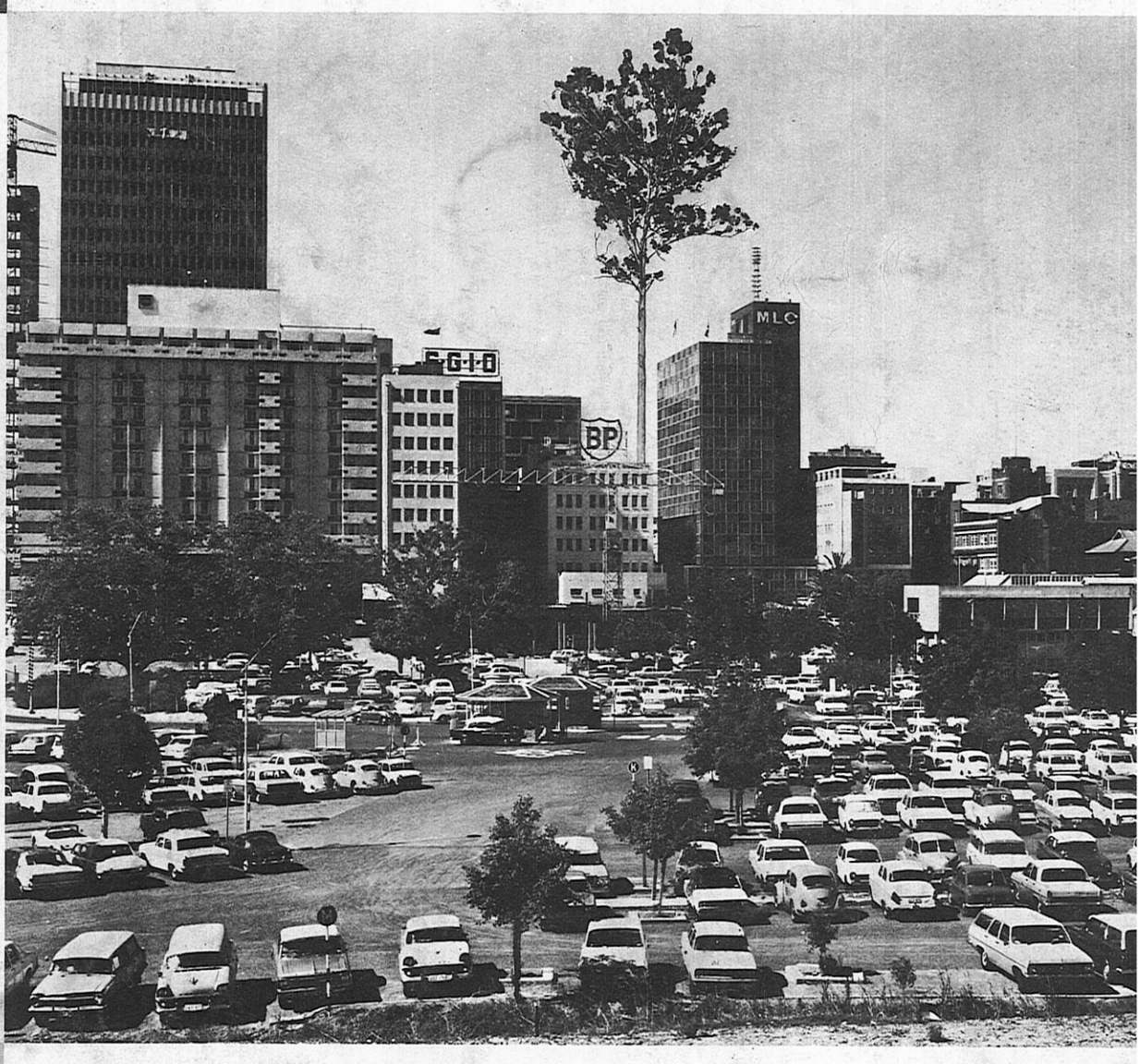
ANNUAL REPORT 1971



PRODUCTION
PROTECTION
RECREATION
CONSERVATION

FORESTS DEPARTMENT
WESTERN AUSTRALIA

Cover:

If Western Australia's tallest known tree, a karri 286 feet (87 m.) high, were transplanted to St. George's Terrace, Perth, this is how it would compare with the City's tallest building, Hamersley House (left) which reaches a height of 266 feet (81 m.).

The crown of the tree is some 140 feet (43 m.) deep and 115 feet (35 m.) wide and is supported by a long clean bole barely 8 feet (2·4 m.) in diameter at the butt—truly a masterpiece of natural engineering combining symmetry with great strength and economy of material.

REPORT

on the operations of the

FORESTS DEPARTMENT

WESTERN AUSTRALIA

for the year ended

30th JUNE, 1971

by

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

Conservator of Forests

☆

PRESENTED TO BOTH HOUSES OF PARLIAMENT

76325—(1)

Forests Department,
PERTH,
30th September, 1971

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, 1971.

Yours faithfully,
W. R. WALLACE,
Conservator of Forests.

Morning sunshine and shower over Lewana pine plantation situated along the Blackwood River valley north-east of Nannup. The first 5-year period of the Commonwealth Softwood Forestry Agreement Act, which has enabled a large increase in the rate of pine planting, concluded this year.

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	R. K. REID.
Accountant	E. G. BAKER, A.A.S.A.
Registrar (Acting)	J. C. ADAMS.

*At 30th June, 1971.

★

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

EUCALYPTS	
Bald Island Marlock	*Euc. lehmannii*
Brown Mallet	*Euc. astringens*
Coral-flowered Gum	*Euc. torquata*
Dwarf Sugar Gum	*Euc. cladocalyx var. nana*
Jarrah	*Euc. marginata*
Karri	*Euc. diversicolor*
Marri	*Euc. calophylla*
River Gum	*Euc. camaldulensis*
Salt River Gum	*Euc. sargentii*
Sugar Gum	*Euc. cladocalyx*
Sydney Blue Gum	*Euc. saligna*
Tallowwood	*Euc. microcorys*
Tasmanian Blue Gum	*Euc. globulus*
Tingle (Red)	*Euc. jacksonii*
Tingle (Yellow)	*Euc. guilfoylei*
Tuart	*Euc. gomphocephala*
W.A. Blackbutt (Yarri)	*Euc. patens*
Wandoo	*Euc. wandoo* Syn. *E. redunca* var. *elata*
CONIFERS	
Maritime Pine (Pinaster Pine)	*Pinus pinaster*
Monterey Pine (Radiata Pine)	*Pinus radiata*
Northern Cypress Pine	*Callitris intratropica*
OTHER	
Sandalwood	*Santalum spicatum*
Sheoak	*Casuarina fraseriana*

CONTENTS

* Not included in this Report as the information was not available at the time of going to print. The information will be presented as a supplement.

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 inch	= 2·540 cm.
	1 metre	= 3·281 ft.	1 foot	= 0·3048 m.
	1 metre	= 1·094 yd.	1 yard	= 0·9144 m.
	1 kilometre	= 0·621 mile	1 mile	= 1·609 km.
	1 yard = 3 feet = 36 inches		1 mile = 1,760 yards = 5,280 ft.	
AREA	1 cm^2	= 0·155 sq. in.	1 sq. in.	= 6·452 cm^2
	1 m^2	= 10·76 sq. ft.	1 sq. ft.	= 0·0929 m^2
	1 km^2	= 0·3861 sq. mile	1 sq. mile	= 2·59 km^2
	1 hectare	= 0·003861 sq. mile	1 sq. mile	= 259 ha.
	1 hectare	= 2·471 acres	1 acre	= 0·4047 ha.
	1 sq. kilometre	= 100 hectares	1 sq. mile	= 640 acres
VOLUME	1 cm^3	= 0·061 cu. in.	1 cu. in.	= 16·39 cm^3
	1 m^3	= 35·31 cu. ft.	1 cu. ft.	= 0·02832 m^3
	1 m^3	= 0·706 load *	1 load *	= 1·416 m^3
	1 litre	= 61 cu. in.	1 cu. in.	= 0·01639 litre
	1 litre	= 0·2642 gal. (U.S.)	1 gal. (U.S.)	= 3·785 litres
	1 litre	= 0·2200 gal. (Imp.)	1 gal. (Imp.)	= 4·546 litres
	1 litre	= 1,000 cm^3	1 gallon	= 4 quarts
MASS	1 kilogramme	= 2·205 pounds	1 pound	= 0·4536 kg.
	1 metric ton	= 1·102 short tons	1 short ton	= 0·9072 metric ton
	1 metric ton	= 0·9842 long tons	1 long ton	= 1·016 metric tons
PRESSURE	1 kg. per m^2	= 0·2048 lb. per sq. ft.	1 lb. per sq. ft.	= 4·882 kg. per m^2
	1 gr. per cm^2	= 0·0142 lb. per sq. in.	1 lb. per sq. in.	= 70·31 gr. per cm^2.
DENSITY	1 kg. per m^3	= 0·06243 lb. per cu. ft.	1 lb. per cu. ft.	= 16·02 kg. per m^3
OTHER	1 m^2/ha.	= 4·356 sq. ft/acre	1 sq. ft./acre	= 0·2296 m^2/ha.
	1 m^3/ha.	= 14·29 cu. ft./acre	1 cu. ft./acre	= 0·07 m^3/ha.

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

1. STATISTICAL SUMMARY OF MAJOR OPERATIONS

Sawnwood Production

	Cubic Feet	M³	
Total Production of Sawn Timber	15,620,486	*442,372*	
Exports—Interstate	1,756,990	*49,758*	(11·2 per cent)
Exports—Overseas	1,047,988	*29,679*	(6·7 per cent)
Local Consumption	12,815,508	*362,935*	(82·1 per cent)

Trends in Production and Consumption

Year Ended 30 June		Production				Total Export	Local Availability	Sawmills (No.)	Employees Monthly Average (No.)
		Sawn		Hewn Non-conifer	Total				
		Non-conifer	Conifer						
1926	cub. ft.	14,522,733	n.r.s.	6,277,952	20,800,685	12,001,384	8,799,301	....	....
	m³	*411,283*	....	*177,792*	*589,075*	*339,879*	*249,196*		
1938	cub. ft.	11,720,642	n.r.s.	2,573,540	14,294,192	7,545,744	6,748,448	134	3,112
	m³	*331,928*	....	*72,883*	*404,811*	213,695	*191,116*		
1946	cub. ft.	8,869,847	n.r.s.	14,041	8,883,888	3,373,025	5,510,863	128	2,876
	m³	*251,194*	....	*398*	*251,592*	*95,524*	*156,068*		
1951	cub. ft.	12,571,635	n.r.s.	1,183	12,572,818	2,342,492	10,230,326	256	4,047
	m³	*356,029*	....	*33*	*356,062*	*66,339*	*289,723*	....	....
1956	cub. ft.	19,213,771	n.r.s.	5,308	19,219,079	4,568,034	14,651,045	274	5,804
	m³	*544,134*	....	*150*	*544,284*	*129,367*	*414,917*	....	....
1960	cub. ft.	16,625,475	n.r.s.	....	16,625,475	6,167,132	10,458,343	265	5,037
	m³	*470,833*	....	....	*470,833*	*174,643*	*296,180*	....	....
1961	cub. ft.	15,783,370	n.r.s.	....	15,783,370	5,212,532	10,570,838	238	4,790
	m³	*446,985*	....	....	*446,985*	*147,619*	*299,366*	....	....
1962	cub. ft.	15,801,067	n.r.s.	....	15,801,067	5,660,639	10,140,428	236	4,906
	m³	*447,486*	....	....	*447,486*	*160,309*	*287,177*	....	....
1963	cub. ft.	15,593,099	n.r.s.	....	15,593,099	5,482,513	10,110,586	221	4,725
	m³	*441,596*	....	....	*441,596*	*155,265*	*286,332*	....	....
1964	cub. ft.	16,088,169	n.r.s.	....	16,088,169	5,266,328	10,821,841	214	*3,448
	m³	*455,617*	....	....	*455,617*	*149,142*	*306,474*	....	....
1965	cub. ft.	16,251,626	800,399	....	17,052,025	4,716,296	12,335,729	206	3,615
	m³	*460,246*	*22,667*	....	*482,913*	*133,565*	*349,348*	....	....
1966	cub. ft.	16,795,276	582,582	....	17,377,858	2,432,378	14,945,480	203	3,518
	m³	*475,642*	*16,499*	....	*492,141*	*68,885*	*423,256*	....	....
1967	cub. ft.	16,284,458	603,284	....	16,887,742	4,898,421	11,889,321	202	3,173
	m³	*461,176*	*17,085*	....	*478,261*	*138,723*	*339,537*	....	....
1968	cub. ft.	16,589,629	583,706	....	17,173,335	2,986,212	14,187,123	188	3,209
	m³	*469,818*	*16,531*	....	*486,349*	*84,569*	*401,779*	....	....
1969	cub. ft.	14,606,844	693,636	....	15,300,480	3,052,797	12,247,683	191	3,233
	m³	*413,666*	*19,643*	....	*433,309*	*86,455*	*346,854*	....	....
1970	cub. ft.	15,017,493	596,510	....	15,614,003	3,399,534	12,214,469	163	2,869
	m³	*425,295*	*16,893*	....	*442,188*	*96,275*	*345,914*	....	....
1971	cub. ft.	14,857,938	762,548	....	15,620,486	2,804,978	12,815,508	150	2,401
	m³	*420,777*	*21,595*	....	*442,372*	*79,437*	*362,935*	....	....

* As from and including 1964 these figures exclude persons employed in associated timber yards in the Metropolitan Area.
n.r.s. Not recorded separately.

Log Production*

	1971		1970	
	cub. ft.	m³	cub. ft.	m³
Jarrah	33,300,153	*943,060*	31,766,669	*899,632*
Karri	7,491,936	*212,172*	8,654,377	*245,092*
Wandoo	1,117,507	*31,648*	1,354,097	*38,348*
Pine	3,101,705	*87,840*	2,923,644	*82,797*
Other	1,145,153	*32,431*	1,102,155	*31,213*
	46,156,454	*1,307,151*	45,800,942	*1,297,082*

* Includes sawlogs and logs for the production of plywood, veneer and reconstituted wood (particle board, etc.)

Made up as follows—
From State Forests and Crown Land—40,436,463 cub. ft. (*1,145,161 m³*)—*87·6 per cent*
From Private Property —5,719,991 cub. ft. (*161,990 m³*)—*12·4 per cent*

Value of Production

	1971	1970
Total Value of Sawn Timber (on mill skids)	$27,291,500	$25,143,600
Total Value of Other Forest Products	$5,234,500	$5,852,770

Forest Area

	acres	*hectares*
Additions to State Forest	16,401	*6,637*
Excisions from State Forest	377	*153*
Land Purchased for pine planting	7,423	*3,004*
Total Area of State Forest	4,476,608	*1,811,683*

Reforestation

Cut-over area treated for regeneration	123,811	*50,106*

Afforestation

Area planted with pines, 1970	6,810	*2,756*
Pinus radiata	2,767 ac.	*1,119 ha.*
Pinus pinaster	3,995 ac.	*1,617 ha.*
Other species	48 ac.	*20 ha.*
Total area of pine plantation established	71,348	*28,874*
Pinus radiata	28,711 ac.	*11,619 ha.*
Pinus pinaster	42,069 ac.	*17,025 ha.*
Other species	568 ac.	*230 ha.*
Total experiment areas (additional)	2,320	*939*

Management

Survey—		
Theodolite surveys (control points)	19 (No.)	
Topographical mapping	728,260	*294,727*
Assessment—		
Area covered	1,327,000	*537,000*
Engineering, new works—	miles	*km.*
Roads and tracks	270	*434*
Houses and Buildings	2 (No.)	

Protection

	acres	*hectares*
Controlled burning	933,400	*377,747*
Fire Outbreaks—		
Number	213 (No.)	
Area burnt	8,640	*3,497*

Nurseries (Hamel and Narrogin)

Trees produced for—	
Private buyers	340,359 (No.)
Forests Department	1,153,106 (No.)

Sandalwood

	tons	*m. tons*
Quantity exported	842	*855*

SOURCE AND APPLICATION OF FUNDS

	1970/71	1969/70
	$	$
Source—		
Royalties on timber etc.	2,986,031	2,891,904
Departmental fees, Sales of logs etc.	1,724,574	1,716,942
Sub-Total	4,710,605	4,608,846
General Loan Fund	500,000	400,000
Federal Aid Road Grant	210,000	210,000
Commonwealth Softwood Forestry Agreement	1,033,000	600,000
Miscellaneous revenue and unexpended balances	—452,922	269,424
TOTAL	6,000,683	6,088,270
Application—		
Expended from Consolidated Revenue Fund—		
Pine and hardwood conversion	891,676	816,521
Administrative and general expenses	853,546	769,829
Transfer to Treasury	286,756	319,370
Expenditure under Reforestation Fund—		
Divisions—Direct operating costs	1,661,668	1,858,126
Head Office and general expenses	2,307,037	2,334,424
	6,000,683	6,088,270

2. REVENUE AND EXPENDITURE

The revenue for the year from all sources amounted to $4,710,605 compared to $4,608,846 received in the previous year.

After deduction of specified expenses, the net revenue transferred to the Reforestation Fund was $2,678,627 ($2,713,126)*. During the year this fund also received $500,000 ($400,000) from the General Loan Fund, advances totalling $1,033,000 ($600,000) under the Commonwealth Softwood Forestry Agreement and Federal Aid Road Grants of $210,000 ($210,000).

Expenditure from the Reforestation Fund for the year amounted to $3,968,705 ($4,192,550) and the balance held in the Fund at the 30th June was $778,813 ($257,430). The balance in each year includes $201,000 held as a reserve for Fire Control.

* Figures in brackets refer to the previous year.

3. FOREST AREA

State Forests (Forests Act, 1918–1969)

The total area of State Forest at 30th June, 1971, was 4,476,608 acres (*1,811,683 ha.*) which is an increase of 16,024 acres (*6,485 ha.*) compared with the total area at 30th June, 1970.

During the year, additions totalling 16,401 acres (*6,637 ha.*) were made to State Forest and 377 acres (*153 ha.*) were excised and reverted to the Lands Department.

	June 1971		June 1970	
	acres	*hectares*	acres	*hectares*
Jarrah	3,214,639	*1,300,964*	3,198,597	*1,294,472*
Karri	172,903	*69,974*	172,797	*69,931*
Jarrah and Karri (mixed)	656,109	*265,527*	656,082	*365,516*
Jarrah and Wandoo (mixed)	163,785	*66,284*	163,785	*66,285*
Tuart	6,435	*2,604*	6,435	*2,604*
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	181,145	*73,309*	181,296	*73,371*
Mallet	54,928	*22,229*	54,928	*22,229*
Miscellaneous	152	*61*	152	*61*
	4,476,608	*1,811,681*	4,460,584	*1,805,197*

Timber Reserves (Forests Act, 1918–1969)

The area held under Timber Reserve at 30th June, 1971, was 169,647 acres (*68,656 ha.*), which is a decrease of 1,693,237 acres (*685,253 ha.*) on the area at 30th June, 1970. The large decrease in area is attributable to the cancellation of reserves which were declared to protect timber required for mining purposes and to provide green belts around mining towns which are now no longer in existence.

	June 1971		June 1970	
	acres	*hectares*	acres	*hectares*
Jarrah	92,957	*37,620*	96,476	*39,044*
Wandoo and Jarrah	71,632	*28,989*	71,682	*29,010*
Jarrah and Karri	465	*188*	465	*188*
Pine Planting	4,584	*1,855*	4,584	*1,855*
Mallet	9	*4*	475	*192*
Sandalwood	....	....	23,100	*9,349*
Mining Timber, Firewood, etc.	....	....	1,666,102	*674,271*
	169,647	*68,656*	1,862,884	*753,909*

Land Alienations, etc.

During the year ended 30th June, 1971, 90 applications for land and road provisions and closures were received covering a toal of 42,078 acres (*17,029 ha.*).

The Department agreed to the release as follows—

Alienations			Leases (Pastoral—Grazing etc.)		
Timber Zone		Outside Timber Zone	Timber Zone		Outside Timber Zone
State Forest	Crown Land		State Forest	Crown Land	
acres	acres	acres	acres	acres	acres
421 (*170 ha.*)	4,130 (*1,671 ha.*)	....	314 (*127 ha.*)	2,649 (*1,072 ha.*)	230,900 (*93,445 ha.*)

No. of alienations approved 13
No. of leases approved 18

76325—(2)

The total of freehold land held at 30th June, 1971 in the name of The Conservator of Forests, was 53,321 acres (*21,579 ha.*), an increase of 2,113 acres (*855 ha.*).

Additional areas totalling 5,310 acres (*2,149 ha.*) have been approved for purchase under Contract of Sale.

Mining in State Forests

The level of mining activity again increased during the year. Alcoa's Kwinana plant, which draws bauxite from the Jarrahdale area, reached maximum production and now requires the mining of 270 acres (*109 ha.*) per annum. Construction of this Company's Pinjarra plant is well advanced, and production is scheduled to commence in 1972. An area of 450,000 acres (*182,000 ha.*) of State Forest and Timber Reserve is included in the agreement with Alwest and Broken Hill Proprietary for a third alumina refinery.

The position at the 30th June, 1971, is shown in the following table with the figures published in the last report for comparison:—

	16/3/70	30/6/71
Area of State Forest and Timber Reserves located in the south-west of the State	4,635,643 ac. *1,876,045 ha.*	4,651,667 ac. *1,882,530 ha.*
Area under Mineral Lease (approx.)	1,650,000 ac. *668,000 ha.*	2,100,000 ac. *850,000 ha.*
Area under Mineral Claim	132,000 ac. *53,000 ha.*	600,000 ac. *243,000 ha.*

Submissions were made to the Committee of Enquiry into the Mining Act set up last year. The Committee recognised the value of State Forests and Timber Reserves and their associated water catchments and recommended sweeping changes in the manner in which these areas are dealt with to reduce the over-riding powers of the current Mining Act.

A serious hygiene problem arose because of the risk of the spread of jarrah root rot (*Phytophthora cinnamomi*) disease due to the level of prospecting being undertaken in State Forests. The Minister for Mines has agreed to the reservation of State Forest areas from occupancy as a temporary measure to overcome this problem.

4. SAWMILLING, TIMBER INSPECTION AND FOREST PRODUCE

Timber Production

The production of 15,620,486 cubic feet (*442,372 m^3*) of sawn timber was an increase of 6,483 cubic feet (*184 m^3*) on last year's figure. Of the total output 1,935,645 cubic feet (*54,817 m^3*) came from private property, a decrease of 172,245 cubic feet (*4,878 m^3*) on the 1969/70 figure.

At December 31, 1970 there were 150 sawmills registered of which 96 operated on Crown land and 54 on private property. This represents a total reduction of 13 on last year's registration being eight for Crown land and five 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 (1829–1971) is given in Appendix 5.

Roundwood production from Departmental pine plantations totalled 3,045,420 cubic feet (*86,246 m^3*) an increase of 175,250 cubic feet (*4,963 m^3*) on the figure for 1969/70 (see Afforestation).

Local plywood factories obtained the following quantities of peeler logs—

	cubic feet	m^3
Karri	169,787	*4,808*
Jarrah	27,030	*765*
Pine	248,502	*7,038*
	445,319	*12,611*

Timber Inspection

The total quantity of timber inspected during the year was 4,578,435 cubic feet (*129,661 m^3*) made up as follows—

Railway Sleepers		3,477,761 cub. ft. (*98,490 m^3*)
Ex Crown Land	2,574,229 cub. ft. (*72,902 m^3*)	
Ex Private Property	899,300 cub. ft. (*25,468 m^3*)	
Re-inspected	4,232 cub. ft. (*120 m^3*)	
Other Sawn Timber		1,100,674 cub. ft. (*31,171 m^3*)

All railway sleepers produced were inspected.

TIMBER PRODUCTION

PRODUCTION OF TIMBER FOR YEAR ENDED JUNE 30, 1971
(EXCLUSIVE OF HARDWOOD MINING TIMBER, FIREWOOD, POLES AND PILES)

Tenure	Log Volumes by Species (1)								Totals	
	Jarrah	Karri	Wandoo	Yarri	Sheoak	Marri	Pine (2)	Other	In Log	Recovery of Sawn Timber
Crown Lands—										
cub. ft.	28,958,091	6,893,378	460,408	67,847	7,803	942,151	3,045,420	61,371	40,436,469	13,684,841
m^3	*820,093*	*195,221*	*13,039*	*1,921*	*221*	*26,682*	*86,246*	*1,738*	*1,145,161*	*387,555*
Private Property										
Cub. ft.	4,342,062	598,558	657,099	61,915	38	1,419	56,285	2,615	5,719,991	1,935,645
m^3	*122,967*	*16,951*	*18,609*	*1,753*	*1*	*40*	*1,594*	*74*	*161,990*	*54,817*
Total										
cub. ft.	33,300,153	7,491,936	1,117,507	129,762	7,841	943,570	3,101,705	63,986	46,156,460	15,620,486
m^3	*943,060*	*212,172*	*31,648*	*3,674*	*222*	*26,722*	*87,840*	*1,812*	*1,307,151*	*442,372*

In addition to the above 14,305 tons (*41,966 metric tons*) of wandoo logs were treated for tannin extract.

(1) Includes sawlogs and logs used in the production of plywood, veneer and re-constituted wood (particle board, etc.)

(2) For log categories see AFFORESTATION.

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

Year Ended June 30	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		
1970						$
Cubic Feet	11,651,792	1,854,321	1,274,252	833,638	15,614,003	25,143,600
m^3	*329,979*	*52,514*	*36,087*	*23,609*	*442,189*	....
1971						
Cubic Feet	11,110,612	2,574,229	1,036,345	899,300	15,620,486	27,291,500
m^3	*314,653*	*72,902*	*29,349*	*25,468*	*442,372*	....

DISTRIBUTION OF SAWN TIMBER*

Distribution		Sleepers	Other	Total
Interstate	Cubic Feet	424,043	1,332,936	1,756,979
	m^3	*12,009*	*37,749*	*49,758*
Overseas	Cubic Feet	603,354	444,635	1,047,989
	m^3	*17,087*	*12,592*	*29,679*
Local	Cubic Feet	2,446,132	10,369,386	12,815,518
	m^3	*69,274*	*293,661*	*362,935*
Total	Cubic Feet	3,473,529	12,146,957	15,620,486
	m^3	*98,370*	*344,002*	*442,372*

* The " break-up " of sawn timber other than sleepers was not available at the time of going to print.

Distribution of Timber

The detailed information on exports and imports normally used in the compilation of this section was not available prior to going to print. However, by courtesy of the Commonwealth Bureau of Census and Statistics, sufficent figures, preliminary only, have been supplied to indicate recent trends in the State's exports and imports of timber. They do not include the items of plywood, veneer and particle board and this has been taken into account when comparing the 1970–71 figures with those of the previous year.

It is intended that the complete information on exports and imports of timber, tanning substances and essential oils, for the year ended 30 June, 1971, be presented as a supplement to this Report.

Exports: Compared with 1969–70 overseas exports of 1,048,000 cubic feet (*29,679 m^3*) fell by some 274,000 cubic feet (*7,760 m^3*), or 20 per cent. The United Kingdom was by far the largest market, taking two-thirds of all overseas exports, sleepers—572,000 cubic feet (*1,620 m^3*)—being the major item.

Interstate exports of 1,757,000 cubic feet (*49,758 m³*) also fell when compared with the previous year, the decrease amounting to some 322,000 cubic feet (*9,119 m³*) or 15 per cent.

The total value of all exports fell by nearly $858,000 when compared with 1969–70.

Imports: Imports from overseas countries continued to rise and their value of approximately $3,611,000 was an increase of some $657,000 or 18 per cent on last year's figure. Malaysian timbers made up 79 per cent of the total value and timber from Indonesia, a further nine per cent.

Interstate imports were valued at $71,000 a little less than half the value for 1969–70.

Local Consumption: Competition from substitute materials continues but there was a strong demand for large section timbers during the year. However the gradual but continuing increase of imports of sawn timber from overseas sources is causing the industry some concern.

Sandalwood

The demand for sandalwood continued and 842 tons (*855* metric tons) were exported compared with 859 tons (*873 metric tons*) for the previous year.

Sandalwood received at Fremantle during the year totalled 1,055 tons (*1,072 metric tons*) compared with 749 tons (*761 metric tons*) for the year ended 30th June, 1970, and this quantity was made up as follows:—

	Tons	*Metric Tons*
Crown Land		
Logwood (including roots and butts)	972	*988*
Pieces	83	*84*
Private Property	Nil	Nil
	1,055	*1,072*

No orders for logwood or roots and butts were placed by distillers for oil distillation purposes.

A total of 3,557 lb. (*1,613 kg.*) of W.A. sandalwood oil was exported interstate and overseas.

Mr. E. S. Budd, who officiated as the Secretary of the Sandalwood Export Committee for many years, retired on the 25th May 1971 and Mr. R. K. Reid was appointed to fill the vacancy.

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		Private Property		Total	
	Tons	*Metric Tons*	Tons	*Metric Tons*	Tons	*Metric Tons*
Sawmills						
For Sale	79,354	*80,624*	5,595	*5,685*	84,949	*86,308*
Own Use	33,425	*33,960*	201	*204*	33,626	*34,164*
Permits and Licenses						
South-West	41,358	*42,020*	....	....	41,358	*42,020*
Permits and Licenses						
Goldfields	19,452	*19,763*	....	....	19,452	*19,763*
Other Permits and Licenses						
Wundowie	102,918	*104,565*	....	....	102,918	*104,565*
Kalgoorlie Mines	1,661	*1,687*	....	....	1,661	*1,687*
Kalgoorlie Pumps	250	*254*	....	....	250	*254*
	278,418	*282,873*	5,796	*5,889*	284,214	*288,761*

Other Forest Produce

Poles and piles obtained from Crown land during the year amounted to 1,224,200 lineal feet (*373,136 metres*) compared with 1,520,949 lineal feet (*463,585 metres*) for the previous year. Returns from private property showed 89,529 lineal feet (*27,288 metres*) as compared with 81,638 lineal feet (*24,883 metres*) for the year 1969–70.

Hardwood fence posts and strainers cut from Crown lands totalled 204,377 of which 2,178 were produced by the Department. Records received show that 13,640 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, 10,498 tons (*10,666 metric tons*) of round or split mining timber were used. All of this was obtained from Crown lands, 6,756 tons (*6,864 metric tons*) being from inland forests.

The number of Christmas trees sold was 9,115 compared with 8,384 the previous year. Revenue from sales amounted to $4,968.

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	....	3,742	....	6,756	10,498
	Metric Tons	....	*3,082*	....	*6,864*	*10,666*
Charcoal	Tons	....	42,114	....	....	42,114
	Metric Tons	....	*42,788*	....	....	*42,788*
Poles, Piles and Bridge Timbers	Lin. Ft.	....	1,224,200	89,529	....	1,313,729
	Metres	....	*373,136*	*27,288*	....	*400,424*
Fence Posts and Rails	No.	2,169	122,872	13,640	68,680	207,361
Strainer Posts	No.	9	10,647	....	....	10,656
Wandoo Timber for Tannin Extract	Tons	....	4,980	36,325	....	41,305
	Metric Tons	....	*5,060*	*36,906*	....	*41,966*
Beansticks, etc.	No.	....	12,550	....	3,500	16,050
Boronia Blossom	Lb.	....	2,976	1,144	....	4,120
	Kilos	....	*1,350*	*519*	....	*1,869*
Gravel and Stone	Cub. Yds.	....	135,559	....	....	135,559
	m^3	....	*103,480*	....	....	*103,480*
Sand	Cub. Yds.	....	4,977	....	....	4,977
	m^3	....	*3,799*	....	....	*3,799*
Scout Staves	No.	500	....	....	....	*500*
Sawdust consumed as Fuel	Tons	....	111,198	....	....	111,198
	Metric Tons	....	*112,977*	....	....	*112,977*

5. FOREST MANAGEMENT AND CONSERVATION

FOREST CONSERVATION

Dryandra State Forest

A detailed Working Plan has been prepared for the future management of Dryandra State Forest to meet the combined needs of recreation, flora and fauna conservation and limited timber production.

These forests contain the few remaining examples of the natural habitat of mallet and the vegetative associations of the near wheatbelt, together with some 19,000 acres of planted mallet. They have also developed into a unique wildlife sanctuary as a result of Departmental fire protection over nearly half a century.

Detailed prescriptions have been drawn up to reconcile the apparent conflict between optimum treatment for the protection of fauna and that required for the protection of flora. These prescriptions are essentially tentative and will be amended where necessary in the light of joint studies currently being carried out in conjunction with the Department of Fisheries and Fauna to determine the limits of the treatments more precisely.

The general maintenance of Dryandra State Forest has been materially assisted by a special Treasury grant, and it is also likely that the unique potential of the area will be realised more fully by the establishment of a properly controlled campsite at the former Dryandra Settlement, which is no longer needed for permanent residence of Departmental employees.

Forest Recreation

Further work in connection with the visitor survey has confirmed previous findings and has clearly demonstrated the value of State forests close to the major centres of population in providing facilities for passive recreational activity to the general public, either as individuals or on a small party basis.

The development of picnic facilities under Treasury grant continued and was extended into the northern forests. Some of the more interesting features were the provision of picnic spots, walking trails and information signposts at such points as Christmas Tree Well, and Lesley on the Brookton Highway, the Mount Dale lookout and the Baden Powell water spout on the Murray River near Dwellingup; whilst a section of the old One-Tree Bridge was recovered from the Donnelly River and reconstructed as a feature of interest at a picnic spot established on the river banks nearby.

In conjunction with the local authorities and Public Works Department, the Department established the necessary liaison to promote development of forest recreational facilities at the Logue Brook Dam near Harvey.

MANAGEMENT

Timber Resources of the Kimberleys

During late July and early August 1970 a party consisting of two officers of the Forests Department one officer each from the Main Roads Department and the Department of the North West and two officers from the Forestry Branch of the Northern Territory Administration, made a reconnaissance of selected areas of the Kimberley region in the north-west of the State. Apart from the south-west corner of Western Australia, the Kimberley region is the only one considered to have sufficient rainfall to support a forest crop.

The object of the reconnaissance was to assess the mixed hardwood and cypress pine (*Callitris intratropica*) resource on the Mitchell Plateau adjacent to the proposed bauxite mining townsite of Amax Mining (Aust.) Inc., and other reportedly useful stands of timber.

The route covered approximately 1,000 miles (*1,600 km.*) by road from Derby to Port Warrender on Admiralty Gulf and to Kalumburu Mission and return to Derby. Thirty plots to assess the standing timber were established in the better timbered areas occurring along the route.

Although trees of satisfactory size and quality occurred on the plateau and along the rivers, the stocking was generally very low. Only limited areas carried sufficient volume to warrant minor sawmilling operations and these were widely scattered. Further work is required to determine whether any commercial forest exists in the North Kimberley Region and in the meantime timber usage is likely to be restricted to the requirements of the few local residents.

Working Plans

Hardwood Inventory

This year assessment was carried out on 1,327,000 acres (*537,000 ha.*) in parts of Walpole, Pemberton, Nannup, Kirup, Busselton, Harvey and Dwellingup Divisions, by measuring 2,303 sample plots. covering 4,498 acres (*1,820 ha.*). One hundred and twenty nine plots were measured to relate the assessors' estimates to actual volumes present. Over 80 per cent of the hardwood forest is now covered by inventory information processed by computer.

Softwood Inventory

Plantations at Mundaring, Harvey, Collie, Kirup and Nannup, were measured by 661 temporary and 599 permanent angle-count plots. Stratification was based on top height for *P. radiata* and on height intercept for *P. pinaster.* A stand volume system of measuring temporary plots has been introduced for *P. radiata* and has proved more economical than the previous system based on plot volumes. A similar system is being developed for *P. pinaster.*

Projects

Two hundred and forty marri sample trees were measured in the northern region as a basis for the preparation of a volume table.

Mallet resources of the Dryandra plantation were assessed for the first time in a special project.

A logging plan for operations in the Warren-Dombakup area was prepared in conjunction with Divisional staff. This plan caters for the requirements of the Pemberton mill, the karri seeding cycle and future marri chipwood logging. It also takes special care to avoid erosion along the Warren River and to preserve the high scenic value of this river.

Colour transparencies (70 mm.) at approximately 1: 3,000 scale were taken in strip samples over some 150,000 acres (*60,700 ha.*) of Busselton and Nannup Divisions. Dying banksia, zamia, blackboys, and jarrah can be detected on these photos, which will be used in conjunction with 9 in. x 9 in. (*23 cm.* x *23 cm.*) black and white prints at 1: 40,000 scale to prepare maps showing the extent of dieback. Prior to this work, reliable mapping of dieback in the southern region was not possible.

Drought deaths in pines at Nannup were assessed in a special project.

A technique was developed for economically measuring the condition of stands after thinning using an angle count sample for basal area and a fixed area plot sample for stocking.

Hardwood chip volume resource figures were prepared for the area east of the Frankland River.

Management Research and Automatic Data Processing

Assessment Data: The development of local stand volume equations which predict the size class components of gross timber volume has led to the introduction of new sampling techniques for young pine stands. Computer programmes to process the new type of data have been provided.

Hardwood inventory data processing facilities have been extensively modified and enlarged to satisfy demands for a wider range of resource summaries.

Permanent Sample Plots and Growth Trials: Computer programmes are being developed to provide for the long-term storage of permanent sample plot and growth trial data on magnetic tapes. The programmes are designed to permit the updating of plot records as re-measurements are made.

Mapping Data: A large quantity of encoded mapping data has been stored on magnetic tapes. Data extracted from these tape files may be either displayed in the form of a stratified map or may be tabulated as detailed acreage statements. The acreage tables are readily transformable to multi-dimensional contingency tables and in this form are useful for testing hypothesis about the inter-relations between site factors. A computer programme which analyses multi-dimensional contingency tables has been developed and applied to the analysis of mapping data.

Management: A computer programme has been developed to simulate the growth of large tracts of forest in response to prescribed thinning, clear felling and regeneration operations. Outputs from the programme include a thinning schedule covering any number of years and a statement summarising the response of the forest to the prescribed management regime in terms of the discounted values of total yields and residual crop. The thinning schedule provides a list of stands which should be thinned during each year of the schedule period and prescribes the appropriate thinning intensity to be applied for each stand. Yields resulting from the schedule satisfy restraints imposed by the current market conditions. An optimal thinning schedule may be derived over several programme runs by an analysis of the financial statements.

Mensuration: Log volume tables were constructed for several major centres of *P. radiata* sawlog production in the south west of Western Australia. The tables provide underbark volumes for a wide range of log lengths and small-end diameter classes.

Stack volume conversion factors were computed for *P. pinaster* and *P. radiata* chipwood logs. The factors convert the space volume of the stack to true volume underbark of logs contained in the stack.

Mapping and Surveys

Emphasis was placed, during the year, on the completion of the topographical map coverage of the forest areas of the South West. In view of the progress which has been made with the one-mile-to-an-inch map series the policy was adopted that this coverage should be completed. This will ensure the minimum effect of forest management of the transition to a metric mapping system.

Two maps, Harvey 80 and Dwellingup 80, were published while maps Busselton, Kirup and Augusta are in course of preparation. Collie 80, which was out of print, has been republished with some amendments. The revision is proceeding of 80 chain maps Manjimup, Shannon, Pemberton, Walpole and Narrogin.

An aerial photograph of *Pinus radiata* at Lewana plantation, near Nannup. The photograph was taken with a 6-inch (*15 cm.*) lens from a flying height of 7,920 feet (*2,414 m.*) in April, 1969.

A total of 19,500 acres (*7,892 ha.*) of pine plantations and environs were mapped. Plantations in Wanneroo, Kirup, Mundaring and Busselton are being mapped and these projects are well advanced.

Co-ordinated survey control for the mapping of Augusta 80 and Ludlow plantation was obtained by a survey party provided from the staff of the Drafting Branch.

Large-scale mapping projects included a contoured map of Manjimup Settlement, West Manjimup Research Centre and Kelmscott Research Area. A total of 21 co-ordination and tower plans were prepared for Divisions.

Forest Engineering

Engineering projects during the year included the construction of 270 miles (434 *km.*) of roads, tracks and firelines and regrading of 3,503 miles (*5,636 km.*) of existing roads.

Plant and Equipment

There was no increase in staff employed in the maintenance of vehicles and field equipment. Seven apprentices completed their training during the year, seven were engaged and the total employed remained at seventeen.

Major items of fabrication completed included conversions of six fire-gang trucks, two flame-thrower units, one 500-gallon (*2,273 litres*) fuel tankstand, one steam soil sterilizer, one fireline plough one rake blade and one mounding plough. In addition a number of small items were made for general field and research use.

Departmental Buildings

Two houses were built during the year, four were sold and two demolished reducing to 501 the total houses owned by the Department. With the relocation of a number of outstation houses in major centres and the overall downturn in employees, it is expected that future works will be largely confined to existing establishments.

Communications

Radio: Repeater station aerials for very high frequency radio (V.H.F.) in the northern zone are approaching the stage when they will soon be due for replacement. A prototype aerial has been successfully developed and tested at Mt. William. It achieves better propogation, is structurally simpler than earlier types and should provide greater signal strength over a wider range.

Development work is well advanced for improved repeater station equipment to replace existing equipment. This upgrading is becoming increasingly important as the traffic load each year shows a marked increase.

Installations of V.H.F. radio were made at Dryandra lookout tower and in the new Walpole office, the latter also being fitted with high frequency (H.F.) radio.

Two Narrogin mobiles were equipped with, and 26 new vehicles wired to take V.H.F. mobile radio. A total of 186 standard mobile sets were modified and returned to the field in good working condition.

Improved results were obtained from a complete re-design of the aerial system of the vehicles carrying the radio beacon required when aircraft are used in controlled burning operations.

Radio Telephones: A further 12 radio telephones were installed in the following five groups—Gloucester Tree, Callcup and Boorara; Mt. Wells and Dwellingup; Mt. Lennard and Collie; Mt. William and Hampden; Wanneroo, Yanchep and Wabling Hill.

Favourable comments on the efficiency of the equipment have been received and serviceability is excellent with no breakdowns to date.

Telephones: The bush telephone system (" earth-return ") was installed at the new Walpole headquarters and the Northcliffe system was overhauled. A survey of bush lines was made in the Pemberton Division prior to upgrading.

6. REFORESTATION

Jarrah Forests

Intensive Management Units: Now that the logging hygiene programme is playing a substantial part in restricting the spread of Jarrah root rot by mechanical means in the northern jarrah forests, attention has been directed to selecting substantial tracts of high quality, uninfected forest for progressive improvement under concentrated management. These areas are termed " Intensive Management Units " and, because of their high productivity, they will provide the highest benefit from expenditure on improvement work. As their name implies, these units will be intensively managed with a view to realising the full site potential, and increasing both the volume and rate of production of high quality material such as poles, piles and veneer logs available from them.

Concentration of effort on the Intensive Management Units will also provide for better supervision for a substantially improved overhead situation and eventually for the continued supply of high quality jarrah.

To date, Intensive Management Units totalling 254,090 acres (*102,830 ha*) have been selected in the Dwellingup, Harvey, Collie, Kirup and Nannup Divisions and delineation of additional areas is proceeding in the Kelmscott and Manjimup Divisions. Economic analysis has demonstrated the profitability of the prescriptions for intensive management units after ensuring the highest degree of hygiene and the rehabilitation of the minor " dieback " patches occurring in them.

Dieback Areas: Re-establishment of resistant species on dieback areas continued both as field trials and as part of the plantation programme in the Northern Divisions. Results of spot sowing or planting in ripped lines as a means of economic reforestation on the less favoured infected sites are encouraging. It is hoped that the effectiveness of this technique can be further improved by the use of " tubelings " in place of seed, which has problems in connection with germination and in the determination of the rate of application necessary to achieve the desired stocking. Conventional plants when compared with " tubelings " have a decided disadvantage of bulk and weight when they have to be carried over considerable distances for planting.

Karri Forests

In the karri forests much of the effort this year was devoted to preparatory work involving scrub rolling, cull felling and perimeter burning in anticipation of an adequate seed supply becoming available for natural regeneration during the coming season.

Results from trials of replanting with karri wildings or open-rooted seedlings show that absolute dependence on natural seedfall for karri regeneration is no longer necessary. Natural regeneration cannot be overlooked for economic reasons, but the added flexibility of having a reliable alternative means of regeneration readily available, will substantially improve management techniques in the karri forest by shortening the regeneration period and by avoiding periods of peak workload resulting from irregular gaps in the natural cycle of seed production.

During the year, 51,559 acres (*20,866 ha.*) of virgin State Forest were cut over, made up of 47,175 acres (*19,092 ha.*) of jarrah forest, 3,454 acres (*1,398 ha.*) of karri and 930 acres (*376 ha.*) of wandoo woodland.

In addition 72,252 acres (*29,240 ha.*) of State Forest previously cut over were again logged.

Timber stand improvement continued over 2,851 acres (*1,154 ha.*) as part of the operations in the Intensive Management Units.

Reforestation of Areas Mined for Bauxite: At Jarrahdale the mining company prepared 138 acre (*56 ha.*) for subsequent replanting by the Department as part of the mining rehabilitation programme.

The site preparation involved replacing the original topsoil, landscaping to remove unsightly banks and extensive deep ripping by heavy bulldozer.

Initially the deep ripping has been highly successful as a means of curtailing erosion due to surface run-off from heavy early rains. This reduction in erosion undoubtedly indicated a higher degree of moisture penetration while the ripped sub-strata remained pliable, but there were some signs of reconsolidation at depth after the surface layers had become fully saturated.

The progress of tree establishment after ripping will be closely watched to see if the treatment has achieved the desired degree of improvement in conditions for early root penetration.

The earlier plantings continue to show promise and there are indications that a limited degree of root penetration is being slowly achieved, but the results of replanting must still be viewed with caution until full site occupancy has been obtained, and until clear evidence of the height of crown break is also available.

7. AFFORESTATION

Commonwealth Softwood Forestry Agreement Act

This year saw the conclusion of the first five-year period of the Softwood Forestry Agreement Act, 1967. The Agreements, between each State and the Commonwealth, which were signed under this Act, allowed for Commonwealth assistance by loans, to enable a big increase in pine planting by the State Forest Services.

The increase in Western Australia's case was from 13,579 acres (*5,495 ha.*) planted in the five years 1961/62 to 1965/66 to 28,115 acres (*11,378 ha.*) planted in the five years 1966/67 to 1970/71. The total area of pine plantations in the State was lifted, during the latter period, from approximately 43,700 acres (*17,685 ha.*) in 1965 to approximately 71,500 acres (*28,936 ha.*) in 1970.

Very broadly the Commonwealth loans covered the cost of planting and tending 12,700 acres (*5,140 ha.*) of the 28,115 acres (*11,378 ha.*) mentioned above, together with some assistance in the repurchase of land suitable for the planting of *P. radiata*.

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A Timberjack hauls long-length logs of 30 year-old radiata pine in Grimwade plantation (1971).

Pine Plantations

A total of 6,810 acres (*2,756 ha.*) of pine were planted during the winter of 1970 and of this, 487 acres (*197 ha.*) were experimental plantings. Allowing for 190 acres (*77 ha.*) of clear felling the total area planted to pine at 31st December 1970 was 73,668 acres (*29,813 ha.*) which includes 2,320 acres (*939 ha.*) of experimental plantings.

The distribution of these plantations was as follows—

Division	*P. radiata*		*P. pinaster*		Other Species		Total	
	ac.	*ha.*	ac.	*ha.*	ac.	*ha.*	ac.	*ha.*
Wanneroo	70	*28*	27,055	*10,949*	154	*62*	27,279	*11,039*
Metropolitan	41	*17*	2,040	*825*	30	*12*	2,111	*854*
Mundaring	2,322	*940*	1,920	*777*	152	*62*	4,394	*1,778*
Kelmscott	446	*180*	2,188	*861*	24	*10*	2,598	*1,051*
Dwellingup	504	*204*	89	*36*	16	*6*	609	*246*
Harvey	4,474	*1,811*	4,790	*1,939*	31	*13*	9,295	*3,763*
Collie	4,382	*1,773*	54	*22*	....	....	4,436	*1,795*
Kirup	6,632	*2,684*	193	*78*	8	*3*	6.833	*2,765*
Nannup	6,905	*2,794*	210	*85*	57	*23*	7,172	*2,904*
Busselton	1,522	*616*	3,532	*1,429*	59	*24*	5,113	*2,069*
Manjimup	524	*212*	....	....	....	....	524	*212*
Pemberton	889	*360*	58	*23*	37	*15*	984	*398*
Plantation Totals	28,711	*11,619*	42,069	*17,025*	568	*230*	71,348	*28,874*
Experimental Areas	361	*146*	1,815	*735*	144	*58*	2,320	*939*
Grand Total	29,072	*11,765*	43,884	*17,760*	712	*288*	73,668	*29,813*

The 1970 plantings were spread over nine Divisions as follows:—

Division	*P. radiata*		*P. pinaster*		Other Species		Total	
	ac.	*hc.*	ac.	*ha.*	ac.	*ha.*	ac.	*ha.*
Wanneroo	17	7	2,596	*1,050*	....	....	2,613	*1,057*
Mundaring	44	*18*	222	*90*	4	2	270	*109*
Kelmscott	265	*107*	168	*68*	....	....	433	*175*
Dwellingup	298	*121*	....	....	....	....	298	*121*
Harvey	490	*198*	367	*149*	....	....	857	*347*
Collie	416	*168*	45	*18*	....	....	461	*187*
Kirup	535	*216*	....	....	8	*3*	543	*220*
Nannup	527	*213*	69	*28*	36	*15*	632	*256*
Busselton	113	*46*	103	*42*	....	....	216	*87*
	2,705	*1,094*	3,570	*1,445*	48	*20*	6,323	*2,559*
	62	*25*	425	*172*	....	....	487	*197*
	2,767	*1,119*	3,995	*1,617*	48	*20*	6,810	*2,756*

Roundwood Production

Roundwood production from Departmental plantations, mainly in the form of thinnings, totalled 3,045,420 cubic feet (*86,245 m³*). This is an increase of 175,250 cubic feet (*4,963 m³*) or 6·1 per cent when compared with 1969–70. The following figures show the trend in pine log removals in recent years—

Year Ended June 30	Cubic ft. (U.B.)	*m³* (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*
1791	3,045,420	*86,245*

Removals by category and by species were as follows—

Category	*P. radiata*		*P. pinaster*		Total	
	cu. ft.	*m³*	cu. ft.	*m³*	cu. ft.	*m³*
Sawlogs	1,119,122	*31,694*	380,677	*10,781*	1,499,799	*42,475*
Chipwood	497,347	*14,085*	754,423	*21,365*	1,251,770	*35,450*
Peeler Logs	219,359	*6,212*	29,143	*825*	248,502	*7,037*
Fence Posts and Rails	17,254	*489*	9,108	*258*	26,362	*747*
Woodwool Logs	....	....	10,780	*305*	10,780	*305*
Miscellaneous Poles	3,474	*98*	4,733	*134*	8,207	*232*
Total	1,856,556	*52,578*	1,188,864	*33,668*	3,045,420	*86,246*

Compared with the previous year's production, sawlogs increased by 242,543 cubic feet (*6,869 m³*) or 19 per cent, and peeler logs by 28,044 cubic feet (*794 m³*) or 13 per cent. There was a reduction in all other categories, mainly in fence posts and rails where removals fell by 37,765 cubic feet (*1,069 m³*) or 59 per cent.

Roundwood removals from the various plantations were as follows:—

	cub. ft.	m^3	cub. ft.	m^3
Wanneroo (Gnangara)			582,717	*16,503*
Metropolitan			206,801	*5,856*
Collier	138,641	*3,926*		
Somerville	68,160	*1,930*		
Mundaring			709,110	*20,082*
Kelmscott (Gleneagle)			26,631	*754*
Harvey			334,652	*9,477*
Harvey Hills	230,208	*6,518*		
Myalup-McLarty	104,444	*2,959*		
Collie			225,541	*6,387*
Kirup (Grimwade)			461,640	*13,074*
Nannup			122,775	*3,477*
Busselton			277,653	*7,863*
Ludlow	100,713	*2,852*		
Keenan	176,940	*5,011*		
Pemberton			94,426	*2,674*
Miscellaneous			3,474	*98*
			3,045,420	*86,245*

Sawn Production

The total sawn production from all sources was 762,548 cubic feet (*21,595 m³*) which was an increase of 166,038 cubic feet (*4,702 m³*) or 30 per cent on the 1969–70 figure. A much greater demand for sawn boards was the primary cause of this increase.

Mallet Plantations

No mallet bark was produced during the year but a quantity of mallet timber was supplied to a small tool-handle factory which operates in Narrogin.

Rehabilitation of Areas Mined for Bauxite

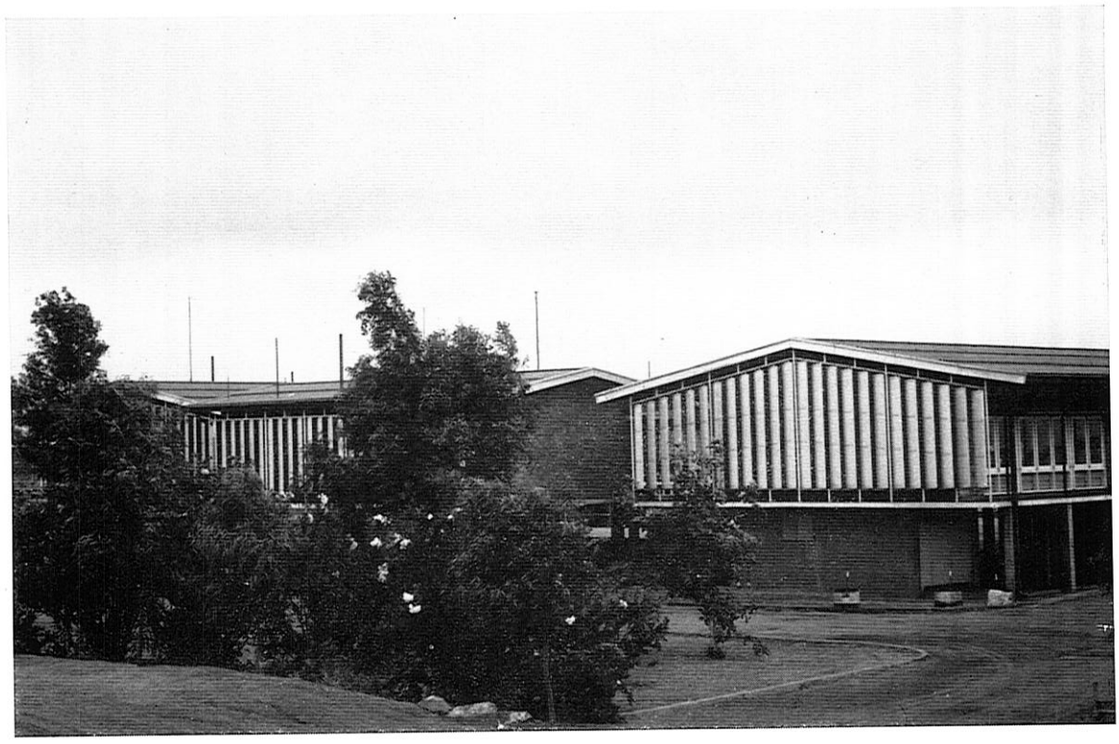
In the Jarrahdale Division 59 acres (*24 ha.*) of pines and 73 acres (*29 ha.*) of eucalypts were planted on areas cleared in the process of mining for bauxite. The methods employed on site treatment prior to planting were stated previously in the Management Section.

Inland Arboreta

South West: No new arboreta was planted during the year but those already established continue to attract considerable interest because they provide a practical demonstration of the benefits of tree planting in farming areas.

A mobile team inspects the arboreta each year and carries out any maintenance or assessment required.

The need for trees and shrubs for shade, shelter and aesthetic appeal is demonstrated in the photograph (above) of State Housing Commission homes at South Hedland. Plantings at Port Hedland School (below) show what can be done in this regard.



North West: During 1970, the Chairman of the North West Planning Authority requested advice on the feasibility of establishing shelterbelts around the rapidly expanding towns of Karratha and South Hedland. In this semi-arid region, trees and shrubs should play an important role in providing shade and shelter, in improving the aesthetic appeal of residential and recreational areas, and in assisting in the control of wind-blown dust.

In September 1970, two officers of the Forests Department, accompanied by Mr. F. Lullfitz of the Authority, inspected existing plantings at Port Hedland, Roebourne, Dampier and Mt. Newman. A report on the feasibility study was prepared and submitted to the Authority.

Tree Nurseries

The policy of providing trees at cost of production to people living in rural areas continued and in 1970 Hamel and Narrogin nurseries sold 340,359 young plants. The demand for eucalypts and ornamental trees was slightly less than in previous years and no doubt reflects the depressed state of the rural economy.

Farmers and graziers (85 per cent) placed the bulk of the orders, followed by Shires and schools (8 per cent) mining interests—mainly in the South-West—(5 per cent) and other Government Departments two per cent.

Distribution by zones was broadly as follows:—

North	15 per cent
Central and South-East	40 per cent
South Coast (Ravensthorpe-Esperance)	40 per cent
South-West	5 per cent

Distribution of plants from Hamel and Narrogin nurseries was as follows:—

Nursery	Number of Plants Sold				Departmental Use			Number of Species
	Potted Stock	Tray Stock	Open Rooted	Total	Pines	Other	Total	
Hamel	42,791	16,162	208,115	267,068	1,083,468	69,515	1,152,983	210
Narrogin	65,995	7,296	....	73,291	....	123	123	86
Total	108,786	23,458	208,115	340,359	1,083,468	69,638	1,153,106	....

The most popular eucalypts sold were:—

River Gum	*E. camaldulensis*
Tuart	*E. gomphocephala*
Dwarf Sugar Gum	*E. cladocalyx var. nana*
Bald Island Marlock	*E. lehmannii*
Salt River Gum	*E. sargentii*
Coral-flowered Gum	*E. torquata*
Sugar Gum	*E. cladocalyx*
Tasmanian Blue Gum	*E. globulus*

Departmental nurseries raised a total of 7,104,400 pine seedlings in 1970. Most of these were required for the Department's afforestation programme but an increasing demand from private plantation projects resulted in the sale of 741,361 young plants.

8. PROTECTION

Fire Protection

State Forests Under Protection

Indigenous Forest	4,383,829 (*1,774,136 ha.*)
Pine Plantations	73,668 (*29,813 ha.*)
Mallet Plantations	19,111 (*7,734 ha.*)

A further two million acres (*809,400 ha.*) of Crown land and private property are indirectly protected due, either to their strategic significance in relation to State Forest, or to their forest value.

The Fire Season

Forest areas south of Kirup experienced a mild season with well spread average rainfall. North of Kirup the season was average except for a prolonged dry autumn. Throughout the forest, peaks in fire danger were less severe than in most years.

The data below was recorded at the Forest Weather Stations at Dwellingup (Jarrah) and Pemberton (Karri).

	Jarrah		Karri	
	Average	1970/71	Average	1970/71
RAINFALL				
Annual (ins.)	50·50	50·50	51·05	53·35
Annual (*mms.*)	*1,283*	*1,283*	*1,297*	*1,355*
October to April inclusive (ins.)	10·77	10·75	14·92	12·69
October to April inclusive (*mms.*)	*274*	*273*	*379*	*322*
NUMBER OF WET DAYS				
Annual	127	143	194	203
October to April inclusive	44	41	83	87
TEMPERATURE				
Mean Maximum—Oct.–Apr. inc. °F	77·2	78·5	73·0	71·9
Mean Maximum—Oct.–Apr. inc. °C	*25·1*	*25·8*	*22·8*	*22·2*
Days of 100°F (38°C) or over (No.)	4	2	2	Nil
Days of 90°F (32°C) or over (No.)	27	30	14	12
RELATIVE HUMIDITY				
Days of 10% or less (No.)	3	Nil	1	Nil
Days between 11 and 15% (No.)	7	6	3	Nil
Days between 16 and 25% (No.)	35	29	8	5
FIRE HAZARD				
No. of Dangerous days	12	5	1	Nil
No. of Severe days	22	30	6	4
Mean Hazard	5·4	6·2	4·4	4·9

Prescribed Burning

	Acres	*Hectares*
Indigenous forest—Hand burning	416,100	*168,396*
Aircraft burning	504,000	*203,968*
Advance and Tops Disposal burning	10,400	*4,209*
	920,100	*372,364*
	930,500	*376,573*
Plantations—Hand burning	2,900	*1,174*
	933,400	*377,747*

There was sufficient suitable weather in spring to complete areas planned for "aerial" ignition and most of the hand burning in indigenous forests. Dry conditions in late autumn proved ideal to finalise the 1970/71 programme and part of the preparatory work on surrounds of areas planned for "aerial" ignition next spring. Few problems were experienced.

Frequency of burning has been under review and in some areas the rotation period has been extended by one year resulting in a slightly lower area being burned this year compared to the past two years. There will be a further reduction when revised plans are implemented throughout the forest.

Prescribed burning of internal buffer strips within plantations continued. These are designed to provide a strategic break system which will minimise losses in the event of wildfires.

Joint arrangements were made with the Department of Fisheries and Fauna for protective burning, to their specifications, of the Bullsbrook swamps which shelter the Short-necked Turtle. Other burning will also be carried out at their East Pingelly Research Station.

Detection

Thirty-two fire lookout towers were manned continuously during the season. Location of towers in the southern forest regions is under review. As a result of fuel reduction by prescribed burning in the hardwood forest adequate detection can be provided by fewer towers. New sites are being investigated which will effectively cover plantation extensions.

Manning of Towers	Karri	Jarrah	Plantations
First Watch	6/11/70	21/10/70	8/10/70
Last Watch	16/4/71	13/5/71	13/5/71

Communications

The fire control organisation continues to be well served by a highly reliable communications system utilising Very High Frequency radios and repeater beacons for control of mobile crews, and High Frequency radios plus P.M.G. telephone for inter-headquarters contact.

" Earth return " telephones which have for many years provided communication between fire lookouts and headquarters are being progressively replaced with Very High Frequency radio telephones. Benefits in effectiveness and saving of line maintenance expenses are apparent.

Rapid and efficient communication is essential for modern fire control techniques which depend on mobility and a high degree of organisation.

Fires and Fire Damage

During the season 213 fires occurred which required Departmental action. This compares favourably with a ten-year average of 300.

There were 171 fires on forest land and they burned 8,640 acres (*3,497 ha.*) as follows:—

Pines	53 fires	29 acres (*12 ha.*)
Indigenous forest	118 fires	8,611 acres (*3,485 ha.*)

Of the pine fires, one at Mundaring burnt 9·5 acres (*3·8 ha.*) of slash from clear felling and another at Somerville burnt 15 acres (*6 ha.*) on the new University site where, after felling operations, only a few trees per acre remained. Of the 53 plantation fires, 51 occurred in near-Metropolitan pine plantations.

Although seasonal weather conditions and a certain amount of good luck are reflected in the low number and area of fires in indigenous forests, there are several other reasons for the success achieved. Prescribed burning throughout the hardwood forest and Metropolitan plantations has reduced fire intensity so that with good detection and well trained, efficiently organised crews, suppression has been more effective. In addition autumn burning by the Forests Department and adjoining land holders was restricted until summer drought conditions had been effectively reduced by rain. It is considered this played a major part in reducing the number of escapes from settler burns to 24 from the previous year's figure of 73 and had some influence on the halving of escapes from Departmental burning.

9. RESEARCH

PINE SILVICULTURE

Pinus Pinaster Plantations

Tree Breeding

Seed Orchards: Three thousand two hundred and sixty four grafts were planted at the Mullaloo orchard in May, bringing the number planted to 6,884, on an area of 22 acres (*9 ha.*). This year's planting included 92 clones. The orchard will be completed with the planting of 1,000 grafts in 1972.

The current cone crop, harvested from the Joondalup orchard in May, was approximately four times as heavy as the previous one. It is anticipated the that 200 *Kg* (450 lb.) of seed to be extracted should enable 3,000 acres (*1,214 ha.*) of plantation to be established.

Controlled Pollination: A total of 742 controlled crosses were manipulated to give a " take " of 66 per cent. The main objectives of this year's programme were to complete the controlled crossing of the imported Portuguese clones, and to commence a system of random paired-matings.

A total of 1·4 *Kg.* (3·0 lbs.) of seed was extracted from the 1968 pollinations.

Progeny Testing: Further progeny trials covering 15 acres (*6 ha.*) at Gnangara, 6 acres (*2 ha.*) at Yanchep and 6 acres (*2 ha.*) at Neaves were planted in May. These included the normal progeny evaluation, and a new series to study the effects of fertilizer elements and regimes on the individual parent and on family development.

The total number of tubed plants raised at Wanneroo was 17,000 consisting mainly of progeny stock of *Pinus pinaster* (12,000) and *Pinus radiata* (3,000).

Progeny trials planted in 1967 were measured for height in January, 1971. The major observation is that 75 per cent of the full-sib progeny had a greater height than the routine stock. A height difference of 10 per cent existed between the best progeny and the routine stock. This difference is important since the initial objective in this programme was to select for stem straightness. Results were consistent with previous trials by demonstrating similar height growth for both the routine stock and plants from half-sib seed collected in Portugal.

The following Table shows height development for *P. pinaster* groups (age 3·5 years) on two dis-similar sites.

	Mundaring metres	Gnangara metres
Leiria, full-sib	3·48	3·11
Leiria, routine	3·38	2·99
Leiria—" plus " trees, Portuguese half-sib collection	3·21	2·97
Leiria x Landes cross	....	2·88
Landes (French)—half-sib.	2·86	2·63

All areas planted prior to 1967, were pruned by handsaws to one half of the tree height to facilitate diameter measurement and an assessment of form in the next measurement.

Results from the older progeny trials indicate that operational use of orchard seed can increase planting espacement to 12 x 8 feet (*450 s.p.a.*)—1,112 stems/ha.—instead of establishing at 8 x 6 feet (*900 s.p.a.*)—2,224 stems/ha.—which is current practice with unimproved seed.

Nursery Research

Completion of the yearly rotational cropping experiment has made it possible to evaluate the effectiveness of green cropping as a means of building up the organic content of the soil and restoring its fertility following raising of pine seedlings. The results of the experiment are summarized in the table below:

	Significance			Continuous Cropping		Rotational Cropping	
	Green Crop	Sterilization	Fertilization	Non-Sterilized	Sterilized	Non-Sterilized	Sterilized
Small stock 0–7 inches per plot %	Yes	....	....	64·5	75·8	19·8	9·7
Optimum stock 7–14 inches per plot %	Yes	....	....	7·9	3·5	33·2	52·4
Large stock 14 + inches per plot %	Yes	Yes	....	0·0	0·0	0·6	8·5
Dry weight of tops gms/plot	Yes	....	....	76·3	57·4	98·7	157·8
Dry weight of roots gms/plot	Yes	....	....	21·1	20·7	25·7	38·1
Shoot/root ratio	Yes	....	....	3·38	2·72	3·88	4·12
Soil reaction (pH)	....	....	....	5·22	5·28	5·15	5·22
Cation exchange capacity m/eg %	....	....	....	3·16	3·29	3·13	3·04
Total soluble salts	....	....	....	0·0094	0·0097	0·0087	0·0089
Organic carbon %	....	....	....	1·012	0·992	1·003	0·984
Soil nitrogen %	Yes	....	....	0·051	0·053	0·055	0·060

Despite the marked superiority of the treatment combining rotational cropping and sterilization, and of rotational cropping as compared with continuous cropping, there is no significant change in soil properties resulting from the two years under green crop other than a slight build up in soil nitrogen from 0·052 to 0·057 per cent. Soil reaction, total soluble salts, cation exchange capacity, phosphate and organic carbon are not significantly different. The better growth thus appears to be due either to temporary increase in nutrient availability or a decrease in organisms harmful to pine. The latter is indicated by additional growth resulting from sterilization.

The experiment on the feasibility of improving the quality of nursery soils by the application of cheap locally mined peat and urea and agricultural lime, offers the possibility of very rapid improvement in soil quality and seedling production, Four of the 32 combinations of peat and urea application tried are shown in the table below.

	Significance			No Peat		4 inch (10 cm.) of Peat	
	Peat	Initial Urea	Subsequent Urea	No Urea	8 cwt Urea/acre (*1218 Kg/ha*)	No Urea	8 cwt Urea/Acre (*1218 Kg/ha*)
Initial germination/plot	....	....	....	50·1	57·0	59·7	56·1
Final stock/plot	....	....	....	48·7	55·4	58·8	54·9
Acceptable seedlings/plot	Yes	Yes	Yes	0·7	0·9	1·12	35·8
Dry weight of tops gms/plot	Yes	Yes	Yes	21·0	36·2	26·3	55·0
Dry weight of roots gms/plot	Yes	....	Yes	10·6	15·4	13·3	19·4
Shoot/root ratio	Yes	Yes	....	1·88	2·24	1·93	2·44
Soil reaction (pH)	Yes	....	....	5·86	5·79	5·17	4·97
Cation exchange capacity m.e.g. %	Yes	....	....	3·17	3·30	6·99	6·42
Total soluble salts %	Yes	Yes	Yes	0·0062	0·0052	0·0097	0·0115
Organic carbon %	Yes	....	....	0·70	1·01	2·46	3·78
Soil nitrogen %	Yes	....	Yes	0·019	0·023	0·073	0·071
Foliar nitrogen %	Yes	Yes	Yes	1·03	1·88	1·15	2·72

The results stress the need for a balanced application of peat and a nitrogeneous source such as urea. The markedly higher content of organic carbon and nitrogen two years after the application of peat indicates that the improvement is permanent. However the comparison of dry weight, soil nitrogen and foliar nitrogen indicates that it is the availability of nitrogen, rather than its absolute level that determines the growth of seedlings, and that further applications of nitrogen will be needed until a stable C/N ratio is reached.

The investigation of weed control methods has also been completed. Detailed examination of the effects of Dacthal on both pine seedlings and main weed species has confirmed the earlier observations that it controls weeds only in the year of application, and has no apparent adverse effect on pine germination at any time. Adequate weed control is obtained with initial spring application of 12 lbs. per acre (*13·5 Kg/ha.*). Subsequent applications, up to the limit of four in one growing season and six in two years, have had no beneficial or adverse effect.

Site Classification

Ecologically-based site survey has now covered a total of 22,334 acres (*9,039 ha.*) spanning the full climatic and physiographic range of the northern jarrah forest. On the basis of this survey, 20 chains-to-an-inch maps, showing such environmental factors as land forms, slopes, rock outcrops, soil texture classes and proximity to roads, and such forest features as occurrence of the main tree species, basal area of the stands, logging history and occurrence of the dieback disease, have been prepared. These are now being inter-related by means of a computer mapping programme, MIADS. The understanding of these relationships will facilitate future broad-scale surveys and will minimize the amount of field work required. The scope of the survey has been broadened from the potential for pine plantations and hardwood silviculture to water catchments, recreation and fauna and flora conservation, as well as open-cut mining of bauxite, which is becoming a prominent form of land use in the region. Commencement has been made in the use of aerial colour photography in broad-scale land use surveys.

Site Amelioration

Analysis of first measurements from the mounding and fertilization trials on a former dieback area has amply shown the need for these measures on wet sites. Mounding has lifted the average survival during the first year from 2·5 to 19·6 seedlings out of 20 planted.

There has been differential response to phosphate and nitrogen fertilization by the three species planted.

The table below shows the height increment in inches, during the first year in field for mounded plots.

Fertilizer	Species		
	Pinus elliottii	*Pinus pinaster*	*Pinus radiata*
2 cwt. Superphosphate/acre	12·8 in. (*32·5 cm*)	8·9 in. (*22·6 cm*)	12·8 in. (*32·5 cm*)
1 cwt. Urea/acre	5·8 in. (*14·7 cm*)	1·9 in. (*4·8 cm*)	1·2 in. (*3·0 cm*)
2 cwt. Superphosphate plus 1 cwt. Urea	8·9 in. (*22·6 cm*)	4·5 in. (*11·4 cm*)	6·1 in. (*15·5 cm*)

Although urea was speared into the soil 6 ins. (*15 cm.*) down slope from the base of the tree, it had a depressive effect on the seedlings which was least marked in the case of *P. elliottii.*

Thinning

Trials within a series of thinning studies embracing basal area control are now sufficiently well developed to provide useful information. The older trial, established in 1965 in a nineteen year old stand, includes five fixed basal area levels within the range 31 to 160 square feet per acre (*7 to 37 m^2/ha.*). It is replicated within five site productivity gradations and consists of fifty plots reduced to the basal area prescription at two yearly intervals. Increment data covering the five-year period since establishment (Table 1) demonstrates a relative loss in effective diameter and basal area increment associated with the lightly thinned and unthinned stands.

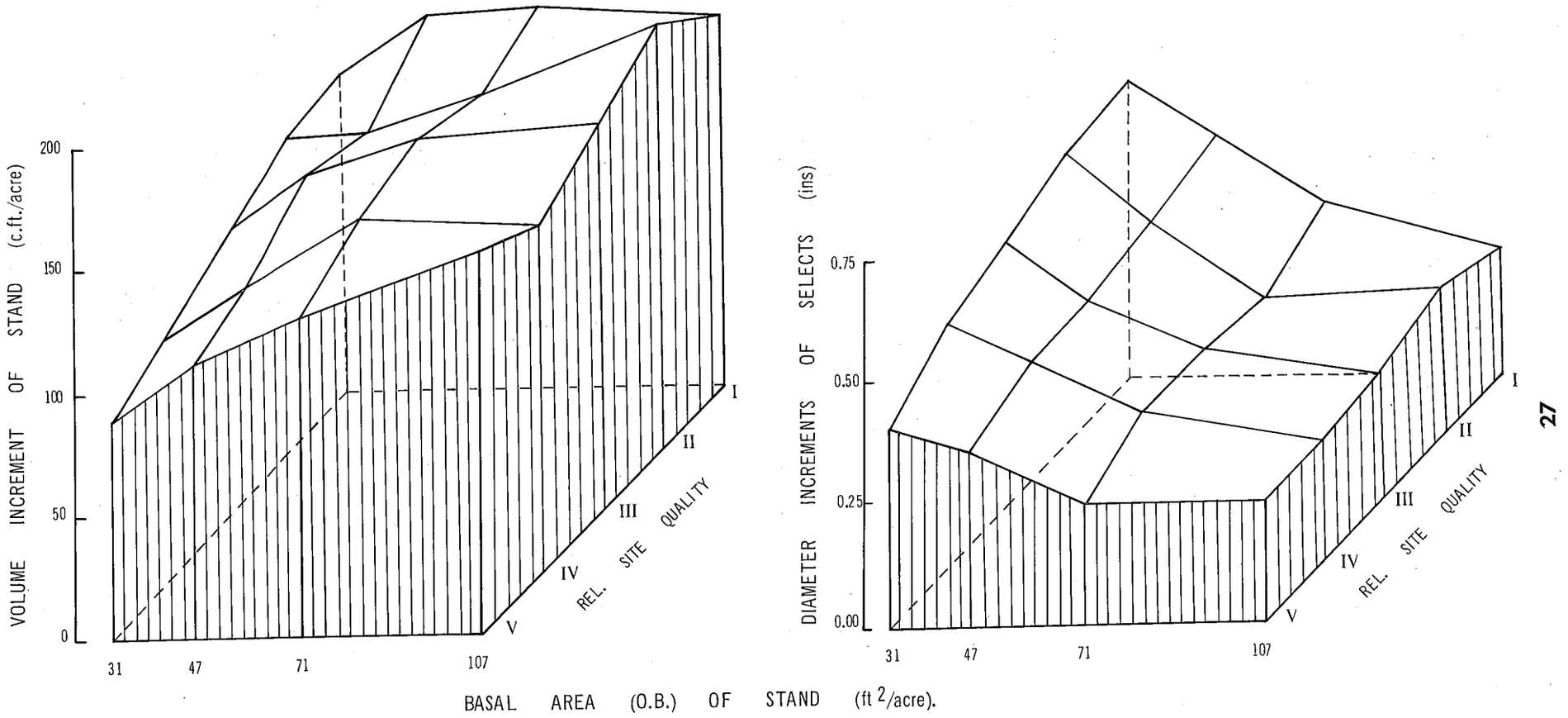


FIGURE 1: AVERAGE ANNUAL INCREMENT (1967-1971) IN STAND VOLUME (TOP DIAMETER LIMIT 2·5 inches) AND DIAMETER OF SELECT STEMS (100 per acre) IN THE YANCHEP BASAL AREA THINNING TRIAL.

TABLE 1.
Increment Data for South Lane-Poole Basal Area Thinning Trial

Parameter	Site Class	Prescribed Basal Area				
		31 ft²/ac.	47 ft²/ac.	71 ft²/ac.	107 ft²/ac.	160 ft²/ac.
Stems per acre 1970	I	40	70	135	240	380
	V	50	110	185	350	555
Mean Height (ft.) 1970	I	64	65	65	63	64
	V	55	51	53	52	54
C.A.I. B.A.O.B. Whole Stand (ft²/ac.)	I	6·2	6·9	7·3	8·8	9·5
	V	5·8	6·2	7·8	7·7	7·5
C.A.I. D.B.H.O.B. Whole Stand (ins.)	I	0·72	0·57	0·38	0·30	0·23
	V	0·60	0·42	0·34	0·23	0·17

Increment on 50 to 100 selected final crop stems per acre (*125–250/ha.*) is maximised in the lower stand density levels and decreases rapidly with increase in the density of the residual basal area.

The second trial was established in 1966 in a 14-year-old stand of *Pinus pinaster* at Yanchep on soils of the Spearwood Dunes System where soil moisture is limiting. Response surfaces in Figure 1 show the development of total stand volume and diameter of 100 select stems per acre (*250/ha.*) in relation to stand density and site productivity classes. The volume expression to a top diameter limit of 4 inches (*10 cm.*) averaged 156 cubic ft/acre (*11 m³/ha.*) over the period 1967 to 1971 for all stand density levels. Analysis to date indicates that with the adoption of a realistic, merchantable top diameter limit of at least 4 inches (*10 cm.*) volume loss due to heavy thinning is negligible and greatly outweighed by the advantages of the decrease in rotation length obtained in forcing a selected final crop to an acceptable breast height diameter.

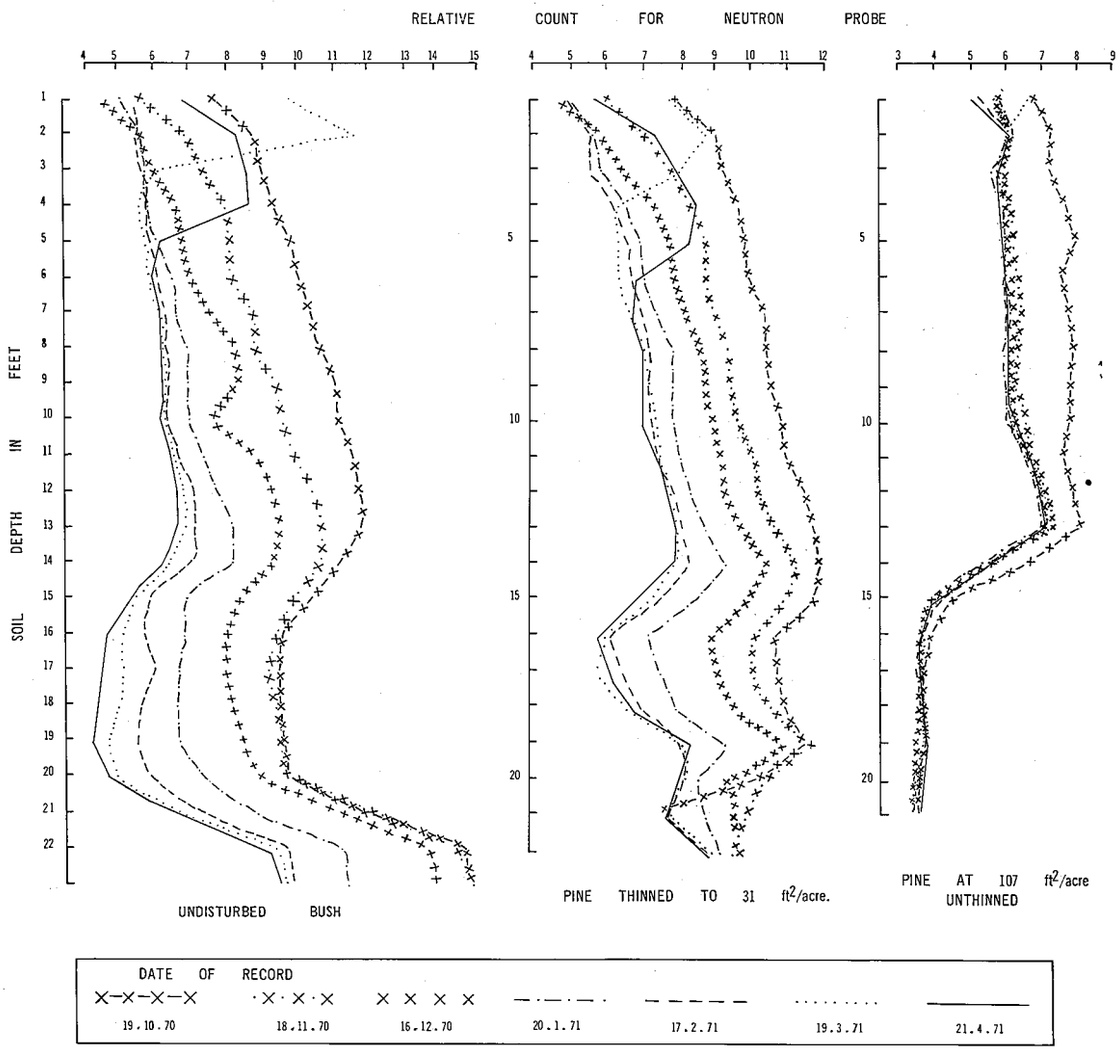


FIGURE 2: COMPARISON OF RATES OF SOIL MOISTURE DEPLETION UNDER NATIVE BUSH, A HEAVILY THINNED PINE STAND AND AN UNTHINNED PINE STAND AT YANCHEP. THE PINE IS 18 YEARS OLD.

The hydrological study which covers this stand density series clearly demonstrates that available soil moisture is a critical factor limiting growth. Measurements of rainfall interception reveal that 30 per cent more throughfall is received under the heaviest thinning. Soil moisture data in Figure 2 demonstrate that limited throughfall and excessive evapotranspiration prevent rewetting of the profile in unthinned stands. The heaviest thinning provides profile wetting and water use comparable to that under native vegetation. The pines in unthinned or lightly thinned stands exhaust water reserves by November of each year. In the heavily thinned stands water is available for growth well into February. The growth response resultant from this difference in water availability is plotted in Figure 3.

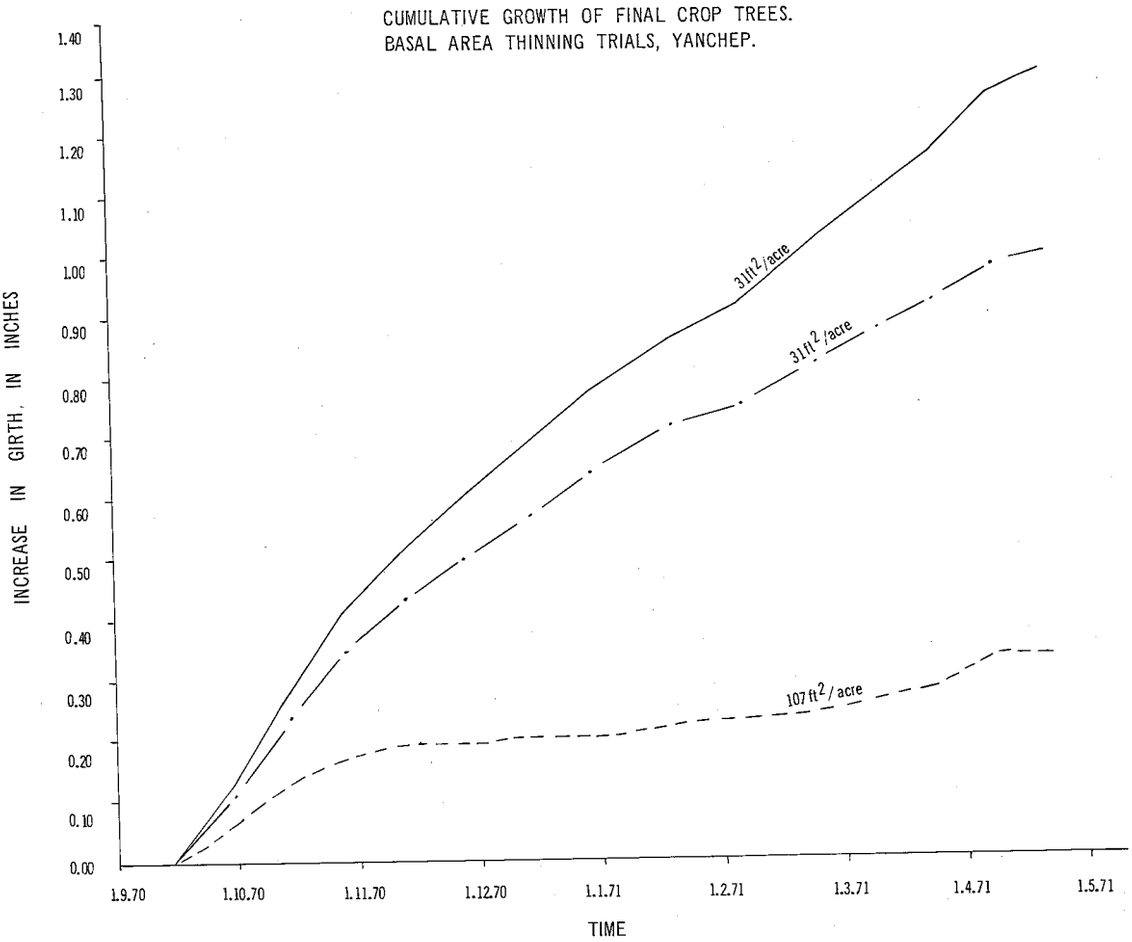


FIGURE 3:

Pinus Radiata Plantations

Tree Breeding

Seed Orchard: A further 2,301 grafts were planted in 16 acres (*6 ha.*) of the West Manjimup seed orchard in May 1971. This year's planting included 53 clones. The area now planted is 24·75 acres (*10 ha.*) containing 3,577 grafts.

Root-stock for the manipulation of 2,200 grafts were transplanted in May 1971. Grafting in August should see the end of the orchard establishment.

Seed Production: An area of 100 acres (*40 ha.*) has been developed at Grimwade plantation for the production of improved seed to meet local plantation establishment requirements. Stands have been thinned to retain the best fifty stems per acre and then heavily fertilized for the promotion of cone production. Collection will commence in summer 1971. All collection will be from felled trees. Selection will be based on the number of cones per tree.

The first " seed area " of 40 acres (*16 ha.*) will be reduced by the removal of 10 stems per acre (*25/ha.*) in 1971. Seed yield from this operation is anticipated to be 287 pounds (*130 kg.*) or sufficient to establish 5,000 acres (*2,033 ha.*) of plantation. Similar seed yields should be available annually to 1980; subsequent supplies will be collected by climbing at the Chandlers and West Manjimup seed orchards.

Progeny Testing: Progeny planted in May 1971 were of clones from A.C.T., South Australia and Victoria. Similar 11 acres (*4·4 ha.*) progeny designs were located in the Blackwood Valley (Kirup group) and Collie (Bussell's group) plantations.

Fifteen thousand progeny will be raised in tubes at the Collie and Wanneroo Research nurseries in spring 1971, as part of the " International Gene Pool " project. The project design will permit later conversion to a seedling seed orchard.

Cuttings: Five related trials were commenced in March 1971, to review techniques and methods for the propogation of *P. radiata* by cuttings. Two thousand, seven hundred and twenty cuttings were made for this study.

Competition Control

Further investigations have commenced to evaluate the economic and productive gains from control of pasture or woody weed competition as a guide to permissible expenditure on control. Interesting results have been obtained from a measurement of the pines in a post-planting weed control experiment established in 1965–66. The weed (*Bossiaea aquifolium*) had been sprayed with various concentrations of 245-T in water when the pines were aged 14–20 months. The following table shows diameter and height data for the extreme treatments, at age seven years.

Month of Treatment	Unsprayed				Sprayed 245-T 0·4 per cent			
	D.B.H.O.B.		Height		D.B.H.O.B.		Height	
	in.	*cm.*	ft.	*m.*	in.	*cm.*	ft.	*m.*
August	3·23	8·20	29·3	8·9	5·45	13·84	37·1	11·3
November	3·76	9·55	31·5	9·6	4·63	11·76	35·9	10·9
February	3·14	7·97	32·0	9·7	4·34	11·02	35·6	10·8

Analysis of the complete data indicated a highly significant effect ($P = 0·01$) of control of competition on diameter and height growth and a trend ($P = 0·05$) for increased growth on plots sprayed early in the season compared with plots sprayed late in the same growing season. An examination of the individual plot data showed that there was no worth while growth response until the degree of weed control exceeded about 60 per cent.

The potential gain from control of woody weed competition is likely to be greater than that given here, as the scrub was controlled for about one year only. Subsequent germinations and growth of surviving *Bossiaea* plants was such that today it is impossible to differentiate sprayed and unsprayed plots.

Pruning

The first full-volume measurement of a high pruning experiment has provided a valuable illustration of the volume loss associated with severe selective pruning. Trees were pruned to three levels—15 feet (*5 m.*) 22 feet (*7 m.*) and 30 feet (*9 m.*) and to three theoretical knotty core sizes—3·5 inches (*8·9 cm.*) 4·5 inches (*11·4 cm.*) and 5·5 inches (*14·0 cm.*). The data given in the table below refer to tree age 11 and are the means for 29–30 trees in each cell.

Nominal Core Size	Pruning Height	Mean D.B.H.O.B. in.	Mean D.B.H.O.B. *cm.*	Mean Height ft.	Mean Height *m.*	Relative Mean Volume (a)
3·5 in. (*8·9 cm.*)	Nil	6·71	17·04	46·9	14·3	100
	15 ft. (*4·6 m.*)	5·66	14·37	43·0	*13·1*	64
	22 ft. (*6·7 m.*)	5·41	*13·74*	42·4	*12·9*	53
	30 ft. (*9·1 m.*)	5·60	*14·22*	43·7	*13·3*	60
4·5 in. (*11·4 cm.*)	Nil	7·92	*20·11*	52·8	*16·1*	100
	15 ft. (*4·6 m.*)	7·36	*18·69*	51·8	*15·8*	82
	22 ft. (*6·7 m.*)	6·91	*17·55*	51·3	*15·6*	71
	30 ft. (*9·1 m.*)	7·21	*18·31*	51·4	*15·7*	78
5·5 in. (*14·0 cm.*)	Nil	7·18	*18·24*	59·0	*18·0*	100
	15 ft. (*4·6 m.*)	7·11	*18·06*	58·5	*17·8*	95
	22 ft. (*6·7 m.*)	7·17	*18·21*	58·4	*17·7*	96
	30 ft. (*9·1 m.*)	6·95	*17·65*	58·5	*17·8*	89

Note: (a) Taking mean tree volume (U.B. to a 2·5 in. (*6·3 cm.*) limit) for the unpruned trees as 100.

Clearly, high pruning to obtain a small knotty core involves a severe loss in volume increment where the pruning is selective. These data emphasize the need to thin at the time of pruning to enable the select stems to maintain their position in the stand.

Site Amelioration

A feature of the past year was the increased attention being given to the problems of growing *Pinus radiata* on what are currently considered poor sites. This is in line with the general trend in plantation forestry to make profitable use of land most favourably situated to markets and to increase productivity generally.

JARRAH SILVICULTURE

Regeneration Studies

Considerable emphasis has been placed on investigations into jarrah regeneration over the past year. Both field and laboratory trials have been established to elucidate factors which may affect seedling establishment and the rate of seedling development of this species.

A major trial was established in May to find the effect of soil disturbance (by ploughing) and stand density on the success of seedling establishment. A range of stand densities from 20 to 130 ft^2/acre basal area (*5–31 m^2/ha.*) was covered. The results to date suggest that some inhibition of germination may occur in close proximity to large jarrah trees. This factor is being further tested in the laboratory using soil collected at various distances from the bole of a large jarrah veteran.

The inability of bushy lignotuberous advance growth to produce a sapling shoot before it reaches a certain minimum size has also been investigated. Shoot elongation of advance-growth plants of a range of sizes was measured over a 9-month period. Small plants (10 in. to 30 in. total shoot length—*25 to 76 cm.*) were found to cease shoot growth by mid-December. Large plants (170 in. + total shoot length—*432 cm.*) of a size known to be capable of producing a sapling shoot, continued to grow throughout the summer. It seems likely that the ability of advance growth to produce a sapling shoot is related to its ability to tap adequate moisture supplies in order to maintain growth through the summer. Work is continiung on this project.

Other investigations into factors affecting seedling development include studies of the effect of daylength and temperature on shoot growth. Daylength affects shoot growth to some degree but is not critical. Temperature, on the other hand, appears critical. Low temperature was found to be the factor causing the cessation of shoot growth in late autumn.

Seedling Root Growth

Seedlings of jarrah and marri were grown in glass-sided boxes where root growth could be observed and measured. In both species the rate of root growth was directly related to the maximum weekly soil temperature, warmer conditions resulting in faster growth. In the warm December to March period the mean rate of extension of the main downward growing roots of jarrah was 4·6 inches (*11·7 cm.*) a week and of marri 7·2 inches (*18·3 cm.*) a week. By mid-June the rates were 2·2 (*5·6 cm.*) and 5·0 inches (*12·7 cm.*) a week respectively. In both species the rate of extension of side roots was about one-tenth that of the main roots.

These growth rates are undoubtedly much greater than would occur in the field where soil temperatures would be lower. However, the results demonstrate a far more rapid development in marri seedling root systems than in jarrah under similar environmental conditions.

Soil temperatures at depths down to 17 feet (*5 m.*) have been measured over the past three years and will enable estimates of the rate of root growth under natural conditions to be made, using the data collected from the studies outlined above.

Response to Fertilizers

The response of pole-sized jarrah to nitrogen (N) and phosphorous (P) fertilizers has continued to increase through the third year after application. The basal area increment of trees given N and P together was more than doubled in the third year.

A second large-scale field trial of N and P fertilizers applied to plots has been established to determine the response of jarrah to increasing quantities of fertilizer. A reliable response curve is essential to determine the economics of fertilizing. Over the first year after fertilizer application in this trial, increases in basal area increment attributable to the fertilizer ranged from 19 per cent with 120 lb/acre (*134 kg/ha.*) of urea and 310 lb/acre (*347 kg/ha.*) of double superphosphate, to 54 per cent with 1,920 lb/acre (*2,152 kg/ha.*) and 5,020 lb/acre (*5,626 kg/ha.*) respectively of the two fertilizers. The trial will continue until the effect of fertilization ceases.

Control of Undesirable Species

The killing of undesirable members of a forest stand is an important technique in silviculture. Considerable difficulty has been experienced in the past in killing large cull veterans, particularly of marri which belongs to the bloodwood group of eucalypts. Shallow injections of the poison Tordon 50D into the stems of these large trees usually results in a copious flow of gum which washes out the poison and results in a poor kill.

Studies of the effects of the poison in the tree have revealed that it acts as a stimulant to the formation of gum. Marri trees treated by boring holes into the stem and injecting Tordon 50D into the holes had nearly 70 per cent of their bole area covered by gum veins. Similarly holes bored in stems with no poison applied showed only a 10 per cent cover of gum veins round the bole. It has been found that by placing the poison well into the sapwood of a tree a high rate of mortality can be achieved in spite of the copious gum production.

Boring relatively deep holes into the bole at the 5-inch (*13 cm.*) spacing normally used for tree poisoning would be prohibitive in cost. Trials have been made attempting to extend the distance between injections and have proven very successful. At the widest spacing tried—40 inches (*100 cm.*)—a 95 per cent mortality rate was recorded. However, it was found necessary to increase the dosage rate of poison at this wide spacing. The present recommendation is to bore $\frac{3}{4}$ in. x 4 in. (2 x *10 cm.*) holes at 40 inch (*100 cm.*) spacing round the hole of cull veterans, and to inject 20 ml. of undiluted Tordon 50D into each hole.

Intensive Management Units (See also, Reforestation)

A project to delineate areas of high quality jarrah forest, which is little affected by dieback, and to declare them intensive management units is well under way. The first such unit was located in 1969 and a number of further areas are in the process of selection. The aim is to eliminate any infections of jarrah root rot in these areas by clearing infected forest and replanting with hardwood species resistant to *Phytophthora cinnamomi*. This operation has a two-fold value; not only is the disease controlled, but due to its tendency to be confined to swamp edges and moist gullies in the initial stages, these sites which formerly were unproductive, are being cleared and converted to high yielding hardwood plantations. The main species used are *Eucalyptus microcorys* and *Eucalyptus saligna* both of which exhibit early growth rates comparable to *Pinus radiata*.

Intensive management units are comprised of the best jarrah forest in the State and intensive silvicultural treatment, commensurate with their relatively high level of productivity, is being afforded them. Immediate operations include the thinning of regrowth stands, the poisoning of cull veteran trees, and the location of understocked stands and their regeneration.

KARRI SILVICULTURE

Large Scale Silvicultural Field Trials

Progress in the four large scale silvicultural trials established since 1965 is summarized as follows:—

1. Clear felling with seed trees in a healthy karri stand (Gray Block).
   The successfully regenerated crop of karri continues to make vigorous growth. An account of the initial phase has been submitted for publication.
2. Alternatives for the treatment of a mixed marri-karri stand (March Road).
   In such a mixed stand, it is possible to favour the regeneration of karri by retaining a karri seed source and effecting complete removal of all other species. Lignotuberous marri advance growth can be relied upon to provide a stocking of that species, irrespective of seed source. Progress, to the establishment phase, has been submitted for publication.
3. Conversion of mixed marri-karri stands to exotics using less than full plantation procedure.
   The planting of exotics into burnt slash following logging, without competition control, results in an unsatisfactory stand of mixed natural species and exotics, both subject to heavy scrub competition. There appears to be no acceptable alternative to the expense of full ground preparation in the establishment of exotics.
4. Alternatives for the treatment of mixed jarrah-marri stands (Coronation Road).
   Regeneration procedures, including regeneration-burning and regeneration-appraisal in the case of natural regeneration, and clearing, ploughing and planting in the case of exotics have been completed. Data is in the process of being evaluated. In the case of natural regeneration the problem of removal of excessive basal area in cull trees is being tackled by stem injection and felling. Coppicing of younger stems is being tried where natural regeneration is deficient.

Regeneration Surveys

In the past, karri regeneration surveys have been done by a " list quadrat " technique which entails the counting of small germinants in a series of milacre quadrats. Because the counting was tedious and difficult, the number observed was limited, and precision therefore suffered. A different technique, using a stocked-not-stocked technique which records only whether the quadrat is stocked or not, has been introduced on trial, and is gaining acceptance. Being much faster, more quadrats can be observed and more reliable results obtained, By observing quadrats on a systematic grid, subsequent plotting of information effectively maps out understocked areas which require remedial treatment.

Karri Improvement Programme

A start was made on the collection of seed parcels from selected karri stems over its complete geographical range. The aim is to establish seed production areas and progeny trials using a wide genetical base of some 400 selected trees. Seed of " superior " trees should be available early from closely planted then heavily thinned stands derived from a mixture of seed from all families.

So far some 30 seed-lots have been collected.

Karri Floral Cycle

Last year's flowering resulted in a fairly reasonable crop of capsules in the main karri areas and seed set appears to have been good. The results obtained on a small trial burn at Pemberton this autumn indicate that regeneration burning should be successful in central karri areas this spring.

The capsule crop in some south coastal areas however, is poor, and it is unlikely that much regeneration burning can be carried out there this season.

No further major seed crops can be expected in any areas until 1974/75.

Karri Planting

In 1966, five acres (*2 ha.*) of well prepared site in the karri forest was planted with woody wildings. A portion of the planting was fertilized with six ounces (*170 gm.*) of blood and bone manure dug in eight inches (*20 cm.*) deep and four inches (*10 cm.*) from the transplant. On fertilized plots the mean annual growth for five years exceeded five feet (*1·5 m.*) and survival was 90 per cent. Without fertilizer the annual increment was approximately two feet (*0·6 m.*) and survival 70 per cent.

Over the last three seasons consistently good results have been obtained using open-rooted nursery stock raised at the Nannup nursery. Root pruning in the nursery and shoot trimming just prior to planting appear to be beneficial.

A trial using superphosphate and two nitrogenous fertilizers, urea (quick acting) and ureaform (slow acting), indicated that a high phosphate to nitrogen ration is desirable for good establishment and high early growth rates. High nitrogen to phosphate ratios tended to have a detrimental effect on growth and also lowered the survival rate. This was especially marked in the urea treatments.

Early growth and survival rates did not benefit by increasing the application rate above the usual 2 oz. (*57 gm.*) per tree. The better results were at least as good as those obtained using the more expensive commonly used compuond, Nutrifert.

Seed Pelleting

Germination in the field of karri seed coated with fire clay and a methyl cellulose sticker was three times better than that of unpelleted seed. Seeds pelleted in winter have been stored for two years at room temperature without loss of viability.

A glasshouse trial compared three factors (pelleting, peat discs and fertilizers) at three levels each in pots. The seeds were impregnated into light foam plastic plugs with four seeds per plug and four plugs per disc. Discs were either imported jiffy—7 discs or units made from local Gnangara peat. The Gnangara discs without fertilizer gave the best germination of 52 per cent. Addition of Magamp fertilizer reduced this to 38 per cent. Jiffy–7 discs with fertilizer, unpelleted seed without fertilizer and pelletted seed with Magamp gave similar (20–24 per cent) germination. With the sole exception of jiffy–7 discs, the addition of fertilizers resulted in improved growth. Design for current experimental sowings was modified in accordance with these results.

A New Variety of Tingle

Preliminary investigations were made on a stand of tingle trees which differs from both Red Tingle (*Eucalyptus jacksonii* Maiden) and Yellow Tingle (*Eucalyptus guilfoylei* Maiden). In external appearance the tree tends to resemble red tingle, yet its wood is pale-coloured, resembling yellow tingle. A botanist from the State Herbarium collected botanical material and forwarded it to the Forest Research Institute, Canberra for examination. In the meantime, seed from it and the other two tingles has been collected, and seedlings raised therefrom have been planted out in the Pemberton arboretum.

Poplars: The first of a number of trials to investigate the performance of eight types of poplar in the lower South West were planted out in August 1970.

SOILS AND NUTRITION

The major lines of work carried out during the year were as follows:

1. The effect of different types of phosphate fertilizer on the growth of young *P. pinaster.*
2. Zinc-phosphorous interaction in young *P. pinaster* stands.
3. The study of genetic-nutrient interaction in different families of *P. pinaster.*
4. A leaf nutrient survey of the young *P. radiata* plots in the Manjimup region.

One major study was concluded during the year. In 1966 a basal area thinning trial was established in *P. pinaster* at Yanchep. Foliar samples were collected from the replicated plots in 1967, '69, '71 to study the effect of thinning on foliar nutrient levels. The overall means for all treatments are shown in the following table.

P. pinaster
Yanchep
Effect of Thinning Treatment on Foliar Nutrient Levels

B.A. sq. m/ha.	Year	Per cent					p.p.m.	
		N	P	K	Ca	Mg	Mn	Zn
7·1	67	·77	·074	·61	·17	·24	19·9	28·1
	69	·85	·076	·83	·20	·23	17·7	33·6
	71	·72	·066	·86	·15	·18	12·7	30·6
10·8	67	·78	·080	·62	·18	·25	17·5	26·2
	69	·90	·085	·80	·21	·25	16·8	34·9
	71	·73	·077	·81	·17	·20	14·4	31·0
16·3	67	·78	·077	·62	·16	·24	18·0	27·8
	69	·88	·077	·72	·20	·23	19·0	32·1
	71	·76	·068	·78	·16	·19	15·9	29·0
24·6	67	·76	·070	·61	·16	·24	17·3	27·7
	69	·88	·076	·69	·18	·24	17·1	32·0
	71	·76	·066	·74	·14	·20	16·2	29·3

Statistical analyses of these data indicated that only the foliar potassium levels were significantly affected by the thinning treatment. The variations between years were highly significant for all elements.

An interesting feature of these data is the low manganese levels recorded. This, together with other observations, indicates that manganese will be needed as a minor element addition on these soils.

FIRE RESEARCH

Fire research concentrated on two main projects: collecting information on fire behaviour in heavy karri fuels and, establishing a large trial in jarrah forest measuring regeneration of scrub species after fires of different frequencies and intensities.

Fire Behaviour Studies

Karri: Last winter a number of plots were prepared for burning in dense karri forest previously protected from fire for 20 to 30 years. Litter beds of up to 20 tons per acre (*50 m. tons/ha.*) occurred under trash of up to 15 tons per acre (*38 m. tons/ha.*). Over 100 fires were measured during spring, summer and autumn through a good range of forest and weather conditions.

Techniques were developed for measuring litter and trash by gauging the depth. Depth-weight relationships were established for a number of litter types. This work formed the basis for another study to improve prescriptions for prescribed burning through a more quantitative system of mapping fuel changes.

A number of analyses were undertaken on karri fire data collected in the 1969–70 season. Rate of area spread proved to be a good means of expressing changes of fire behaviour in these fuels. Moisture gradients through the depth of the litter beds were worked out to separate fuels burning in the main fire front from those which smoulder away afterwards. These, and other similar analyses are being combined in indices for fuel, moisture and scrub which eventually will form the basis of fire behaviour tables.

Pine: A preliminary fire behaviour table was produced for prescribed burning under unthinned plantations of maritime pine (*P. pinaster*). Collection of data from thinned stands has commenced.

A method was devised for mapping changes in needle bed and slash fuels from thinning operations. Mapping of 800 acres (*324 ha.*) of plantation is proceeding to demonstrate the technique on a broad scale and to evaluate alternative sampling intensities. These fuel maps will improve prescriptions for prescribed burning and form a quantitative basis for evaluating risks either from prescribed burning or from wildfire.

Growth Studies

Two new trials measuring responses in girth growth after prescribed burning, were established in thinned and unthinned stands of pinaster pine. Similar trials already established in radiata pine and karri were reburned.

None of these trials has shown changes in average girth growth after mild prescribed burning although individual trees may respond. Fire intensities were increased in recent burning to establish levels of acceptable risk.

Karri saplings averaging 19 feet (*6 m.*) high, which survived burning under fires of approximately 30 B.T.U. (British Thermal Units) per second per foot (refer 1970 report) have grown in height at a similar rate to unburned saplings.

Pinaster pine, scorched by fire which left only one or two feet of green tip on the crown, are returning to normal girth growth after four years.

Fire Effects on Understorey Scrub

About 60 plots, each four chains square (*80 m.* square) were established in jarrah forest near Dwellingup to measure effects of prescribed burning on regeneration of understorey scrub. Each plot contained 16 metre-square quadrats, on which scrub species were identified and plants counted and mapped. Point-sampling was used to measure density and height of foliage for the 60 species identified in the trial.

The burning treatments should start next spring and will include a range of fire intensity, season and frequency of burning.

Three years ago plots of dense fireweed scrub were burnt by mild fires (20 B.T.U. per second per foot). These plots lie in marri-karri forest near Manjimup where fireweeds had germinated from a fire five years previously.

TABLE 2

* Frequency of the Main Fireweed Species

Plot	Scrub Type	Before Burning	2 years after	3 years after
Burnt				
1	Acacia strigosa	65·6	3·1	8·3
2	Acacia pulchella	75·8	0·6	2·3
3	Bossiaea aquifolium	61·7	6·9	19·7
Control				
1	Acacia strigosa	69·4	....	60·6
2	Acacia pulchella	54·5	....	14·4
3	Bossiaea aquifolium	43·3	....	48·9

* F = Number of rods contacting a species X 100
total number of rods

Scrub on three burnt plots, and on unburnt controls alongside, was measured by point-sampling methods. Table 2 shows the frequency of the main fireweeds before burning, when the plants were five years old, and for two and three years after burning. There was a considerable drop in the frequency for all three fireweeds. The increase between the second and third year was due to larger plants rather than an increase in numbers.

The unburnt plots maintained similar frequencies for two of the fireweeds but *Acacia pulchella* decreased markedly. This species declined in both the burnt and unburnt plots and may need fairly regular burning by intense fires to maintain a dense coverage.

TABLE 3

Number of Species with Frequency Greater than 0·3

Plot	Fireweed Type	Before Burning	2 years after	3 years after
Burnt				
1	Acacia strigosa	15	29	28
2	Acacia pulchella	14	22	20
3	Bossiaea aquifolium	11	14	18
Control				
1	Acacia strigosa	18	....	22
2	Acacia pulchella	12	....	22
3	Bossiaea aquifolium	11	....	16

Table 3 lists number of species in burnt and control plots with frequencies greater than 0·3. In general there was a greater increase in numbers for the burnt plots but the results were by no means clearcut. For the *Acacia pulchella* type more species were observed in the unburnt plot whilst the difference of only two species for the burnt *Bossiaea aquifolium* plot may not be of much significance. It does not, however, seem likely that burning has decreased the number of species or their frequency.

Plots have also been established to study the effect of intensity, frequency and season of burning in a number of popular plant communities. Three major wildflower species, Brown Boronia, Crowea and Karri Hovea (or Blue Bush) and some of the major scrub species are involved. Seed of major scrub and wildflower species is being used in laboratory and greenhouse germination trials, to test their reaction to various heat treatments.

The effect of fire on the vegetation is undoubtedly very complex, and it appears that basic research into floral cycles, seed shed, temperature effect on seed germination and the role of soil and litter as insulators need to be carried out before the results of field trials may be interpreted soundly.

FAUNA

During the year investigations of fauna in the forest were initiated to increase the scope of fire ecology. An experienced zoologist was engaged to conduct training schools of one weeks duration at Manjimup and Dwellingup, introducing key staff to procedures for identifying species and sampling populations. The zoologist was also contracted to prepare field guides for major forest regions, to assist field staff to identify fauna present.

In October a road survey of State forests was conducted to obtain some indication of the relative numbers of grey kangaroos (*Macropus fuliginosus*) and brush wallaby (*Wallabia irma*). A total of 76 crews took part in the survey and 1,652 miles (*2,658 km.*) of road were covered. A general breakdown of results is contained in Table 4.

TABLE 4

Animal Sightings by Forest Type

(This is expressed as the number of animals observed per 100 miles of travel. Forest types with poor coverage have been excluded from this Table. Data for jarrah forest north of Collie include an additional 250 miles of " reruns " in the Dwellingup, Harvey and Collie Divisions).

Forest Type	Miles Travelled	No. of animals/100 miles		
		Kangaroo	Brush Wallaby	Total
Coastal heaths and *P. pinaster* plantations	99	49	5	54
Jarrah forests north of Collie	683	22	13	35
Mixed jarrah-wandoo forest north of Collie	411	22	25	47
Jarrah forest, " Sunklands "	126	35	7	42
Jarrah forest south of Collie (western portion)	109	51	15	66
Jarrah forest south of Collie (eastern portion)	104	87	23	110
Karri forest	211	26	1	27

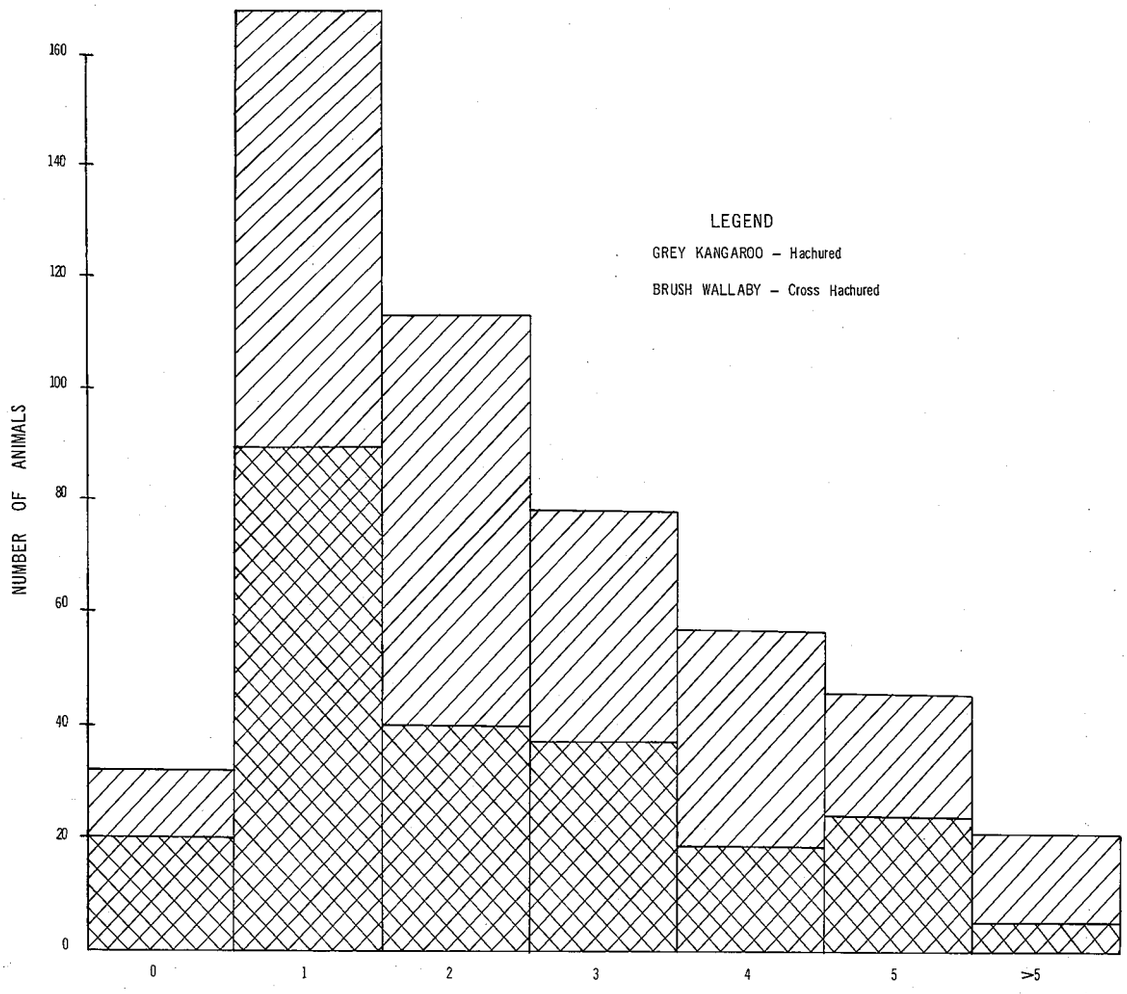


FIGURE 4: THIS HISTOGRAM SHOWS THE NUMBER OF ANIMALS WITH RELATION TO FUEL AGE (OBSERVATIONS IN PLANTATIONS & PASTURE AREAS ARE EXCLUDED)

An important result of the survey was the establishment of a relationship between the frequency of animal sightings and the distribution of vegetation following prescribed burning (Figure 4).

A fauna study was initiated in the Dwellingup Division in mid-April to investigate the effect(s) of fire on fauna. Basically, a 2-stage approach has been adopted with the following objectives.

Stage 1—

A field evaluation of the effectiveness of various trapping trechniques.

A survey of the fauna population to determine what animal species occur locally and the type(s) of vegetation they inhabit.

Stage 2—

A periodic, detailed survey of one or more study areas to assess both the effects of controlled burning and fire exclusion on population numbers and distribution of fauna species selected for study.

To date, interim results from Stage 1 have shown that two species of mammals, which occur in relatively large numbers locally, are readily live-trapped using box traps, while another species can be caught with the use of wire snares. These mammals respectively are the introduced ship rat (*Rattus rattus*), the yellow-footed marsupial-mouse or mardo (*Antechninus flavipes*) and the short-tailed pad-emelon or quokka (*Setonix brachyurus*). Rat traps have also been used in the initial study with success, but their use is not foreseen in Stage 2 investigations.

Two views of the Mardo or Yellow-footed Marsupial Mouse (*Antechinus flavipes leucogaster*) found in the jarrah forest near Dwellingup.

The procedure has been to trap various vegetation types using the traps already mentioned. All animals that were live trapped were anaesthetised, measured and marked by toe-clipping, and released for future study. Using this procedure, it has been possible to begin sorting out such factors as territorial sizes and habitat preferences. Referring to Table 5, it is readily apparent that swamps and the edges of watercourses are the most attractive habitat for small mammals in the northern jarrah forest. Upland sites, in contrast, have produced very few mammals as yet.

TABLE 5

Fauna Survey Summary (6 July 1971)

Vegetation Type	No. Trap Nights	Catches		No. Animals Caught		
		No.	Rate %	Rats	Mardos	Other
Swamp Edge	892	78	8·7	32	37	9
Creek (on Scarp Edge)	293	28	9·6	24	....	4
River Plateau	220	7	3·2	3	....	4
Upland	794	5	0·6	1	2	2
Totals	2,199	118	5·4	60	39	19

Other species represented in the last column of the table include the short-nosed bandicoot (*Isoodon obesulus*), western water rat (*Hydromys fuliginosus*), western brush wallaby (*Wallabia irma*), feral cat, common house mouse, (*Mus musculus*), little mouse sminthopsis (*Sminthopsis murina*), and an unidentified member of the genus Sminthopsis. Two species of birds have also been caught, these being the white-breasted robin (*Eopsaltria georgiana*) and the spotless crake (*Porzana tabuensis*).

Stage 1 provided a considerable amount of information which is being used to plan the second phase of the study. Stage 2, which will commence in the near future, should provide some answers as to how best to use fire as a wildlife management tool.

In the south, a study of the fauna in two blocks east of Tone River has commenced. Periodic surveys will be continued over a number of years to determine the effect of controlled burning on the distribution of the grey kangaroo, the brush wallaby and the woilie or rat kangaroo.

A more detailed study on the effect of hot burns on small mammals is planned for this year.

Litter Fauna

During the year data collection on the numbers and feeding and reproductive activities of microscopic soil animals in the Gnangara *Pinus pinaster* plantation was brought to a close. The majority of the soil animals are most active in the winter but a few, notably the *Psocoptera* (Insects) and the Tuckerellidae (*Acarina*), are more active in the late spring and early summer. However maximum densities in July were lower in 1970 than in 1969, 135,000 animals per square metre compared with 215,800 animals per square metre. This was probably caused by the long summer of 1969–1970 and the false break of season in late February, 1970 when the animals bred but the young died during a hot dry March and April.

The rate at which cellulose is broken down in the soil litter layer was studied and decomposition in 25–50 year-old stands of *P. pinaster* was as rapid as in the native bush, although the species composition of the fauna is quite different. Cellulose decomposition on burnt litter was significantly slower than in adjacent unburnt litter and this was correlated with decreased feeding and reproductive activity in the soil animals.

In September 1970 a paper " The effects of fire on litter decomposition and on the soil fauna in a *Pinus pinaster* plantation " was read at the Fourth International Colloquium of the Soil Zoology Committee of the International Society for Soil Science in Dijon, France. In February 1971 a paper " The effects of *Folsomia candida* (Collembola) on the amount of myceluim in laboratory cultures of soil fungi " was read at a Specialist Conference in Soil Biology held at C.S.I.R.O. Division of Soils in Adelaide.

JARRAH DIEBACK

Extensive soil temperature and soil moisture studies in the southern forest areas have indicated that, on well drained sites, conditions are never favourable for zoospore infection and spread. Moist gullies, swamp edges and similar sites where soil moisture is maintained by ground water seem to be the only situations where infection and spread by this means could occur. Soil cover strongly influences both soil moisture and soil temperature. Removal of scrub, canopy or litter cover may increase the moistness of the site and cause soil temperatures to rise above the critical level earlier in spring so causing a lengthening of the period during which these sites are susceptible. This data confirms the earlier trends obtained in the northern jarrah forest, and reaffirms the importance of site on the likelihood of successful infection and spread by the pathogen.

Hygiene measures designed to reduce the artificial spread of the fungus on road building and logging equipment have been devised and are being implemented by the timber industry and other forest users. To assist the dissemination of factual data on the disease, a free booklet which describes the disease, the organism responsible and the known methods of control has recently been published. This knowledge is essential to all forest users if the hygiene measures are to be fully effective.

Overseas reports of results from controlled experiments indicate that an uninterrupted drying cycle of two months will greatly reduce the rate of survival of *P. cinnamomi* in roots and soil. Field data indicates that it is highly unlikely that fungal propagules in clods of diseased soil falling on freely drained soil or roads during our hot summers will in fact survive. In moisture-gaining sites or where the inoculum is buried, the probability of survival and of subsequent infection is considerably higher.

TABLE 6

Percentage recovery of *P. cinnamomi*, by lupin baiting from small clods of diseased soil placed in different ecological situations for varying lengths of time.

Time		Ecological Situation				
Placed	Baited	Road Surface	Ridge Top (Soil Surface)	Valley Bottom (Soil Surface)	Ridge Top (Buried at 3 in.)	Valley Bottom (Buried at 3 in.)
November	June	....	....	....	25	25
January	June	....	....	25	50	75
May	June	100	50	75	75	75

10. UTILIZATION

Engineering

Locally-grown radiata pine was largely used in the construction of an insectory for the Manjimup Research Station.

Working drawings for a building with 100 feet (*30 m.*) span bowstring trusses, are practically finished and could be made available to industry for the construction of timber storage sheds.

Timber Seasoning

The seasoning test on jarrah joinery stock at Yarloop confirmed earlier results obtained at Welspool and showed that 6 in. x 3 in. (*15·2 x 7·6 cm.*) timber seasoned under cover in opensided sheds, dried to an average moisture content in the core of 16 per cent in 12 months. After a further five months through the summer of 1971 the average was 12 per cent and the range was 9 per cent to 13 per cent. This indicates that a total seasoning time under cover of 15 months, including two summers, on the coastal plain should be sufficient to bring 6 in. x 3 in. (*15·2 x 7·6 cm.*) sawn jarrah into acceptable condition for running into joinery.

Marine Borer Tests

A total of 40 species of Teredine marine borers have been collected by Dr. Turner in Australian waters and of these, half came from West Australian shores. As the world total of Teredine borers recognised by Dr. Turner is only 66, Australia has the doubtful distinction of being very rich in this form of marine life. This material and the various series of trap specimens is being examined at the University of New South Wales and it is expected that a report on it will be available about the end of this year.

Sleeper Tests

The test plots of sleepers treated with oily preservatives installed near Merredin and Bowelling in collaboration with Division of Forest Products were inspected in September 1970. No changes in trends were found and the treatments are showing their value even with a durable species such as jarrah.

An inspection of the treated marri sleeper test laid at Goomalling in 1962 showed that treatment with pentachlorphenol have given better results than creosote to date.

Committees and Conferences

The Department was represented on the following Committees or sub-Committees—Standards Association, Seasoning Productivity, Clean Air, Timber Industry Regulation Act and Metric Conversion in Timber.

The biennial conference of the C.S.I.R.O. Division of Forests Products held in Melbourne in June, 1971, was attended by the Utilization Officer.

11. LIBRARY

Statistics on the library operations are little changed from last year. The continued high rate of journal loans indicates the importance of this service to Departmental officers.

	1970/71	1969/70
Journal loans	10,593	10,473
Accession list requests	3,592	3,731
Loans and queries	4,714	4,782
Publications received	1,123	1,025

The library's space problems will be overcome with the move to the larger area allocated on the third floor. Unfortunately this has been delayed through the lack of furnishing and fittings.

12. EDUCATION AND PUBLICITY

Education

State Forestry Cadetships: Two Forestry Cadetships were awarded in 1971 for commencement of studies at the University of Western Australia. Two cadets graduated from the Australian National University in 1970, three cadets are expected to graduate in 1971 and a further two in 1972.

Several officers attended a number of managerial and other courses during the year. Two officers attended the Rescue Service Course at Mt. Macedon, three completed the Executive Development Course conducted at the Western Australian Institute of Technology, and one attended a course conducted by the Australian Institute of Management. Two officers attended an Automatic Data Processing Appreciation course and six attended a Fortrain course.

Field Cadet Training: Eighteen Forest Field Cadetships were granted this year. These replaced the seven cadets from the 1970 intake who passed out of Mount Lawley Technical College to commence studies at the Cadet School, Dwellingup.

During the year there were three resignations from first year cadets.

In-Service Training: Nine cadets from the 1969 intake of the Forest Field Cadet Course graduated in a special ceremony held at the Como auditorium. Initially, 17 cadets commenced the course and this represents a wastage rate of 47 per cent which compares with previous courses. The cadet graduates will now undergo two years in-service training.

The Field Staff correspondence course was continued, there being 13 applicants. Because of duties in the fire season, the course will be conducted in the winter months over a period of two years.

Publicity

Meetings of the Australian Forestry Council were held in Perth in July, 1970 and in Sydney in June, 1971. The Standing Committee met in Sydney in October, 1970 and in Canberra in May 1971. The Conservator, Mr. W. R. Wallace attended these as well as meetings of the Heads of Forest Services in Melbourne in February and May this year. He also accompanied other members of the Australian Forestry Council on a study tour of New Zealand in February 1971.

Other meetings attended by the Conservator during the year included the 1970 Forest Industries Machinery Exposition and the ceremony celebrating Australia's millionth acre of pine plantations both held in New South Wales. Meetings of the Austis Council in Melbourne, the Sirex Committee in Hobart and Austis meeting in New Guinea were also attended.

New publications released during the year included—

" Forest Focus " Nos. 2, 3 and 4 with the focus on forest conservation, controlled burning and loss of productive forest, respectively,

Miscellaneous Publication No. 1—" Jarrah Root Rot ". This booklet describes in simple terms the disease, the organism responsible (*Phytophthora cinnamomi*) and the known methods of control.

Publications currently with the printers include " Forestry in Western Australia " 2nd Revision, and " Selected Flowering Eucalypts of Western Australia ", a 4-colour booklet illustrating some 34 species and varieties. A further four research bulletins are also with the printer.

13. TIMBER INDUSTRY REGULATION ACT 1926-1969

The number of mills registered under the provisions of the Act as at December 31, 1970 totalled 150 (96 Crown Land and 54 Private Property).

The average number of persons employed in the timber mills each month throughout the year was 2,401, a reduction of 468 on last year's figure of 2,869.

The District and Workmen's Inspectors made 1,241 inspections of timber holdings.

There were 169 notifiable accidents for the year ending June 30, 1971, one being fatal.

The number of accidents per 100 persons employed was 8, the same figure as for the previous year.

The cost of administering the Timber Industry Regulation Act for the year ending June 30, 1971, was as follows—

Salaries	$10,013
Mileage, Travelling Allowances Office Rent, Plant Cost and Sundries	$5,560
	$15,573

14. FOREST OFFENCES

Thirty-two breaches of the Forests Act and Regulations were reported during the year. No legal proceedings were instituted and nineteen cases 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 $4,474·14. Warnings were issued in all other cases.

15. EMPLOYMENT IN FORESTRY AND THE TIMBER INDUSTRY

The number of wage earners directly employed in Forestry and the Timber Industry was estimated at 3,998, made up as follows—

Forestry—		
Professional officers	53	
General field staff	263	
Clerical and drafting	69	
Wages employees	519	
Contractors and employees (estimated)	20	
		924
Timber Industry—		
Sawmill employees including bush workers at December 31*	2,401	
Firewood cutters and pole getters working under permits	174	
Sandalwood workers	99	
Apiarists, estimated (795 sites registered)	400	
		3,074
		3,998

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

16. ACCIDENT PREVENTION (SAFETY)

Forestry, due to its variety of operations, has long been recognised as one of the most difficult fields in which to apply the principles of accident prevention.

Since its inception the Western Australian Forests Department has been aware of the accident problem; particularly as it affected the major forest industry of sawmilling. In 1926 the Timber Industry Regulations Act was passed giving the Department legislative powers and responsibilities to record, investigate and secure safe working conditions in the milling industry. Until the last decade however, safety precautions in forestry and the industry were largely directed at guarding unsafe equipment. In 1959 Government Departments were instructed by the Minister for Labour to direct their attention to accident prevention.

The Forests Department formed a committee of senior officers who instituted detailed accident recording and met regularly to discuss accident causes and prevention methods. Similar committees were formed in each field division. There was however little evidence of success from these moves and it became clear that further action was necessary.

In 1965 the Department initiated a training programme for field staff. An officer of the Department of Labour gave several " package " courses in Safety and a few officers attended two day sessions held by the National Safety Council, at which the principles of accident prevention, the benefits and the management techniques used in a successful campaign were identified. Following this, with the guidance of National Safety Council officers a programme was planned and initiated in the Forests Department in 1967.

All officers and overseers were given formal coaching in the various techniques used to achieve accident prevention and policy in this field was defined thus ensuring that Safety was backed by all levels of Management and that it became an integral part of supervision.

A senior field staff officer was seconded from fire control duties, given ten weeks schooling at the National Safety Council and charged with the exclusive responsibilities of training and field promotion of the Safety campaign.

Success has been general throughout the Department with Awards being won from the National Safety Council by most field divisions—one has already worked 250,000 hours without a disabling injury and five others 100,000 hours.

The most important economic benefits to the Department are associated with a drop in lost time due to disabling injury accidents from an average of 2,896 days per year before 1967 to 590 in 1970/71. This is a saving of 10 man years. Less men are needed to do the job so less houses have to be provided and overheads well in excess of 100 per cent of wages are saved. "Down time" and damage to equipment and machinery is reduced, less time is lost by workmates associated with each accident and less time is spent training new men. There is a saving on insurance premiums which this year amounts to $16,000.

There are a number of intangible benefits, as the training places the spotlight on supervisors, supervision standards and work methods and therefore general efficiency improves.

Communication between employees, overseers and officers improves with immediate benefit to morale.

Maintenance and care of Departmental assets improves as a result of standard Safety demands for good housekeeping and removal of hazards.

The attitude of employees to their job becomes more favourable as they feel the Department is thinking of them as individuals.

The humanitarian benefits of reduced suffering and pain are of course most significant and result in better employer-employee relationships.

Accidents are becoming steadily less frequent and it appears that the full measure of success in Safety is yet to be realised.

The following table indicates the degree of success in this field—

Year	Disabling Injury Accidents (No.)	Frequency Rate	Days Lost
1966–67	185	100+	2,896
1967–68	124	65	1,701
1968–69	96	48	1,738
1969–70	70	37	721
1970–71	48	27	590

Eighteen National Safety Council Awards have been won since 1967.

17. STAFF MATTERS

Public Service Act

Following the retirement of Mr. E. S. Budd on 25 May 1971 from the position of Secretary of the Department, Mr. R. K. Reid was appointed to the vacancy.

Mr. K. B. Hayes retired from the position of Clerk in Charge of Records and Mr. P. Morrison was promoted from the Mines Department to the position.

Resignations during the year included Mrs. J. M. Nowicki, Librarian; M. H. Tassell, Senior Draftsman; A.D.F.O. Slotemaker de Bruine and Mrs. J. C. Bennett, Machinist in Charge.

Appointments included two graduates from the Australian National University, Messrs. G. M. McArthur and A. W. Walker as Assistant Divisional Forest Officers. Dr. F. H. McKinnell was appointed Senior Silviculturist.

Mr. E. Willis was appointed as Librarian. Two Senior Draftsmen (J. E. Forster and D. E. Holmes) were appointed.

Forests Act

Appointments to the permanent staff included the following:—

13 Forest Guards, 14 Technical Assistants, one Forest Assistant.

Promotions included one Forester to District Forester, one Assistant Forester to Forester and 2 Forest Rangers to Assistant Foresters.

Mr. N. Rice was appointed Mill Examiner.

Eight officers retired, namely Senior Foresters R. J. Donovan and N. Percival, Forest Rangers A. A. Cooper and L. W. McLaughlin and Forest Assistants E. H. S. Adams, J. G. W. King, G. R. Laidlaw and C. R. Scanlon.

Resignations also accounted for one Technical Officer, 8 Technical Assistants, 4 Forest Guards, 2 Forest Rangers, 3 Forest Assistants and 2 Field Cadets.

It is with deep regret that I have to record the deaths of Assistant Forester L. D. O'Grady and Mill Examiner N. D. Johnson.

APPENDIX 1A

Statement of Revenue and Expenditure of the Consolidated Revenue Fund for the year ended 30th June, 1971

1969/70	Revenue	1970/71	1969/70	Expenditure	1970/71
$	*Royalties*	$	$		$
2,494,593	Logs	2,637,372	535,520	Salaries	590,131
109,728	Sleepers	90,468	92,151	Incidentals	100,006
2,877	Sawn Timber	1,410	4,799	Timber Industry Regulations Act	5,560
215,787	Poles and Piles	185,282	139,895	Hardwood Conversion	141,198
13,626	Mining Timber	10,070	676,626	Pine Conversion	750,478
25,296	Firewood	22,422	74,834	Recoupable Projects	96,791
14,369	Posts	12,833	45,698	Tree Nurseries	52,474
11,288	Sandalwood	19,249	3,343	Arboreta	4,896
4,340	Miscellaneous	6,925	3,504	Printing and Stationery	3,688
2,891,904		2,986,031		*Excess of Revenue over Expenditure distributed as follows*	
			2,713,126	9/10 to Reforestation Fund	2,678,627
	Pine Conversion		319,350	Transferred to Treasury	286,756
611,824	Pine Logs	570,476			
430,567	Sawn Pine	529,708			
1,042,391		1,100,184			
	Hardwood Conversion				
81,597	Sawn Hardwood	46,729			
102,131	Logs	81,264			
3,140	Posts, Poles and Piles	1,380			
186,868		129,373			
	Other Sales and Fees				
40,611	Seeds and Trees	34,820			
54,983	Inspection Fees	67,415			
49,993	Rents and Leases	49,677			
263,797	Miscellaneous	257,107			
409,384		409,019			
	Recoupable Projects				
61,085	Specific Roads	62,864			
17,214	Other	23,134			
78,299		85,998			
4,608,846		4,710,605	4,608,846		4,710,605

APPENDIX 1B

Forest Improvement and Reforestation Fund Account and General Loan Funds for the year ended 30th June 1971

1969/70	Source of Funds	1970/71	1969/70	Expenditure	1970/71
$		$	$	*Divisional*	$
255,928	Balance as at 1st July	56,430	1,858,126	Wages, material, etc.	1,661,668
2,713,126	9/10 Revenue	2,678,627		*Head Office*	
69,926	Rents	68,461	1,060,086	Salaries and Allowances	1,255,776
210,000	Federal Aid Road Grant	210,000	76,113	Incidentals	71,072
201,000	Reserve Fire Fighting	201,000	184,416	Plant and Vehicles	147,115
600,000	Cwlth. Government Softwood		606,202	Plant Operations	654,796
	Forestry Agreement	1,033,000	252,484	Purchase of Land	195,663
400,000	General Loan Fund	500,000	82,296	Fire Equipment	63,480
			147,202	Head Office Housing and Building	52,507
			31,690	Como Headquarters	33,693
			24,506	Communications	27,267
			56,903	Research	45,420
			11,671	Drafting	8,047
			5,036	Surveys	4,855
			23,391	Training of Staff	6,096
			129,012	Insurances	127,454
			71,004	Pay Roll Tax	75,320
			44,028	Utilisation	11,214
			2,806,040		2,779,775
			4,664,166	TOTAL	4,441,443
			471,616	Less Recoups	472,738
			4,192,550		3,968,705
			201,000	Reserve Fire Control	201,000
			56,430	Balance working account	577,813
4,449,980		4,747,518	4,449,980		4,747,518

APPENDIX 1C

Statement showing distribution of Forests Department Expenditure

	$
Consolidated Revenue Fund	1,745,222
Reforestation Fund	3,468,705
General Loan Fund	500,000
	5,713,927
Distribution of Expenditure—	
1. Busselton	437,806
2. Mundaring	334,636
3. Dwellingup	485,660
4. Collie	338,508
5. Kirup	476,017
6. Manjimup	443,559
7. Narrogin	35,941
8. Kelmscott	182,229
9. Metropolitan	110,010
10. Harvey	522,004
11. Pemberton	302,423
12. Nannup	452,551
13. Walpole	206,285
14. Kalgoorlie-Esperance	34,862
15. Wanneroo	432,957
Head Office	918,479
	5,713,927

NOTE: Appendices 2A and 2B giving information on West Australian exports and imports of timber, furniture, tanning substances and essential oils, for the year ended 30 June 1971, will be presented as a supplement to this Report. The necessary information was not available at the time of going to print.

Supplement

to

Annual Report of the Forests Department

1971

Appendices 2A and 2B

Exports and Imports of Timber, Tanning Substances and Essential Oils

APPENDIX 2A

Exports *from Western Australia of Timber, Tanning Substances and Essential Oils for the Year ended June* 30, 1971

	Item and Destination	Quantity	Value
		cu. ft.	$
	TIMBER		
1	Sawlogs and Veneer Logs, in the rough or roughly squared—Conifer	....	....
2	Sawlogs and Veneer Logs, in the rough or roughly squared—Non-Conifer (including poles, posts, piling and other wood in the rough)—		
	Overseas—		
	Japan	5	22
3	Sleepers—		
	Overseas—		
	Israel	59,028	112,400
	Pakistan	51,203	94,222
	South Africa	17,125	26,135
	United Kingdom	572,480	1,230,832
		699,836	1,463,589
	Australian States—		
	South Australia	360,741	581,532
	Northern Territory	2,210	3,771
		362,951	585,303
	Timber, sawn lengthwise, sliced or peeled, but not further prepared, of a thickness exceeding 5 mm—		
4	Non-Conifer—		
	Jarrah (*a*)—		
	Overseas—		
	Bahrain	183	550
	Christmas Island	1,102	2,323
	Greece	925	2,436
	Iran	2,100	5,880
	Mauritius	792	1,617
	Netherlands	403	1,075
	New Zealand	26,355	43,774
	South Africa	28,880	52,946
	United Kingdom	114,846	251,549
		175,586	352,150
	Australian States—		
	New South Wales	232	634
	Victoria	109,356	158,720
	South Australia	568,705	679,705
	Northern Territory	17,279	35,888
		695,572	874,947
5	Karri (*a*)—		
	Overseas—		
	Germany, Federal Republic of	20,636	40,592
	Greece	1,903	3,537
	Mozambique	5,899	11,108
	Netherlands	5,092	10,285
	New Zealand	86,218	137,701
	South Africa	27,674	50,711
	South-West Africa	700	1,622
	United Kingdom	8,787	18,039
	United States of America	8,908	20,674
		165,817	294,269
	Australian States—		
	New South Wales	3,101	5,372
	Victoria	9,997	18,323
	South Australia	452,361	601,249
	Northern Territory	73,784	149,471
		549,243	774,415
6	Other—		
	Overseas—		
	Christmas Island	4	27
	Malaysia	17	20
	Singapore	8	10
		29	57
	Australian States—		
	Queensland	171	442
	South Australia	17	61
		188	503

	Item and Destination	Quantity	Value
		cu. ft.	$
	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—		
7	Flooring—		
	Overseas (*b*)—		
	United Kingdom	1,975	6,200
	Australian States (*c*)—		
	New South Wales	56,735	131,923
	Victoria	33,410	119,289
	South Australia	36,598	87,880
	Northern Territory	17,021	90,078
		143,764	429,170
8	Other (*d*)—		
	Overseas—		
	Belgium Luxembourg	145	342
	United Kingdom	2,671	4,061
		2,816	4,403
	Australian States—		
	Victoria	55	86
	South Australia	1,286	1,678
	Northern Territory	3,931	7,050
		5,272	8,814
	Total of Timber Items 1-8	**2,803,054**	**4,803,842**
		sq. ft.	
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 (e)—		
	Overseas—		
	Singapore	29,039	2,980
	Total, Timber Exports on this Return	....	**4,806,822**
10	Casks, vats, barrels, etc., empty (e)—		
	Overseas—		
	United Kingdom	....	9,458
11	Manufactures of Wood, except furniture, n.e.i.—		
	Overseas—		
	Christmas Island	....	2,453
	United States of America	....	8,457
		....	10,910
	Australian States—		
	New South Wales	....	469,408
	Victoria	....	990,973
	Queensland	....	21,044
	South Australia	....	545,048
	Tasmania	....	40,176
	Northern Territory	....	20,805
		....	2,087,454
12	Tanning Substances of Natural Origin	N.R.S.	N.R.S.
		lb.	
13	Essential Oils; concretes and absolutes; resinoids—		
	Overseas—		
	Ceylon	40	47(
	China, Republic of (Taiwan)	112	1,03
	France	9,751	24,31(
	Germany, Federal Republic of	21,679	12,11
	Hong Kong	1,920	13,95
	Italy	21,076	60,16
	Japan	3	1,32
	Malaysia	1,841	2,89
	Singapore	7,787	20,58
	Switzerland	12,584	9,18
	Thailand	178	42
	United Kingdom	48,639	49,49
	United States of America	32,174	41,39
		157,784	237,33
	Australian States—		
	New South Wales	37,736	34,9
	Victoria	27,698	58,4
	Queensland	32	1
	South Australia	3,856	13,4
		69,022	106,1
	Total Value of all Exports on this Return	....	**7,258,1**

(*a*) Excludes timber cut to size for making boxes or staves (included in Item 6).
(*b*) Relates to overseas exports of conifer flooring only. Overseas exports of non-conifer flooring included in Item 8.
(*c*) Relates to Interstate exports of non-conifer flooring only. Interstate exports of conifer flooring included in Item 8.
(*d*) See footnotes (*b*) and (*c*). Item also includes conifer timber, sawn lengthwise, sliced or peeled, but not further prepared, of a thickness exceeding 5 mm.
(e) Interstate exports included in Item 11.

" N.E.I." means " not elsewhere included "
" N.R.S. " means " not recorded separately "
Basis of Value—F.O.B. at the point of final shipment.
(Information Supplied by the Commonwealth Bureau of Census and Statistics).

APPENDIX 2B

Imports *into Western Australia of Timber, Tanning Substances and Essential Oils for the Year ended June 30, 1971 (a)*

	Item and Origin	Quantity	Value
	TIMBER	cu. ft.	$
1	Sawlogs and Veneer Logs, in the rough or roughly squared, Non-Conifer (including poles, piling, posts and other wood in the rough) (a)—		
	Overseas—		
	Indonesia	448,192	290,094
	Malaysia	350,812	279,059
	Thailand	1,644	14,864
		800,648	584,017
	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)—		
2	Redwood (b)—		
	Overseas—		
	United States of America	3,697	12,660
3	Douglas Fir (b)—		
	Overseas—		
	New Zealand	1,659	2,139
	United States of America	75,704	182,964
		77,363	185,103
4	Other—		
	Overseas—		
	Canada	3,379	7,236
	Japan	150	235
	Malaysia	2,746	4,764
	New Zealand	12,207	28,997
	United States of America	4,169	15,647
		22,651	56,879
	Australian States (c)	....	....
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)—		
	Overseas—		
	Ghana	8,609	24,971
	Indonesia	5,070	7,413
	Ivory Coast	7,191	20,998
	Malaysia	1,057,789	1,638,327
	New Zealand	7,590	11,745
	Philippines	1,647	2,739
	Singapore	6,092	8,615
	Thailand	9,255	59,766
	United Kingdom	105	979
	United States of America	5,261	21,211
		1,108,609	1,796,764
	Australian States—		
	New South Wales	847	5,578
	Victoria	239	1,119
	Queensland	79	416
	South Australia	125	180
	Tasmania	16,091	47,371
		17,381	54,664
6	Shooks and Staves, sawn lengthwise, sliced or peeled, but not further prepared, of a thickness exceeding 5 mm (d)—		
	Overseas	....	....
7	Wooden Beadings and Mouldings (including moulded skirting and other moulded boards) (e)—		
	Overseas—		
	Austria	....	241
	Germany, Federal Republic of	....	1,538
	Malaysia	....	10,891
	Norway	....	2,284
	United Kingdom	....	6,267
	United States of America	....	48
		....	21,269
	Timber (including blocks, strips and friezes for parquet or wood block flooring not assembled), planed, tongued, grooved, rebated, chamfered, V-jointed, beaded, centre beaded or the like, but not further manufactured—		
8	Flooring (f)—		
	Overseas—		
	Sweden	2,296	4,163

	Item and Origin	Quantity	Value
		cub. ft.	$
9	Other—		
	Overseas—		
	Malaysia	26,406	85,564
	New Zealand	1,496	1,962
	Singapore	94	455
		27,996	87,981
	Australian States (g)—		
	Tasmania	4,206	13,817
	Total of Timber Items 1-9	**2,064,847**	**2,817,317**
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—		
	Overseas—	sq. ft.	
	Belgium-Luxembourg	39,433	2,040
	China (Mainland)	562,260	22,884
	China, Republic of (Taiwan)	1,034,408	52,719
	Germany, Federal Republic of	84,565	4,416
	Ghana	48,811	654
	Ireland	156,688	3,169
	Italy	44,812	3,900
	Japan	1,189,120	120,634
	Malaysia	5,128,374	117,190
	Netherlands	195,117	7,359
	New Zealand	77,433	16,279
	Philippines	9,600	565
	Singapore	437,578	43,872
	South Africa	1,011,531	22,195
	United Kingdom	2,026,628	53,986
	United States of America	29,840	8,911
		12,076,198	480,783
	Australian States—		
	New South Wales	1,241,624	177,597
	Victoria	1,382,237	336,783
	Queensland	3,992,457	763,039
	South Australia	44,966	17,829
	Tasmania	14,136	3,571
		6,675,420	1,298,819
11	Reconstituted Wood (also known as particle board, chip board, silver board, shaving board, flake board, residue board and wood waste board)—		
	Overseas—		
	China, Republic of (Taiwan)	7,278	2,060
	France	2,660	403
		9,938	2,468
	Australian States—		
	Victoria	1,352,132	330,965
	South Australia	2,477,169	411,985
	Tasmania	1,716,002	324,515
		5,543,303	1,067,465
	Total of Timber Items 10, 11	**24,306,859**	**2,849,535**
	Total, Timber Imports on this Return	....	**5,666,852**
12	Match Splints (e)—		
	Overseas—		
	Finland	....	62,963
13	Rulers, any material (a)—	No.	
	Overseas—		
	China (Mainland)	47,700	1,821
	Germany, Federal Republic of	10,359	2,434
	Japan	1,600	958
	Hong Kong	3,744	67
	Italy	9,440	438
	Japan	8,933	1,233
	Netherlands	5,016	1,441
	United Kingdom	33,713	23,379
	United States of America	217	226
		119,122	31,039
14	Table Mats, wooden	N.R.S.	N.R.S.
15	Wood Flour (h)	....	....

APPENDIX 2B—*continued*

Imports *into Western Australia of Timber, Tanning Substances and Essential Oils for the Year ended June* 30, 1971 (*a*)

	Item and Origin	Quantity	Value
			$
16	Manufactures of Wood (except furniture) n.e.i. (*i*)—		
	Overseas—		
	Austria	....	42
	China (Mainland)	....	109
	China, Republic of (Taiwan)	....	74,438
	Czechoslovakia	....	396
	Denmark	....	2,454
	Finland	....	617
	France	....	392
	Germany, Federal Republic of	....	2,256
	Hong Kong	....	9,303
	India	....	9,817
	Indonesia	....	1,700
	Israel	....	104
	Italy	....	6,185
	Japan	....	44,469
	Kenya	....	61
	Malaysia	....	7,473
	Mexico	....	403
	Netherlands	....	917
	New Zealand	....	32,854
	Norway	....	89
	Pakistan	....	37
	Philippines	....	28,467
	Portugal	....	607
	Singapore	....	4,286
	Spain	....	11,919
	Sweden	....	68,208
	Switzerland	....	74
	Tanzania	....	614
	Thailand	....	2,563
	United Kingdom	....	14,194
	United States of America	....	2,044
	Re-import	....	50
		....	314,608
	Australian States—		
	New South Wales	....	309,150
	Victoria	....	227,245
	Queensland	....	22,875
	South Australia	....	49,983
	Tasmania	....	7,075
		....	616,328
17	Clothes Pegs, wooden	N.R.S.	N.R.S.
18	Tool Handles, wooden—	doz.	
	Overseas—		
	Germany, Federal Republic of	4	4
	Italy	3	2
	Japan	3	26
	Switzerland	8	6
	United Kingdom	20	92
	United States of America	1,370	11,887
		1,408	12,017
	Australian States (*j*)—		
	New South Wales	....	22,653
	Victoria	....	5,307
	Queensland	....	15,245
	Tasmania	....	2,260
		....	45,465

	Item and Origin	Quantity	Value
		cwt.	$
19	Tanning Extracts of vegetable origin— wattle bark extracts (*k*)—		
	Overseas—		
	Brazil	1,255	10,994
	South Africa	5,036	47,793
		6,291	58,787
20	Other	....	....
21	Synthetic Tanning Substances; artificial bates for pre-tanning; tannins (tannic acids) and their salts, ethers, esters and other derivatives—		
	Overseas—		
	Belgium-Luxembourg	1	130
	Germany, Federal Republic of	1,492	15,145
	United Kingdom	582	16,823
		2,075	32,098
	Australian States—		
	New South Wales	124	2,728
	Victoria	523	9,763
	South Australia	15	481
		662	12,972
		lb.	
22	Essential Oils; concretes and absolutes—		
	Overseas—		
	Brazil	9,126	12,879
	China (Mainland)	23,948	12,892
	France	45	601
	Germany, Federal Republic of	1,764	1,699
	Indonesia	19,211	26,191
	Italy	850	5,858
	Netherlands	5	7
	South Africa	50,870	29,790
	Swaziland	106,893	53,048
	United Kingdom	44	92
	United States of America	4,800	20,817
		217,556	163,874
	Australian States—		
	New South Wales	363	1,160
	Victoria	3,184	10,297
		3,547	11,457
	Total, Value of all Imports on this Return	....	**7,040,994**

(*a*) Interstate imports are not recorded separately.
(*b*) Interstate imports included in Item 4.
(*c*) See footnote (*b*). Item also includes imports of conifer timber, planed, tongued, grooved or the like.
(*d*) Interstate imports included in Items 4 (Conifer) and 5 (Non-Conifer).
(*e*) Interstate imports included in Item 16.
(*f*) Figures relate to overseas imports of conifer flooring only. Interstate imports of flooring included in Item 4 (Conifer) and Item 9 (Non-Conifer).
(*g*) Relates to Non-conifer timber only. All conifer timber, planed, tongued, grooved, etc., included in Item 4.
(*h*) Interstate imports included in Item 11.
(*i*) Includes imports of blockboard, laminboard, battenboard and similar wood products.
(*j*) Includes brush and broom handles and the like.
(*k*) Interstate imports included in Item 21.

"N.E.I." means "not elsewhere included"
"N.R.S." means "nor recorded separately"
Basis of Value: Overseas—F.O.B. at the point of final shipment
Interstate—Landed cost in Western Australia
(Information supplied by the Commonwealth Bureau of Census and Statistics)

APPENDIX 3

Summary of Exports of Forest Produce since 1836

Year	Timber			Year	Timber			Wood Manufactures	Tanning Materials	Essential Oils
	Cub. ft.	M^3	Value		Cub. ft.	M^3	Value	Value	Value	Value
			£				£	£	£	£
1836 (a)	10,000	283	2,500	1901....	7,150,600	202,505	572,354	....	....	....
1837	....	....	....	1902	6,256,750	177,191	500,533	....	....	....
1838	....	....	....	1903	7,748,450	219,436	619,705	....	859	....
1839	....	....	....	1904	8,072,300	228,608	654,949	....	32,876	....
1840	....	....	....	1905	8,709,500	246,653	689,943	....	154,087	....
				1906	(c) 8,830,700	(c) 250,085	708,993	....	140,720	....
1841	....	....	....	1907	(c) 6,409,550	(c) 181,518	511,923	....	98,773	....
1842	....	....	....	1908	(c) 9,869,509	(c) 279,504	813,591	....	79,934	....
1843	....	....	....	1909	(c) 10,830,450	(c) 306,718	867,419	....	59,633	....
1844	(b)	(b)	163	1910	(c) 12,074,100	(c) 341,939	972,698	....	93,733	....
1845	....	....	....							
1846	2,550	72	255	1911	(c) 12,449,500	(c) 352,570	986,341	....	83,470	....
1847	12,200	346	1,120	1912	(c) 11,297,100	(c) 319,934	903,396	....	49,004	....
1848	3,350	95	333	1913	(c) 13,619,850	(c) 385,714	1,089,481	....	47,377	....
1849	....	....	....	1914 (d)	(c) 6,279,750	(c) 177,843	502,152	....	18,197	777
1850	10,500	297	1,048	1915 (e)	(c) 9,968,500	(c) 282,308	803,392	....	6,127	381
				1916	5,432,100	153,837	441,991	....	10,208	1,102
1851	1,250	35	268	1917	3,890,650	110,183	310,893	....	18,959	2,060
1852	7,050	200	806	1918	3,436,250	97,315	274,141	....	16,886	3,995
1853	52,200	1,478	5,220	1919	4,135,750	117,124	332,584	11,535	18,875	3,987
1854	58,500	1,657	7,023	1920	5,065,300	143,449	465,731	21,935	22,121	3,704
1855	76,900	2,178	12,076							
1856	70,500	1,997	9,671	1921	9,816,250	277,996	1,137,819	24,916	23,073	10,017
1857	69,200	1,960	9,449	1922	8,309,750	235,332	1,041,047	22,248	13,328	6,878
1858	29,250	827	2,340	1923	7,911,310	224,048	997,454	12,377	21,161	20,075
1859	67,350	1,907	6,051	1924	11,126,861	315,113	1,367,517	11,505	29,606	39,877
1860	54,800	1,552	4,932	1925	11,844,303	335,431	1,477,997	13,298	40,136	42,057
				1926	12,001,384	339,879	1,522,958	10,072	15,056	47,819
1861	27,750	786	2,497	1927	12,580,262	356,273	1,651,149	8,727	15,818	26,544
1862	68,800	1,948	7,151	1928	10,384,784	294,097	1,265,383	7,783	27,662	39,131
1863	32,900	932	2,963	1929	7,635,237	216,230	960,435	6,603	35,850	63,307
1864	58,300	1,651	5,508	1930	6,579,743	186,338	807,425	4,687	40,628	77,510
1865	183,950	5,210	15,693							
1866	85,650	2,426	6,849	1931	4,127,856	116,901	507,382	26,615	35,333	56,170
1867	56,750	1,607	4,541	1932	3,062,673	86,735	361,700	85,488	42,016	59,301
1868	8,000	227	638	1933	2,235,540	63,310	262,617	80,332	33,352	26,331
1869	179,900	5,095	14,273	1934	4,060,830	115,003	487,248	76,107	20,904	26,720
1870	157,200	4,452	17,551	1935	5,326,117	150,836	636,466	65,494	15,284	35,363
				1936	5,598,180	158,540	697,522	50,665	12,237	27,526
1871	218,500	6,188	15,304	1937	5,673,903	160,685	699,684	52,338	14,491	38,185
1872	37,000	1,048	2,590	1938	7,545,744	213,695	932,420	47,934	13,865	35,128
1873	68,150	1,930	4,771	1939	5,704,250	161,544	722,310	43,518	17,842	25,550
1874	345,600	9,787	24,192	1940	5,049,585	143,004	634,859	62,796	19,485	47,736
1875	342,350	9,695	32,965							
1876	219,050	6,204	23,743	1941	6,091,187	172,502	790,876	74,935	13,686	59,867
1877	336,150	9,520	26,979	1942	5,244,634	148,528	700,474	64,454	6,986	74,904
1878	580,900	16,451	63,902	1943	3,516,566	99,589	605,327	32,426	1,598	70,523
1879	627,250	17,764	69,742	1944	3,645,354	103,236	613,994	25,324	1,294	72,704
1880	662,550	18,763	66,252	1945	2,851,475	80,754	570,028	27,307	2,795	103,055
				1946	3,373,025	95,524	722,061	(f) 2,618	4,872	128,050
1881	792,750	22,451	79,277	1947	3,458,628	97,948	865,255	13,118	12,056	151,768
1882	936,500	26,522	93,650	1948	3,584,405	101,510	1,099,073	6,572	9,556	116,465
1883	997,000	28,235	79,760	1949	3,198,212	90,573	993,152	6,639	5,112	75,395
1884	861,700	24,403	68,936	1950	2,857,946	80,937	974,493	13,525	8,243	78,550
1885	848,150	24,020	67,850							
1886	626,150	17,733	50,902	1951	2,342,492	66,339	(g) 918,485	25,101	16,581	125,833
1887	354,800	10,048	28,384	1952	2,373,553	67,219	1,032,909	47,689	19,120	119,109
1888	525,570	14,884	42,060	1953	3,965,188	112,294	(g) 2,074,421	120,095	34,136	70,852
1889	788,500	22,330	63,080	1954	3,858,956	109,286	2,248,320	59,360	80,248	55,273
1890	1,172,200	33,197	82,052	1955	3,477,249	98,476	(g) 1,935,019	79,893	37,338	80,882
				1956	4,568,024	129,367	2,818,716	119,459	554,760	90,928
1891	1,273,950	36,078	89,179	1957	4,684,017	132,651	(g) 3,256,719	78,934	588,544	58,993
1892	1,082,650	30,661	78,419	1958	5,572,681	157,818	(g) 3,875,705	39,762	337,655	101,814
1893	512,950	14,527	33,888	1959	6,461,535	182,991	4,373,218	41,612	259,046	52,843
1894	1,063,700	30,124	74,804	1960	6,133,240	173,693	(g) 4,160,354	20,549	366,606	63,905
1895	1,255,250	35,549	88,146							
1896	1,545,600	43,771	116,420	1961	5,533,847	156,719	3,838,387	25,305	201,957	95,475
1897	2,393,300	67,778	192,451	1962	5,660,937	160,318	3,993,663	194,380	281,364	81,506
1898	4,086,150	115,719	326,195	1963	5,484,259	155,314	(g) 3,966,697	255,190	254,726	70,402
1899	6,913,550	195,792	553,198	1964	5,266,329	149,142	3,686,732	272,187	322,916	88,666
1900	5,725,400	162,143	458,461	1965	4,716,296	133,566	3,545,627	523,596	326,156	76,019
							$	$	$	$
				1966	2,431,248	68,853	(g) 4,361,278	1,365,441	289,841	314,817
				1967	4,898,421	138,723	7,467,696	1,335,872	262,808	269,044
				1968	2,986,211	84,569	(g) 4,947,595	3,016,850	N.r.s.	280,806
				1969	3,052,796	86,455	4,984,098	3,802,927	N.r.s.	267,565
				1970	3,399,534	96,275	(g) 5,661,547	3,906,699	N.r.s.	317,553
				1971 *....						
				Total						

(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 from 1915 onwards.
(f) Excludes casks (principally empty returns) previously recorded in this item from 1946–1966 inclusive.
(g) Includes items for which the quantity in M^3 is not available—from 1951 onwards.
N.r.s.—Not recorded separately.
* See Supplement

APPENDIX 4

Summary of Imports of Timber, Furniture, Tanning Materials and Essential Oils, since 1843

Year	Timber, Woodware, etc.	Tanning Materials	Essential Oils
	£	£	£
1848	464	....	....
1849	....	....	....
1850	189	....	....
1851	3,216	....	....
1852	2,479	....	....
1853	790	....	....
1854	831	....	....
1855	1,464	....	....
1856	1,124	....	....
1857	744	....	....
1858	1,528	....	....
1859	690	....	....
1860	2,005	....	....
1861	1,459	....	....
1862	1,920	....	....
1863	1,568	....	....
1864	894	....	....
1865	548	....	....
1866	1,442	....	....
1867	1,727	....	....
1868	1,451	....	....
1869	1,408	....	....
1870	1,518	....	....
1871	736	....	....
1872	1,660	....	....
1873	1,008	....	....
1874	1,774	....	....
1875	2,707	....	....
1876	3,098	....	....
1877	2,036	....	....
1878	2,947	....	....
1879	2,340	....	....
1880	3,061	....	....
1881	3,639	....	....
1882	3,692	....	....
1883	6,667	....	....
1884	2,930	....	....
1885	11,479	....	....
1886	17,888	....	....
1887	8,136	....	....
1888	4,461	....	....
1889	7,686	....	....
1890	14,979	....	....
1891	18,406	....	....
1892	26,713	....	....
1893	14,493	....	....
1894	17,964	....	....
1895	47,128	....	....
1896	5,381	....	....
1897	164,552	....	....
1898	55,566	....	....
1899	45,689	....	....
1900	56,266	1,416	1,105
1901	80,134	1,740	1,546
1902	97,810	3,418	1,751
1903	102,383	3,556	1,348
1904	157,856	1,322	2,122
1905	98,494	582	1,592
1906	95,229	1,412	1,915
1907	122,016	2,767	1,549
1908	93,205	2,392	4,584
1909	90,502	4,129	4,033
1910	171,280	3,531	3,686
1911	152,133	2,912	4,938
1912	167,244	3,089	4,598
1913	202,640	2,651	5,392
1914	78,736	629	2,823
1914–15	107,763	2,082	4,988
1915–16	76,849	3,313	4,788
1916–17	75,681	2,848	3,848
1917–18	58,305	2,020	4,358
1918–19	62,824	1,181	4,168
1919–20	100,083	3,748	10,043
1920–21	171,654	*4,899	6,106
1921–22	92,448	5,865	6,577
1922–23	109,428	6,991	4,033
1923–24	133,983	2,790	3,301
1924–25	161,893	2,670	4,429
1925–26	144,989	5,826	4,449
1926–27	162,193	8,971	4,254
1927–28	183,196	9,648	6,955
1928–29	241,601	6,894	4,413
1929–30	197,532	10,825	3,980
1930–31	76,533	4,145	3,160
1931–32	164,496	4,705	3,505
1932–33	197,916	4,903	3,421
1933–34	183,944	4,310	3,888
1934–35	211,056	4,076	5,040
1935–36	228,451	5,401	3,921
1936–37	257,164	5,267	4,810
1937–38	270,126	4,777	6,560
1938–39	254,315	3,974	7,014
1939–40	259,399	6,802	23,027
1940–41	249,111	3,798	32,399
1941–42	283,611	15,846	33,828
1942–43	163,480	6,250	47,718
1943–44	149,928	7,883	68,871
1944–45	148,838	9,264	75,449
1945–46	†219,466	19,573	56,295
1946–47	386,465	12,395	78,091
1947–48	345,508	8,019	96,769
1948–49	470,755	8,662	42,926
1949–50	521,815	24,923	51,197
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.

NOTE: The information for 1970–71 was not available at the time of going to print.

APPENDIX 5

SUMMARY OF LOG VOLUMES PRODUCED IN WESTERN AUSTRALIA SINCE 1829

Year	Crown Land*		Private Property		Totals	
	Cubic feet	M^3	Cubic Feet	M^3	Cubic Feet	M^3
1829–1916†	....	....	....	....	663,267,850	*18,784,136*
1917 (*a*)	19,665,550	*547,513*	2,144,500	*60,732*	21,477,600	*608,245*
1918 (*b*)	7,665,550	*217,088*	504,950	*14,300*	8,170,500	*231,388*
1919 (*c*)	19,987,050	*566,033*	3,390,450	*96,018*	23,377,500	*662,051*
1920	28,292,200	*801,235*	5,762,900	*163,205*	34,055,100	*964,440*
1921	29,308,950	*830,029*	7,018,450	*198,763*	36,327,400	*1,028,792*
1922	36,122,400	*1,022,986*	15,640,150	*442,929*	51,762,550	*1,465,915*
1923	26,807,300	*759,183*	9,867,050	*279,435*	36,674,350	*1,038,618*
1924	42,004,450	*1,189,566*	9,342,800	*264,588*	51,347,250	*1,454,154*
1925	43,832,900	*1,241,348*	18,142,250	*513,789*	61,975,150	*1,755,137*
1926	48,823,750	*1,382,689*	25,037,600	*709,065*	73,861,350	*2,091,754*
1927	46,887,600	*1,327,857*	31,356,100	*888,005*	78,243,700	*2,215,862*
1928	42,781,250	*1,211,565*	23,334,450	*660,832*	66,115,700	*1,872,397*
1929	32,289,750	*914,446*	11,098,950	*314,322*	43,388,700	*1,228,768*
1930	31,654,150	*896,446*	11,653,600	*330,030*	43,307,750	*1,226,476*
1931	18,822,600	*533,056*	12,148,500	*344,046*	30,971,100	*877,102*
1932	11,742,850	*332,558*	4,115,950	*116,564*	15,858,800	*449,122*
1933	13,165,650	*372,851*	2,456,650	*69,572*	15,622,300	*442,423*
1934	21,263,100	*602,171*	6,330,400	*179,277*	27,593,500	*781,448*
1935	27,458,250	*777,618*	11,451,750	*324,314*	38,910,000	*1,101,932*
1936	31,400,600	*889,265*	13,436,150	*380,512*	44,836,750	*1,269,777*
1937	31,703,850	*897,853*	15,902,200	*450,350*	47,606,050	*1,348,302*
1938	31,737,450	*898,805*	15,928,950	*451,108*	47,666,400	*1,349,913*
1939	29,247,650	*828,293*	11,086,000	*313,956*	40,333,650	*1,142,249*
1940	27,660,100	*783,334*	9,139,550	*258,832*	36,799,650	*1,042,166*
1941	28,089,200	*795,486*	10,289,000	*291,384*	38,378,200	*1,086,870*
1942	26,636,650	*754,350*	5,633,400	*159,538*	32,270,050	*913,888*
1943	23,604,900	*668,491*	4,322,950	*122,426*	27,927,850	*790,917*
1944	22,252,500	*630,191*	4,456,200	*126,200*	26,708,700	*756,391*
1945	21,970,000	*622,190*	4,309,550	*122,046*	26,279,550	*744,236*
1946	21,126,500	*598,302*	5,482,350	*155,260*	26,608,850	*753,562*
1947	21,948,550	*621,583*	7,831,950	*221,801*	29,780,500	*843,384*
1948	22,251,350	*630,158*	8,871,900	*251,252*	31,123,250	*881,410*
1949	20,261,800	*573,814*	9,814,300	*277,941*	30,076,100	*851,755*
1950	21,081,150	*597,018*	9,932,650	*281,293*	31,013,800	*878,311*
1951	25,391,450	*719,086*	10,713,050	*303,394*	36,104,500	*1,022,480*
1952	28,942,550	*819,653*	11,938,300	*338,093*	40,880,850	*1,157,746*
1953	34,223,400	*969,207*	13,021,400	*368,766*	47,244,800	*1,337,973*
1954	37,485,950	*1,061,602*	13,562,000	*384,076*	51,047,950	*1,445,678*
1955	37,467,650	*1,061,084*	15,195,450	*430,335*	52,663,100	*1,491,419*
1956	39,811,350	*1,127,457*	13,773,350	*390,061*	53,584,700	*1,517,518*
1957	39,426,100	*1,116,547*	11,585,350	*328,097*	51,011,450	*1,444,644*
1958	39,069,500	*1,106,448*	12,397,450	*351,096*	51,466,950	*1,457,544*
1959	40,533,471	*1,147,908*	13,756,198	*389,576*	54,289,669	*1,537,484*
1960	38,882,028	*1,101,140*	12,017,553	*340,337*	50,899,601	*1,441,477*
1961	37,752,774	*1,069,159*	10,818,790	*306,388*	48,571,564	*1,375,547*
1962	39,243,552	*1,111,377*	9,789,268	*277,232*	49,032,820	*1,388,609*
1963	38,671,715	*1,095,183*	9,831,552	*278,430*	48,503,267	*1,373,613*
1964	39,431,089	*1,116,688*	10,220,000	*289,430*	49,651,089	*1,406,118*
1965	41,430,800	*1,173,320*	9,815,867	*277,985*	51,246,667	*1,451,305*
1966	42,224,817	*1,195,807*	10,105,791	*286,196*	52,330,608	*1,482,003*
1967	40,941,527	*1,159,464*	9,967,907	*282,291*	50,909,434	*1,441,755*
1968	43,485,765	*1,231,517*	8,060,784	*228,281*	51,546,549	*1,459,798*
1969	40,385,056	*1,143,705*	5,676,938	*160,771*	46,061,994	*1,304,476*
1970	39,597,323	*1,121,396*	6,203,619	*175,686*	45,800,942	*1,297,082*
1971	40,436,463	*1,145,161*	5,719,991	*161,990*	46,156,454	*1,307,151*
Total	....	....	....	....	2,968,722,458	*84,074,222*

* 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—from 1919 onwards.

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WILLIAM C. BROWN, Government Printer, Western Australia