and suppression methods, equipment, and research techniques. Both official and private communications from the visitors later confirmed the value of the tour to all concerned.

## 9. RESEARCH

The current year has been one of stabilization, both in terms of staff and buildings, following rapid growth over the preceding four years. The only major building undertaken was the construction of a glasshouse at the Manjimup Research Centre.

### Pinus Pinaster Plantations

#### Tree Breeding

**Grafting.** A total of 3,000 grafts for seed orchard establishment were made from 37 local clones and 41 imported clones. The "take" was 90 per cent and 2,700 grafts were planted in the Mullaloo orchard in May. Stocks have been prepared for a further 4,000 grafts in the spring of 1970.

**Controlled Pollination.** A total of 926 controlled crosses were manipulated to give a take of 79 per cent. Most pollinations were against clones imported from Portugal. The per cent take is most satisfactory as it had been inexplicably low for the past two years.

A total of 481 grams (17 lb.) of seed was extracted from the 1967 pollinations.

**Progeny Testing**—Further progeny trials, covering 22 acres (9 ha.) at Gngangara and 15 acres (6 ha.) at Yanchep, were planted in May. The total number of tubed plants raised at Wanneroo for the year was 17,000 and quality was excellent.

Progeny trials, established in 1965 and 1966, were measured for height development for the first time in January. Results are most encouraging as some doubt existed concerning the vigour of trees selected in Portugal. Where plants from half-sib\* seeds collected in Portugal can be compared with normal planting stock, height growth of at least 50 per cent of the Portuguese families is as good or better than that of routine stock.

In the first small full-sib† progeny test planted at Gngangara, height growth of all six full-sib families exceeds that of routine stock. Mean height of the best family was 9.5 feet (2.9 m.) compared with 7.5 feet (2.3 m.) for the routine control.

\* One parent known.

† Both parents known.

Mean height of the grouped six full-sib families exceeds the control average by 20 per cent at age 4.5 years. The trial was a 7 x 7 latin square with nine trees per unit.

There is reason to assume that superior growth rates of this order will be maintained in subsequent development. Since the main objective of the programme was to select for stem straightness, these early results are considered to be most promising.

**Seed Orchards.** A further 2,700 grafts were planted in 8 acres (3 ha.) of the Mullaloo orchard bringing the total plantings to 3,620. This second orchard is closely planted at 10 x 10 feet (3 m. x 3 m.) spacing with a 20 feet (6 m.) outrow every third row. The year's planting included 78 clones and future plantings will contain 100 clones. The design of the orchard provides for heavy, early seed yields and gradual culling to leave the best 20—30 proven clones.

Fifty-five kilos (121 lb.) of seed were collected from the Joondalup orchard and passed on to "operations". This should be sufficient to establish over 500 acres (202 ha.) of plantation. Six kilos (13 lb.) of orchard seed was sown for operational use in August, 1969.

Pollen and cone production in the orchard was excellent in spring 1969, and in 1971, high seed yields are expected. Some bird damage in the orchard was evident during the year and the current crop was harvested in May.

**Provenance Testing.** A provenance trial incorporating seed from Leiria (Portugal), Landes (France), Lucca (Tuscany, Italy), Corsica and an undefined Italian source was measured during the year. The trial is a 5 x 5 latin square planted in 1964 at 8 x 6 feet (2.4 x 1.8 m.) spacing. Plots contain 128 trees and results expressed in the table refer to the best 30 trees (200 per acre—494/ha.) in each plot.

Comparison of provenances at age 5 years at Walton Block  
Gngangara Plantation

Origin	Mean Height		Number of Whorls per ft. of Height	Number of Branches per Whorl	Average Branch Angle at 4 ft. 3 in. Height		Percent of Trees in 1969 with	
	(ft.)	(m.)			Largest	Smallest	No Pollen	No cones
Leiria	15.2	4.6	0.43	5.0	67°	46°	1.3	54.7
Lucca	15.3	4.7	0.44	5.0	68°	46°	0.7	46.7
Landes	10.9	3.3	0.54	6.1	69°	46°	91.3	99.3
Corsica	11.1	3.4	0.53	5.9	67°	46°	82.7	99.3
Italy	10.4	3.2	0.65	5.5	69°	48°	26.7	87.3



The height superiority of the Portuguese provenance, its tendency to uninodal habit and early flowering characteristics are clearly evident from the data in the table. The Luccan stock is almost identical in appearance and growth characteristics within the trial. An inspection of the original stand at Val Freddano in Italy confirms that it is atypical although considered to be indigenous. The Italian provenance in the table is representative of normal Italian stands.

Comparison of 24 batches of seed, collected from "plus" trees selected in Tunisia, with seed obtained from "plus" trees in Portugal revealed that the Tunisian provenance is of low vigour in Western Australia. Height means for the Tunisian batches range from 5.5 to 6.9 feet (1.7 to 2.1 m.) while Portuguese means range from 6.8 to 8.8 feet (2.1 to 2.7 m.). Routine Portuguese stock averaged 7.7 feet (2.3 m.) height. It is of interest to note that provenances from North Spain and West Spain averaged 7.9 and 8.4 feet (2.4 and 2.6 m.) respectively, in this trial. The trial was planted in 1966 and involved eight replications of 10-tree provenance units.

#### Site Studies

The detailed stage of the large site survey in the northern jarrah forest has been completed. The initial large number (500) of potential site indicator species was reduced by repeated testing to 55 trees and shrubs, and a final principal component analysis was carried out on this basis. The analysis made it possible to relate 314 vegetation plots (most of which are associated with either pine pilot plots or hardwood increment plots) to each other, in terms of four major environmental factors operating in the region. The factors found most significant were topographical position and soil moisture regime, the degree of leaching and the fertility of the soil. The plots were arranged in a four-dimensional continuum which for the purpose of mapping was divided into 18 segments, each with its particular set of environmental conditions and plant indicators. The system, already applied to detailed mapping of 4,500 acres (1,821 ha.) in the steep, moist western regions will shortly be followed by the survey of a somewhat larger area in the drier, flatter eastern region. This should provide a link between the initial detailed groundwork and the ultimate large scale surveys based on interpretation of aerial photographs.

#### Site Amelioration

The first experiment dealing with site amelioration has already yielded results. Whereas pines planted on wet swampy sites have almost completely failed, mounding on identical areas has virtually eliminated deaths due to water logging and flooding. Marked differences in responses to fertilizer application were observed between species, *P. radiata* being least capable of coping with low levels of nutrition, but responding best to heavy fertilizer application.

#### Fertilizers

Sampling of fertilizer experiments at Gngangara revealed that early fertilization by superphosphate results in virtual doubling of volume production when compared with later fertilization. On the most highly leached sites a second fertilization is needed as early as four years after planting, and volume production is doubled at age nine years. Alternative methods of fertilizer application in young unpruned plantation were studied and aerial application from light aircraft was greatly superior to ground application by tractor-drawn spreaders, in terms of both reliability and evenness of distribution.

#### Nursery Studies

Nursery studies have been concluded with the completion of a long-term green cropping and continuous production experiment. Although two years green cropping produced very large stock, continuous production with soil sterilization has, even in the fourth year, produced satisfactory stock on soil with a moderately low initial organic matter content. Soil with very low organic matter content can be brought into satisfactory production immediately by a balanced application of local peat and urea, compared with the very slow build up using green cropping. The pre-emergent weedicide Dacthal, which with mineral spirits is the basis of weed control in the nurseries, has had no adverse effect on *P. pinaster* even after six applications within two years. The final test will be carried out in the coming sowing.

#### Thinning and Hydrology

Examination of data from thinning plots indicates that heavy thinning affects both the growth of the pines and the soil moisture recharge under them. Over the first two years of the basal area trials at Yanchep, heavy thinning resulted in depression of basal area increment, but as this is distributed over markedly fewer trees, the diameter increment doubled. Under unthinned stands the current winters rains have rewetted the soil only down to 7.9 feet (2.1-2.7 m.) whereas the soil under the heavily thinned stands has been rewetted to 14 feet (4.3 m.), the same as under native woodland. The implications of this rewetting on growth and survival in the normal long, dry, hot summers is obvious.

In older trials, the mean diameter of 100 final crop trees per acre, measured 11 years after thinning to this stocking, was 13.3 in. (33.8 cm.) compared with 9.3 in. (23.6 cm.) for 100 select stems in the unthinned stand.

In the heavily thinned stand, the 100 select final crop stems represent virtually the whole of the standing basal area, but in unthinned stands they represent only one sixth of the total.

Total volume production to 4 in. (10 cm.) crown diameter U.B. is greater in unthinned stands—4,801 cub. ft. per acre (336 m<sup>3</sup>/ha.) than in heavily thinned stands—4,113 cub. ft. per acre (288 m<sup>3</sup>/ha.). Volume production of larger, higher value timber—top diameter 7 in. (18 cm.)—shows a reverse trend—2,107 cub. ft. per acre (147 m<sup>3</sup>/ha.) for heavily thinned stands as against 1,396 cub. ft. per acre (98 m<sup>3</sup>/ha.) for unthinned stands.

## Pinus Radiata Plantations

### Drought Effects

Widespread drought conditions prevailing over the whole of the south-west of the State during 1969 and early 1970, accelerated the incidence of "autumn brown top" in young, high quality, unthinned stands of *P. radiata* near Nannup.

With less than two-thirds of the normal 38 inches (96 cm.) annual rainfall, almost 50 per cent of the trees in unthinned 11-year-olds stands planted on shallow soils were affected. The worst sites were exposed ridge tops and slopes with a northerly aspect. However, thinning of these areas prevented further "brown topping" and there was little timber loss from affected trees felled.

The disorder highlights the need for early thinning on such sites. This is now being achieved following an agreement to supply regular quantities of chipwood log to the particle board industry.

A pleasing feature was the high survival of the 1969 planting despite the drought.

### Tree Breeding

**Seed Orchard.** To date, 10 acres (4 ha.) have been established at West Manjimup and a further 13 acres (5 ha.) will be planted next year with grafted stock from Collie and Manjimup.

Pimelea plantation was cruised in autumn for "plus" trees of *P. radiata*. Four trees were selected and material from them will be included in the grafting programme.

**Seed Production.** At Grimwade, the area of superior or "plus" stands thinned to 50 stems per acre (124 stems/ha.), to develop a seed production area, was increased to 85 acres (344 ha.). Further thinnings of 20 acres (81 ha.) are planned and the first improved seed will become available in 1973.

### Planting Stock

Three trials have confirmed that large planting stock—12 in. + (30 cm. +) and over—give better field survival and subsequent height and diameter growth than small stock. Five years after planting the larger plants have an average 0.5 in. (1.3 cm.) advantage in diameter growth over smaller stock.

Nursery trials to produce the maximum number of optimum size seedlings are nearing completion.

### Pruning

The following table shows that pruning young pines to a standard height of 7 feet (2.1 m.) can be detrimental to form and vigour if carried out too early.

LOW PRUNING TO 7 FT. (2.1 M.)

Age (yrs.)	D.B.H.O.B.		Height		Results of Pruning
	in.	cm.	ft.	m.	
4	2.7	6.8	16	5	Many tips break off; serious loss in increment; recovery takes 3 years.
5	3.9	9.9	23	7	Reduction in diameter and height growth; recovery takes one year.
6	5.0	12.7	32	10	Minimum effect.

A study has commenced to assess the effect of pruning to 7 feet (2.1 m.), one third of the stems in a 5-year-old stand planted at a spacing of 8 ft. x 6 ft. (2.4 m. x 1.8 m.).

### Thinning

Basal area thinning trials have shown that marked improvement in diameter growth over a wide range of basal areas, can be achieved without loss of basal area increment.

Similar conclusions can be drawn from trials of early non-commercial thinning. However, the trend is best shown in the numerical thinning trials, which were the first to be established. In these trials the original stocking of 440 stems per acre (1,087/ha.) was reduced at age 8.5 years to 200 and 300 stems per acre (494 and 741/ha.) respectively. At age 12.5 years the position was as follows—

The trend is clearly the concentration of increment on fewer trees as a result of thinning so that a loss of volume production in small size timber is more than compensated for by higher production of large size timber.

To further the investigation, additional thinning treatments have been carried out in this trial and the full range of treatments is now 440, 300, 220, 200, 150 and 100 stems per acre (1,087, 741, 544, 494 stems/ha.).

Measure	Control	Treatment	
	440 stems/ac. 1,087 stems/ha.	300 stems/ac. 741 stems/ha.	200 stems/ac. 494 stems/ha.
B.A. increment over 4 years (sq. ft./ac.)	66	68	70
(m <sup>2</sup> /ha.)	15.1	15.6	16.1
B.A. increment over last year (sq. ft./ac.)	12	14	16
(m <sup>2</sup> /ha.)	2.7	3.2	3.7
Mean diameter of all trees (ins.)	9.1	10.2	11.4
(cm.)	23.1	25.9	29.0
Mean diameter of 100 selects (ins.)	10.9	11.4	12.4
(cm.)	27.7	29.0	31.5
Total volume to 2.5 in. top diam. (cu. ft.)	5,645	5,221	4,329
(m <sup>3</sup> )	160	148	123
Total volume to 9.0 in. top diam. (cu. ft.)	1,705	2,241	2,501
(m <sup>3</sup> )	48	63	71

### JARRAH DIEBACK

Environmental studies concentrating primarily on aspects of soil moisture and soil temperature were continued during the year. Standard soil thermometers were installed at 3 in. (8 cm.) depth within meteorological enclosures at Departmental field stations. Considerable differences between regional centres were observed. Following a wildfire in spring, soil temperatures at 3 in. (8 cm.) depth were increased by between 1.5°C and 5°C depending on the surrounding temperature. The differences between the burnt site and an unburnt control were maintained until the autumn rains. Under glasshouse conditions, temperature differences of 5°C can greatly affect the rate of root rot and mortality in susceptible species. The effects of fluctuating, as well as constant temperature regimes, are under investigation.

Screening of species for resistance in pot and field trials continued and existing trials were maintained.

It is recognised that the spread of the fungus *Phytophthora cinnamomi* unaided by man, is slow. A large proportion of the forest area currently infected has resulted directly from the unintentional spread of the pathogen by logging units and gravel trucks carrying infected soil into "clean" areas. Location of diseased areas from aerial photographs, plane and ground reconnaissance has been obtained and mapped. Tests on various types of equipment indicate that the weight of soil carried may range from approximately 1,600 lbs. (726 kilos) for a Caterpillar D7 to 12 lbs. (5 kilos) for a Land Rover. Differences between soil types are also large, and tests on a 3-ton Bedford have ranged from 100 lbs. (45 kilos) for a loam to 8 lbs. (4 kilos) for a sandy soil. Rubber-tyred units are much more efficient at self-cleaning than is tracked equipment. Washing with high pressure jets of water may reduce the weight of soil carried by about 90 per cent for tracked units and 99 per cent for rubber tyred units.

Under laboratory conditions, *P. cinnamomi* has been able to survive for up to 20 weeks at varying moisture contents ranging from wilting point to field capacity. The ability of this pathogen to survive the dry hot West Australian summer in small clods of soil on roads and various other ecological situations was tested during the past summer. Survival of the pathogen was highly dependent on the ecological situation where it was placed, and the length of exposure.

The current state of knowledge on this disease has been disseminated throughout the Department and the Industry. Over 300 persons have attended seminars on *P. cinnamomi*, photographic displays have been prepared and an illustrated pamphlet is currently being reviewed. A circular on logging hygiene has been drafted and distributed to the Industry. The Industry has agreed to the principles laid down and these are being implemented. A system of logging priorities have been compiled and these are based on the recognition of three "dieback" zones:

**ZONE A** Unaffected; to be logged when no other areas are available, and then preferably by permits completely contained in this zone; logging will be under strict hygiene and along carefully selected access routes.

**ZONE B1** Slightly affected; logging will be restricted to affected portions only for the time being.

**ZONE B2** Severely affected; logging will be concentrated in the affected portions; unaffected portions may be logged under hygiene conditions before proceeding elsewhere.

In November, 1969, the Department organised a seminar on *P. cinnamomi* at the Como Research Centre. Twenty-seven research scientists from throughout Australia attended the proceedings. The aims of the seminar were to review the current knowledge on the biology and ecology of this disease and to discuss the direction in which the various research programmes were heading. The delegates considered that this pathogen is of importance to both forestry and agriculture throughout Australia, and strongly recommended a co-ordinated research programme.

## JARRAH SILVICULTURE

### Site Quality

Field work for a study of site and vegetation factors which might indicate jarrah site quality in the high rainfall forest belt was completed during the year. Analysis of the data collected has revealed a rather complex situation. Few topographical factors were found to reflect site quality. A weak correlation was found to exist between site quality and slope, slope profile and aspect. The amount of laterite rock visible on the soil surface also bore a weak relationship.

The part of the study involving vegetation relations has so far been subjected to principal component analysis in which sites with similar vegetation characteristics are grouped. A number of the ground vegetation species studied showed distinct grouping when plotted on co-ordinates according to certain site characteristics. This suggests that these species may have some value as site indicators. However, there is little correlation between these vegetative indicators and jarrah site quality to date. The processing of the data will continue with the emphasis on plant indicators for site quality.

### Root Distribution

A study of the distribution of jarrah roots in the soil profile was made in disused mine pits in the Jarrahdale area. There was a dense concentration of roots of all sizes in the top two feet (61 cm.) of soil, becoming sparse at four feet (122 cm.) depth. Sinker roots, descending vertically in the soil, were found to be fairly frequent. They remained lightly branched, however, until they approached the water table in white kaolinitic clay at the considerable depth of 40 to 60 feet (12 to 18 m.). Heavy branching was found to take place in the three to four feet of clay immediately above the water table, and fine roots were dense in cracks in the clay structure.

This secondary root system located in the vicinity of the water table is obviously necessary for growth activity of jarrah in the hot summer months when the surface horizons contain no water available to the tree.

### Soil Moisture in Regrowth Stands

Assessments of soil moisture in the top 18 inches (46 cm.) of lateritic gravel under jarrah regrowth stands at three stocking levels were continued for the second summer. The results have been consistent over the two years and they show that soil moisture falls to wilting point i.e. when none is available to plants—in mid-January. The rate of soil moisture loss is inversely proportion to tree stocking. The soil in plots with a stocking of 145 sq. ft./acre (33 m.<sup>2</sup>/ha.) basal area consistently reached wilting point a week to 10 days later than plots with only 65 sq. ft. (6 m.<sup>2</sup>). This result suggests that at the lower stocking level evaporation contributes markedly to moisture loss but is less effective beneath the dense canopy of the heavier stocking.

Additional moisture measurements were made in the same experiment down to a depth of 17 feet (5 m.) over the past year. All points of measurement had reached wilting point by mid-March, indicating the dependence of the jarrah forest on very deep water supplies in summer.

### Indirect Measures of Stand Density

Methods of estimating point density, or the degree of competition to which an individual tree is subjected, in a forest stand, were investigated during the year. Girth increment of the subject tree was used as an indicator of the degree of competition, and this parameter was tested by regression methods against nine classical methods of measuring tree or plant density. The best correlation with tree growth was given by the model zone count, an ingenious method of estimating stand density developed by Opie in Victoria. However, the model zone count only accounted for 21 per cent of the variation in girth increment, and this increased to 24 per cent when the girth of the subject tree was taken into account. It seems likely that the crown condition of the subject tree should also be considered for improved precision, and investigations are being made into this aspect.

### Response to Fertilizers

An appreciable response of pole-sized jarrah to Nitrogen (N), Phosphorus (P) and Potassium (K) fertilizers was described in last years report. An estimate of the magnitude of the response is now possible. The amounts of N, P, and K applied to the test trees was 100, 100, and 70 lb./acre (112, 112 and 78 kilos/ha.) respectively. The increase in growth rate attributable to the fertilizer over the past two years is shown in the following table.

THE RESPONSE OF JARRAH TO N, P, AND K FERTILIZERS  
(percentage increase in basal area)

Fertilizer	Thinned Stand	Unthinned Stand	Mean, both Stands
N	+19.4	+20.8	+20
P	-17.6	+ 2.2	- 8
K	-28.9	-19.6	-24
NP	+29.1	+38.4	+34
NK	+37.1	+15.2	+26
PK	-12.7	- 9.1	-11
NPK	+23.8	+33.1	+28



The responses in the unthinned stand were almost invariably greater than in the thinned stand. Combinations of N and P increased the growth rate by up to 38 per cent, while P and K by themselves and in combination proved detrimental and resulted in markedly lower than normal growth rates.

A field-scale fertilizer trial to test the response of jarrah to a range of application rates of an NP mixture has been established.

#### Regeneration Studies

The rate of seed production in three jarrah stands of differing age-class distribution has been measured over the past five years. The results indicate a marked degree of variation in seed production between different aged stands, and they highlight the poor yield of seed from veteran trees.

Forest Type	Mean Annual Production of Seed per Acre
55 year-old poles	114,000 ( $\pm 39,000$ )
Uneven-aged (all sizes represented)	143,000 ( $\pm 74,000$ )
Veterans	37,000 ( $\pm 22,000$ )

The highest yield in one year came from the 55-year-old pole stand which shed 338,000 sound seeds per acre (835,200/ha.) in 1967.

#### Rehabilitation of Dieback Areas

**Direct Seeding of *Pinus pinaster*.** Further trials were laid down to test methods of direct seeding *Pinus pinaster* on sites where the jarrah forest has been destroyed by dieback disease. The results confirm those of previous trials. The success of direct seeding is dependent on the degree of ground preparation, ground vegetation control, and the date the seed is sown. The most thorough form of ground preparation and vegetation control tried in the recent trial, namely complete ploughing, resulted in 30 per cent of the sown seed yielding established seedlings. A marked fall-off in seedling establishment resulted from sowings made later than the middle of June. Sowings in mid-May gave 30 per cent success, in mid-June 25 per cent and in mid-July only seven per cent.

**Preparation of Pine Seed for Sowing.** Investigations were continued on the development of a pelleting medium for pinaster seed which is both effective as an insect and rodent repellent and compatible with the pine seed and the mycorrhizal inoculum. Trials with Endrin as a repellent showed that it depressed germination of the pine seed when its concentration in the pelleting mixture exceeded four per cent. The mycorrhizal inoculum of spores of a *Rhizopogon* sp. was unaffected by Endrin concentrations of up to eight per cent.

Field trials to test the losses of Endrin-coated seed to insects and rodents demonstrated that levels as low as 0.5 per cent Endrin in the pelleting mixture formed an effective repellent.

The current pelleting mixture developed from the above trials contains one part by volume of methofas sticker, four parts by volume of homogenised *Rhizopogon* fruiting bodies, one part by volume of water, and Endrin added to 3 per cent. Approximately 50 millilitres of this mixture is used to coat one pound of seed.

**Tubeling Planting Stock.** An attempt at raising *Pinus pinaster* planting stock in small  $\frac{1}{2}$  inch (one cm.) diameter, 3 inch (8 cm.) long plastic tubes has met with a fair degree of success. The plants are ready for putting out in the field about 2 $\frac{1}{2}$  months after germination. The first year trials of this type of planting stock gave 90 per cent survival in the field. The test period included the unusually dry summer of 1970.

A planting implement is now being developed for this tubeling type of stock, which will eliminate the planter having to bend down to put a plant in the ground. It is anticipated that a combination of tubeling and suitable planting tool will double or treble the planting rate.

## KARRI SILVICULTURE

#### Karri Floral Cycle

Last summer saw the dispersal of the remaining seed from the big seed crop of 1967-69. With the exception of the Margaret River area it was considered that no districts had sufficient seed supply for successful burns in autumn 1970.

The annual autumn sampling revealed that the three-year-old crop which flowered this autumn was the only one of significance and it is predicted that it will produce a mediocre seed crop in 1971-72. Regeneration burning should be possible in some areas in autumn 1971 and 1972, and in spring 1972. It seems unlikely that there will be enough seed to permit much burning after spring 1972.

No further seed crops of any significance can be expected until 1974-75 or 1975-76. The latter date is favoured, and it is expected that this crop will be a heavy one.

The work on karri seed sampling has been written up and forwarded for publication as a Departmental Bulletin. The main findings were that it is difficult to measure seed crops accurately prior to burning, but good estimates of future seed crops should be possible with developed techniques.

#### The Effect of Regeneration Burning on Karri Seedfall

The greater proportion of the seedfall occurs within two weeks of the burn. A fairly light burn causing only 15 per cent crown scorch, will result in total seedfall. Seedfall from unscorched branches is due to the capsules drying out after the development of an abscission layer across the peduncle. The development of the abscission layer is stimulated by the fire.

### Karri Seedling Studies

*Germination.* Trials have shown that germination commences soon after the break of the season in mid-April and by mid-June 90–95 per cent of the seed has germinated. The trials also showed that—

- (a) Germination in mixed marri-karri sites was superior to that on karri sites.
- (b) Non-ashbed gave significantly better results than ashbed.
- (c) The application of dieldrin significantly improved germination of seed sown both in spring and autumn.
- (d) Shade and fungicide treatments had little effect.
- (e) Because of the heavy losses caused by insects when seed is left lying on the ground, autumn burns should give better results than spring burns.

*Survival.* Seedlings grow very little during the winter months and cannot be considered large enough for germination counts till early spring. Mortality appears to be heaviest in the very early stages just after germination.

### Karri Planting

An experimental area of 30 acres (12 ha.) was planted this autumn with 24 in. (61 cm.) trimmed wildlings. Most of the area was planted at 12 ft. x 12 ft. (3.7 m. x 3.7 m.) spacing but an espacement trial of 5.2 acres (2.1 ha.), divided into four parts, was planted at spacings of 6 ft. x 6 ft. (1.8 m. x 1.8 m.), 10 ft. x 10 ft. (3 m. x 3 m.), 14 ft. x 14 ft. (4.3 m. x 4.3 m.) and 18 ft. x 18 ft. (5.5 m. x 5.5 m.)

A comprehensive set of trials designed to obtain further information on time of planting is being established while a further trial to find the best ratio of phosphorus and nitrogen and the optimum amount to apply to karri transplants has been put in. Two different nitrogenous fertilizers are being used, one slow-acting, the other fast-acting.

Open-rooted nursery stock from Nannup are also being tested.

### Dieback Studies

The soil moisture and temperature studies in Iffley Block have been discontinued and the data are being analysed.

No further results have been obtained from the rate of spread plots.

The trials on the effects of host species roots on the rate of spread of *Phytophthora* have yielded no results to date.

### Large Scale Silvicultural Field Trials

Since 1965, four large scale field trials demonstrating alternative silvicultural systems have been established. These are—

1. *Clear felling with seed trees in a healthy karri stand—(Gray Block).*
2. *Alternatives for the treatment of mixed marri-karri stands (March Road)*  
It is evident that the favouring of karri regeneration by the retention of karri seed trees results not only in increasing the proportion of karri, but ensures full stocking over the whole area. It is evident also that a stocking of marri from advance growth can be relied upon, irrespective of the retention of any seed trees of either species.
3. *Conversion of mixed marri-karri stands to exotics using less than full plantation procedure (April Road)*  
Competition from marri and scrub is a major factor in establishment. Competition control by spraying before planting shows promise at this stage. Planting directly into a recent slash burn appears to create a competition situation which is difficult and expensive to overcome.
4. *Alternatives for the treatment of mixed jarrah-marri stands (April Road)*  
The field work is only part complete. Regeneration burning and investigation of resultant stocking is programmed for the coming year. So far the main problem appears to be the large number of small stems of doubtful quality.

## SEED HANDLING

Within recent years, considerable attention has focused on seed handling. Increases in plantation programmes, and the need to ensure best use of seed obtained from the breeding programme led to the establishment of a seed handling centre at Como. Facilities are now available to extract, dry, store, test, and pretreat conifer seed at that centre.

This activity, together with the need to test seed of many exotics required for establishment in three regional arboreta, and for trials in dieback rehabilitation, has led to staff training and the development of improved testing procedures. During the year, over 200 separate batches of seed were tested and techniques were developed to directly cater for the different germination requirements for different species. The facility is now considered to be quite satisfactory for present and future operational requirements.

*Seed Pelleting.* Trials to investigate the potential of seed pelleting of eucalypts and pines to improve direct sowing procedures were continued. Direct sowing is not used operationally but could be required for rehabilitation of dieback areas and emergency regeneration of karri following fire or seeding failure. Most pelleting studies are concentrated on karri.

Trials sown in the field last winter were disappointing and work during the year has concentrated on studying germination of pelleted seed under controlled conditions at Como. With karri seed it is desirable to incorporate fertilizer within the pellet and recent studies have concentrated on this aspect.

## SOILS AND NUTRITION

During the second half of the year there was a marked improvement in the staff situation and an increased number of analyses were carried out on existing and new lines of research.

The major project for the year was the analysis of soil samples collected during the ecological survey of the northern jarrah forest. This study involved some 3,000 analyses of the more common soil constituents.

A detailed soil study of the Gngangara nursery was commenced. This nursery is the major source of *P. pinaster* planting stock in the State, and the maintenance of soil organic matter and fertility levels has posed considerable problems in the coarse textured sandy soil. A factorial trial involving peat, lime and nitrogen was established to improve the soil organic matter levels, and detailed sampling has been carried out to test the effect of these amendments on the nursery soils.

A new study was initiated into the effect of controlled burning on the forest floor and soil properties of a *P. radiata* plantation at Grimwade. The experimental area has the following history—

Planted	....	....	....	1951
Thinned	....	....	....	1966 to 300 stems/acre (741 stems/ha.)
Controlled burns	....	....	....	(1) 28/10/1965
				(2) 22/4/1966
				(3) 25/9/1969

The three burns caused a marked reduction in the forest floor, the mean values in 1970 being—

Burnt	....	....	....	$12.7 \times 10^3$ lb/acre ( $14.2 \times 10^3$ kilos/ha.)
Unburnt	....	....	....	$20.0 \times 10^3$ lb/acre ( $22.4 \times 10^3$ kilos/ha.)

Surface soil samples (0—3 in.) (0—8 cm.) showed very little difference in the two sets of plots, so a detailed series of samples were collected from the 0—1 in. (0—3 cm.) soil layer. A comparison of some of the soil chemical data is shown in the following table—

*P. radiata*  
CONTROLLED BURNING STUDY—GRIMWADE  
Soil Properties (0—1 in.)

				Burnt	Unburnt
pH	....	....	....	6.53	6.32
Total Soluble Salts	....	....	....	0.023	0.021
Ignition Loss	....	....	....	14.28	15.19
Organic Carbon	....	....	....	5.68	6.12
Nitrogen	....	....	....	0.211	0.236
Exchangeable Calcium	....	....	m.e. %	7.76	8.36
Exchangeable Magnesium	....	....	m.e. %	2.07	1.73
Exchangeable Potassium	....	....	m.e. %	0.46	0.46
Exchangeable Sodium	....	....	m.e. %	0.28	0.26
Exchangeable Hydrogen (pH 7)	....	....	m.e. %	12.15	12.17
Cation Exchange Capacity	....	....	m.e. %	22.72	22.98
Saturation	....	....	m.e. %	47	47

The difference in the two sets of means were not significant. This work is to be expanded in the coming year by further studies on burnt and unburnt areas.

### Studies on Soil Animals

During the year information on the population dynamics of soil animals has been collected from sample sites at Gngangara. Leaf litter decomposition rates have also been studied. There is a marked reduction in cellulose decomposition on *Pinus pinaster* sites which have been control burnt. Decomposition of experimental material (unbleached calico) fell from 93 per cent to 75 per cent at the soil litter interface. Some of this work has been written up and will be presented at the Fourth International Colloquium of the Soil Zoology Committee of the International Soil Zoology Committee, of the International Soil Science Society to be held in Dijon in September, 1970.

The taxonomic survey of soil animals in W.A. forests continued. Specimens have been collected and sent to experts for identification. Three new species of Enchytraeid worm have been described by J. A. Springett and these descriptions will be published in the Journal of the Royal Society of W.A. during 1970.

## FIRE RESEARCH

The main fire research effort was directed into fire behaviour studies in karri forest and pine plantations and associated projects developing techniques to measure scrub and litter fuels.

### Fire Behaviour Studies

Karri Forest—The main problem in studying fire behaviour in karri forest is to devise some system for evaluating fuel characteristics in dense high scrubs. Fire behaviour can change quickly from low intensity flames burning in litter under the scrub to intense fires consuming whole plants.

An assessment technique has been developed which divides scrub foliage into fuel components which can be added as fire intensity increases. The technique includes a description of vertical disposition, height and density as well as quantities of green and dry foliage, twigs and stems. Density and height are recorded with point sampling and quantities by cutting and weighing cylinders of foliage taken vertically through the scrub.

This technique was used for 180 plots, each about three chains (60 m.) square, or sufficient for an experimental fire. The scrub was 6 to 12 ft. (1.8 m. to 3.6 m.) high, very dense, and included a good range of common species. The plots were divided into nine scrub types. Weight measurements were undertaken for the range of density and height in each type. An example of total weights of foliage for three of the scrub types are given in the accompanying table.

#### WEIGHT OF GREEN AND DEAD FOLIAGE

Tons/acre equivalent oven-dry weight  
(Kilos/ha. equivalent oven-dry weight)

Scrub Type	Range	Average	No. of Cylinders	Standard Deviation
Bossiaea aquifolium dominant (1) ....	6.2 to 13.4 (15.6 to 33.6)	9.8 (24.7)	18	2.1
Acacia pulchella dominant (2) ....	3.4 to 10.8 (8.4 to 27.2)	7.4 (18.5)	9	2.5
Trymalium spathulatum dominant (3)....	4.7 to 13.4 (11.9 to 33.6)	10.00 (25.2)	9	1.1

- (1) "Netic" or "Waterbush"  
(2) "Prickly Moses"  
(3) "Hazel"

After the scrub assessments 160 experimental fires were measured in spring, summer and autumn. They covered quite a good range of weather and fuel conditions, and intensity ranged from barely sustained flames to intense ones consuming the whole scrub. Results are being studied.

*Pine Plantations.* During winter more experimental fires were completed under pine plantations. Over 100 have been measured in unthinned *P. pinaster* and this data is in the process of analysis. Thirty more fires were added in *P. radiata*.

Re-analysis of jarrah fire data suggested that methods for measuring litter beds were inadequate. A new technique was tried in *P. pinaster* involving assessments of disposition and weight of tops, limbs and needle-bed.

Litter-moisture studies were entirely revised and new ones started, modelled on Canadian work. Already better correlation with weather changes have been observed, overnight rises were related to hours when relative humidity exceeded 70 per cent, and daily drops with morning moisture content and minimum relative humidity. Heavy fuels were also sampled to provide data on drought index.

#### Growth Studies

None of the growth trials in pole-sized karri, jarrah, or pines have shown girth responses after mild controlled burning. Some were treated with a second burn to maintain 4-year rotations. Two large trials were established in *P. pinaster* where a range of higher fire intensities will be tested.

Previous work showed karri saplings averaging 12 ft. (4 m.) in height, were nearly all killed by fire of 20 B.t.u. (British Thermal Units) per second per foot. Last spring, saplings averaging 19 ft. (6 m.) high were burnt under with intensities of about 30 B.t.u. Half were killed but the remainder have a normal crown and for controlled burning operations, karri saplings will have to be taller than 19 ft. if damage is to be avoided.

#### Fire Ecology and Scrub

In 1964 a survey of scrub species and density was completed through controlled burnt and intensely burnt forest near Dwellingup. High intensity fires had little effect on the number of species present but favoured regeneration of fireweeds of *Acacia* and *Bossiaea*. These formed a dense overstorey in the scrub.

Since this survey, plots have been maintained to study the effect of controlled burning on the regeneration of three fire-weed types. Again, there was little difference in total number of species before and after controlled burning. (See Table). The dense *Acacia* and *Bossiaea* scrub, which regenerated after the Dwellingup fires, failed to re-establish in the same density. Similar plots are due for measurement in southern forest.





A careful record of prevailing weather conditions is required when experimental fires are lit in pine plantations. Here a fire research officer takes measurements of temperature, relative humidity and wind speed during burning trials in a stand of *Pinus pinaster*.

#### REGENERATION OF SCRUB AFTER FIRE

A — 4 years after the Dwellingup Fire of Jan. 1961

B — 2 years after a spring controlled burn in 1968

Measure	Plot 1		Plot 2		Plot 3	
	A	B	A	B	A	B
Number of Species Present	30	31	30	27	32	35
Number of plants of main species						
<i>Bossiaea aquifolium</i>	220	12				
<i>Acacia strigosa</i>			210	7		
<i>Acacia pulchella</i>					95	4
Number of plants of other species	325	308	247	160	376	393

#### STATISTICAL ANALYSIS AND AUTOMATIC DATA PROCESSING

##### *Pine Inventory*

Local volume equations have been prepared for all productive pine forest areas.

The pine inventory processing system has been greatly extended to provide for data security, inventory up-dating, a wider range of resource summaries and to accommodate the import of the great variety of local volume equations now available. The system consists of five computer programmes and is based on magnetic tape files of per acre stratum summaries.

#### *Long Range Yield Prediction for Pine Forests*

Resource statements, summarising pine timber production for each year of the period 1970 to 1998, have been prepared for a variety of administrative, management and marketing units. The summaries assume that current management and silvicultural practice will be maintained over the period. The statements were produced by a system of two computer programmes which simulate thinning and regeneration operations and accumulate volume production over any required territorial unit.

#### *Map Display System*

A system of computer programmes has been developed which allows storage of map information on magnetic tape and the rapid access, manipulation and display of the information. The system is based on MIADS (map information and display system) used by the United States Forest Service, which has been modified to provide for magnetic tape storage and to permit operation on a small computer lacking punched card output and off line printing facilities.

#### *Information Retrieval System*

Facilities have been provided for the storage on magnetic tape and the rapid access of references to articles published in Forestry and related fields. The basis for storage and retrieval is the Oxford Decimal System of classification.

#### *Economic Analysis*

A computer programme has been developed to compare the economic consequences of alternative management regimes applied in forest stands. The programme discounts revenues and costs over a range of interest rates and overhead rates and computes the internal rate of return for each alternative.

## 10. UTILIZATION

### **Departmental Sawmills**

The new one-bench pine mill at Pemberton was completed and is operating satisfactorily.

Modifications were made to the small pine mills at Keenan and Grimwade and drawings to modify the standard prefabricated dip to enable it to handle 25 ft. (7.6 m.) lengths were completed for Harvey.

### **Timber Seasoning**

Following a suggestion from C.S.I.R.O. Division of Forest Products, a steaming test of thick joinery stock was set up at Yarloop but the steaming arrangements proved unsuitable and it has developed into a test of merits of seasoning under cover.

Two officers of the seasoning branch of the Division of Forest Products visited the State and their recommendations on the seasoning of timber from "dieback" logs confirmed what the industry had already been told by this Department.

A large concertina-type folding plastic door was designed for a timber firm to provide complete closure of large drying sheds to allow seasoning under controlled humidity at all times of the year.

### **Marine Borer Tests**

After 10 years exposure the West Australian test reached the limit of its usefulness and was terminated. Although these first Australia-wide trials set up by the Division of Forest Products proved to be largely indicators of how such tests should be arranged, they did provide some useful information. Karri and jarrah roundwood treated with creosote and copper-chrome-arsenic (C.C.A.) salts both resisted attack much longer than untreated jarrah roundwood. Karri is considerably inferior to jarrah with either treatment, while jarrah treated with creosote is appreciably superior to that treated with C.C.A. salts.

The first and second Australia-wide tests are still running and trap specimens have been set to provide Teredines for examination by Dr. Turner of Harvard University over the next few months.

### **Committees**

*Seasoning Productivity Committee.* Six meetings were held during the year.

*Clean Air—Timber Sub-Committee.* One meeting was held at which it was decided that conical burners would not be approved for built-up areas. However further investigations by the Public Health Department suggest that a change in thinking may result.

Fall-out measurements are being taken at Manjimup, Boyup Brook and Nannup and the Department has arranged for fittings to burners at the last two centres for emission and temperature tests.

### **General**

Design work during the year included the Walpole office, Manjimup insectary, water supply, dwellings, roading etc.

A host of timber technology problems from the general public, other Government departments and the timber industry were attended to.

## II. LIBRARY

Statistics of "Journal Loans," "Loans and Queries" and "Publications Received" were comparable with those of the previous year, but "Accession List Requests" showed a marked upward trend. Perhaps there were more interesting items on the 1969/70 Accession Lists, or maybe more people have begun using the Accession Lists as an avenue of Library borrowing.

	1969/70	1968/69
Journal Loans	10,473	10,521
Accession List Requests	3,731	2,557
Loans and Queries	4,782	4,610
Publications Received	1,025	1,022

A start was made on the application of specified subjects into the computer-operated "Retrieval System." At this stage it would be impractical to place the whole of the library's index system on computer. However, it is felt that several subject fields, including complex, frequently used subjects and local subject matter will receive sufficient use to warrant their present inclusion within the system.

## 12. EDUCATION AND PUBLICITY

### Education

*State Forestry Cadetships.* Only one Forestry Cadetship for the first-year studies commencing 1970 at the University of Western Australia was accepted. One cadet graduated from the Australian National University in 1969, three cadets are expected to graduate in 1970, and a further two in 1971.

*Field Cadet Training.* Following the completion of the 1968 course, arrangements were made to conduct the first year of background studies at Mount Lawley Technical College and to conduct the second year of practical studies at the Dwellingup Cadet School. This is a departure from previous arrangements under which both years of the course were conducted at Dwellingup. Under the new scheme seven students are currently in training at Dwellingup and a further seven are undertaking first year studies at the Mount Lawley Technical College.

The wastage of potential students both before and after final selection for the course has been very disappointing and appears to arise from the number of highly paid unskilled job opportunities available to "school-leavers" under the current conditions of full employment.

*In-Service Training.* A correspondence course for mature-age entrance to the field staff was successfully introduced in 1969. The course aims to impart a background knowledge of general forestry subjects and the initial response was so overwhelming that only half of the total number of applicants could be accepted in that year. In view of the expressed interest of junior members of the field staff in this type of instruction, the course will be continued in 1970.

On the managerial side, two officers attended the three-week full time Executive Course conducted by the W.A. Institute of Technology, and a number of officers attended the A.D.P. Executive Appreciation Course conducted by the Treasury Computer Centre. At the more technical level, four officers attended courses in computer techniques, also conducted by the Computer Centre.

A number of officers attended special technical courses during the year including the Industrial Civil Defence Course conducted under the auspices of the Civil Defence and Emergency Services.

### Publicity

Officers of the Department assisted in the organisation of the successful 7th All-Australia Timber Congress held in Perth in October, 1969.

During the year the Conservator, Mr. W. R. Wallace, attended the one meeting of the Australian Forestry Council held in Hobart in October, 1969, and the three Standing Committee meetings—two in Canberra and one in Brisbane.

The Conservator also attended a Paper Science and Technology Course at C.S.I.R.O. Division of Forest Products, Melbourne; the Plywood Symposium held in Canberra; a meeting of the Sirex Committee in Melbourne and the APPITA Conference at Surfers Paradise, Queensland.

New publications released during the year included—

Bulletin No. 77 — "The Estimation of Fire Hazard in Western Australia".

Pamphlet No. 3 — "Marri (*Eucalyptus calophylla*).

"Officer Training in Forestry" — a pamphlet which replaces and updates the previous "Careers in Forestry".

"Smokey Bear's Story of the Forest" — a 16 page booklet designed to serve both as an education medium and a colouring-in book for primary school children.

"Forest Focus" — with the focus on the karri forest. This high quality booklet, which it is hoped to produce three times a year, will provide information on the role of forestry in Western Australia from the point of view of the productive, protective, recreational and social functions of the forests.

"Rainbow Trail" — a leaflet in four colours (See Forest Recreation).

In addition a booklet which very briefly summarises forestry in Western Australia was prepared for members of the Food and Agriculture Organisation Fire Study Tour, 1970.

In May 1970, a party of six Queensland Parliamentarians and senior Government officers visited the south coastal and south-west regions of Western Australia in a study tour of hardwood forests, national parks and forest recreation spots, pine plantations and two major Forests Department research centres.

They also visited the Esperance region to examine current practices in farm land development.

The party was composed of the Hon. V. B. Sullivan (Minister for Forests and Lands) and Mrs. Sullivan, Mr. K. B. Tomkins (M.L.A.) and Mrs. Tomkins and Messrs. H. M. Hungerford (M.L.A.), C. Haley (Conservator of Forests), W. Wilkes (Secretary, Department of Forestry and Chief of National Parks) and B. Heffernan (Land Utilization Board).

### 13. TIMBER INDUSTRY REGULATION ACT, 1926-1969

The number of mills registered under the provisions of the Act as at December 31, 1969, totalled 163 (104 Crown Land and 59 Private Property).

The average number of persons employed in the timber mills each month throughout the year was 2,869, a reduction of 364 on last year's figure.

The District and Workmen's Inspectors made 1,103 inspections of timber holdings.

There were 239 notifiable accidents for the year ending June 30, 1970, four being fatal. However, the accident rate throughout the industry continued to decline, the number of accidents per 100 persons employed being eight (8) compared with 12 the previous year.

The Timber Industry Regulation Act and Regulations were redrafted to bring them into conformity with modern logging and sawmilling practice, and were gazetted.

The cost of administering the Act for the year ending June 30, 1970, was as follows—

Salaries	\$8,562
Mileage, Travelling Allowances, Office Rent, Plant, Cost and Sundries	\$4,799
	<hr/>
	\$13,361

### 14. FOREST OFFENCES

Legal proceedings were taken in two of the thirty-six forest offences reported during the year and fines and costs amounted to \$170 and \$47·10 respectively.

Warnings were issued in 13 instances and the remainder were dealt with by charging royalty, forfeiture of deposits, collection of damages or confiscation and sale of timber illegally cut. The amount received by the Department in this way totalled \$3,617·99.

### 15. EMPLOYMENT IN FORESTRY AND THE TIMBER INDUSTRY

The number of wage earners directly employed in Forestry and the Timber Industry was estimated at 4,573, made up as follows—

#### Forestry—

Professional Officers	51
General Field Staff	246
Clerical and Drafting	69
Wages Employees	578
Contractors and Employees (estimated)	20
	<hr/>
	964

#### Timber Industry—

Sawmill employees including bush workers at December 31*	2,869
Firewood Cutters and Pole Getters working under permits	232
Sandalwood workers	58
Apiarists, estimated (301 sites registered)	450
	<hr/>
	3,609
Total Forestry and Timber Industry	<hr/>
	4,573

\* Includes employees of registered sawmills only and excludes persons employed in associated yards in the Metropolitan area.

## 16. STAFF MATTERS

### Public Service Act

Following the retirement of Mr. A. C. Harris from the position of Conservator of Forests on the 30th June, 1969, Mr. W. R. Wallace was appointed to the vacancy on the 1st July, 1969.

Other promotions during the year included Mr. D. W. R. Stewart to Deputy Conservator of Forests, Mr. P. J. McNamara to Chief of Division, Mr. J. B. Campbell to Superintendent and Mr. J. A. W. Robley to Inspector.

Appointments included two graduates of the Australian National University, Messrs, J. A. Skillen and C. R. V. Slotemaker De Bruine as Assistant Divisional Forest Officers.

Assistant Divisional Forest Officers A. R. Gobby and G. G. Journeaux resigned and A.D.F.O. S. R. Shea was granted study leave for post graduate study in Forestry at the University of Toronto in Canada.

Two draftsmen (P. Murphy and P. Scott) were appointed to the permanent staff and three draftsmen (M. K. Day, R. C. King and R. D. Sumpton) resigned. Mr. B. Walker (Senior Draftsman) transferred to the Mines Department.

Mr. E. J. Wells, District Inspector under the Timber Industry Regulation Act, was reclassified G-II-5/6 as from 1st January, 1970.

Two forestry Cadets (one State and one Commonwealth) commenced the first year of the course at the University of W.A. and one Forestry Cadet (State) withdrew from the second year of the course.

Salary increases were granted during the year to officers in the Special, Professional, Administrative and Clerical, and General Divisions.

### Forests Act

Appointments to the permanent staff during the year included the following—

10 Forest Guards, 2 Forest Rangers, 1 Assistant Forester, 1 Plant Inspector, 8 Technical Assistants, 1 Technical Officer, 3 Forest Assistants.

Promotions included 4 officers to Assistant Forester, 2 to Forester, 2 to District Forester and 1 to Technical Officer.

Two officers were reclassified, namely B. T. Cowcher to District Forester and N. C. Crawford to Workmen's Inspector Level F.3/4.

Five officers retired, namely Senior Foresters, J. H. Currie and H. J. McCoy, Forester E. E. Brown, Assistant Forester E. F. Crawford and Forest Ranger A. D. McQueen.

Eight Forest Field Cadets commenced a course, one of whom subsequently withdrew.

Resignations accounted for 11 Technical Assistants, 2 Forest Guards, 2 Forest Rangers and 1 Forest Assistant.

It is with deep regret that I have to record the death of Forest Ranger W. F. Cornell and also Forester J. Rate who was fatally injured by a falling limb.



**APPENDIX IA**

*Statement of Revenue and Expenditure of the Consolidated Revenue Fund for the Year ended 30th June, 1970*

1968/69	Revenue	1969/70	1968/69	Expenditure	1969/70
\$	<i>Royalties</i>	\$	\$		\$
2,715,409	Logs .....	2,494,593	522,556	Salaries .....	535,520
115,095	Sleepers .....	109,728	92,125	Incidentals .....	92,151
5,851	Sawn Timber .....	2,877	5,998	Timber Industry Regulations Act .....	4,799
158,074	Piles and Poles .....	215,787	156,393	Hardwood Conversion .....	139,895
13,177	Mining Timber .....	13,626	684,342	Pine Conversion .....	676,626
24,290	Firewood .....	25,296	83,701	Recoupable Projects .....	74,834
10,312	Posts .....	14,369	44,771	Tree Nurseries .....	45,698
11,224	Sandalwood .....	11,288	5,026	Arboreta .....	3,343
7,208	Miscellaneous .....	4,340	4,994	Printing and Stationery .....	3,504
3,060,640		2,891,904	2,761,178	Excess of Revenue over Expenditure distributed as follows—	
	<i>Pine Conversion</i>		293,322	9/10th to Reforestation Fund .....	2,713,126
565,100	Pine Logs .....	611,824		Transferred to Treasury .....	319,350
374,547	Sawn Pine .....	430,567			
939,647		1,042,391			
	<i>Hardwood Conversion</i>				
108,350	Sawn Hardwood .....	81,597			
108,657	Logs .....	102,131			
292	Posts, Piles and Poles .....	3,140			
217,299		186,868			
	<i>Other Sales and Trees</i>				
39,604	Seeds and Trees .....	40,611			
57,725	Inspection Fees .....	54,983			
53,898	Rents and Leases .....	49,993			
212,091	Miscellaneous .....	263,797			
363,318		409,384			
	<i>Recoupable Projects</i>				
57,667	Specific Roads .....	61,085			
15,835	Other .....	17,214			
73,502		78,299			
4,654,406		4,608,846	4,654,406		4,608,846

**APPENDIX IB**

*Forest Improvement and Reforestation Fund Account for the Year Ended 30th June, 1970*

1968/69	Source of Funds	1969/70	1968/69	Expenditure	1969/70
\$		\$	\$	<i>Divisional</i>	\$
269,707	Balance as at 1st July .....	255,928	1,786,652	Wages, Materials, etc. ....	1,577,202
2,694,532	9/10 Revenue .....	2,639,660		<i>Head Office</i>	
66,646	Bauxite Areas Compensation .....	73,466	836,970	Salaries and Allowances .....	998,660
69,720	Rents .....	69,926	58,396	Incidentals .....	76,113
210,000	Federal Aid Road Grant .....	210,000	196,027	Plant and Vehicles .....	184,416
201,000	Reserve Fire Fighting .....	201,000	549,502	Plant Operations .....	543,519
600,000	C/W Government Softwood Forestry Agreement .....	600,000	40,304	Purchase of Land .....	252,484
			67,489	Fire Equipment .....	82,296
			119,619	Head Office Housing and Building .....	147,202
			19,877	Como Headquarters .....	31,690
			25,876	Communications .....	24,506
			84,162	Research .....	56,903
			8,910	Drafting .....	11,671
			3,023	Surveys .....	5,036
			31,498	Training Staff .....	23,391
			135,020	Insurances .....	120,202
			60,906	Payroll Tax .....	64,919
			31,675	Utilisation .....	44,028
			2,269,254		2,667,036
			4,055,906	Total .....	4,244,238
			401,230	Less Recoups .....	451,688
			3,654,676		3,792,550
			201,000	Reserve Fire Control .....	201,000
			255,929	Balance Working Account .....	56,430
4,111,605		4,049,980	4,111,605		4,049,980

**APPENDIX IC**

*Statement of Afforestation Expenditure for the Year ended 30th June 1970*

1968/69	Source of Funds	1969/70	1968/69	Expenditure	1969/70
\$ 400,000 281,900 939,647	General Loan Fund ..... Reforestation Fund ..... Sale of Pine Logs and Timber.....	\$ 400,000 327,551 1,042,391	\$ 586,006 145,475 22,081 49,879 42,694 27,076 6,723 23,033 34,238 684,342	Plantation Establishment ..... Plantation Maintenance ..... Houses and Buildings ..... Road Construction and Maintenance ..... Fire Prevention and Suppression ..... Silviculture and Research ..... Surveys and Plans ..... Essential Services and Communications ..... Administration ..... Direct Conversion of Pine .....	\$ 710,626 136,780 29,291 56,599 41,639 35,549 7,582 32,049 43,201 676,626
1,621,547		1,769,942	1,621,547		1,769,942

**APPENDIX ID**

*Statement Showing Distribution of Forests Department Expenditure  
Details*

Consolidated Revenue Fund	.....	.....	.....	.....	.....	\$ 1,576,369
Reforestation Fund	.....	.....	.....	.....	.....	3,792,550
General Loan Fund	.....	.....	.....	.....	.....	400,000
						<u>5,768,919</u>
Distribution of Expenditure—						
1. Busselton	.....	.....	.....	.....	.....	450,246
2. Mundaring	.....	.....	.....	.....	.....	340,281
3. Dwellingup	.....	.....	.....	.....	.....	442,346
4. Collie	.....	.....	.....	.....	.....	332,207
5. Kirup	.....	.....	.....	.....	.....	431,735
6. Manjimup	.....	.....	.....	.....	.....	431,930
7. Narrogin	.....	.....	.....	.....	.....	62,447
8. Kelmscott	.....	.....	.....	.....	.....	234,856
9. Metropolitan	.....	.....	.....	.....	.....	236,126
10. Harvey	.....	.....	.....	.....	.....	605,493
11. Pemberton	.....	.....	.....	.....	.....	317,146
12. Nannup	.....	.....	.....	.....	.....	378,039
13. Walpole	.....	.....	.....	.....	.....	203,041
14. Kalgoorlie-Esperance	.....	.....	.....	.....	.....	24,661
15. Wanneroo	.....	.....	.....	.....	.....	343,143
Head Office	.....	.....	.....	.....	.....	935,222
						<u>5,768,919</u>

APPENDIX 2A

Exports from Western Australia of Timber, Furniture, Tanning Substances and Essential Oils for the Year ended June 30, 1970 (a)

Item and Destination		Quantity	Value	Item and Destination		Quantity	Value
		cub. ft.	\$			cub. ft.	\$
1	<b>TIMBER</b> Sawlogs and Veneer Logs, in the rough or roughly squared—conifer	....	....	6	Timber (including blocks, strips and friezes for parquet or wood block flooring, not assembled), planed, tongued, grooved, rebated, chamfered, v-jointed, centre v-jointed, beaded, centre beaded or the like, but not further manufactured.		
2	Sawlogs and Veneer Logs, in the rough or roughly squared—non conifer (including poles, posts, piling and other wood in the rough)				Other—		
	Overseas—	12	42		Overseas—	22	22
	Japan	....	....		Malaysia	....	....
	Australian States—				Australian States—		
	Victoria	28,246	28,214		Victoria	1,109	3,347
	South Australia	4,238	3,650		South Australia	5,293	5,227
					Northern Territory	60	140
		32,484	31,864			6,462	8,714
3	Sleepers—			7	Flooring (c)		
	Overseas—				Overseas—		
	Israel	42,146	75,139		Greece	948	1,807
	Kenya	68,989	108,780		New Zealand	453	2,368
	Pakistan	49,672	81,392		United Kingdom	4,259	8,419
	South Africa	7,919	12,968		United States of America	63	150
	Tanzania	48,196	81,744			5,723	12,744
	United Kingdom	442,405	870,593		Australian States—		
		659,327	1,230,716		New South Wales	81,305	187,232
	Australian States—				Victoria	25,929	89,058
	South Australia	478,341	786,148		Queensland	29	197
	Northern Territory	11,485	22,055		South Australia	40,908	97,261
		489,826	808,203		Northern Territory	13,323	69,591
						161,494	443,339
4	Timber, sawn lengthwise, sliced or peeled, but not further prepared, of a thickness exceeding 5 mm—non-conifer—			8	Other (e)		
	Jarrah (b)				Overseas—		
	Overseas—				Belgium—Luxembourg	369	875
	Bahrain	2,056	6,104		Christmas Island	163	282
	Christmas Island	83	292		New Zealand	37	155
	Germany, Federal Republic of	1,026	2,143		South Africa	50	340
	Iran	1,400	3,640		United Kingdom	9,683	18,137
	Kenya	69,517	108,447		United States of America	147	349
	Korea, Republic of	6,933	20,000			10,449	20,138
	Mauritius	1,000	1,811		Australian States—		
	Netherlands	999	2,135		New South Wales	2	3
	New Zealand	34,066	59,428		Victoria	2,101	3,531
	South Africa	26,495	49,305		South Australia	822	1,550
	Tanzania	9,231	14,400		Tasmania	86	164
	United Kingdom	309,756	645,619		Northern Territory	1,346	3,069
		462,562	913,324			4,357	8,317
	Australian States—			9	Plywood, wood sawn lengthwise, sliced or peeled, but not further prepared, of a thickness not exceeding 5 mm; veneer sheets and sheets for plywood of a thickness not exceeding 5 mm. (f)		
	New South Wales	255	669		Overseas—		
	Victoria	84,150	138,885		Cocos Island	11	20
	South Australia	636,666	780,633				
	Northern Territory	12,076	24,038				
		733,147	944,225		<b>Total, Timber Exports</b>	<b>3,399,534</b>	<b>5,661,547</b>
5	Karri (b)						
	Overseas—						
	Germany, Federal Republic of	31,240	60,258				
	Greece	947	1,807				
	Italy	8,333	18,048				
	Mozambique	782	1,455				
	Netherlands	8,086	15,874				
	New Zealand	81,227	134,205				
	South Africa	46,771	85,316				
	South West Africa	104	202				
	United Kingdom	1,597	2,887				
	United States of America	5,000	11,371				
		184,087	331,423				
	Australian States—						
	New South Wales	3,832	5,584				
	Victoria	1,899	3,091				
	South Australia	514,927	654,697				
	Northern Territory	128,913	245,084				
		649,571	908,456				



APPENDIX 2B

Imports into Western Australia of Timber, Furniture, Tanning Substances and Essential Oils for the Year ended June 30, 1970 (a)

	Item and Origin	Quantity	Value		Item and Origin	Quantity	Value	
1	Sawlogs and Veneer Logs, in the rough or roughly squared, non-conifer (including poles, piling, posts and other wood in the rough) (b)	cub. ft.	\$	8	Timber (including blocks, strips and friezes for parquet or wood block flooring not assembled), planed, tongued, grooved, rebated, chamfered, U-jointed, beaded, centre beaded or the like, but not further manufactured.	cub. ft.	\$	
	Overseas—				Flooring (g)			
	Ghana	928	1,426					
	Indonesia	172,583	118,209					
	Malaysia	672,338	524,042					
	Thailand	1,519	13,614					
	Origin Unknown	48	649					
		847,416	657,940	9	Other—			
2	Timber, sawn lengthwise, sliced or peeled, but not further prepared, of a thickness exceeding 5 mm.—conifer (overseas imports exclude shooks and staves—see item 6)				Overseas—			
	Redwood (c)				Malaysia	21,505	64,270	
	Overseas—				New Zealand	2,149	5,945	
	United States of America	2,733	9,923		Singapore	439	2,326	
						24,093	72,541	
3	Douglas fir (c)				Australian States (h)			
	Overseas—			10	Plywood; wood sawn lengthwise, sliced or peeled, but not further prepared, of a thickness not exceeding 5 mm.; veneer sheets and sheets for plywood, of a thickness not exceeding 5 mm.			
	New Zealand	23,790	29,925		Overseas—	sq. ft.		
	United States of America	82,169	204,854		China (mainland)	18,000	673	
		105,959	234,779		China, Republic of (Formosa)	56,000	3,056	
4	Other—				Gabon	33,120	1,656	
	Overseas—				Germany, Federal Republic of	41,104	2,649	
	New Zealand	7,264	10,902		Hongkong	10,500	1,042	
	Thailand	1,592	11,211		Ireland	98,673	2,866	
	United States of America	3,495	12,859		Japan	375,108	39,411	
		12,351	34,972		Malaysia	1,117,288	30,029	
	Australian States (d)—				Netherlands	353,590	14,191	
	New South Wales	2,760	16,199		New Zealand	160,661	36,119	
	Victoria	403	923		Singapore	11,006	277	
	Queensland	1,031	2,906		South Africa	199,409	5,239	
	South Australia	6,395	23,394		Thailand	7,440	841	
	Tasmania	1,510	3,590		United Kingdom	1,165,661	31,442	
		12,099	47,012		United States of America	20,712	5,294	
5	Timber, sawn lengthwise, sliced or peeled, but not further prepared, of a thickness exceeding 5 mm.—non-conifer (overseas imports exclude shooks and staves—see item 6)					3,668,872	174,785	
	Overseas—				Australian States—			
	Brunei	2,930	3,655		New South Wales	429,044	54,146	
	Denmark	508	2,302		Victoria	1,243,211	211,228	
	Ghana	1,995	8,556		Queensland	3,938,181	688,189	
	Ivory Coast	1,525	3,883		South Australia	206,269	27,692	
	Malaysia	1,292,961	1,848,272		Tasmania	12,830	2,972	
	New Zealand	1,670	2,109			5,829,535	984,227	
	Philippines	3,599	5,540	11	Reconstituted wood (also known as particle board, chip board, sliver board, shaving board, flake board, residue board and wood waste board).			
	Singapore	9,329	15,208		Australian States	5,533,497	1,123,126	
	Thailand	5,905	41,750			2,357,036	5,395,058	
	United Kingdom	154	315	12	Match splints (i)			
	United States of America	1,190	3,508		Overseas—			
		1,321,766	1,935,098		Finland		64,347	
	Australian States	29,407	91,964	13	Rulers, any material (b)	No.		
6	Shooks and staves, sawn lengthwise, sliced or peeled, but not further prepared, of a thickness exceeding 5 mm. (e)				Overseas—			
	Overseas—				China (mainland)	31,200	316	
	Malaysia	619	511		Germany, Federal Republic of	11,623	1,058	
	New Zealand	593	1,037		Hongkong	30	3	
		1,212	1,548		Japan	3,123	161	
7	Wooden beadings and mouldings (including moulded skirting and other moulded boards (f))				Netherlands	3,122	933	
	Overseas—				United Kingdom	42,463	28,183	
	Germany, Federal Republic of		1,513		United States of America	1,003	131	
	Malaysia		17,250			92,564	30,785	
	Netherlands		1,105			(f)	(f)	
	New Zealand		261		14	Table mats, wooden	(f)	(f)
	Norway		1,419		15	Wood flour (j)	cwt.	
	United Kingdom		5,595		Overseas—			
			27,143		United States of America	31	507	





APPENDIX 3

Summary of Exports of Forest Produce since 1836

Year	Timber		Year	Timber		Wood Manu-	Tanning	Essential
	Cub. ft.	Value		Cub ft.	Value	factures	Materials	Oils
		£			£	£	£	£
1836(a) ....	10,000	2,500	1901 ....	7,150,600	572,354	....	....	....
1837 ....	....	....	1902 ....	6,256,750	500,533	....	....	....
1838 ....	....	....	1903 ....	7,748,450	619,705	....	859	....
1839 ....	....	....	1904 ....	8,072,300	654,949	....	32,876	....
1840 ....	....	....	1905 ....	8,709,500	689,943	....	154,087	....
1841 ....	....	....	1906 ....	(c) 8,830,700	708,993	....	140,720	....
1842 ....	....	....	1907 ....	(c) 6,409,550	511,923	....	98,773	....
1843 ....	....	....	1908 ....	(c) 9,869,509	813,591	....	79,934	....
1844 ....	(b)	163	1909 ....	(c) 10,830,450	867,419	....	59,633	....
1845 ....	....	....	1910 ....	(c) 12,074,100	972,698	....	93,733	....
1846 ....	2,550	255	1911 ....	(c) 12,449,500	986,341	....	83,470	....
1847 ....	12,200	1,120	1912 ....	(c) 11,297,100	903,396	....	49,004	....
1848 ....	3,350	333	1913 ....	(c) 13,619,850	1,089,481	....	47,377	....
1849 ....	....	....	1914 (d) ....	(c) 6,279,750	502,152	....	18,197	777
1850 ....	10,500	1,048	1915 (e) ....	(c) 9,968,500	808,392	....	6,127	381
1851 ....	1,250	268	1916 (e) ....	5,432,100	441,991	....	10,208	1,102
1852 ....	7,050	806	1917 (e) ....	3,890,650	310,893	....	18,959	2,060
1853 ....	52,200	5,220	1918 (e) ....	3,436,250	274,141	....	16,886	3,995
1854 ....	58,500	7,023	1919 (e) ....	4,135,750	332,584	11,535	18,875	3,987
1855 ....	76,900	12,076	1920 (e) ....	5,065,300	465,731	21,935	22,121	3,704
1856 ....	70,500	9,671	1921 (e) ....	9,816,250	1,137,819	24,916	23,073	10,017
1857 ....	69,200	9,449	1922 (e) ....	8,309,750	1,041,047	22,248	13,328	6,878
1858 ....	29,250	2,340	1923 (e) ....	7,911,310	997,454	12,377	21,161	20,075
1859 ....	67,350	6,051	1924 (e) ....	11,126,861	1,367,517	11,505	29,606	39,877
1860 ....	54,800	4,932	1925 (e) ....	11,844,303	1,477,997	13,298	40,136	42,057
1861 ....	27,750	2,497	1926 (e) ....	12,001,384	1,522,958	10,072	15,056	47,819
1862 ....	68,800	7,151	1927 (e) ....	12,580,262	1,651,149	8,727	15,818	26,544
1863 ....	32,900	2,963	1928 (e) ....	10,384,784	1,265,383	7,783	27,662	39,131
1864 ....	58,300	5,508	1929 (e) ....	7,635,237	960,435	6,603	35,850	63,307
1865 ....	183,950	15,693	1930 (e) ....	6,579,743	807,425	4,687	40,628	77,510
1866 ....	85,650	6,849	1931 (e) ....	4,127,856	507,382	26,615	35,333	56,170
1867 ....	56,750	4,541	1932 (e) ....	3,062,673	361,700	85,488	42,016	59,301
1868 ....	8,000	638	1933 (e) ....	2,235,540	262,617	80,332	33,352	26,331
1869 ....	179,900	14,273	1934 (e) ....	4,060,830	487,248	76,107	20,904	26,720
1870 ....	157,200	17,551	1935 (e) ....	5,326,117	636,466	65,494	15,284	35,363
1871 ....	218,500	15,304	1936 (e) ....	5,598,180	697,522	50,665	12,237	27,526
1872 ....	37,000	2,590	1937 (e) ....	5,673,903	699,684	52,338	14,491	38,185
1873 ....	68,150	4,771	1938 (e) ....	7,545,744	932,420	47,934	13,865	35,128
1874 ....	345,600	24,192	1939 (e) ....	5,704,250	722,310	43,518	17,842	25,550
1875 ....	342,350	32,965	1940 (e) ....	5,049,585	634,859	62,796	19,485	47,736
1876 ....	219,050	23,743	1941 (e) ....	6,091,187	790,876	74,935	13,686	59,867
1877 ....	336,150	26,979	1942 (e) ....	5,244,634	700,474	64,454	6,986	74,904
1878 ....	580,900	63,902	1943 (e) ....	3,516,566	605,327	32,426	1,598	70,523
1879 ....	627,250	69,742	1944 (e) ....	3,645,354	613,994	25,324	1,294	72,704
1880 ....	662,550	66,252	1945 (e) ....	2,851,475	570,028	27,307	2,795	103,055
1881 ....	792,750	79,277	1946 (e) ....	3,373,025	722,061	(f) 2,618	4,872	128,050
1882 ....	936,500	93,650	1947 (e) ....	3,458,628	865,255	(f) 13,118	12,056	151,768
1883 ....	997,000	79,760	1948 (e) ....	3,584,405	1,099,073	(f) 6,572	9,556	116,465
1884 ....	861,700	68,936	1949 (e) ....	3,198,212	993,152	(f) 6,639	5,112	75,395
1885 ....	848,150	67,850	1950 (e) ....	2,857,946	974,493	(f) 13,525	8,243	78,550
1886 ....	626,150	50,902	1951 (e) ....	2,342,492	(g) 918,485	(f) 25,101	16,581	125,833
1887 ....	354,800	28,384	1952 (e) ....	2,373,553	(g) 1,032,909	(f) 47,689	19,120	119,109
1888 ....	525,570	42,060	1953 (e) ....	3,965,188	(g) 2,074,421	(f) 120,095	34,136	70,852
1889 ....	788,500	63,080	1954 (e) ....	3,858,956	(g) 2,248,320	(f) 59,360	80,248	55,273
1890 ....	1,172,200	82,052	1955 (e) ....	3,477,249	(g) 1,935,019	(f) 79,893	37,338	80,882
1891 ....	1,273,950	89,179	1956 (e) ....	4,568,034	(g) 2,818,716	(f) 119,459	554,760	90,928
1892 ....	1,082,650	78,419	1957 (e) ....	4,684,017	(g) 3,256,719	(f) 78,934	588,544	58,993
1893 ....	512,950	33,888	1958 (e) ....	5,572,681	(g) 3,875,705	(f) 39,762	337,655	101,814
1894 ....	1,063,700	74,804	1959 (e) ....	6,461,535	(g) 4,373,218	(f) 41,612	259,046	52,843
1895 ....	1,255,250	88,146	1960 (e) ....	6,133,240	(g) 4,160,354	(f) 20,549	366,606	63,905
1896 ....	1,545,600	116,420	1961 (e) ....	5,533,847	(g) 3,838,387	(f) 25,305	201,957	95,475
1897 ....	2,393,300	192,451	1962 (e) ....	5,660,937	(g) 3,993,663	(f) 194,380	281,364	81,506
1898 ....	4,086,150	326,195	1963 (e) ....	5,484,259	(g) 3,966,697	(f) 255,190	254,726	70,402
1899 ....	6,913,550	553,198	1964 (e) ....	5,266,329	(g) 3,686,732	(f) 272,187	322,916	88,666
1900 ....	5,725,400	458,461	1965 (e) ....	4,716,296	(g) 3,545,627	(f) 523,596	326,156	76,019
			1966 (e) ....	2,431,248	(g) 4,361,278	(f) 1,365,441	289,841	314,817
			1967 (e) ....	4,898,421	(g) 7,467,696	1,335,872	262,808	269,044
			1968 (e) ....	2,986,211	(g) 4,947,595	3,016,850	N.r.s.	280,806
			1969 (e) ....	3,052,796	(g) 4,984,098	3,802,927	N.r.s.	267,565
			1970 (e) ....	3,399,534	(g) 5,661,547	3,906,699	N.r.s.	317,553
			Total ....	471,347,667 (13,349,846 m <sup>3</sup> )	203,380,152	19,263,411	10,925,283	7,309,605

(a) The exports up to the year 1834 consisted only of supplies to shipping, of which no record is kept.

(b) Not available.

(c) Approximate figures only.

(d) Six months ended 30th June.

(e) Year ended 30th June.

(f) Excludes casks (principally empty returns) previously included in this item.

(g) Includes items for which the quantity in cub. ft. is not available.

N.r.s. Not recorded separately.

APPENDIX 4

Summary of Imports of Timber, Furniture, Tanning Materials and Essential Oils, since 1848

Year	Timber, Woodware, etc.	Tanning Materials	Essential Oils	Year	Timber, Woodware, etc.	Tanning Materials	Essential Oils
	£	£	£		£	£	£
1848	464			1900	56,266	1,416	1,105
1849				1901	80,134	1,740	1,546
1850	189			1902	97,810	3,418	1,751
1851	3,216			1903	102,383	3,556	1,348
1852	2,479			1904	157,856	1,322	2,122
1853	790			1905	98,494	582	1,592
1854	831			1906	95,229	1,412	1,915
1855	1,464			1907	122,016	2,767	1,549
1856	1,124			1908	93,205	2,392	4,584
1857	744			1909	90,502	4,129	4,033
1858	1,528			1910	171,280	3,531	3,686
1859	690			1911	152,133	2,912	4,938
1860	2,005			1912	167,244	3,089	4,598
1861	1,459			1913	202,640	2,651	5,392
1862	1,920			1914	78,736	629	2,823
1863	1,568			1914-15	107,763	2,082	4,988
1864	894			1915-16	76,849	3,313	4,788
1865	548			1916-17	75,681	2,848	3,848
1866	1,442			1917-18	58,305	2,020	4,358
1867	1,727			1918-19	62,824	1,181	4,168
1868	1,451			1919-20	100,083	3,748	10,043
1869	1,408			1920-21	171,654	*4,899	6,106
1870	1,518			1921-22	92,448	5,865	6,577
1871	736			1922-23	109,428	6,991	4,033
1872	1,660			1923-24	133,983	2,790	3,301
1873	1,008			1924-25	161,893	2,670	4,429
1874	1,774			1925-26	144,989	5,826	4,449
1875	2,707			1926-27	162,193	8,971	4,254
1876	3,098			1927-28	183,196	9,648	6,955
1877	2,036			1928-29	241,601	6,894	4,413
1878	2,947			1929-30	197,532	10,825	3,980
1879	2,340			1930-31	76,533	4,145	3,160
1880	3,061			1931-32	164,496	4,705	3,505
1881	3,639			1932-33	197,916	4,903	3,421
1882	3,692			1933-34	183,944	4,310	3,888
1883	6,667			1934-35	211,056	4,076	5,040
1884	2,930			1935-36	228,451	5,401	3,921
1885	11,479			1936-37	257,164	5,267	4,810
1886	17,888			1937-38	270,126	4,777	6,560
1887	8,136			1938-39	254,315	3,974	7,014
1888	4,461			1939-40	259,399	6,802	23,027
1889	7,686			1940-41	249,111	3,798	32,399
1890	14,979			1941-42	283,611	15,846	33,828
1891	18,406			1942-43	163,480	6,250	47,718
1892	26,713			1943-44	149,928	7,883	68,871
1893	14,493			1944-45	148,838	9,264	75,449
1894	17,964			1945-46	†219,466	19,573	56,295
1895	47,128			1946-47	386,465	12,395	78,091
1896	5,381			1947-48	345,508	8,019	96,769
1897	164,552			1948-49	470,755	8,662	42,926
1898	55,566			1949-50	521,815	24,923	51,197
1899	45,689			1950-51	640,059	21,147	161,358
				1951-52	1,037,499	18,494	167,697
				1952-53	509,667	21,493	69,804
				1953-54	923,367	45,202	58,019
				1954-55	816,052	27,395	76,464
				1955-56	839,581	27,315	131,758
				1956-57	830,700	35,403	99,863
				1957-58	873,520	28,310	101,680
				1958-59	815,300	9,365	62,983
				1959-60	895,845	14,608	74,199
				1960-61	1,203,641	12,621	60,942
				1961-62	1,236,106	13,853	130,876
				1962-63	1,978,937	9,868	63,739
				1963-64	1,903,772	19,412	37,494
				1964-65	2,289,999	21,677	69,741
					\$	\$	\$
				1965-66	4,856,090	60,963	132,862
				1966-67	6,458,909	68,928	191,796
				1967-68	8,135,532	75,657	143,696
				1968-69	8,731,114	109,905	206,309
				1969-70	10,968,170	153,169	293,845
				Total	91,807,979	1,673,128	5,244,076

\* This and subsequent years include tanning extracts, not previously recorded.

† This and subsequent years include values for furniture, bamboo, cane, etc., not previously included.

APPENDIX 5

SUMMARY OF LOG VOLUMES PRODUCED IN WESTERN AUSTRALIA SINCE 1829

Year	*Crown Land	Private Property	Total	Year	*Crown Land	Private Property	Total
1829-1916†	Cubic feet	Cubic feet	Cubic feet				
1917 (a) ....	19,333,100	2,144,500	21,477,600	1939 (c) ....	29,247,650	11,086,000	40,333,650
1918 (b) ....	7,665,550	504,950	8,170,500	1940 (c) ....	27,660,100	9,139,550	36,799,650
1919 (c) ....	19,987,050	3,390,450	23,377,500	1941 (c) ....	28,089,200	10,289,000	38,378,200
1920 (c) ....	28,292,200	5,762,900	34,055,100	1942 (c) ....	26,636,650	5,633,400	32,270,050
1921 (c) ....	29,308,950	7,018,450	36,327,400	1943 (c) ....	23,604,900	4,322,950	27,927,850
1922 (c) ....	36,122,400	15,640,150	51,762,550	1944 (c) ....	22,252,500	4,456,200	26,708,700
1923 (c) ....	26,807,300	9,867,050	36,674,350	1945 (c) ....	21,970,000	4,309,550	26,279,550
1924 (c) ....	42,004,450	9,342,800	51,347,250	1946 (c) ....	21,126,500	5,482,350	26,608,850
1925 (c) ....	43,832,900	18,142,250	61,975,150	1947 (c) ....	21,948,550	7,831,950	29,780,500
1926 (c) ....	48,823,750	25,037,600	73,861,350	1948 (c) ....	22,251,350	8,871,900	31,123,250
1927 (c) ....	46,887,600	31,356,100	78,243,700	1949 (c) ....	20,261,800	9,814,300	30,076,100
1928 (c) ....	42,781,250	23,334,450	66,115,700	1950 (c) ....	21,081,150	9,932,650	31,013,800
1929 (c) ....	32,289,750	11,098,950	43,388,700	1951 (c) ....	25,391,450	10,713,050	36,104,500
1930 (c) ....	31,654,150	11,653,600	43,307,750	1952 (c) ....	28,942,550	11,938,300	40,880,850
1931 (c) ....	18,822,600	12,148,500	30,971,100	1953 (c) ....	34,223,400	13,021,400	47,244,800
1932 (c) ....	11,742,850	4,115,950	15,858,800	1954 (c) ....	37,485,950	13,562,000	51,047,950
1933 (c) ....	13,165,650	2,456,650	15,622,300	1955 (c) ....	37,467,650	15,195,450	52,663,100
1934 (c) ....	21,263,100	6,330,400	27,593,500	1956 (c) ....	39,811,350	13,773,350	53,584,700
1935 (c) ....	27,458,250	11,451,750	38,910,000	1957 (c) ....	39,426,100	11,585,350	51,011,450
1936 (c) ....	31,400,600	13,436,150	44,836,750	1958 (c) ....	39,069,500	12,397,450	51,466,950
1937 (c) ....	31,703,850	15,902,200	47,606,050	1959 (c) ....	40,533,471	13,756,198	54,289,669
1938 (c) ....	31,737,450	15,928,950	47,666,400	1960 (c) ....	38,882,048	12,017,553	50,899,601
				1961 (c) ....	37,752,774	10,818,790	48,571,564
				1962 (c) ....	39,243,552	9,789,268	49,032,820
				1963 (c) ....	38,671,715	9,831,552	48,503,267
				1964 (c) ....	39,431,089	10,220,000	49,651,089
				1965 (c) ....	41,430,800	9,815,867	51,246,667
				1966 (c) ....	42,224,817	10,105,791	52,330,608
				1967 (c) ....	40,941,527	9,967,907	50,909,434
				1968 (c) ....	43,485,765	8,060,784	51,546,549
				1969 (c) ....	40,385,056	5,676,938	46,061,994
				1970 (c) ....	39,597,323	6,203,619	45,800,942
				Total	.....	.....	2,922,566,004 (82,766,029 m <sup>3</sup> )

\* Includes State Forest Timber Reserves, Crown Land and Private Property (Timber Reserved).

† Estimated.

(a) Year ended 31st December.

(b) Six months ended 30th June.

(c) Year ended 30th June.

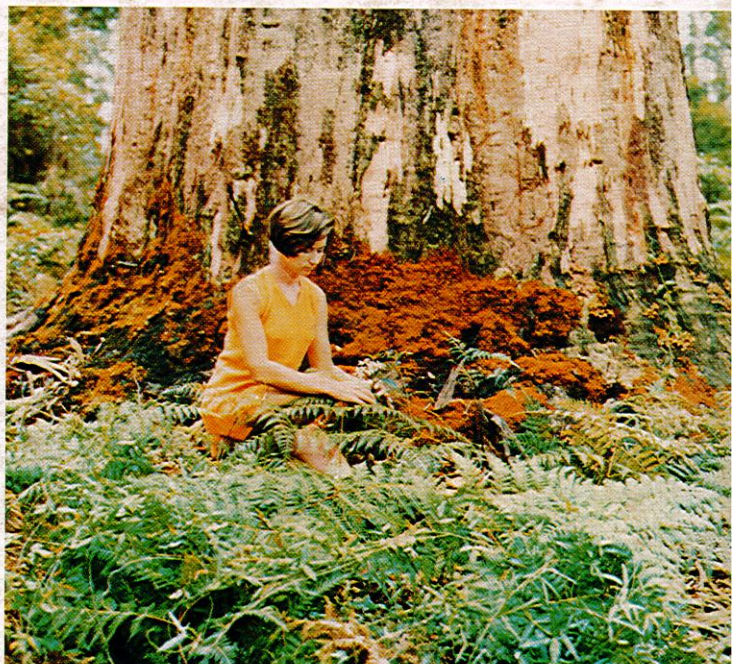




*This area at Lefroy Brook picnic spot was a wheat farm in 1865. Abandoned in 1867, it regenerated to karri after a fire in 1875. Walking trails branch off the Rainbow Trail.*



*Picnic seats and bench hewn from solid karri logs, at Big Brook Arboretum.*



*Butt of an 8 ft. diameter karri tree, Vasse Road.*

*Rainbow Trail winds through vigorous karri re*

