1971

QUEENSLAND

ANNUAL REPORT

OF THE

DEPARTMENT OF FORESTRY

FOR THE

YEAR 1970-71

PRESENTED TO PARLIAMENT BY COMMAND

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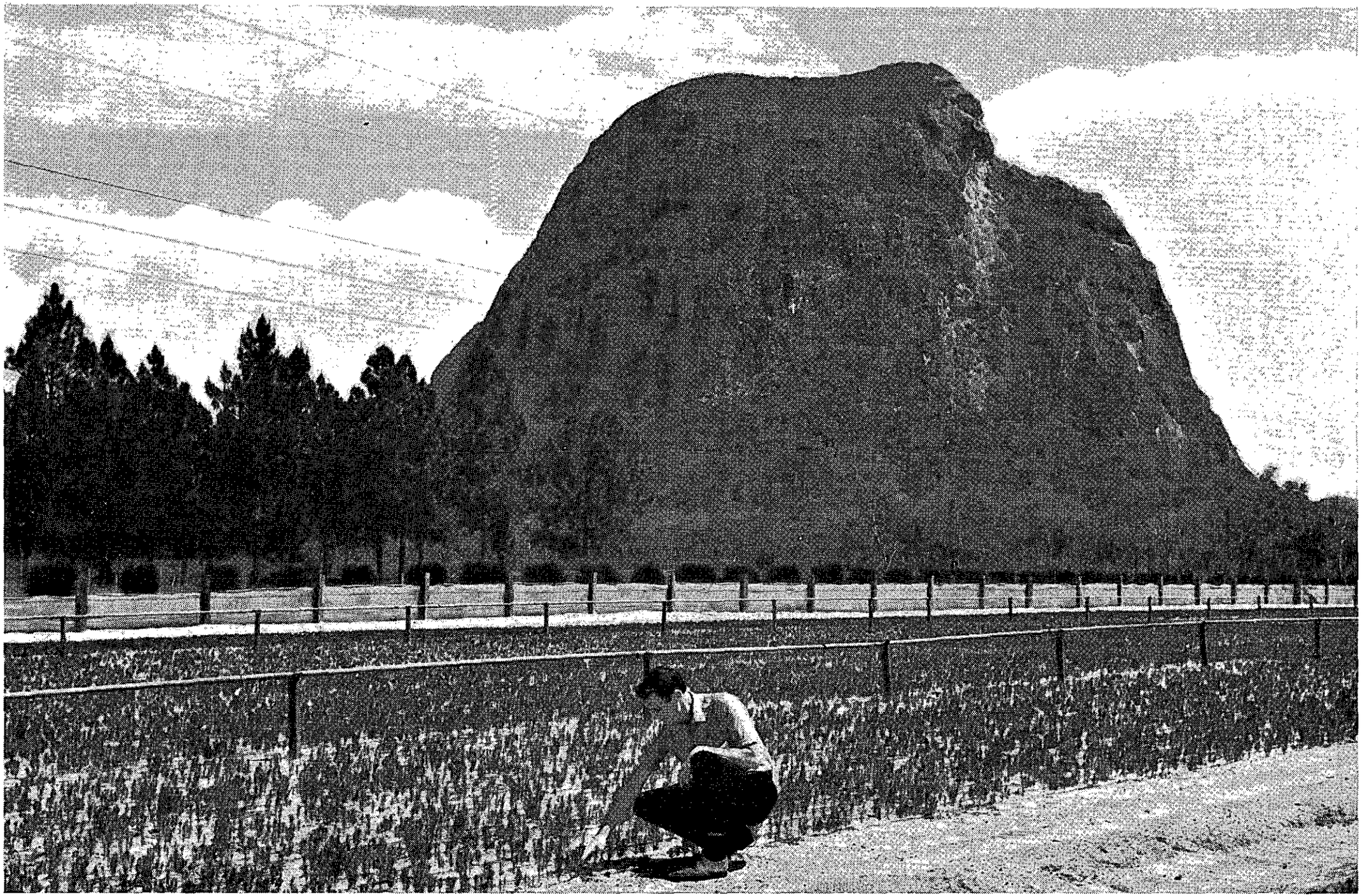


Beerburrum Nursery—Slash Pine seed orchard on left. Mt. Tibrogagen in background.

REPORT OF THE CONSERVATOR OF FORESTS

For the Year ended 30th June, 1971

TO THE HONOURABLE THE MINISTER FOR LANDS

INTRODUCTION

The year under review marked the end of the first five-year period of the Commonwealth Softwood Agreement Act which has had a profound effect on establishment of softwood plantations in this State and throughout the Commonwealth. Each year under the agreement has seen a fresh record set in respect to area of new plantings and the effort has culminated with 15,107 acres planted during the year. This brought the total area established since the inception of the five-year period to 56,961 acres as against 23,767·4 acres in the five years immediately prior to the advent of Commonwealth Assistance. The way in which the annual programme has increased is shown by the following figures—

	Acres
1966-67	7,958
1967-68	9,420
1968-69	11,936
1969-70	12,540
1970-71	15,107

As in Queensland other States have made full use of the funds made available and as a result the Australian target set to achieve self sufficiency by the turn of the century has been surpassed. This has been done within the estimate of Commonwealth funds that would be required for this first period.

It was hoped that there would be an increase in approved programmes and in areas of new plantation funded by the Commonwealth during the second five years of the Act but, though final details of the extension of the Agreement are not known, it is clear that there will be some reduction in the area of new plantings the Commonwealth will pay for and in the approved programmes of all of the States. As a result of this reduction it will be necessary to defer plans for an expansion of the planting programme in the Ingham area and to reduce the overall State annual planting. It is hoped to be able to do this and still maintain the level of activity in the south-east corner of the State to make provision for the requirements of the major industries projected for in this region. In this regard work is well advanced in the building of Woodlands first particle board factory at Sunshine and it is expected that production will commence late in October initially using Hoop Pine from the Mary Valley and later embracing Slash Pine from the Tuan-Toolara area.

In association with the commencement of these operations it is planned to introduce integrated logging which will permit the diversion to the particle board factory of tops of mill logs and of stems which by reason of stem form are unsuited for sawn timber production. This should be of great assistance to the milling industry by disposing of their least profitable logs and by improving the quality of the sawn timber produced from these plantation grown logs which will more and more contribute to the supply of the State's timber requirement. Fresh mill studies will be necessary to derive equitable stumpages but, pending the results of these studies, appropriate prices have been determined on an empiric basis which entailed the principle that the Department should not receive less for a stem as mill log and pulp to 3 inches diameter under bark than it did for the same stem as a mill log to 4 inches diameter under bark.

Increasing costs of major road work and other activities essential to Harvesting and Marketing operations make it necessary that serious consideration be given to an increase in stumpages for Crown log timbers. It is now 10 years since any real general rise in stumpage has been imposed on the industry in this State though adjustments have been made to key market and depot prices to maintain stumpage level against increased costs of extraction. Within the Department ways of effecting savings through streamlining of operations are being carefully examined and a number of modifications have been recently introduced to help reduce other costs. Some of these have been the adoption of paint marking and overbark measurement with Cypress Pine and reserve pricing related to predominant height of stand was approved for introduction to the plantations of the Beerwah-Beerburrum area as a preliminary to its extension to other suitable plantation areas throughout the State. However there is a limit to what can be achieved by measures such as this and recent sharp increases in wages and costs of materials can be met only by an increase in stumpage rates.

All changes were introduced with the support of the industry after full discussion through the forum provided by regular meetings of Aus.T.I.S. and after reference to the appropriate sawmillers associations. It is pleasing to be able to report that excellent co-operation has been experienced from these bodies during the year and that good relationships persist between the Department and all branches of the industry. To an important extent this happy position has been contributed to by the functioning of the two T.R.A.D.A.C. Councils where representatives of the Department and of industry are brought together to work for the common good of the timber industry. The existence of these Councils also provides a ready means by which industry and Government can join forces in attacking problems or in promotion and in this regard the representation of the Housing Commission on the research committee of T.R.A.D.A.C. can be of real assistance.

Effective use continues to be made of the provisions under which amalgamation of sawmills may be approved within certain defined zones. Since the change in policy was made two years ago 78 mills have taken part in amalgamations and it is known that action is in hand at present in a number of other cases. By far the greatest number of these—59 in all—involved hardwood mills in central and southern Queensland, where the position regarding timber supplies is most critical. The wisdom of the introduction of this policy is attested by the report of the Economic Study Group which made an intensive study of the timber industry throughout Australia and by the unqualified support it has received from all sections of the local industry. Some concern has been expressed by those interested in the effect of closure of mills on small country towns or settlements but it must be realised that it is essential to strengthen the economics of the sawmilling industry so that it can cope with the current pressures of cost rises and competition. In this way only can the livelihood of bushworkers engaged in the felling, snigging and transport of log timber be preserved.

An important development in the life of the Department was the purchase during the year of an area of about 28 acres two miles north of Gympie for the establishment of a complex which will embrace a centre for the training of staff at sub-professional level, a research centre to deal with hardwoods and plantations of Slash and Hoop Pine for which the station is well located, and a new office for the administration of the important Gympie District. It is hoped that an early start will be made in building the training centre which is the most urgent of the three projects and which will fill a long felt want in the field of Forestry education within the State. Other important building projects for which provision has been made in next year's programme include a new

district office for Yarraman and a Forest Products Research Laboratory at Rocklea which will also incorporate a soils laboratory.

Once again a further improvement can be reported in respect to the position in relation to the assessment of timber values on properties subject to freeholding. Areas awaiting field survey declined from 1,997,000 to 1,487,000 acres during the year and the area covered by valuations exceed by 770,000 acres the area of new applications.

Though the area of new national park reservation during the past year was only 9,813 acres the year has been a particularly busy one for the National Parks Section and proposals which have been investigated and are subject to action towards reservation amount to just over 1,000,000 acres. An important change was made in the organisation within the Department to place the National Parks Section on the same basis as other sections by involving all ten District Foresters throughout the State in the field management of National Parks within their Districts. It is hoped that this will relieve the specialist staff of the Section of much administrative detail and allow them to devote more of their time to field inspections and to technical matters of management. At the same time the reorganisation means that the National Park Section can use the services of the 94 graduates that the Department employs without drawing on park funds. Another very important step taken in the field of conservation of the environment was the passing of legislation making provision for the reservation of marine National Parks and inclusion in the Estimates of funds to permit work to proceed to investigate areas proposed initially for reservation.

The retirement at the end of 1970 of Mr. W. Wilkes after 17 years as Secretary of the Department was a severe loss to the administrative section and above all to the National Parks Section. In his 49 years in the service of the State Mr. Wilkes grew up with National Parks policies and earned for himself the respect of all sections of the community and was affectionately known as "Mr. National Parks". This Department and the State owes a lot to officers such as Mr. Wilkes who have dedicated themselves to the service of the public and contributed so much to the development of sound policies. They have enhanced the status of the service and set an example for us to follow. It was therefore most gratifying that this was not overlooked by the Premier who wrote a fine tribute to Mr. Wilkes on the occasion of his retirement.

MANAGEMENT

General

The area of State Forest as at 30th June, 1971, was 7,708,354 acres, a net increase of 208,577 acres.

Timber Assessment

A further 46 permanent plots were established during the year representative of an area of 10,000 acres of plantation and coastal hardwood forests.

Remeasurement of permanent plots in plantations and major Cypress Pine State Forests were continued covering a further 500,000 acres.

A further 80,000 acres of hardwood forests were assessed by strip survey, while some 310,000 acres of grazing selections were assessed because of their potential for permanent timber production.

Aerial reconnaissance was continued in the far western Cypress Pine area covering 30 selections and holdings with a total area of 1,060,000 acres.

A start has been made on preparing estimates for the Australian Forestry Development Conference in 1973.

Valuation of Timber on Land for Conversion of Tenure

The rate of applications for conversion of tenure has again fallen by about one third, and was the lowest rate since 1961-62. Including blocks in Brigalow Development Area No. III for which the Department has been asked to provide valuations, but which are not tabulated in the table listing the freeholding position, the Department has been asked to value 2,995 selections with a total area of 25,527,000 acres. Valuations have been completed on 2,648 (21,783,000 acres) of these and field work remains to be done on only 138 totalling 1,487,000 acres. This is less than 5 per cent. of all applications or 6 per cent. of the total area.

Expenditure

Expenditure under the Reforestation Vote was $5,784,232 compared with $5,130,000 in 1969-70. Expenditure from Trust Funds on projects associated with the Reforestation Vote was $120,756.

Expenditure is itemised as follows:—

Item	Expenditure	Percentage of Total
Direct Expenditure on Projects—	$	
Plantations	1,425,384	24·2
Natural Regeneration	172,049	2·9
Nursery Expenses	225,697	3·8
Research	192,193	3·3
Protection	863,793	14·6
Surveys	95,371	1·6
New Construction	194,824	3·3
Seed Collection	29,645	0·5
Maintenance of Capital Improvements	117,122	2·0
Total Direct Expenditure	$3,316,078	56·2
Indirect Expenditure—		
Wet Time, Holidays and Leave	697,954	11·8
Supervision, Tools, Cartage, &c.	1,083,804	18·3
Camp Allowance	340,953	5·8
Pay Roll Tax	93,544	1·6
Workers' Compensation	103,648	1·8
Administration	180,192	3·0
Miscellaneous	88,815	1·5
Total Indirect Expenditure	$2,588,910	43·8
Total Expenditure	$5,904,988	100·0

Employment Wages Staff

	Average 1970–71	As at 1–7–70	As at 30–6–71
Reforestation	1,341	1,364	1,337
Harvesting and Marketing	181	180	166
National Parks	60	64	59
Road Construction and Maintenance	72	76	74
Maintenance of Plant	56	53	60
	1,710	1,737	1,696

Average expenditure on Reforestation per man-year was $4,313 compared with $3,910 for 1969-70.

FREEHOLDING POSITION IN RELATION TO PREVIOUS YEARS

	As at 30th June, 1969		As at 30th June, 1970		As at 30th June, 1971	
	No.	Area	No.	Area	No.	Area
		Acres		Acres		Acres
Total applications made	2,601	20,775,000	2,784	22,692,000	2,911	23,832,000
Withdrawn before valuation	24	171,000	27	256,000	29	245,000
Total requiring valuation	2,577	20,604,000	2,757	22,436,000	2,882	23,587,000
Valuation complete and determined by Land Court	1,464	9,183,000	1,842	13,038,000	2,323	17,987,000
Valuation complete and awaiting Land Court determination	684	6,349,000	544	4,960,000	240	1,931,000
Field assessment complete but not yet valued	257	2,898,000	216	2,441,000	181	2,182,000
Awaiting field assessment	172	2,174,000	155	1,997,000	138	1,487,000
Totals	2,577	20,604,000	2,757	22,436,000	2,882	23,587,000

Protection

SEASONAL CHARACTERISTICS. The fire season commenced severely with drought indices similar to those of 1968, but the early onset of the wet season in October resulted in a year that had an average number of fires. One of the wettest summers on record with widespread flooding caused an increase in maintenance costs on protection roads.

The wet summer conditions resulted in a build-up of fuel in all forest areas. The western districts in the 1971-72 fire season will have heavy fuel for the first time in many years.

FIRE INCIDENCE. There were 190 fires attended by departmental employees as against 119 for 1969-70. Thirteen fires were in excess of 1,000 acres, compared with 16 in 1969-70. Police Officers assisted in the investigation of 31 fires for breaches of provisions of the Rural Fires Act or the Forestry Act. Three successful prosecutions resulted in fines totalling $67.50. Four demands met for cost of fire-fighting resulted in $239.65, being recovered. Twenty-eight letters of warning were issued. On the other hand three letters of thanks were sent to persons helping to combat fire outbreaks in various ways.

The number of fires by month of occurrence and size attained is set out in the table following:—

Month	Number of Fires	Size of Fires in Acres (Private and other Crown Lands as well as State Forests and Reserves)				
		0–10	11–100	101–1,000	1,001–10,000	10,001+
July	7	2	3	2	..	..
August	42	13	17	5	6	1
September	47	15	14	16	2	..
October	57	11	13	25	8	..
November	22	7	7	6	2	..
December	3	1	1	..	1	..
January	3	..	1	2	..	..
February	..	..	..	..	..	..
March	1	1	..	..	..	..
April	1	1	..	..	..	..
May	2	..	1	1	..	..
June	5	3	1	1	..	..
Totals	190	54	58	58	19	1

Six of the 190 fires were in softwood plantations. Of these two were in isolated plots and one in a failed Kauri Pine plantation. The total area burnt over by the six fires was 117·1 acres. By far the most damaging plantation fire for many years occurred in the Jimna sub-district (Murgon district), where 106·9 acres of two, three and four years old Hoop Pine and four years old Caribbean Pine were destroyed for a monetary loss of $27,502. Costs of suppression of this fire were $4,142. The area was burnt when fire spotted some thirty chains from a scrub burn (on 1970-71 planting area) into a pocket of heavy blady grass. Steep and broken topography were conducive to rapid spread of the fire. The area burnt was subsequently replanted with Hoop Pine.

Apart from the Jimna plantation fire, only three fires cost in excess of $1,000 to control and all were adjacent to exotic pine plantations. Two of these three fires were in the Beerburrum area where costs of suppression were $1,262 and $1,037. The other fire near the Esk plantation cost $1,049 to suppress. None of the three fires entered the plantation.

The following table gives details of the occurrence by districts:—

District	No. of Fires	Area Burnt Over (acres)			
		Crown Timber Areas		Private	Total
		Inside Protection Systems	Partly Protected or Unprotected		
Atherton	26	2,776	130	502	3,408
Brisbane	44	4,627	1,212	9,570	15,409
Dalby	11	146	1	38	185
Gympie	26	962	570	15,607	17,139
Mackay	6	5,446	50	2,601	8,097
Maryborough	19	5,660	2,540	5,450	13,650
Monto	3	650	..	..	650
Murgon	18	582	4,425	23,135	28,142
Warwick	2	4	..	1,055	1,069
Yarraman	23	757	227	16,048	17,032
National Parks—All Districts	12	160	356	511	1,027
Totals	190	21,770	9,511	74,527	105,808

Major known causes of fire outbreaks by percentages were:—

Unauthorised burning off	23·7%
Government, Semi-Government Authorities and bush workers	11·0%
Escapes from permit fires	14·7%
Re-lights of old fires	3·2%
Lightning	0·5%
Camp and billy fire escapes	9·5%
Incendiarists	0·5%
All other known causes	5·9%
Unknown causes	31·0%
Total	100·0%

Communications

In line with the continued expansion of the Department's communication system 25 more VHF mobiles were purchased together with some five more 100-watt single sideband units for base and mobile use in Central and Northern Queensland.

Installation of mobiles has been largely completed in all Districts. Some Districts have been supplied with solid state equipment which has supplanted hybrid units.

Action to establish a communications Headquarters in North Queensland at Atherton is proceeding and should be complete in the near future.

A communications development plan is being prepared covering the next ten-year period. Implementation of this plan will do much to reduce overheads and increase installation and maintenance efficiency.

Present staff comprises three technicians, one radio mechanic, one apprentice, one clerk storeman and the Communications Officer.

Equipment in service includes 43 VHF Bases, 361 VHF mobiles, 25 VHF portables and 70 handphones.

Telephone services are being converted by the P.M.G. to automatic working. Some private lines have been taken over by the P.M.G. while lookout tower lines in general are being replaced by VHF portables operating into the VHF system.

Detection

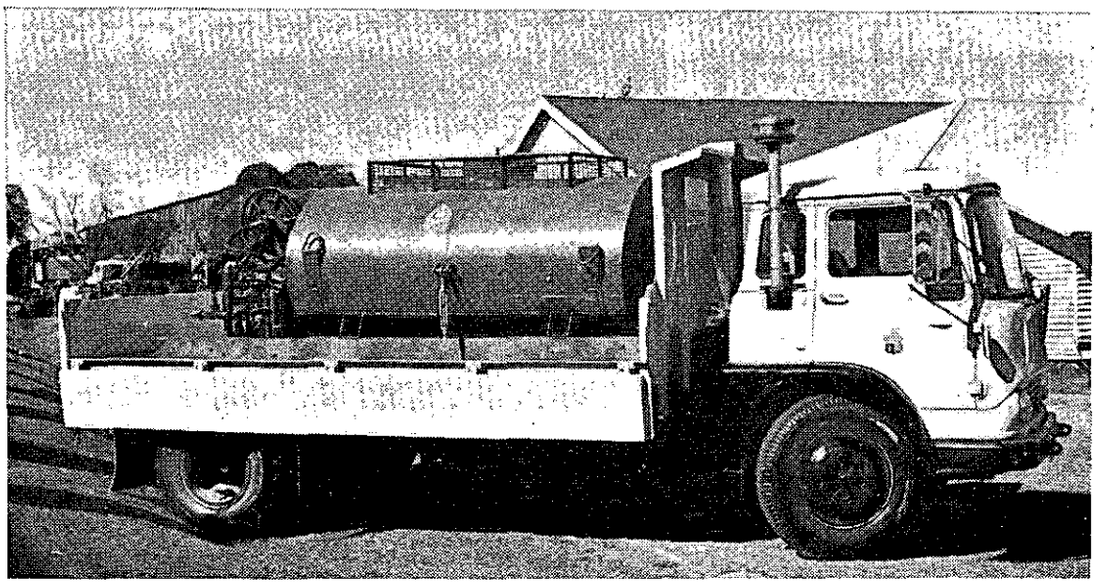
During the year two three-legged fire towers were completed—one on State Forest 302 Malcolm in Chinchilla sub-district and the other on State Forest 309 Enoggera in Brisbane sub-district. Heights to floor level are 131 feet 4 inches and 80 feet respectively.

A lookout cabin was constructed on State Forest 20/55 Mt. Hutton in the Roma sub-district during the year.

Use was again made of aircraft for fire detection in many areas. A total of 32 flying hours was logged.

Equipment

During the year 17 slip-on tank units were constructed—nine of 275 gallon, four of 475 gallon and four of 850 gallon capacity. In addition 32 mop-up pumps were purchased for use on the older slip-on tanks or with 100 gallon steel tanks.



Standard fire truck with 850 gallon slip-on fire tank fitted with ¾-inch rubber hose and 1½-inch canvas hose.

Two tanks were manufactured for carrying on the three-point linkage of four wheel drive tractors. These units will be of use for fire fighting in sandy areas.

Trials conducted with a V-blade mounted on a rubber-tyred Michigan loader for fire line construction in Cypress Pine areas were very encouraging.

Fire Research

In association with the Fire Research Section of the Forest Research Institute, Canberra, an investigation was commenced in October 1970, on the problems confronting the sugar industry in relation to the pre-harvest burning of sugar cane.

Work in the Tully and Gin Gin mill areas has so far entailed collection of information on fire behaviour, weather conditions and burn results on 80 cane fires.

The most important aspects of burning cane are the wind strength and its direction in relation to surrounding cane or grassland. The predictability of the wind strength and direction is largely affected by solar heating and its influence on the sea-breeze cycle and other local winds.

There are numerous other factors which affect cane fire behaviour and burn result, such as cane variety, heavy weed infestation, the extent of lodging (cane fallen over), and by no means least, the effect of drought on curing of the cane trash.

It is hoped to present guide-lines to the sugar industry to help growers and millers' organisations in establishing safer and more effective burning practices suited to their local requirements. The study has given this Department a better knowledge of the burning practices of the sugar industry and their relationship to the protection of adjoining State Forests.

Experimental burning in Slash Pine plantations continued. In addition to small areas burnt for documentation of fire behaviour, three blocks planted in 1954 and 1955, were burned in June 1971, after rain. The area of these three blocks was 48·9 acres. Results are very encouraging. Average fire intensities for the three blocks varied from 15 to 35 B.T.U. per second per foot. Average rate of fire spread was 1·2 feet per minute. Fuel reduction ranged from 40 to 77 per cent. Dead needles suspended in the undergrowth were largely eliminated and the remaining fuel lay close to the ground. All burns were done within three days after rain when temperatures were 64–66°F and relative humidity ranged from 35 to 64 per cent. Wind velocities varied from one to three m.p.h.

The first trials of aerial ignition for prescribed burning in Queensland hardwood forests were conducted. A total of 16,000 acres was covered in two burns in the Kullogum and Cordalba areas of the Maryborough district. Average scorch height was below ten feet and percentages of the areas covered by fire were 95 and 65 per cent. These results are very acceptable and encourage further use of the technique, which has the advantage of covering large areas quickly and making full use of suitable conditions.

General

Expenditure of fire fighting, patrol and detection was $137,747.17 (compared with $94,397 in the 1969-70 year). Direct suppression costs were $21,748.28 ($10,910). Prescribed burning to reduce fuels prior to the fire season cost $9,823.74 ($8,981) and covered 94,350 acres (89,358 acres). Burning of logging debris cost $3,907.73 ($6,019).

Co-operative burning with neighbours cost $16,428.52 ($7,176). New roads charged to protection and new fire breaks cost $298,543.30 ($264,556) and maintenance of existing protection roads and fire breaks cost $351,582.11 ($271,586).

Industrial Safety

The accident frequency rate for the year was 112·9 being a slight improvement over the 1969-70 figure of 119·0.

During the year three foresters attended courses for safety officers.

The breakdown of accident causes for the year by percentages is:—

	Per Cent.
Cuts from hand tools	13·3
Tool sharpening	2·3
Falls	27·8
Striking objects	9·5
Sprains, jars, bruises from hand tools	6·6
Strains from manual handling	8·5
Infection of minor injuries	2·2
Objects falling, flying, rolling	5·0
Objects flying, splashing into eyes	2·8
Burns	12·5
Others	9·5
Total	100·0

MECHANICAL EQUIPMENT

General

A comprehensive Plant Census carried out by the Mechanical Equipment section was completed in May of this year, and new procedures will greatly simplify the updating of records for all plant items.

Fourteen caravans were purchased during the year to provide improved accommodation for employees engaged on Survey and Road Construction and Maintenance work. Three van units have been designed for survey gangs operating in remote areas, each unit including a general purpose accommodation van, a van for the Officer-in-Charge with Drafting facilities, and a kitchen van.

A sixteen-foot plywood launch, fitted with an 80-h.p. outboard motor was also purchased during the year for use as an emergency service between Fraser Island and Maryborough.

The new workshop at Toolara was completed during the year and is now fully operational. Action to provide new workshops for Dalby and Ingham is now in hand.

A Plant Inspector was transferred to Gympie in April this year to be responsible for the Gympie and Murgon districts. The Department now has Plant Inspectors and Driver Instructors stationed at Townsville, Maryborough, Gympie, Dalby and Brisbane thus giving a wide range of cover over the Department's Plant and Motor Vehicles.

Receipts and Expenditure

Details are:—

	1969–70	1970–71	Difference
Trust and Special Funds—	$	$	$
Reforestation Trust Fund—			
Purchase of Plant ..	669,174	636,584	−32,590
Forestry and Lumbering Fund—			
Maintenance of Plant ..	817,836	864,244	+46,408
Plant Hire Credits ..	1,173,866	1,395,979	+222,112
Excess of Plant Hire over Maintenance of Plant	356,030	531,734	+175,704
Sale of Plant	77,590	86,096	+8,506

Purchase of Plant:—Major items for Plant purchased during the year were:—

12 Tractor/dozers
51 Replacement Motor Vehicles
12 Additional Motor Vehicles
14 Caravans

Maintenance of Plant—Main items for the years 1969-70 and 1970-71 were:—

	1969–70	1970–71	Difference
	$	$	$
Fuel	123,833	141,686	+17,853
Oils	18,581	18,735	+154
Tyres and Tubes ..	28,994	26,642	−2,352
Repairs	457,349	476,613	+19,264
Registration and Insurance ..	52,851	51,004	−1,847

Census of Major Plant as at 30th June, 1971:—

Motor Vehicles and Trucks	458
Crawler Tractors	64
Rubber Tyred Tractors	48
Power Graders	33
	—

ACQUISITION OF LAND

During 1970-71 an amount of $38,276.42 was expended on the acquisition of land for Forestry purposes as follows:—

	$
Purchase of Land	19,500.00
Survey Fees	15,842.77
Real Property Fees and Lands Department Charges	234.65
Compensation for Improvements ..	2,699.00
	$38,276.42

The expenditure of $19,500 represents the purchase of four parcels of land with a total area of 242 acres 3 roods 2·7 perches.

About 28 acres of this land, located near Gympie, was acquired with a view to the establishment of a forestry complex to include district administration, research and non-professional staff training facilities.

The balance of the land acquired will be added to existing State Forests and National Parks.

FOREST SURVEYS

Twenty-five survey parties operated during the year ending 30th June, 1971.

For the various type surveys the parties were divided as follows:—

Parties	Type of Surveys
2	Theodolite Control Surveys (to provide a framework for other type Forestry Surveys)
14	General plantation management surveys associated with reforestation programme or general native forest management surveys
4	Forestry Inventory and Assessment Surveys to provide basic management data
5	Timber Assessment Surveys in connection with applications for freeholding actions

Details of all surveys carried out by the parties are:—

DETAILS OF SURVEY IN MILES

Theodolite Controls	Forestry Compass Traverses	Connections and Relocating old Traverses	Level Surveys	Stripping and Assessment	Road Grades
149	1,148	1,082	85	3,985	55

Total mileage of surveys for period, 6,504.

Personnel

SURVEYS.—At the end of the period the total strength of survey parties consisted of 113 members classified as follows:—

Forest Surveyor	Foresters	Survey Rangers	Survey Overseers	Survey Leading Hands	Survey Trainees	Cooks	Labourers
1	7	11	27	5	3	7	52

MAPPING.—Drafting Branch comprises 36 officers of whom 17 are engaged in cartographic compilations and revisions, 1 in theodolite control surveys, 1 in survey training and supervision, 2 in reproduction duties of duplication and photo copying and the remainder carry out administration mapping and drafting duties.

SURVEY TRAINING.—Four Survey Training Courses were conducted in the Beerburrum area for periods ranging from one week to three weeks duration. The following officers attended these courses, 8 Foresters, 4 Survey Leading Hands, 54 Forest Trainees, one New Guinea Forestry Student received instructions on road surveying procedures for one week.

GENERAL.—Extremely wet conditions during the latter months of 1970 and early months of 1971 forced survey operations to slow down considerably along the entire coastline, and the adjacent inland districts. Moderate interruptions due to wet conditions were reported from the inland area.

Four District survey camps changed over from tent to caravan accommodation. Each of the four camps was provided with a three caravan unit including, one office—2-berth van, one 4-berth van, and one cookhouse—cooks quarters van. Living conditions were improved considerably by the provision of the caravans.

AUTOMATIC DATA PROCESSING

Development of the Harvesting and Marketing Computer project continued and a designed system for Stage 1 (A) "Production of Stumpage Accounts for Natural Grown Timbers" was submitted to the Department of the Public Service Board, The Treasury and the Auditor-General and approved.

A Cost-Benefit Study has indicated that the use of computer methods should effect a substantial annual saving and the training of field and office staff involved in the system is proceeding so that the system may be implemented as soon as possible.

Work on the redesigned computer system for the Plantation Register continued, and several programmes have been put into production at the Treasury installation. Use of the University computer has been discontinued.

The Plant accounting and other minor systems are operating satisfactorily.

REFORESTATION

General

As in previous years, reforestation work carried out during the year comprised mainly establishment and maintenance of plantations of Hoop Pine and Exotic Pines, raising in nurseries of planting stock for plantations, and silvicultural treatment of native forests.

These operations are affected by weather conditions, and this applies particularly to plantation work. Rainfall for 1970-71 was generally well above average, and this is illustrated in the table below for some Hoop Pine and Exotic Pine centres.

RAINFALL IN POINTS

—	Hoop Pine Centres			Exotic Pine Centres		
	Yarraman	Imbil	Kalpowar	Beerwah	Tuan	Bowenia
1970-71	4,383	6,023	5,319	9,217	7,296	9,376
Average	3,186	4,667	3,476	6,298	5,262	6,451

Generally speaking, conditions in late winter and spring were relatively dry, and favourable for clearing of sites for Hoop Pine plantations and for subsequent burning of the debris. Monthly rainfall figures for typical summer and winter planting areas were:—

RAINFALL IN POINTS

Month	Hoop Pine Centre Yarraman (summer planting)		Slash Pine Centre Tuan (winter planting)	
	Points	Average	Points	Average
July	42	160	63	237
August	38	123	111	181
September ..	191	131	296	163
October	244	286	206	334
November ..	152	311	586	367
December ..	1,343	415	1,087	571
January	589	428	1,093	794
February ..	1,504	453	2,889	872
March	148	350	436	779
April	32	196	232	339
May	67	179	82	311
June	33	154	215	314
Totals ..	4,383	3,186	7,296	5,262

Rainfalls below average for the winter months resulted in unfavourable conditions for the planting of Slash Pine, whereas high summer rainfalls provided favourable conditions for the planting of Hoop Pine. No major losses due to dry weather have been recorded though refilling has been necessary in a number of Compartments planted early in the winter season.

The cyclones which affected the coastal areas of Queensland in early 1971, brought heavy falls of rain, and the accompanying winds resulted in wide spread damage to young exotic pines at a number of plantation areas. The damage consisted mainly of wind-throw of trees in plantations aged 2-, 3- and 4-years-old, which were rendered susceptible to this type of damage by water-logged soil conditions. Where practicable the damage was repaired soon after it occurred by re-standing the trees. The most extensive damage occurred to Slash Pine at Toolara. Caribbean Pine (*Pinus caribaea var. hondurensis*) suffered wind-throw at Bowenia where about 780 acres were affected, and at Kennedy where about 160 acres were damaged. At Beerburrum too, small areas of *Pinus caribaea var. hondurensis* aged 11 and 12 years were severely damaged, but Slash Pine sustained little damage. Wind-throw of plantations up to two years old can be repaired fairly effectively by standing the affected trees upright and by packing soil against them as a temporary support. Three-year-old plantations can be similarly treated, but the work is more difficult and less effective because of the larger size of the trees. Trees four years old are commonly too large for straightening to be practicable. Caribbean Pine is superior to Slash Pine in volume production, particularly in Central and Northern Queensland, but unfortunately it is more susceptible to wind damage in the early years.

Field Operations

Actual expenditure in the field on silvicultural operations, excluding overheads, amounted to $1,918,449 in 1970-71, compared with $1,793,095 in 1969-70.

The following summary shows the acreages on which the main silvicultural operations were carried out in 1969-70 and in 1970-71:—

Operation	1969–70	1970–71
	Acres	Acres
Area of plantations established	12,633	15,135
Area of plantations covered in pruning ..	11,836	10,657
Area of plantations tended	62,840	83,724
Area of plantations thinned merchantably	9,334	8,936
Area of plantations thinned unmerchantably	1,599	919
Area of natural forest treated	33,072	21,372

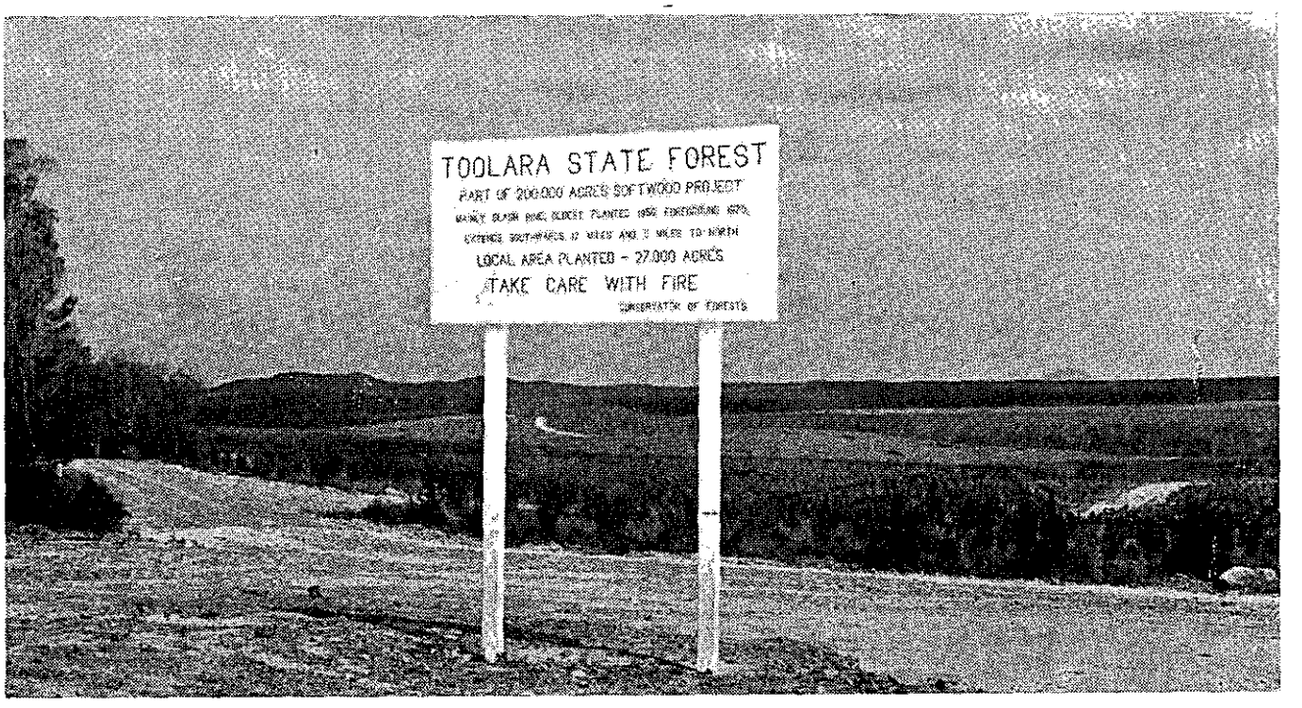
Practically the whole of the increase in area of plantation established occurred in the Slash Pine areas of the South East. There was a decrease in acreage of natural forest treated.

Planting

Areas of plantations established by Districts and species between 1st April, 1970, and 31st March, 1971, are shown in Appendix F. Similarly the net areas of effective plantation as at 31st March, 1971, appear in Appendix G.

Total planting in 1970-71 included:

	Acres
New plantations	15,135
Replanting failed areas	257
Replanting burnt areas	96
Underplanting	204
	15,692



The acreage of new plantations was again a record, being 2,502 acres more than that planted in 1969-70. Acreages of the various species planted in 1969-70 and 1970-71 were:—

Species	1969–70	1970–71
	Acres	Acres
Native conifers (mainly Hoop Pine)	3,556·6	3,823·9
Slash Pine	7,002·5	9,210·8
Loblolly Pine	140·2	152·0
Caribbean Pine	1,532·0	1,521·2
Radiata Pine	282·1	325·0
Patula Pine	20·0	65·6
Others	99·8	36·7
Totals	12,633·2	15,135·2

The total acreages planted at Beerburrum, Tuan and Toolara are:—

Centre	Acreage Planted 1970–71	Total Acreage Planted to 31–3–71
	Acres	Acres
Beerburrum	1,474·7	24,264
Toolara	4,094·8	21,464
Tuan	3,653·2	23,277
Totals	9,222·7	69,005

The 257 acres of failed areas replanted comprised mainly Southern Kauri Pine plantations in the Mary Valley which were clear felled following severe attack by the Kauri Pine coccid (*Conifericoccus agathidis*), areas of failed exotic pines in the Brisbane Valley and areas of frost damaged Hoop Pine at Jimna.

The planting season for Slash Pine is limited to the period May to August when soil conditions are suitable and when the plants are sufficiently dormant. The winter of 1970 was a difficult planting season for Slash Pine because of lack of soil moisture, and it can be seen from the table below that rainfall at Tuan for all of the months April to August 1970 was far below average. Rainfalls were also below average for the first part of the 1971 winter planting season.

RAINFALL AT TUAN

Month	1970 Planting Season	Average	1971 Planting Season
April	197	343	232
May	2	321	82
June	134	318	215
July	63	237	..
August ..	111	181	..

The shortening of the effective planting season because of lack of soil moisture results in difficulty in recruiting sufficient staff to plant the acreages prepared for planting in the limited time available. To alleviate this problem, investigations into the use of planting machines are being continued.

The work of improving the drainage of poorly drained areas which would otherwise be too wet to plant has been continued, by constructing drains with a ditch-digging machine.

Under current practice, planting lines three feet wide are ploughed in preparation for the planting of exotic pines. In the years following planting considerable cost is incurred during tending operations in the destruction and re-growth of wattle, eucalypts, &c. particularly on the unploughed strip between planting lines. Trials have been carried out to test whether complete ploughing, with its attendant reduction in tending cost and improved early growth, results in over-all economy.

Pruning

Acreages of plantation pruned as compared with those of 1969-70 were:—

Year	Stage of Pruning				Total
	1st	2nd	3rd	4th	
	Acres	Acres	Acres	Acres	Acres
1969–70 ..	3,489	3,828	3,145	1,374	11,836
1970–71 ..	2,426	3,473	3,273	1,534	10,706

Slash Pine is pruned to a height of 21 feet in three stages; other species are pruned to the same height in four stages. Action is in hand to convert pruning of all species to three stages.

Tending

The total area of plantations tended during the year, as compared with previous years are:—

Year	1968–69	1969–70	1970–71
	Acres	Acres	Acres
Area covered in tending ..	80,975	62,840	83,725

The high rainfall of the summer months resulted in a need for tending an increased acreage, particularly in young plantations of exotic pines and in older plantations of Hoop Pine. A tender was accepted during the year, at a very favourable price per acre, for aerial spraying with hormone weedicide of about 11,000 acres of young plantation of exotic pine at Tuan and Toolara. The wet summer months caused weed growth greater than normal in young Hoop Pine plantations. However, as a result of the efficiency of the tending techniques using hormone sprays adopted for Hoop Pine plantations in their first year, there was a minor increase only in costs per acre of tending these plantations. Growth of lantana seedlings in Hoop Pine plantations continues to be a serious problem.

Releases were made during the year of further species of insects which attack lantana, viz. *Octotoma scabripenis* and *Uroplata girardi*. These insects were supplied by the Lands Department, and both species are leaf mining beetles.

Thinning

The acreage of plantations thinned merchantably during the year was 8,936 acres, a small reduction from the 9,334 acres thinned in 1969-70. Thinning operations were held up by wet weather during the summer. The quantity of timber cut was 48·6 million super. feet as compared with 50·4 million for 1969-70.

Fertilizing

The area of plantations fertilised during the year was 11,402 acres, as compared with 8,275 acres fertilised during 1969-70. Fertiliser was applied to 10,583 acres of Slash Pine and to 545 acres of Caribbean Pine.

Slash Pine was fertilised at time of planting with a N.P. mixture as a routine measure for the first time during the 1970 planting season when di-ammonium phosphate was applied on ploughed and mounded sites at the rate of 2·4 ounces adjacent to each individual tree. A booster broadcast application of phosphate will be applied at a later stage. Results from the application of di-ammonium phosphate have been exceptionally good, some plants having reached five feet high at the end of their first year in the field.

Caribbean Pine at Bingera receives a broadcast application of 2½ cwt. of rock phosphate per acre.

Treatment of Natural Forest

The total acreage of natural forest treated was 11,700 acres less than the acreage treated during 1969-70. Acreages of the various types of forest treated during 1969-70 and 1970-71 and the total acreages treated to 30th June, 1971, are shown in Appendix H, from which the following table has been derived.

Forest Type	1969–70	1970–71
	Acres	Acres
Eucalypt Forest	15,152	6,246
Cypress Pine Forest	16,775	14,638
Tropical Rain-Forest	1,145	488
Natural Hoop Pine	Nil	Nil
Totals	33,072	21,372

There has been a reduction in the acreage of Spotted Gum forest treated. The possible utilisation of young hardwood trees for hardboard and chip production in the coastal region and the need to conserve timber suitable for underground coal mining in the central region have affected approval for treatment work in the native hardwood forests.

In treatment of Cypress Pine forest for the past several years, the practice has been to destroy unwanted stems of Bull Oak (*Casuarina luehmanii*) and Cypress Pine which are too small to ringbark, by cutting them down with axes. Cypress Pine is cut to high stumps, but to prevent the development of re-growth it is necessary to cut Bull Oak to stumps 6 inches high and spray the cut surface of the stump with hormone.

Preliminary trials have indicated that this work of cutting can be done more cheaply if small chain saws are used instead of axes; chain-saw cutting provides a bigger cost advantage if the stems are cut to high stumps rather than low stumps.

There are also some indications from early trials that the growth of Cypress Pine over a period of about 10 years has been little better on areas where Bull Oak has been treated with hormone as compared with areas where Bull Oak has not been treated with hormone and an understorey of Bull Oak regrowth allowed to develop. Investigation is proceeding into whether small Bull Oak should be cut to high stumps by chain saw in replacement of the currently adopted technique of cutting to stumps 6 inches high and applying hormone.

Nurseries

The Department operates a total of 24 nurseries, classified as under:—

13 Hoop Pine
3 Caribbean Pine
3 Slash Pine
2 Radiata Pine
3 Amenity Nurseries

The work at one of the Hoop Pine nurseries is performed by prison labour at the Palen Creek Prison Farm.

No sowing was made at the nursery at Kalpowar during 1970, and the stock remaining in that nursery will be ready for planting out during 1971-72 planting season. This nursery is to be closed, and additional plants will be raised at nearby Bulburin nursery.

Planting stock to the field from all nurseries during 1970-71 totalled approximately 9·1 million plants, (exclusive of sales for amenity plantings), as compared with 7·5 million during 1969-70.

Construction of a new Slash Pine nursery on a 50 acre site at Toolara has been commenced. This nursery is intended to raise Slash Pine in replacement of the existing nurseries at Toolara and Tuan.

Closure of the Toolara nursery currently in use is necessary because of an infestation of the soil fungus *Phytophthora cinnamomi* which causes root rot of exotic pines. Precautions are being taken to prevent the introduction of *Phytophthora cinnamomi* to the new Toolara nursery, which is being constructed to allow for a greater extent of mechanisation of operations than is practised at the existing nurseries.

Action has been taken to acquire a site for a new amenity nursery in the Town of Dalby.

Seed Collection

Quantities of seed collected in 1969-70 and 1970-71 were as follows:—

Species	1969–70	1970–71
	pounds	pounds
Hoop Pine	3,372	476
Bunya Pine	Nil	5,846
Slash Pine	4,733	4,604
Caribbean Pine	66	238
Radiata Pine	78	31
Patula Pine	21	77
Loblolly Pine	Nil	613
Totals	8,270	11,885

Hoop Pine produced a light seed crop only in restricted localities in 1970-71. As a major seed crop is produced at intervals of three to five years it is necessary to store quantities of seed in cold storage for sowings in the years of no seed crop. The life of Hoop Pine seed in cold storage at 38°F is about 6 years as viability falls off rapidly. Sowings of Hoop Pine require about 10,000 to 12,500 lbs. of seed annually, and there is at present about 50,000 lbs. of seed in cold storage. The last major collection was in 1968. Small collections of Hoop Pine seed were made during 1970-71 from very limited crops available to supplement the reserves of particular provenances which were held in cold storage.

Slash Pine was collected from the Department's seed orchards and also from plantation trees specially selected as suitable for seed collection. The quantity of seed collected was a little less than that collected in 1969-70. The collection from the seed orchards was less than anticipated as the yield of seed was about 1 lb. of seed from 60 lb. of green cones as compared with a more normal yield of 1 lb. of seed from 30 lb. of green cones. This may have been due to incomplete extraction of seed from the cones, and to some ineffective pollination in the seed orchards. Action is in hand to design and construct a seed drying and extraction plant. Additional plantation trees of Caribbean Pine were selected for seed collection purposes and a reasonably large collection was made.

The total value of seed sold was $15,834.94, Slash Pine being the principal species sold.

Sale of Trees

The number of plants sold to the public, Government Departments and other instrumentalities was as follows:—

Forest plots	318,430
Schools and Government Departments	12,969
Other private plantings	87,911
Total	419,310

The Department provides a free extension service to persons interested in establishing and maintaining plantations. Departmental Officers are available to inspect the soils on areas proposed for planting and furnish advice on site preparation, species to be planted, and management.

Plants are supplied for approved forest plots at concessional rates of $2.50 per 100 for open root plants and $7.50 per 100 for tubed plants.

The sale in 1970-71 of 318,430 plants for forest plot planting is greatly in excess of the 179,432 plants sold in 1969-70 and reflects increasing interest in the establishment of forest plots. Forest plot sales comprised species as under:

	No. of Plants
Slash Pine	257,455
Caribbean Pine	32,945
Hoop Pine	20,130
Miscellaneous	7,900
Total	318,430

Amenity Nurseries

The amenity nurseries at Rocklea and Dalby made sales as under for windbreak, shade and ornamental purposes.

Nursery	Plants Sold	Value
		$
Rocklea	81,169	12,902.75
Dalby	16,815	2,933.50
Totals	98,004	15,836.25

Demand for plants for amenity plantings was at a high level. Sale of plants from the new amenity nursery at Bunya, Brisbane, has not yet commenced.

Christmas Trees

6,287 Christmas trees were sold for a total of $3,383.90.

Diseases and Pests

(*a*) Insects, Birds and Animals

No new outbreaks of any serious insect pest occurred in plantations during the year. In general, growing conditions have been favourable and natural levels of insect pests have not caused undue adverse effects on trees. However, the level of activity of the many insect pests on ornamental trees, particularly in the Metropolitan area has been maintained, and replies have been furnished to numerous enquiries from the public regarding insect damage to ornamentals.

The restricted areas of plantation Hoop Pine at Imbil affected by the branch pruner *Coptopterus decoratus* did not increase during the year and most trees have shown some recovery. Good seasonal conditions appear to have assisted in this improvement. A considerable loss of increment has occurred on areas showing severe attacks. Little response has occurred on experimental areas to heavier thinning and application of fertiliser.

Damage to Hoop Pine plantations by native rats continues to be a serious problem. The rat principally responsible is *Rattus culmorum*. Serious damage during the year was confined to relatively small areas of plantations in Yarraman and Murgon Districts. Damage normally occurs only in late winter and spring, and despite sustained baiting of the affected areas with wheat treated with sodium-fluoroacetate, the damage was not effectively arrested. Thus there is reason for concern that Hoop Pine plantations may sustain more extensive damage should populations of the rat again rise to high levels, unless more effective means of controlling their numbers can be devised.

Investigations by the Zoologist, who is stationed at Archookoora in the Yarraman District, into the biology of *Rattus culmorum* have been continued, and aspects of the investigation are being supervised by Dr. Dwyer of the Zoology Department of the University of Queensland. Information relating to the breeding habits and home-range movements of *Rattus culmorum* has been obtained.

(*b*) FUNGI

Root rot caused minor losses of seedlings of *Pinus caribaea, Pinus radiata* and *Pinus merkusii* in three nurseries. It is suspected that this root rot was caused by *Phytophthora cinnamomi,* a fungus which causes root rot of several species of Pinus and many other plants. This fungus is present in the soil of a number of Pinus nurseries, and fumigation of the nursery soil with chloropicrin is carried out as necessary to control the fungus.

Phytophthora cinnamoni has been associated with the death of small patches of Caribbean Pine on poorly drained sites in young plantations at Bowenia and Kennedy.

In co-operation with the Australian National University, a survey was carried out during the year to obtain information on the occurrence of *Phythophthora cinnamomi* in Queensland. The fungus was found in association with a root rot of *Banksia integrifolia* at Coolum, and this is probably its first recorded occurrence on native vegetation in Queensland.

Phytophthora cinnamomi was also recovered from samples collected at a further six sites in North Queensland where native vegetation was evhibiting symptoms of root rot. This indicates that the organism may have wide-spread occurrence on native vegetation in Queensland and investigations are to be continued.

Root rot and butt rot have continued to cause injury and death to a minor extent of Hoop Pine in plantations in the Mary Valley. These are believed to be caused by the fungus *Fomes noxius.* Observations on the study plots which have been established in affected areas have been continued.

Fomes annosus is a fungus which causes serious root rot and butt rot of conifers in the Northern Hemisphere. For some years, this fungus has been known to occur on stumps of Hoop Pine in a plantation near Atherton.

More recently the fungus has been found on stumps of Hoop Pine in a plantation at Imbil and on a standing dead tree of *Pinus patula* in a plantation near Atherton. As yet this fungus is not known to have caused injury or death to Hoop Pine or Pinus in Queensland. However it does cause death of both Slash Pine and Loblolly Pine in south eastern United States. A series of inoculation trials was established at Imbil during the year to provide data as to the capability of the local strain of the fungus to cause disease of Slash Pine. An officer of the Division of Applied Chemistry, C.S.I.R.O. is advising on these inoculation studies.

There were minor outbreaks of root rot of Hoop Pine caused by the fungus *Rhizoctonia crocorum* in nurseries at Kenilworth and Jimna. The affected areas were treated with P.C.N.B. Earlier trials had indicated that losses due to this fungus could be controlled by fumigation of the nursery bed before sowing with chloropicrin. Prior to the 1970 sowing of Hoop Pine, nursery beds at Jimna and Kenilworth in which the organism was known to be present were fumigated with chloropicrin. This is the first time such a fumigation has been done as routine practice in the Department's Hoop Pine nurseries.

SILVICULTURAL RESEARCH

During the year the Commonwealth Forest Research Institute established a co-operative research station at Atherton known as the Queensland Research Station. The programme of work of this station is decided jointly by the Director-General of the Commonwealth Forestry and Timber Bureau and the Conservator of Forests. The station will work initially on the identification of forest types within the rain-forest and the correlation of these with edaphic and other environmental factors.

The reports of the four departmental regional research stations and of the mensuration and biometrics section of research branch follow.

Atherton Regional Research Station

The main work of this station is research into the silvicultural characteristics of North Queensland rain-forests with the object of determining treatment prescripitions suitable for application to these forests. Steadily increasing research work is being done on the establishment and maintenance of exotic pine plantations on poor sclerophyll forest areas on the coastal lowlands at about 18° S while some research effort is still being directed to plantation work on the upland areas.

(i) *Rain Forests.*—In silviculturally treated areas, the natural regeneration of desirable species under 10 feet in height is frequently very bendy. This is the result of severe competition prior to treatment. Concern has been expressed that the butt 10 feet of such trees will be ill-shapen. A number were marked and photographed during the year and will be observed at intervals to study how they develop.

Data on early height growth of seedlings and small trees on rain-forest yield plots have been collated by species, height class, treatment, basal area of surrounding forest, soil type and altitude. These data have not been fully analysed but it is clear that silvicultural treatment is the most important factor in stimulating height growth. Basal area of the forest following treatment is far less important and similar height increments are recorded in treated forests with basal areas ranging from 50 sq. feet to 200 sq. feet. The relationship between height and girth breast high was examined for trees under 25 feet in height. It was found that girth in inches equals 0·273 height in feet and that this relationship applies reasonably well to all species.

Two experiments were established during the year to test the effect of four intensities of overwood removal on the growth rate of seedlings in low quality rain-forest. One was established on metamorphics on State Forest 607 and the other on red volcanic soils at Gadgarra. Brushing of the underwood was not included in any of the treatments.

Tests on the effectiveness of picloram in killing lawyer vine clumps and of "dacamine T" as a substitute for arsenical arboricides were carried out but have yet to be evaluated.

In last year's Annual Report it was shown that about half the vegetation on an area was moderately or severely damaged in logging about 12,000 super. feet per acre from that area. Three further logging damage studies were made in the current year, the basis of assessment on this occasion being the number of selected trees damaged. Experiment 408 was virgin rain-forest on Baldy Mountain while Experiment 486 area was forest on State Forest 605 which had been selectively logged twenty years earlier. Experiment 434 area was an area at Gadgarra which had an enrichment planting in 1930 following heavy logging. Stocking per acre of selected trees is shown in table form.

STOCKING PER ACRE OF SELECTED TREES BY TWELVE INCH GIRTH CLASSES—LOGGING DAMAGE STUDIES

Expt. No.	−24	−36	−48	−60	−72	72+	Total
408	62·7	24·2	14·5	8·6	5·4	3·5	119
486	8·6	16·9	12·6	10·8	5·1	4·6	59
434	3·4	18·8	27·5	10·7	3·3	0·8	65

The quantity logged per acre is also shown in an accompanying table.

REMOVALS PER ACRE IN LOGGING—LOGGING DAMAGE STUDIES

Expt. No.	No. of Trees Logged	Gross Volume Logged—Super. Feet
408	9·9	13,270
486	4·2	5,440
434	10·1	5,820

Damage to selected trees was assessed as follows. Heavy damage indicates crown has been completely destroyed as a result of felling operations or tree has been completely smashed in snigging operations. Moderate damage is less than heavy damage and covers trees with more than 50 per cent. of the crown damaged or trees which have suffered both bark and wood damage in snigging operations. Light damage covers trees with less than 50 per cent. of the crown damaged and trees with bark damage caused by felling or snigging operations. The percentage of selected trees damaged in logging operations is shown in table form.

PERCENTAGE OF SELECTED TREES BY DAMAGE CATEGORIES—LOGGING DAMAGE STUDIES

Expt. No.	Heavy	Moderate	Light	Nil
408	26	3	11	60
486	6	2	10	82
434	4	2	8	86

In Experiment 408 heavy and moderate damage totals 29 per cent. In the previous Annual Report moderate and heavy damage to the vegetation as a whole was shown to be 45 per cent. in logging a similar quantity per acre as in Experiment 408. It is clear the operators have been selective in the trees they have damaged and have taken effective steps to lessen damage to selected stems. The greater the volume logged per acre, the greater has been the damage. In Experiments 486 and 434 damage is similar, volumes logged are similar but number of trees logged and tree size are different.

Felling caused considerably more damage than snigging. A greater percentage of small trees has been damaged than large trees. The large number of small trees selected in Experiment 408 has played some part in the high percentage of heavily damaged trees in this experiment. Even in this experiment the number of selected stems which have suffered light or nil damage, is quite adequate to stock the area. In the other two experiments damage has been minor. These studies indicate that cyclical selection logging is feasible in rain-forests.

A young rain-forest in Compartment 2 Maunder Logging Area, which had routine treatment in 1963, was covered in 1970 by linear sampling along permanently marked lines. It was found that 60 of 160 quadrats per acre were stocked with "A" group species and that 40 of these contained trees over 20 feet high with a mean girth of 18·2 inches. These trees had a mean annual girth increment of 0·8 inches in 1970-71 and the maximum mean increment was 1·4 inches in the 2-feet–3-feet girth class. Bull Kauri gave a mean increment of 1·5 inches and its potential for enrichment planting or for plantations, warrants further investigation.

A detailed report was prepared on an area in Gadgarra which was given natural regeneration treatment in 1917 and which was enriched with Queensland Maple and Maple Silkwood planted on brushed lines in 1926 and 1928 when the useless overwood was ringbarked. Following logging and treatment in 1969 there is an excellent stand, entirely of "A" group species, mainly Queensland Maple and Maple Silkwood. Mistletoe has caused the deaths of a number of the larger trees of Queensland Silver Ash and Silver Silkwood and reduced the growth rate of the survivors. The other "A" group species are not affected or not seriously affected by mistletoe. The growth rate of Red Cedar indicates the site is not optimum for this species. An adequate log length of 30 feet had been attained by 1953. With more intensive treatment from this time a girth increment of 0·8 inches per year could have been maintained by the selected stems of Maple and Maple Silkwood.

A paper was written summarising work done on the establishment and treatment of Red Cedar stands in North Queensland over the period 1903 to 1970. Open plantings of Red Cedar are so severely attacked by the twig borer (*Hypsipyla robusta*) that the trees are commercially useless. Attack is reduced under shade and 30 per cent. to 40 per cent. of full rain-forest canopy appears optimum for vigorous growth with twig borer damage at acceptable levels. It is desirable to have non-overtopping side competition to ensure satisfactory form in planted Red Cedar. When the Red Cedar attains a height of 25 feet the competing overwood and understory should be removed to permit vigorous girth growth of the crop stems. On the Atherton Tableland, Red Cedar has thrived only on red basaltic soils and at the junction of these soils and grey metamorphic soils. The best stands are found on well drained, protected sites with good moisture availability. Established stands should be maintained in the basal area range 90 square feet to 200 square feet. The mean annual girth increment in such stands will be about one inch. On suitable sites Red Cedar grows satisfactorily under planted Southern Silky Oak, North Queensland Kauri and Queensland Maple. It does not grow well under Hoop Pine.

First year's growth of American Mahogany in an enrichment planting on a lowland rain-forest site has been encouraging. Height growth of the Mahogany over a period of 10·5 months has been 4·7 feet while that of Queensland Maple has been 3·2 feet. Survival is in excess of 90 per cent. in both species.

(ii) *Upland Plantations.*—A mixed plantation of Hoop Pine and *Albizia falcata* was established on a grassed ex-rain-forest site at Danbulla. It is hoped the *Albizia* will assist in control of the grass and add to the nitrogen status of the soil. Both of these effects would be of benefit to the Hoop Pine. An outplanting of several provenances of Kamerere, part of an international provenance trial of this species, was made on Quaker Logging Area, State Forest 458 Stone. Several provenances of Benguet Pine and Ocote Pine were outplanted in the Kuranda area early in 1971. Survival has been good.

For the second year in a row the cone crop was harvested from a number of tagged Honduras Caribbean Pine trees on the Atherton Tableland and from comparable trees on the coastal plain. As in the previous year the coastal crop was very much the larger.

Fomes annosus has been found on dead Hoop Pine on Baldy Mountain. Nearly all the dead trees belonged to the suppressed and intermediate classes in the plantation. Root rot also occurs in plantations at Wongabel and Gadgarra. Several fungi appear to be involved; one with a sterile mycelial mat on the butt has been tentatively identified as *F. noxius,* while one with no such mat could be *F. annosus.* At Gadgarra *F. annosus* conks have been collected from a Hoop Pine stump and from dead Patula Pine which is the first record of this fungus occurring on a Pinus species in Australia. Staff of the Atherton station are carrying out observations to determine the extent of the plantation root rot problem.

Survival in the 1969-70 trial plantings of Pringle's Pine, Tenasserim Pine and Montezuma Pine at Danbulla is fairly low. The plants were small at time of outplanting and prolific weed growth has provided severe competition. Further growth data are not available for the 1967-68 trials of Benguet Pine and Ocote Pine at Danbulla. A recent inspection revealed symptoms of a nutritional deficiency in Benguet Pine, possibly boron. The Ocote Pine is growing vigorously but stem form is poor.

Hoop Pine wildlings from Coen, Hann Tableland and Huntsbrook Creek with seedling stock from Coen seed and stock derived from Atherton plantation seed of an unknown south Queensland provenance, were outplanted at Danbulla in 1969-70. The Coen stock has fern like branch fronds which makes it similar to New Guinea provenances in appearance. The Hann Tableland and Huntsbrook Creek stock has the bluish appearance noted in other tropical Queensland provenances. Height growth of all the North Queensland provenances exceeds that of the southern provenance in the first sixteen months in the field.

(iii) *Coastal Plantations.*—Experiments were initiated in 1970 with the aim of introducing chemical control of unwanted growth in young plantations of Honduras Caribbean Pine. Concentrations of hormone-type weed-killers and their ability to control unwanted species have been intensively investigated by the Department, but little is known about the most suitable method of application in young Caribbean Pine plantations, which are far more sensitive to hormone type weed-killers than are Slash Pine plantations.

Two techniques of application were tested. These were foliar spraying with 0·5 per cent. 2,4,5-T butyl ester in water and basal bark spraying with a concentration range of 2 to 3 per cent. 2,4,5-T butyl ester in distillate. Both treatments gave a satisfactory kill of weeds. The foliar application is to be preferred because labour costs are lower. Ordinary knapsacks fitted with Monarch F 97S nozzles and 14·5 tips were used for this treatment and the quantity of solution required varied from 15 gallons to 30 gallons per acre. The pines suffered no ill effect from spray drift.

The effects of varying concentrations of wetting agents were also tested. This experiment revealed that, in species not closely related, leaf surfaces are subject to differential wetting and that increased concentrations do not necessarily improve weed kill, though they increase the risk of damage to the pines.

An experiment was conducted in Kennedy nursery to investigate means of improving the vigour of Honduras Caribbean Pine as tubed stock. The addition of 5-7·5-4·1 fertilizer at 600 p.p.m. and filter press to the tubing soil resulted in the production of uniform, well grown tubed stock with marked resistance to pathogenic fungi. Testing of tubing soils of different origins is also in progress. The subsequent development of thrifty and unthrifty tubed plants has been observed in the field over a period of 12 months. Both types of plant are now healthy but growth and survival of the thrifty plants has been better.

Provenance trials of Benguet Pine and Ocote Pine were outplanted in 1970-71. These trials are contiguous and adjacent plots of Honduras Caribbean pine will permit reasonable comparisons to be made between these species. A trial planting of Montezuma Pine was established and *Albizia falcata* and Hoop Pine were planted as a mixture to test whether the legume could provide the nitrogen requirements of Hoop Pine on these nitrogen deficient soils.

Two new species were planted during the year in the series of trial plantings on mined areas at Weipa. These were Tenasserim Pine, of Philippines origin, and *Cordia alliodora.* The most promising species to date are Northern Cypress Pine, African Mahogany, American Mahogany and Honduras Caribbean Pine which has problems of establishment on ill-drained areas. Three further species have been included in the arboretum at Kennedy—African Mahogany, American Mahogany and *Chukrasia tabularis.* Survival in in all three species at the end of the first year was 100 per cent. with a height increment of 2 feet. Where they occur on an ash bed their growth is much improved.

Stocks which had been established in the Kennedy seed orchard of 6·5 acres, to replace trees lost since the original grafting, were grafted during the year. It is planned to extend this seed orchard by 16 acres. This area has been cleared and 8 acres planted at 20 feet x 20 feet with stocks for grafting in 1972. A number of new clones will be introduced into the seed orchard, to extend the representation of clones and replace the incompatibles from the previous selection. The establishment of other grafted areas of Honduras Caribbean Pine is dealt with in the tree-breeding section of the report of the Beerwah Research Station.

Thirty per cent. of the Honduras Caribbean Pine trees established on an ill-drained area at Kennedy in winter 1967 had severe leans caused by cyclone "Gertie". It appeared the mounded areas were more severely affected than control areas. In an experiment established last year, on alternating ploughed and non-ploughed strips, height one year from planting was 3·1 feet on the ploughed strips and 2·7 feet on the unploughed strips.

The growth of six provenances of Tenasserim Pine, outplanted early in 1970, has been slow. The Indonesian seed sources (Sumatra and Java) have put on some height growth but there has been little growth in the Asiatic mainland and Philippines provenances.

In April 1970, sowings of Townsville lucerne (*Stylosanthes guayanensis*) were made on four sites—(i) a newly cleared and burned sclerophyll forest, (ii) a newly planted Caribbean Pine plantation which had been double disced, (iii) the three-year-old seed orchard which was single disced and (iv) a three-year-old plantation thinned to 300 stems per acre and double disced. Germination was satisfactory and inspection in May 1971 showed that 70 per cent. of the ground area in the 1967 plantation was covered with Townsville lucerne and 100 per cent. of the ground area in the other three trials. It appears that sowing of the legume in a plantation three years or older is not likely to give a sufficient cover to suppress weed growth. However grazing values would improve. In younger plantations a complete cover can be expected, but the trees should be given one year's start to avoid damage from smothering. On open fire-breaks an excellent cover can be anticipated.

A paper was prepared for 15th I.U.F.R.O. Congress, Gainesville, dealing with trial plantings of Honduras Caribbean Pine and Benguet Pine, established in North Queensland between 1953 and 1957. Caribbean Pine grows vigorously on a variety of well drained sites and to the age covered can equal the volume production of high quality Radiata Pine stands of southern Australia. A mean annual rainfall of at least 45 inches and a mean monthly rainfall in excess of two inches for at least seven months of the year appear to be necessary for satisfactory growth of Caribbean Pine in North Queensland. Bole straightness is frequently unsatisfactory but this will be improved by selective breeding. Benguet Pine is more demanding as regards soil fertility than Caribbean Pine and branching is much heavier. It is generally less vigorous than Caribbean Pine, but on optimal sites volume production is very similar.

Beerwah Regional Research Station

At this station three sections handle various aspects of research into the establishment and maintenance of exotic pine plantations on the coastal plain south of latitude 23° S, and on the hinterland plateau country of southern Queensland. A fourth section deals with native coastal hardwood forests in the sub-tropics.

(i) *Plantation Silviculture.*—This section is responsible for silvicultural research into the southern pine plantations of sub-tropical coastal Queensland, the Honduras Caribbean Pine plantations at Byfield just within the tropics and the Radiata Pine plantations of the southern inland tablelands near Stanthorpe.

(*a*) Sub-tropical Coastal Region.—The programme of nursery research reported on in the 1968-70 Annual Reports, aimed at defining optimum grades of open-root Slash Pine planting stock, is now nearing completion. Eight morphological grades of seedlings, based on needle and bud development, have been recognised.

Multiple regression analyses correlating field survival and height increment with morphological grade of seedling, and the interactions with plant size and root condition are now being finalised. Preliminary examination of the data shows that best survival and increment are obtained from seedlings which have formed a hard bud, even though this hard bud may have opened at time of planting.

Following improved survivals of Slash Pine seedlings from the use of clay slurry root dips during the 1969 planting season, two further trials were initiated in 1970, incorporating "Agricol" (sodium alginate) as well as clay slurry dips. One trial was located at Beerwah using unculled planting stock, and one at Toolara using hard stock only. Both trials were planted on mounded ridge sites in August 1970 under adverse planting conditions. The accompanying table shows the improved survivals with clay slurry dips, but "Agricol" has given inconsistent results.

PERCENTAGE SURVIVAL AND HEIGHT INCREMENT (FEET) OF ROOT DIPPED SLASH PINE SEEDLINGS—7 MONTHS AFTER PLANTING

Location	Not Dipped		Agricol Dip		Clay Slurry Dip	
	Survival	Height Increment	Survival	Height Increment	Survival	Height Increment
Beerwah ..	78	0·83	72	0·80	93	0·93
Toolara ..	78	N.R.	91	N.R.	93	N.R.

N.R.—Not recorded.

Nursery research is continuing with all Caribbean Pine varieties in an effort to derive reliable techniques for open-root planting of this species and initial results are encouraging. The experiment sown in October 1969 to produce physiologically harder stock by severe root wrenching at weekly, fortnightly and monthly intervals, with and without topping to 5 inches, was outplanted at Beerwah in August 1970 under adverse conditions, half of the untopped stock had their roots dipped in clay slurry at lifting. Percentage survivals two months after planting are shown in the accompanying table.

PERCENTAGE SURVIVALS OF OPEN-ROOT CARIBBEAN PINE TWO MONTHS AFTER PLANTING

Frequency and Number of Wrenchings	Untopped Stock		Topped Stock
	Not Dipped	Clay Slurry Dip	Not Dipped
Honduras Caribbean Pine			
Weekly (22)	84	98	90
Fortnightly (11) ..	87	98	86
Monthly (6)	75	96	86
Bahamas Caribbean Pine			
Weekly (14)	72	..	72
Fortnightly (7) ..	96	..	91
Monthly (4)	93	..	66
Cuban Caribbean Pine			
Weekly (14)	69	86	79
Fortnightly (7) ..	61	71	70
Monthly (4)	48	86	55

With the exception of Bahamas Caribbean Pine the more severe weekly and fortnightly root wrenchings have given stock with a better capacity for survival. Generally, topped stock has survived marginally better than untopped stock while the addition of clay slurry dips to untopped stock has markedly increased survival. Further sowings have been made in 1970 to confirm these results.

A detailed evaluation of the older species trials with Slash and Honduras Caribbean Pines at Beerburrum, Toolara and Tuan was carried out during the year. The growth potential of Honduras Caribbean Pine on loamy lateritic podsolic soils at three centres in the coastal sub-tropics is shown in accompanying table.

GROWTH OF 16-YEAR-OLD SLASH AND HONDURAS CARIBBEAN PINE—SUB-TROPICAL COASTAL LOWLANDS

Location	Species	Predominant Height (ft.)	Stems/ Acre	BA/Ac. (sq. ft.)	Merchant. Vol./Ac. (cu. ft.)
Beerburrum ..	Caribbean ..	73·0	278	168·9	3,361
27° S	Slash ..	64·1	298	117·6	2,221
Toolara ..	Caribbean ..	72·7	304	184·7	3,689
(26° S) ..	Slash ..	64·5	288	114·5	2,194
Tuan	Caribbean ..	65·5	301	161·9	2,749
(25° 45′ S) ..	Slash ..	56·6	301	107·8	1,755

Whilst there is no doubt of the greater productivity of Honduras Caribbean Pine on well-drained sites in this region a detailed evaluation of the wood properties and an improvement in stem straightness of the species is needed before it could supplant Slash Pine as the major plantation species in the sub-tropics.

All long term thinning, spacing and pruning experiments were measured and maintained during the year, and further progress achieved in the transformation of past measure

data to automatic data processing. This work has now reached the stage where a further review of standing basal area, basal area increment, site index and age relationships in Slash, Loblolly and Honduras Caribbean Pine should be possible within the next year.

As experiment dealing with direction of pulp thinning in 1955-planted Slash Pine stands premerchantably thinned to 400 stems per acre was initiated in 1964. Treatments involved: (A) Pulp thinning from above to favour pruned stems at age 9½ years to the same basal area as in Treatment B, followed by second pulp thinning from below to straddle limiting basal area at age 15 years; (B) Pulp thinning from below to 300 stems per acre at age 9½ years, followed by sawlog thinning (27 inches + g.b.h.o.b.) from above to straddle limiting basal area at age 15 years. Stand development after the second merchantable thinning in 1970 at age 15 years is shown in table.

DIRECTION OF PULP THINNING—SLASH PINE, AGE 15 YEARS (Means of 2 replications)

Treatment	Stems/Acre		Mean GBH BA (Ins.)			Predom. Ht. (ft.)	Basal Area/Acre (sq. ft.)				
			Select.		All		Standing		Thinnings		Total
	Select.	All	Mean	Inct. 64–70			Select.	All	Pulp	S'log	
A	121	243	32·11	7·60	30·01	63·3	69·3	121·0	43·1	..	164·1
B	121	245	31·50	7·14	29·77	64·3	66·5	120·0	16·5	26·1	162·5

Treatment	Merchantable Volume/Acre (cu. ft.)					Value/Acre ($A)				
	Standing		Thinnings		Total	Standing		Thinnings		Total
	Select.	All	Pulp	S'log		Select.	All	Pulp	S'log	
A	1,480	2,503	607	61	3,172	210·5	271·1	28·6	2·3	302·1
B	1,427	2,509	187	524	3,220	193·5	263·2	8·8	40·8	312·8

After two merchantable thinnings direction of the first pulp thinning has not materially affected volume production or value yield, although the stands initially thinned from below have a slight advantage in both parameters.

Two new spacing experiments, designed to compare the growth of orchard quality Slash Pine in both square and rectangular patterns have been established at Toolara; one in 1970 on cultivated ridge sites with lateritic podsolic soils, and the other in 1971 on mound-ploughed swamp sites with ground-water podsol soils. Spacings under test are:—

Stocking per Acre	Square Spacing	Rectangular Spacings
	(feet)	(feet)
889	7·0 x 7·0	5·0 x 9·8 : 6·0 x 8·2
680	8·0 x 8·0	6·0 x 10·7 : 7·0 x 9·1
605	8·5 x 8·5	6·0 x 12·0 : 7·0 x 10·3
538	9·0 x 9·0	6·0 x 13·5 : 7·0 x 11·6
436	10·0 x 10·0	6·0 x 16·7 : 7·0 x 14·3

It is envisaged that the square spacing designs will be managed under selective thinning schedules to favor selects, akin to current routine practices; with the rectangular spacings row thinning with tree harvesters is envisaged.

(*b*) Tropical Coastal Region, Latitude 23° S—In the central region where Honduras Caribbean Pine is the principal plantation species, and where there is no immediate pulp market, routine practices prescribe premerchantable thinning to 400 stems per acre when the stand averages 9 feet in height —about age 4 years. Current management envisages the production of high quality sawlogs on a minimum cutting girth of 27 inches g.b.h.o.b. In a 1957 Honduras Caribbean Pine plantation at 9 feet x 8 feet spacing the following premerchantable thinning treatments were applied:—(A) Control, unthinned apart from removal of runts and useless stems; (B) Premerchantable thinning to the best 400 stems per acre at age 4½ years; (C) Premerchantable thinning to the best 300 stems per acre at age 4½ years; (D) Premerchantable thinning after selection for carry-up pruning at age 5½ years to favour 120 selected stems per acre, to leave a residual stocking of 360 stems per acre. First merchantable thinning was applied when basal area per acre of other than select stems 27 inches and over g.b.h.o.b. exceeded 40 square feet per acre, of which all but 10 square feet was removed to favour select stems. Growth data at completion of the first sawlog thinning is shown in table.

GROWTH OF HONDURAS CARIBBEAN PINE—AGE 13·5 YEARS—AFTER EARLY PREMERCHANTABLE THINNING
(Means of 5 replications)

Treatment (Stems/Acre)	Stems/Ac.		GBH BA (ins.)			Basal Area/Ac. (sq. ft.)				Pred. Ht. (ft.)		
	Sel.	All	Select.		All	Stand 1970		Thinnings	Total	Mean 1970	Inct. 61–70	Site Index (ft.)
			Mean	Inct. 61–70	Mean	Sel.	All					
300 (C)	120	237	32·4	18·0	30·1	69·5	118·8	32·1	150·9	72·1	44·1	106
360 (D)	121	302	31·3	17·6	28·1	65·4	131·3	30·4	161·7	70·4	41·5	105
400 (B)	119	327	30·7	16·6	27·8	62·4	140·0	34·4	174·4	70·1	42·5	104
480 (A)	120	405	30·2	15·9	26·7	60·6	160·1	35·5	195·6	72·0	41·2	107

GROWTH OF HONDURAS CARIBBEAN PINE—AGE 13·5 YEARS—AFTER EARLY PREMERCHANTABLE THINNING
(Means of 5 replications)

Treatment (Stems/Acre)	Merchantable Volume/Acre (cu. ft.)				Value/Acre ($A)				
	Stand 1970		Thinning	Total	Stand 1970		Thinning	Total 1970	Discount Value 1961*
	Sel.	All			Sel.	All			
300 (C)	1,353	2,237	559	2,796	263	343	63	406	240
360 (D)	1,217	2,298	516	2,814	212	300	54	354	209
400 (B)	1,148	2,439	565	3,004	187	290	56	347	205
480 (A)	1,147	2,802	618	3,420	178	306	64	370	219

(Treatment differences are not significant, with the exception of total basal area at the 1 per cent. level, and merchantable volume production at the 5 per cent. level).

* Discounted value at 6 per cent. to the time of application of premerchantable thinning.

Where no pulp market exists the results indicate that in comparison with unthinned stands there is no benefit in premerchantable thinning to 400 stems per acre, or in premerchantable thinning to favour selected stems; the increased size of logs has been insufficient to offset the loss in volume increment through added value production. However although both standing and discounted value differences do not yet attain statistical significance the increased value returns with premerchantable thinning to 300 stems per acre are of sufficient magnitude to recoup the costs of premerchantable thinning and this treatment is recommended where management aims at the production of high quality sawlogs. These results have also been substantiated in a similar older experiment with Honduras Carribbean Pine at Beerburrum.

The detailed results of several experiments on premerchantable thinning in Slash Pine and Honduras Caribbean Pine plantations in Queensland were presented in a paper to the 15th I.U.F.R.O. Congress in Gainesville, Florida, U.S.A. in March 1971.

(*c*) Inland Southern Tablelands—Because of the staff position, work in the Radiata Pine plantations is currently restricted to measurement and maintenance of existing long-term species trials and thinning and spacing experiments, apart from limited new investigations on nursery and establishment techniques aimed at increasing first-year survivals in this region where low and unreliable rainfall prevails.

First year results from a nursery trial on planting stock chacacteristics of Radiata Pine indicated that stock topped to 14 inches three months prior to planting gave as good a survival and better increment than untopped (normal) stock, in which there was a slight advantage in the larger size classes. Root-collar diameter of the seedlings has had a large effect on their performance in the field as shown in the following figures:

PERCENTAGE SURVIVAL AND HEIGHT INCREMENT OF RADIATA PINE AFTER ONE YEAR IN THE FIELD

Root Collar Diameter (sixteenths of an inch)	Per cent. Survival	Height Increment (ft.)
1[1]	20	·40
2	67	·25
3	83	·37
4	88	·38
5	88	·35
Over 5	86	·34

[1] Only 5 seedlings planted.

(ii) *Tree Breeding.*—The Officer-in-Charge of the Department's Tree Breeding Section is located at the Beerwah Regional Research Station. Breeding work with Pinus species is conducted from Beerwah. Most of the work with Hoop Pine, which is reported under the heading "Imbil and Yarraman Research Stations", is conducted from Imbil; the provenance trials being established in the Atherton and Mackay districts are co-ordinated with the southern work by Officer-in-Charge, Tree Breeding Section.

(*a*) Slash Pine.—The Department's first-generation seed orchards comprise clones from trees selected on well-drained sites in the Beerwah-Beerburrum area. They have supplied all seed required throughout Queensland since 1965. As previously reported considerable genetic gain is being realised in plantations derived from this orchard seed. It is believed that considerable additional gain could be achieved through a second cycle of individual selection and orchard establishment, selection this time being done within known families that are replicated on uniform sites. Accordingly, one or more second-generation trees have been selected in numerous families at Beerburrum, usually when 13 to 15 years of age.

Consideration is now being given to ranking these selections and using the best of them to establish a new clonal orchard. They will also be control-pollinated to produce full-sib families for future selection.

In recent years, the Slash Pine planting programme in south-east Queensland has been greatly increased. This has involved reforestation of environments that are rather different from the well-drained sites at Beerwah and Beerburrum, from which clones in the first-generation seed orchards were selected. The new environments are well-drained sites in the Tuan-Toolara area and swampy sites throughout the region. In this range of new and old environments, family-by-environment interaction may be important. Experiments established to investigate this phenomenon are still too young to yield the information needed to determine how new orchards should be constituted. Meanwhile, selection has been undertaken in small areas of plantations available from early plantings in the new environments.

Open-pollinated cones collected from 29 of the "plus" trees that were selected on swampy sites at Beerburrum yielded 12 lb. of seed in 1971, and this will be used to raise stock for planting on this type of site.

An outline was given in the 1970 Report of a project which aims at producing many intra- and inter-specific crosses with Slash Pine trees selected in the four environments, for further studies of population—and family-by-environment interactions. The mating design for the intra-specific crosses is an incomplete, nested polycross with 10 cone and 10 pollen parents in each of four nests. The interspecific crosses are made on the same groups (half nests) of cone parents, using 10-parent pollen mixes from one F_1 hybrid and four Honduras Caribbean Pine populations. In 1970, 122 of the required 300 crosses were completed on 27 cone parents.

(*b*) Caribbean Pine.—Individual selection was continued at Byfield, the major centre for reforestation with var. *hondurensis,* and at Beerwah, Toolara and Tuan. Twenty good phenotypes were found, and most of these have now been established as clones.

Although Byfield is just in the tropics, all four centres experience a sub-tropical climate, whereas the Ingham region (18-19 degrees S.) is markedly tropical. Some 1,500 acres of var. *hondurensis* plantations have been established there recently, and a large area may be developed in the future. Although the total area of public and private plantations suitable for individual selection up to the present is small, 15 good phenotypes were found during 1970 and 1971. All have now been established as grafted clones in a seed production area at Kennedy. Stock plants were outplanted in an area near Cardwell which is to be developed as a clonal reservoir for tropical and sub-tropical selections.

The 1971 seed fall at Byfield was the largest observed to date, and the harvest of 235 lb. of clean seed is the best collection in quantity and genetic quality, made so far. Some 75 lb. of seed was obtained from grafted ramets of selected clones, 30 lb. from progeny stands, and 110 lb. from selected, individual "seed" trees. The remainder was obtained from "crop" trees. A further 6·5 lb. of seed was collected in the Ingham region. The largest stand of grafted ramets at Byfield, which was established in the period 1960-61,

yielded more than 38 lb. of improved seed this year. Following the 1971 seed fall a second thinning was carried out in this stand to improve the space available to healthy ramets of the better clones in terms of combining ability and seed production. The accompanying photograph, taken in 1970, shows portion of the stand planted with potted grafts in 1960.

Ten year old grafts of superior Honduras Caribbean Pine trees selected in Queensland plantations. This stand, at Byfield, yielded 38 lb. of improved seed in 1971.

The good seed fall of 1971 provided opportunity to collect seed of many individual clones and selected ortets. Two studies were started at Byfield nursery with the seed obtained. Co-operative Progeny Study 1A comprises 25 families from the largest stand of local clones, and Study 1B involves 48 families from ortets chosen throughout eastern Queensland and Fiji. Field trials will be established at several locations.

Progeny studies with full-sib families from selected, local "plus" trees have been established at Byfield annually from 1963 to 1968. Some have been replicated at Beerburrum. Early results of the 1963 trial at Byfield and Beerburrum have been given in previous Reports. The study planted at Byfield in 1965 (No. 184) has been assessed for stem straightness and measured at age 5·5 years. Statistical analyses of the results have not been completed yet, but there appears to be large variation among and within families. Field observations suggest most families have very satisfactory stem straightness. This confirms previous reports of the general success of individual selection and controlled breeding in improving stem straightness of var. *hondurensis*.

Seed of a further 25 full-sib families was harvested in 1971. An additional 25 families, resulting from pollination in 1970 and 1971, will be available by 1973. This will bring to 80 the total number of such families whose seed is being accumulated for a future study.

(*c*) Hybrids.—Eighteen *P. elliottii* x var. *hondurensis* F_1 hybrid trees were selected within different known families at Beerburrum and Byfield. Their clones were established at Byfield for the production of F_2 seed under orchard conditions. The clones may also be used for fully-controlled breeding in the future. Two smaller groups of F_1 trees were also chosen on the basis of flowering time, for establishment of two separate small back-cross orchards, one to produce back-cross var. *elliottii* seed, the other to produce back-cross var. *hondurensis* seed. Pollinations to produce more F_1 hybrid and back-cross families were carried out, and seed was collected of a number of such families produced from the 1969 crossing programme.

The first two *P. elliottii* x var. *hondurensis* F_2 hybrid families (non-inbred) that have been produced in Queensland were planted in the field at Beerwah and Byfield, together with appropriate parental and F_1 hybrid control lots.

(*d*) Loblolly Pine.—Pending availability of seed from the clonal orchard established in the period 1968-1970, the small amount of seed required locally is obtained from the ortets; 16 lb. was obtained in 1971. Many of these high-quality trees have been progeny-tested; a few are second-generation selections. Also, a collection (4·5 lb.) was made again from selected trees within a small, local population of the Silver Springs provenance. This population grows very rapidly, but stem form is poor. Seed was also obtained of five crosses made in 1969 between local "plus" trees of the north Florida and Silver Springs provenances.

(*e*) Radiata Pine.—Further evidence was found in results of progeny studies measured at Pechey this year which shows that certain families are much better adapted to the harsh environment than others. Interestingly, the better adapted families derive from some selections made outside the area, at Passchendaele (Queensland) and in New Zealand (notably PR55), as well as from some trees chosen at Pechey.

(*f*) Miscellaneous Tropical Pines, Hoop Pine.—Field trials with several provenances of Benguet and Ocote Pines were established at several centres throughout the eastern part of the State. Seed from several continental sources of Benguet Pine has been sown.

Provenance trials with Hoop Pine were started at the Danbulla and Cathu nurseries in 1970 and 1971. These trials are of similar design to those being established in south Queensland which are dealt with in the "Imbil and Yarraman Research Stations" section of this Report. They contain a higher proportion of northern provenances than do the southern trials.

The Officer-in-Charge, Tree Breeding Section attended the 15th I.U.F.R.O. Congress at Gainesville, Florida in March, 1971. He is senior Co-chairman of the I.U.F.R.O. Working Group on Breeding Tropical and Subtropical Species, which in conjunction with the Congress conducted a Symposium on Selection and Breeding to Improve Some Tropical Pines.

A paper entitled "A Proposal for International Co-operation in the Breeding of Certain Conifers, with Special Reference to *Pinus caribaea* Mor." was presented in the Symposium, and other contributions to the Proceedings are being completed. In the course of travelling to and from the Congress, he visited many countries where tree improvement work is in progress with the same exotic species as those grown in Queensland. Also, he investigated Caribbean Pine and Ocote Pine in their native ranges in Central America. This journey, sponsored jointly by the Department and A.P.M. Forests Pty. Ltd., enabled many valuable contacts to be made for the exchange of information and breeding materials. Appreciation is expressed to members of all institutions visited for the ready assistance and generous hospitality given the Queensland officer.

(iii) *Nutrition.*—This section is concerned chiefly with the determination of optimum fertilizer regimes for the southern pine plantations of coastal south east Queensland. This year however a great deal of work has been directed towards various studies on the nutrition of Hoop Pine, particularly in relation to elucidating the problems associated with "Yarraman Disease". Nutrition experiments established on deep lateritic krasnozem soils at Pechey to test response of Radiata and Patula Pines to fertilizing have been maintained.

The soils and plant laboratory which operates in conjunction with this section, as well as providing an analytical service to all district staff, is carrying out an increasing number and diversity of chemical analyses. The soils chemist, apart from the supervision of the routine chemical analyses, is actively engaged in studies on nutrient cycling in exotic plantations, particularly phosphorus. He is responsible for carrying out work on the refinements of analytical techniques and their testing before their adoption in routine.

It has been well documented that phosphorus is the major limiting nutrient of exotic pines grown on the coastal lowlands. In a trial initiated in 1952, Loblolly Pine planted on red earth residual soils continues to show a good response to fertilizing with Nauru rock phosphate applied at planting with a follow up dressing at age 13 years. Results are shown in table form.

RESPONSE OF LOBLOLLY PINE TO APPLICATIONS OF NAURU ROCK PHOSPHATE—AGE 19 YEARS (Mean of 3 replications)

Quantity of Rock Phosphate Added[1]	Predominant Height (ft.)	Total Volume/Acre (cu. ft.)	Increments 1969–71	
			Predominant Height (ft.)	Total Volume/Acre (cu. ft.)
Nil	52·5	1,743	2·6	195
2½ cwt.	60·9	2,457	4·0	388
5 cwt.	63·0	2,964	4·2	509
7½ cwt.	64·1	3,114	4·4	486
10 cwt.	63·8	3,085	4·3	471

[1] Fertilizers were applied as a split dressing, ⅔ at planting and ⅓ at age 13 years.

There has been a large response to the 2½ cwt./acre dressing and a further large response to the 5 cwt./acre dressing. There has been little additional response to heavier dressings. Current increment is also greatest in the 5 cwt./acre treatment with no additional response to heavier treatments. When growth of individual replicates is examined, it can be shown that the magnitude of the response decreases with increasing site index of the control plot.

An accompanying table illustrates the varying response of Slash Pine to different phosphatic fertilizers. The experiment is established on a mounded low humic gley soil type, which is very acid in reaction. The basal fertilizer contained nitrogen, potassium and copper. All fertilizers were applied as split dressings to individual trees.

EFFECT OF DIFFERENT PHOSPHATIC FERTILIZERS ON MEAN HEIGHT (FT.) OF SLASH PINE AT AGE FOUR YEARS—(Means of 3 replications)

Treatment	Mean Height
Control	3·69
Basal fertilizer only	2·98
Basal + Florida rock phosphate (100 lb./ac. P_2O_5)	7·58
Basal + Nauru rock phosphate (100 lb./ac. P_2O_5)	8·33
Basal + Superphosphate (100 lb./ac. P_2O_5) ..	9·38

From the table it can be seen that there is a slight depression in growth due to the basal fertilizer alone, but there is a large response to phosphatic fertilizer when applied in the presence of the basal fertilizer. The response to Nauru rock phosphate, a finely divided relatively insoluble source of phosphorus (·0012 per cent. water soluble P), has been better than the response to Florida rock phosphorus, an even less soluble source of phosphorus, (·0004 per cent. water soluble P). The best response to age four years has been to superphosphate, which is almost completely water-soluble.

A considerable amount of past work with Slash and Loblolly Pines has been directed towards the development of response curves correlating stand increment with foliar phosphorus levels. This work is aimed at incorporating a crop logging approach to forest management to allow plantations to be maintained near the optimum nutrient levels. Critical levels, defined as the foliar phosphorus concentration associated with 90 per cent. of maximum basal area increment, have been set at ·075 to ·080 per cent. for Slash Pine and ·095 to ·105 per cent. for Loblolly Pine. Over the range of material examined, the critical levels are independent of age, site index and stand density. During the year this crop logging approach was again employed on a routine scale at Beerburrum to define areas of plantations which require refertilizing. The total area of routine plantations now sampled over the past two years is 2,856 acres, 1,828 acres of Slash Pine and 1,028 acres of Loblolly Pine.

As mentioned in the previous Annual Report, work is being carried out investigating the long term nutritional status of the exotic pine nurseries. It is planned to extend this work into the field to test the effect of various nutritional regimes in the nursery on field survival and subsequent growth. The establishment of a 50-acre nursery at Toolara will mean detailed initial soil sampling, followed up by the establishment of detailed long term nutritonal studies.

During the year this section has been involved in the planning and establishment of experiments designed to elucidate the cause of "Yarraman Disease". This disease seriously affects young plantations of Hoop Pine particularly in the Yarraman Forestry District. Symptoms of the disease are severe malformation and twisting of the stem and at times tip die-back and development of multiple leaders. In general the vigour of the trees is good to very good, but the severe twists and kinks will seriously affect log quality. At this stage the disease is suspected to be a manifestation of a nutrient disorder possibly associated with either copper or boron.

A large field sampling programme involving a total of 364 foliage samples plus 182 soil samples from healthy and affected areas has recently been completed. These samples together with a further 364 foliage samples yet to be collected will be submitted for complete chemical analyses.

Several field and nursery experiments have been established at Yarraman, and several experiments commenced in the Beerwah glasshouse. One recently established sand culture experiment designed to catalogue visual nutrient deficiency symptoms of Hoop Pine is already demonstrating the deficiency symptoms of iron, sulphur and nitrogen. In a further glasshouse trial a rapidly growing nutrient sensitive tropical legume (*Phaseolus lathryoides* L.) is being used as a test plant, together with Hoop Pine, in an omission experiment. The initial glasshouse trial, established in April 1970, using soil collected from severely affected areas as well as from healthy areas, is designed to test the effects of nitrogen potassium, manganese and copper at various soil pH levels. Soil pH levels are decreased by the addition of aluminium sulphate and increased by the addition of lime. Marked differences in vigour between treatments are now apparent but the field symptoms of the disease have not yet been produced in the glasshouse.

(iv) *Coastal Hardwoods.*—The work of this section is aimed at increasing productivity from wet and dry sclerophyll forests of coastal south Queensland.

The series of control burning experiments with Blackbutt was commenced during the year with satisfactory burns achieved on the Bellthorpe and Peachester plots. Treatments are nil burning, and burning at two- and four-year intervals. Unfortunately, one Bellthorpe plot was set alight from an adjacent routine burn in July 1970 and fire intensity measurements are not available. Fire intensities for the dry site Peachester plots burnt in April 1971, were high but scorch was not excessive. It is estimated from 3 to 10 tons of fuel per acre were consumed and bark scorch height varied from 15 feet to 30 feet. Burning conditions were ideal with a temperature of around 72° F and relative humidity of 45 per cent. Wind strength was from one to three miles per hour and average rate of fire spread was six feet per minute. It is expected that the wetter site Fraser Island plots will be burnt in winter 1971 and the remaining Peachester plots in winter 1972. Similar experiments are proposed in Spotted Gum forest.

A pot trial was conducted in the Beerwah glasshouse using sand from Types 1 and 2 Blackbutt stands on Fraser Island to test the effect of the addition (in pure form) of nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, and trace elements. No difference in plant growth between soils from each type was detected. Growth responses were obtained to the addition of nitrogen, phosphorus, potassium

and sulphur and to a smaller extent trace elements. The levels applied were equivalent to 2 cwt. per acre urea, 6 cwt. per acre superphosphate, 2 cwt. per acre potassium chloride, 1½ cwt. per acre sodium sulphate and small amounts of copper, manganese, zinc, boron and molybdenum. Optimum levels could not be determined from the design used. The trial indicated that the application of a proprietary NPK fertilizer (containing some sulphur and trace elements as impurities) to enrichment planted Blackbutt stock on Fraser Island should increase plant growth and assist plants in beating competing vegetation. Studies to test field responses are proposed.

In enrichment planting operations, the actual planting may be delayed because of a hold up in 'dozer disturbance or the occurrence of a dry period. When jiffy-pot stock is used such delays are likely to produce tall, somewhat spindly plants, which would transpire rapidly. To determine if jiffy pot stock could be successfully held-over in the nursery for late plantings, Blackbutt seedlings, sown in 2·25 inch diameter jiffy pots in June 1969, were topped back to approximately 6 inches in height when they had reached a height of 18-20 inches and outplanted after rain in November, 1969, on snig tracks in a Blackbutt, Red Mahogany, Turpentine forest. A year later the survival was 96 per cent., and all the plants had developed single stems. Topping is a successful method of checking excessive height growth in Blackbutt jiffy pot stocks.

Following Blackbutt regeneration burns on Fraser Island an assessment is required to ascertain the success or failure of regeneration following the burn. The sampling technique must be cheap and effective enough to enable the sampled area to be divided into areas adequately stocked with regeneration, or in need of enrichment planting.

A milliacre assessment was carried out in September 1969 *over 150 acres of a March 1969 regeneration burn* in Compartment 2 McKenzie Logging Area. Strips were 4 chains apart with circular milliacre plots located at 1 chain intervals along each line. The number of Blackbutt seedlings in each milliacre plot was recorded and plots grouped according to the number of Blackbutt seedlings present. A check of past records of experimental burns indicated that a prediction factor could be applied to these plot groupings which gave a relationship between milliacre stocking in September after the burn and percentage of milliacres stocked two years after the burn. Details are shown in table form.

PREDICTION FACTORS FOR MILLIACRE PLOTS ON BLACKBUTT REGENERATION BURNS—FRASER ISLAND

No. of Blackbutt Seedlings/ Milliacre in September after Burn	Predicted Percentage Milliacres Stocked 2 Years after Burn
0	0
1–3	50
4–9	80
10+	100

Forty milliacre plots of the September 1969 sampling were pegged and regeneration assessed in February 1970 *and 1971, to check the reliability of the prediction factor and* the survival of the Blackbutt seedlings. It was found the 4 x 1 chain milliacre assessment gave a relatively cheap ($0·40 per acre) and effective indication of the success of the regeneration burn. The prediction factor, although conservative in this experiment, would give a satisfactory indication of Blackbutt stocking two years after the burn. This allows definition in September after the burn of the areas to be enrichment planted in the following summer. The overall survival of Blackbutt seedlings was found to be 70 per cent. over the two year period, and the mean height of the tallest seedling in each stocked milliacre was 4·5 feet.

An experiment investigating the effect of understorey on increment of even-aged Blackbutt on State Forest 445 Kenilworth, showed that the removal of Blackbutt coppice *is advantageous to the growth of the Blackbutt crop trees.* Regrowth of scrubwoods, Brush Box and Turpentine following the removal of Blackbutt coppice has had no deleterious effect on growth of the Blackbutt crop trees during the fourteen years under review.

Several provenances of Kamerere have been planted at Fraser Island and Bellthorpe as part of an international *Kamerere provenance trial. The plants were difficult to raise* in the nursery because of their sensitiveness to low humidities. Better results were obtained by sowing direct in jiffy pots rather than by pricking out into tubes. Provenances from New Guinea and the Philippines were planted in deep sands on a Carrol scrub site at Fraser Island and on an open Blackbutt, Tallowwood, Brush Box site at Bellthorpe. Both sites were cleared of vegetation before planting.

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A small pilot trial has been established on a sand mined site at Rainbow Beach north-east of Gympie to test the survival of Blackbutt seedlings, the response to various fertilizers, and the degree of shading afforded by natural regrowth. Following clearing and mining of the Eucalypt-Sand Cypress forest type, the topsoil is returned and regrowth, mainly of wattle species, develops. Blackbutt seedlings were planted under regrowth from 4 feet to 12 feet high. A more comprehensive experiment is planned next year to determine the most suitable tree species, and the most effective establishment techniques to be used for reforestation of sand mined forest sites in the Rainbow Beach-Inskip Point area.

Trial plots covering nearly 18 acres were outplanted in Mountain Logging Area, State Forest 788 Conondale during the year to observe the growth and behaviour of a number of native and exotic conifers and several Eucalypts as plantation species on wet sclerophyll forests in the coastal ranges. Forest types represented in this trial range from rain-forest, through Eucalypt and/or Brush Box forests with *a rain-forest understorey to* Eucalypt and/or Brush Box forests without a rain-forest element in the understorey. Species under test are Hoop Pine, Bunya Pine, Honduras Caribbean Pine, Bahamas Caribbean Pine, Cuban Caribbean Pine, Patula Pine, Radiata Pine, Loblolly Pine, Blackbutt and Gympie Messmate.

An experiment has been laid down in Spotted Gum-*Ironbark forest in the* Maryborough District to test the effect on growth and economic returns of (A) the presently used routine tree marking prescription, involving an average tree spacing of 25 feet x 25 feet with a minimum of 20 feet between any two retained stems; (B) a prescription aiming at 40 feet x 40 feet spacing; and (C) an untreated control. Five blocks, each containing the three treatments, cover a range of Spotted Gum-Ironbark forest types at State Forest 958 Gundiah.

Dalby Regional Research Station

This station carries out research in the White Cypress Pine and hardwood forests in the area west of Dalby and Warwick with an annual rainfall of 20 inches to 30 inches and in rain forests and sclerophyll forests on the Dividing Range, east of Warwick, where the rainfall generally exceeds 50 inches per annum.

An order of priorities for new projects in White Cypress Pine research was drawn up at the beginning of the year and the establishment of a number of experiments in this programme has now been completed. The determination of optimum basal area and spacing for the older Cypress stands was given top priority in this programme and large scale, replicated experiments have now been established at Barakula and Yuleba to permit the determination of these parameters. The standing basal area range covered by the experiments is 25 square feet to 85 square feet per acre as it is considered the optimum basal area level for maximum value increment will lie within this range.

The recent acquisition as State Forest of large areas of Cypress Pine towards the western limits of occurrence of this species has prompted the establishment of plots to determine growth rates and responses to treatment and logging in these low rainfall areas. One such series of plots was established on State Forest 10 Hillside during the year. This area, which is located at longitude 147° 30'E, has a mean *annual rainfall of 20 inches.*

Experiments dealing with the removal of the Bull Oak understorey from White Cypress Pine stands were summarised during the year. It was shown that cutting down or frill-ringing the Bull Oak produced an immediate, and large, growth response in the Cypress Pine. This response tapered off with time and after 6 to 8 years there was little difference *in the current increments* of the treated and untreated plots. The application of 1·0 per cent. 2,4,5-T amine to the cut stumps of the Oak prevented suckering. These plots now carry far less Oak than the treated plots which were not given a weedicide application. However increments over a period of 9 to 11 years since the treatments were applied have been very similar for both treatments. It was recommended that the use of hormone weedicides should be discontinued in the treatment of *Bull Oak as the response* to their application was insufficient to warrant the expenditure involved. It was postulated that the response to the treatment of the Bull Oak understorey was the result of nutrient release from the foliage and stems of the Bull Oak and was not a response to increased water availability for the Cypress Pine.

A trial was carried out to compare the cost of using light weight (8½ lb.) chainsaws in treatment work in Cypress forests with a Bull Oak understorey with the cost of using the conventional axe. The accompanying table shows the cost of frill-ringing all stems greater than four inches in diameter at waist height and cutting the remainder off at waist height, and the cost of doing a similar job six inches above ground level using the axe or the chain saw.

The chain saw costs include maintenance and fuel, but not the depreciation of the machine. It is clear that the use of the chain saw promises considerable cost savings in treatment of Cypress Pine forests.

TREATMENT—COST PER ACRE USING AXE OR CHAIN SAW

Implement	Waist-High Cutting	Low Cutting
	$	$
Axe	8.33	8.76
Chain Saw	3.68	4.65

Trial plantings of three provenances of Northern Cypress Pine and one provenance of local White Cypress Pine were made at Barakula and Inglewood early in 1970. Virtually all the Northern Cypress Pine was killed in the heavy frosts of the 1970 winter, which also killed 30 per cent. of the White Cypress Pine.

Extensive species trials, on a sandy Cypress Pine site at Dunmore which was gutted by fire in 1964, were remeasured during the year. White Cypress Pine was planted in 1965 together with a number of exotic pine species and additional small plantings have been made from time to time. Apart from some light losses in Loblolly Pine, survivals have been good.

In the earlier plantings Slash Pine, Radiata Pine and Loblolly Pine have been the most successful species with mean heights ranging from 13 feet to 16 feet at five years of age. In the later plantings Cuban Caribbean Pine and Bahamas Caribbean Pine are showing promise. Older plantations of Slash Pine and Radiata Pine on sandy sites at Inglewood, where the rainfall is 25 inches per annum, are growing satisfactorily as can be seen from the table.

GROWTH PARAMETERS OF EXOTIC PINES AT INGLEWOOD

Species	Age	Predominant Height	Total Volume Increment	
			Current Annual	Mean Annual
Slash ..	23	68 ft.	98 cu. ft.	76 cu. ft.
Radiata	15	52 ft.	124 cu. ft.	132 cu. ft.

Moonlight cactus (*Eriocereus tortuosus*) is a noxious weed which occurs over an area of about 20,000 acres on State Forest 154. An experiment was established during the year to determine the effect of the application of several concentrations of 2,4,5-T.P. through a portable misting machine to dense patches of the cactus. A complete kill of the above-ground portions of the plants was achieved within two months of treatment with a 5·0 per cent. solution of the chemical, which was applied until the surface was visibly coloured by a dye incorporated in the solution. Though it is not anticipated the tubers will be killed, this is a rapid and effective method for preventing seeding in densely stocked areas.

Inland Spotted Gum research continued as an extension of the coastal programme since the management of inland Spotted Gum forests is based on the same techniques which apply to the coastal forests, with some modifications to allow for the harsher climatic conditions encountered. An experiment was established during the year to determine the effect on the increment and regeneration of this species of using very wide spacings in treatment and logging prescriptions. The wide spacings allow retention of only the best trees and it is expected that the increased value increment put on by these stems, together with the development of more regeneration in the gaps, will more than compensate for the loss of total volume which will occur.

Work was commenced on an experiment to study the relationship between Cypress Pine and Spotted Gum where they occur in mixed stands. This is a complex problem because of variations in stand composition which can be encountered. Protection of the Spotted Gum forest from fire has allowed the Cypress to invade these stands and prolific regeneration of the Cypress has occurred over large areas which were originally pure Spotted Gum forest. The experimental programme in these mixed forests will aim at defining the competition effect of one species on the other. This will allow prescriptions to be drawn up which will favour the more valuable species but which will also take full advantage of the current stocking of both species.

Species trials in the Gladfield area on the Great Dividing Range, near Warwick, were continued during the year with the outplanting of two replications of the Hoop Pine provenance trial, together with further native and exotic species, on a cleared rain-forest site.

Extensive trials have been carried out in this high altitude, high rainfall area over the past five years, with native and exotic species being planted in either the rain-forest or sclerophyll areas, which comprise the two main forest types of the region. A number of species have grown rapidly in open plantations on both sites, although increment is smaller on the sclerophyll sites where the original vegetation was mainly Sydney Blue Gum, Killarney Ash and Tallowwood. Some growth figures are given in table form.

MEAN ANNUAL HEIGHT INCREMENTS OF EXOTIC PINES AT GLADFIELD IN FEET

Species	Rain-forest		Sclerophyll	
	Age	Increment	Age	Increment
Radiata Pine ..	4½	6·06	3½	1·45
Loblolly ..	4½	4·23	3½	2·34
Patula Pine ..	4½	5·15	3½	2·35
P. tenuifolia ..	4½	3·29	2½	1·36

Underplanting trials have been carried out on the rain-forest sites, with Hoop Pine, a native to the area, being the most successful species. Good growth has been obtained where non-commercial trees in the canopy were thinned to leave only 25 per cent. cover, but this was associated with severe damage to the young trees through falling limbs. All underplants required frequent tending for at least the first five years and the density of the weed growth increased with thinning of the overstorey. It was concluded that underplanting in openings following logging of commercial species will give an acceptable stocking and growth rate with a minimum of site disturbance on these high altitude rain-forest areas.

Imbil and Yarraman Research Stations

These stations are concerned mainly with research into the establishment and maintenance of plantations of Hoop Pine and other species in rain-forest sites in south-east Queensland. Imbil, with an annual rainfall of 45 inches represents the warmer and wetter Hoop Pine plantation areas, while Yarraman, with an annual rainfall of 32 inches represents the drier and colder inland sites.

(i) *Plantation Silviculture.*—Last year it was reported that ammonium sulphate had been applied to beds in the Imbil nursery carrying non-vigorous eleven month Hoop Pine seedlings, the added nitrogen ranging from 50 lb. to to 200 lb. per acre. These plants were graded early in the report year. Cull percentage increased with the amount of nitrogen added, this being caused mainly by stem malformation. There was a small response in height growth to the added nitrogen.

Trials were commenced in Imbil and Kenilworth nurseries to investigate substitutes for cow manure in maintaining nursery fertility and soil structure. The readily available organic materials Hoop Pine sawdust and fowl manure are on trial in addition to various inorganic dressings. Fertilizers were used in an attempt to correct stunted and chlorotic plant development in some beds in the Yarraman nursery and a curled needle disorder in other beds. The fertilizers were not successful in correcting the disorders.

Previous work has shown that bromacil applied at less than 1 lb. per acre, about four months after sowing, effectively controls weeds in Imbil nursery with little adverse effect on the development of the Hoop Pine seedlings. The use of bromacil in the Kenilworth nursery, where a wider spectrum of weeds occurs, has given variable results. Further trials with bromacil were initiated at Kenilworth during the year. It appears that the main weed problem at Kenilworth is encountered between November, the time of sowing, and the following March. Trials are being planned for the coming year to investigate weedicide treatments made before the Hoop seed germinates.

Increasing interest is being shown in the possibility of utilising excessively large nursery stock by cutting the plants back. In a preliminary trial seventy nursery plants were cut back in May, some to 15 inches and some to 20 inches. Subsequent development of these plants will be observed.

After the 1970 winter, checks were made in the Yarraman District on frost damage to Hoop Pine planted between the frost line as defined by Pegg and the outer confidence line as defined by Pegg and also on the frost damage outside this outer confidence line. There was negligible damage to Hoop Pine, in the previous three years' plantings, outside the outer confidence line. There was moderate frost damage to Hoop Pine planted between the frost line and the outer confidence line in the 1967-68 plantings, but not in the two later plantings. Evidence is growing that in the Yarraman District the two frost lines defined by Pegg are satisfactory for separating areas which will be frosted, areas which are likely to be frosted only in cold years and areas which will not be frosted. However, they are not necessarily applicable to areas outside the Yarraman District.

Last year it was reported there had been a marked response by Hoop Pine to the application of ammonium sulphate on a Eucalypt site at Imbil. A further dressing was given in the spring of 1970. There has been a continued response to added nitrogen up to 54 lb. per acre, but no additional response to higher levels of nitrogen. The responses have been inadequate to recoup the cost of fertilizing.

A determined effort was made this year at Imbil to establish clearly the effectiveness of diuron, applied as a mist prior to weed germination, in controlling weeds in the field. Experimental design consisted of 50 pairs of milliacre plots on each of two blocks of one acre. One plot in each of the pairs was covered with polythene sheeting. One block was misted with diuron at 1 lb. per acre in four gallons of water. The other block was not misted. The covered plots in the misted block served as unmisted controls whilst those in the unmisted block checked on any effect on weeds of covering the ground for some hours. Weed counts are shown in accompanying table.

WEED COUNTS ON PLOTS MISTED WITH DIURON OR COVERED WITH SHEETING OR UNCOVERED AND UNMISTED. TOTALS OF 50 MILLIACRE PLOTS

Weed Species	Misted with Diuron		Not Misted	
	Uncovered	Covered	Uncovered	Covered
Inkweed ..	124	362	382	374
Wattle	103	133	102	87
Peach	20	54	94	79
Tobacco ..	24	26	42	80

The misting with diuron has substantially reduced the number of germinants in inkweed and peach and possibly in tobacco. It has had a negligible effect on germination of wattle.

This and earlier experiments have shown that pre-plant misting with diuron will have very limited application in routine tending because of the following restraints. It will be effective only where there is a heavy weed potential, because of the poor distribution of the chemical when applied as a mist. This limits its use to good scrub sites and then only in good seasons. Its effectiveness decreases in areas where wattle is prevalent. It should be considered only as an auxiliary treatment to misting with hormone weed-killers, for use under circumstances where a delay in planting, until the weeds have germinated, is to be avoided.

Two new formulations of 2,4-D and 2,4,5-T, known as dacamines, were tested for their ability to control weeds following scrub burns, when applied as a mist. They were found to be very effective in controlling inkweed and peach, even when applied at only 8 oz. of each per acre. However, they were relatively ineffective in controlling wattle, even when applied at twice this rate. A pilot trial was also conducted testing the effectiveness of the invert emulsion "brushvert", used as a post-plant spray to control weeds in Hoop Pine plantations. It proved to be more effective in controlling wattle than the currently standard 2,4,5-T ester applied at equivalent strengths. The economics of the use of this herbicide will have to be investigated because of the requirement of diesel in the mixture. The emulsion is not easily applied through the normal knapsack nozzle and tip assembly, and other mixtures and equipment will have to be tested.

Twenty-two experiments have been established in the field at Yarraman in an effort to elucidate the cause of Yarraman Disease. A brief description of the disease and an account of laboratory and glasshouse work carried out at Beerwah in connection with the disease is included in the report of the Nutrition Section, Beerwah Research Station. The percentage of malformed stems has increased with each successive planting since 1964-65 and there is no indication that older stems are outgrowing the trouble. The only conclusive evidence from the experiments to date is negative. The problem is not viral. It is not induced by applications of biocides nor by inducing fast growth rates by irrigation or weed-control. It is not overcome by decapitation or form pruning of malformed stems and continues to develop on stems replanted in affected areas.

Indications to date point to some nutrient imbalance, possibly quite complex, which may be aggravated by seasonal conditions. A series of nutrition studies is in progress in the field, in the nursery, in Beerwah glasshouse and in the laboratory. The field nutrient trials include a copper-boron-sulphur factorial design, a trial to gauge the response to various forms of copper application and a trial designed to assess the effect of varying soil pH by the addition of lime or aluminium sulphate. One trial has indicated some response in form to foliar application of copper. It is a small trial and one hesitates to place much weight on the observation.

Considerable thought was given to the thinning treatments to be applied in the large scale experiments at Imbil designed to establish the most satisfactory thinning prescriptions to be adopted in the select fraction of the stand. The experiments seek to clarify the effect of competition between select stems in stands of site index 75, 80, 85 and 90. In three of the treatments the direction of thinning from 140 stems per acre to 110 stems per acre will be varied. One prescription aims to achieve thinning largely from above to favour 80 well spaced final crop trees while another prescription will provide for thinning almost completely from below. The third prescription will be intermediate. There will be a control treatment where no thinning will be done. The fifth treatment will be a mechanical treatment aimed to achieve a uniform stocking throughout the stand. In each small unit area the number of stems to be retained will be prescribed and removals will be decided rapidly on silvicultural grounds with little note being taken of trees outside the unit area being considered. Single tree increment studies will be carried out with a view to establishing a model relating individual tree growth with measures of competition. Thinning will commence in this series of experiments in winter 1971.

Trees on five acre plots in stands of about 35 years of age of high and low site quality at Yarraman and Benarkin have been segregated into the following stand fractions—unpruned stems; pruned stems to be removed in thinning from 160 stems per acre to 120 stems per acre; pruned stems to be removed in thinning from 120 stems per acre to 80 stems per acre; 80 final crop stems. One stem is felled in each inch girth breast high class 32 inches and above, in each stand fraction on each plot. Sawing studies to determine relative value of stems in the different stand fractions are carried out in the departmental sawmill. Two plots were handled in this way during the report year.

In 1969 plots were established at Imbil to test the effect of heavy thinning and heavy fertilizing on recovery of stands ravaged by the Hoop Pine branch pruner (*Coptopterus decoratus*). About one ton per acre of N.P.K. fertilizer has been applied since 1969 to the fertilizer plots. This has resulted in a marked improvement in crown density and a substantial increase in basal area increment, particularly on the more heavily attacked plots. It is too early to draw any conclusions as to the effect of thinning on the incidence of the attack.

Investigations into the pathological problems of root rotting fungi in Hoop Pine plantations have been intensified and in all there are now 10 observation plots in Imbil sub-district and three in the Gympie sub-district at Mary's Creek each about 0·25 acres in area. Since establishment in April 1970, the plots have already demonstrated the spread of the fungus, *Fomes noxius*, that is occurring in some areas of young plantations. In plot 3, seven additional trees have been killed by root rot in the past 12 months. In the same period three trees have died on plot 4, two trees on plot 2 and two trees on plot 5. In the other plots the position is stabilised and no further deaths have occurred. *F. annosus* has been recorded on Hoop Pine stumps in several different localities in the Imbil area, but there is no evidence to suggest that it is pathogenic to Hoop Pine.

Work continued through the year on the Red Cedar plantation established at Imbil in October, 1969, to test the cost of obtaining 20 feet log lengths by controlling the twig borer by fortnightly spraying with 0·05 per cent. endrin during the period in which attack is likely. Parts of the plantation were severely frosted in 1970 and again in 1971. There have also been drought losses. However, on part of the area the Red Cedar has grown well and here, at age 20 months, the average height was 12 feet with a maximum of 17 feet. Twig borer attack was well controlled by the spray treatment until the trees exceeded 15 feet in height, but the spray has been ineffective beyond that height. The cost of spraying has been $260 per acre. This is a prohibitive cost and fortnightly spraying with endrin cannot be recommended as an economic method for establishing Red Cedar plantations with a reasonable log length. A small trial is now in progress to study the possibilities of using systemic insecticides to control the twig borer in Red Cedar. Effective control has been obtained over the first eight months with 0·05 per cent. azodrin. The application of azodrin is much cheaper than the application of endrin.

Further trial planting were made in forest areas in the Yarraman district. Species planted included Benguet Pine, Ocote Pine, Bahamas Caribbean Pine, Pringles Pine, Scrub Pine, Sugi and *Pinus taiwanensis*. The most promising species in earlier trials on forest sites have been Bahamas Caribbean Pine, Radiata Pine, Patula Pine and Loblolly Pine.

(ii) *Tree Breeding*.—During the year a review was made of the status of all Hoop Pine trees selected for tree improvement purposes since the program began in 1957. An inventory of the superior trees available in each region and of those represented in progeny tests up to 1971 are given in an accompanying table. This shows that 875 superior trees, in two classes, have been selected in 28,800 acres of plantations, aged 15 to 35 years. The 233 "plus" trees constitute the base population in the current, first cycle of selection, controlled breeding, and establishment of F_1 progeny. This base can be enlarged in the future, if necessary, by drawing on the large pool of 642 "seed trees" that have been marked, graded and mapped, and/or by further selection in additional areas of "wild" plantations.

Families from about one half of the "plus" trees have been established in progeny trials. But only 48 of the 233 "plus" trees have been control pollinated, although more than 240 full-sib families have been produced and planted since this work began in 1960. Consideration has been given, therefore, to the application of mating designs which will more effectively generate a second base population of largely-unrelated families of high genetic quality for future selection. A disconnected single-pair mating design combined with polycrossing was employed with 26 new "plus" trees at Imbil in 1970-71.

INVENTORY OF SUPERIOR HOOP PINE TREES SELECTED IN EACH REGION SINCE 1957 AND THOSE REPRESENTED IN PROGENY TESTS STARTED BY 1971

Region	Area Searched (Ac.)	No. of[1] "Plus" Trees	"Plus" Trees in Tests		No. of[2] "Seed" Trees
			Open-Poll.	Control-Poll.	
Gympie ..	12,000	110	59	33	330
Yarraman	12,000	75	40	15	128
Murgon ..	3,500	35	Nil	Nil	138
Monto ..	1,300	13	6	Nil	46
Totals ..	28,800	233	105	48	642

(1) These are the best trees available; 110 of them are represented in open—or control-pollinated progeny trials, and 65 are contained in two clonal orchards started in 1965 and 1970.

(2) These are additional superior trees, but they have been graded as of lower phenotypic quality.

Since 1962 the 106 of the "plus" trees considered to be the best have been scored carefully in the field for relative vigour and stem form, and wood samples from them have been studied and scored for several properties. As a result, 20 trees judged best from the Gympie region were established in a clonal orchard started at Imbil (Gympie region) in 1965. A further 45 trees from the other regions and 6 Gympie trees have been included in an orchard started at Taromeo (Yarraman region) in 1970. The Imbil orchard yielded seed in 1969 (48 lb.) and 1970 (150 lb.), mostly resultant from hand pollination. Hand pollination was necessary as the orthotropic, grafted ramets of Hoop Pine do not produce pollen effectively until about 10 years after grafting.

Further good progress was made in the grafting of the Taromeo seed orchard. Grafting of the 30 early-flowering clones is now complete, except for four clones which are showing symptoms of "early-incompatibility" (that is, successful "take", profuse bud development, but failure of the buds to produce a vigorous shoot). These will be replaced. During the year, 21 clones were selected for inclusion in the late-flowering section of the orchard. Fifteen of these were selected from the Murgon and Monto districts, and six are clones previously included in the Imbil seed orchard. Grafting of all 21 clones commenced during the year. Some 993 grafts were made, and 99·6 per cent. of these have taken successfully. Forty-seven per cent. of the grafting required in the late-flowering section of the orchard is now complete. Grafting of pollinator grafts in the early-flowering section has recently been commenced. In the Imbil seed orchard, the first significant crops of male flowers were produced in 1970 on pollinator grafts, as well as on orthotropic grafts of six of the 20 clones grafted in the orchard.

Several progeny trials have been established since 1963. This year one study of 19, wind-pollinated families and routine (control) stock at Imbil was assessed for stem straightness and measured for height and girth at age 7·5 years. The results for one section of the trial, comprising 10 known families and routine stock, are summarised in the accompanying table.

FAMILY MEANS FOR TRAITS ASSESSED IN A 7·5 YEAR, OPEN-POLLINATED PROGENY TRIAL OF HOOP PINE

Family No.	Mean Girth	Family No.	Mean Height	Family No.	Frequency (%) Straight Trees
H16*	15·01	H16*	30·0	H29†	63·4
H17	14·53	H17	29·9	H 6	62·2
H 6	14·38	H 6	27·8	H17	54·7
260	14·29	260	27·8	HK	54·2
H 5	13·85	H 5	25·8	H 5	47·3
H20	12·85	HK	25·5	H16	43·1
H23	12·78	H23	25·4	H20	42·3
H29	12·77	H20	25·1	H28	33·1
HK	12·11	H28	24·6	H23	32·5
H28	11·73	H29	23·9	260	27·2
Rout.	10·74	Rout.	20·0	Rout.	5·6

† Vertical bars encompass means not significantly different from one another at the 0·01 and 0·05† significance levels.

The results show that all 10 open-pollinated families were significantly superior to the routine (control) stock in girth, height and stem straightness. There were significant differences among families too, with family H6 being marginally the best for a combination of the traits assessed. Interestingly, H6 is the only parent included in both this section of the trial and in the clonal seed orchard started at Imbil in 1965. In the other section of the trial, comprising 9 selected families and routine (control) stock, 8 families were superior to the control in height and straightness, but there were no significant differences between entries for girth. The best family was H12. Although tree H12 is not included in the first Imbil seed orchard, some of its progeny may have a place in a future orchard. These pleasing results confirm the policies of mass selection (to secure early modest gains), and of individual selection coupled with various forms of pollination control (to secure larger gains in the future through seed orchards and recurrent selection schemes).

A new progeny trial comprising 33 full-sib families and three routine (control) lots was planted using a 6 x 6 lattice design with 6 replicates of 10-tree line plots at each of three locations.

A major activity this year was establishment in the field of a comprehensive study of geographic variation in Hoop Pine. Collection of seed from 45 locations ranging from New South Wales, through Queensland to New Guinea, was carried out in 1966, 1967 and 1968. Sowing in nurseries commenced in 1968, and stock was ready for outplanting commencing in November 1970. Establishment of the study is spread over two planting years, and the work planned for the first year was carried out in 1970-71 with very few problems.

For the study, 25 seed sources were chosen to represent the full range of Hoop Pine, and they were planted out at each of eight locations in south Queensland and two locations in New South Wales. Establishment in New South Wales was carried out by officers of the New South Wales Forestry Commission. At each location the field design is a 5 x 5 partially balanced simple lattice. Provenance plots consist of six trees from each of six open-pollinated families interplanted in a random arrangement, and with parentage of individual plants recorded. In one subsidiary study 20 provenances, including 18 not planted in the main trial, are planted at two locations in a 4 x 5 incomplete block design. In a second subsidiary study 100 individual families from nine seed sources are planted in single-family plots in a 10 x 10 partially-balanced, simple lattice design. A special study of potentially frost-hardy provenances and families was also established.

During the year analysis was completed of a study of the effects, from a tree breeding point of view, of the disorder currently known as "Yarraman Disease." The disease has been causing malformation and leader defects in recent years, particularly at Yarraman. It appears that the occurrence of the disease may have little impact on the breeding programme, because it was shown that the fastest growing families were least affectetd by the disease.

Optimum conditions for storage of Hoop Pine pollen are being investigated in a long-term study. Pollen was stored in desiccators in a refrigerator, and a range of relative humidities was maintained by a drying agent and by sulphuric

acid solutions. Optimum relative humidity for up to three years of storage appears to be 15 per cent. The investigation is continuing, using saturated salt solutions rather than sulphuric acid to maintain known relative humidities.

Mensuration and Biometrics

With the return of one officer from overseas study, and the appointment of another biometrician, a full biometrical service is again available to field research stations, and other branches of the Department, principally Forest Products Research, Forest Resources and Silviculture.

During large scale trials of fertilizer application in young plantations, using an aircraft fitted with improved distribution apparatus, sampling was carried out to determine the amount of fertilizer reaching the ground and local variations in the rate of application. Considerable importance is attached to the quantity received by each tree, and part of the work involved a two-stage sampling scheme with the 9 feet square area occupied by each tree as the primary unit. The overall catch of 200 ± 9 lb. per acre was very close to the planned figure, but variation between squares was much greater than that within squares. However, 80 per cent. of the squares received at least 150 lb. per acre and 95 per cent. at least 100 lb. per acre. Sampling has also been carried out in exotic plantation areas aerially sprayed for weed control, covering effects on both weed species and pines. The design of a scheme for soil sampling in the new Toolara nursery, to permit monitoring of nutrient levels, was completed. Advice on sampling procedures was given in relation to standards for preservative treatment of timber.

Initial measurements of the large Hoop Pine provenance trial have been made and preliminary processing of the data carried out. Development of the program to be used in the analysis of this experiment is well advanced. The Taromeo seed orchard design was extended to include the late flowering section and the location of the pollinator grafts.

The Imbil Hoop Pine volume table was revised to provide a consistent set of tables for use in integrated logging sales, where volumes are now required to top diameters of 3, 4 and 6 inches underbark, and between 6 inches and 3 inches diameter. These are derived from the following equations:—

$$V3 = 0{\cdot}5841 + 2{\cdot}3058A - 0{\cdot}03946H + 0{\cdot}38700\,AH$$
$$V3\text{–}V4 = 0{\cdot}2663 - 0{\cdot}004765/A + 0{\cdot}001064H/A$$
$$V3\text{–}V6 = 0{\cdot}7676 - 0{\cdot}04841/A + 0{\cdot}01162H/A$$

where V3, V4 and V6 are volumes in cubic feet to diameters of 3, 4 and 6 inches underbark respectively, A is basal area in square feet and H is predominant height in feet. The 4 and 6 inch tables are obtained by subtraction. Checks were applied to current volume tables as required. An address on the construction and application of the Department's volume tables, as used in sales of plantation thinnings, was given at a meeting of the Queensland branch of AUS.T.I.S. A preliminary volume table based on log length and small end diameter was prepared for Hoop Pine, but the effect of predominant height on this volume is being investigated in detail before the final table is issued.

Revised standing tree value equations were developed for Hoop Pine, Blackbutt and Cypress Pine. These are used in comparisons of experimental treatments, but the relationships may be markedly affected by changes in log price structure. In the case of Blackbutt, the production of a standing value equation from a set of log prices for a given depot has been fully automated.

Development of a general g.b.h.-height relationship for Cypress Pine is in progress, including an examination of the effect of site, locality and stand factors. It is hoped to reduce the necessity for frequent measurements of total height of all trees in experiments and detailed yield plots, when extension of volumes is required.

Processing of experiment remeasures continues to occupy an important place. Enhancements have been made to existing programs and a new program developed to provide long term increment summaries. As the preparation of old measurements for inclusion in the system advances, data are becoming available for revision of site index and basal area increment relationships. The program used by Forest Resources Branch for basic calculations in plantation yield plots was rewritten in a greatly expanded form and a new data validation program prepared. These use the same data layout as experiments. Only a limited amount of further work has been done on the system for processing North Queensland rain-forest yield plots. Extraction of old measure data is well advanced and this has revealed a number of additional problems. Once these have been resolved, punching of data can commence.

The final version of the rain-forest key has been produced following checking and correction of existing data, field testing and inclusion of additional data. Three hundred sets of cards have been reproduced and titled and issue of the key now awaits the completion of the accompanying booklet.

A small but unusual project was a program to provide a graphical display of seasonal bird song frequency from data recorded by National Parks Branch.

A FORTRAN programming course was conducted to provide an introduction to computer use for a number of officers of Forest Research, Forest Products Research and Forest Resources Branches.

FOREST HYDROLOGICAL RESEARCH—NORTH QUEENSLAND

The main function of this work is to investigate the influence of forest vegetation on the water resources and to arrive at methods of forest management which will maintain soil and water values at a high level.

The sedimentation experiment in Scrubby Creek catchment R.194 which commenced during 1968-69 is continuing. This is planned to test the effectiveness of special conditions in the timber sale agreements in maintaining the domestic water supply free of sediment during and after logging operations. Logging of the catchment commenced during September 1970 and ceased in mid November due to the onset of storms. During this period approximately 194,000 super. feet of log timber were removed.

The 1970-71 wet season was marked by early storms and protracted heavy rain lasting until late April. The first rain caused very high levels of suspended sediment in the stream as measured at the sampling point adjacent to the water supply intake. Levels of up to 3,200 parts per million (p.p.m.) were measured during each stream rise from late December until mid January. This is ten times greater than pre-logging levels. The bulk of this sediment appeared to be derived from a birdge which had been constructed just above the main sediment sampling station. A second sampling station was installed upstream of the bridge early in February in an attempt to determine the exact contribution of the bridge to the sediment load in the stream. However, by this time sediment levels during heavy rains had dropped to 300–400 p.p.m. because the loose easily removed soil was washed into the streams by the first few heavy rains leaving more compacted surfaces which are less prone to erosion by running water. For the remainder of the wet season sediment levels remained below 420 p.p.m. and there was little apparent difference in levels above and below the bridge.

The results to date have confirmed the conclusions drawn from earlier sedimentation investigations, viz., that the bulk of the suspended sediment in streams is frequently derived from a small number of sediment source areas such as poorly located roads, snig tracks and log ramps.

Measurements continued in the experiment to investigate the nature of water use from different aged Hoop Pine plantations, from rain-forest and from tropical pastures on the Atherton Tableland. This involves the routine measurement of soil moisture levels to depths of nine feet in each of the vegetation types, using a neutron soil moisture probe and scaler. During the year throughfall plots were established at each of the sites to assist in apportioning the incoming precipitation to either interception or soil moisture storage. In an environment such as occurs on the Atherton Tableland where a large proportion of the precipitation occurs as low intensity long duration falls (drizzle), a significant amount is held in the tree canopy. No conclusions have yet been drawn regarding the relative water usage by the different vegetation types.

The experimental catchment project east of Babinda to investigate the hydrological consequences of converting lowland rain-forest to pastures is continuing. Considerable effort was expended early in the wet season to obtain a stage height-discharge relationship for each of the measuring weirs. Some improvement resulted in the rating curve and it is quite acceptable in the low flow range, but current meter gaugings are still required for the high flow range. The meteorological instrumentation was further strengthened during the year by the installation of a Digital-Event Recorder with rainfall and evaporation transducers. These instruments, which were purchased from a $2,200 equipment grant from the Australian Water Resources Council, will allow extremely accurate measurements of rainfall and evaporation to be made.

Soil moisture access holes to a depth of ten feet were constructed during the year and these will allow soil moisture changes to be followed with the neutron probe. Throughfall plots were also established in each catchment so that the interception portion of the water balance can be determined. Logging commenced in one of the catchments in June 1971 and it is hoped that sufficient data have been accumulated to allow the effects of this operation to be determined.

Measurements are continuing in a study of the effects of prescribed burning in Eucalypt forest near Atherton. Experimental burns were carried out on four of the plots during 1970. The general trend of past years was repeated, viz., surface runoff from the burnt plots showed a marked increase from the first few rains of the wet season, but this increase diminished in magnitude as the ground cover recovered.

NATIONAL PARKS

Administration of both Forestry activities and National Parks by a single authority is unusual. Despite some early misgivings on the part of conservationists, it has proved successful in Queensland and the management of the park system has received praise from informed overseas visitors able to assess the work in terms of international standards. This success has undoubtedly been a direct result of the calibre of the men who framed the basic policies and guided the development of the National Park system through its formative years.

The 31st December, 1970, marked the end of what may well prove to have been the most important era in the history of Queensland National Parks. With the retirement on that day of Mr. W. Wilkes direct control of the parks passed from the hands of the last of four men who together were responsible for administering the parks from the commencement of active work in them in 1937. Mr. Wilkes joined the Department in 1921 and as Secretary was directly responsible for administration of the parks from 1954 until his retirement.

In paying tribute to "Mr. National Parks" as he was affectionately known in Government circles, it is appropriate to recall the names of the three officers with whom he was associated in park administration; The late Mr. C. J. Trist, Secretary from 1921–1954; his brother Mr. A. R. Trist, Deputy Conservator from 1947–1964 and Conservator from 1964–1969; and Mr. V. Grenning, Conservator from 1932–1964. These four men shared a deep and abiding love for the Australian bush and their wisdom and their dedication to the National Parks concept have given Queensland the basis of a parks system of which its people can be justly proud and which provides a clear lead to future administrations.

Expenditure

An amount of $274,157 was spent on National Parks work in Queensland during 1970-71. This amount is not large but is very effectively used because the work is done within the framework of the Forestry Department. It has been estimated, through services supplied by various sections of the Department and by savings in overhead charges the value of this expenditure is increased by some $100,000, while to provide these services as an independent organisation at least double that amount would be necessary.

New Reservations

The following new reservations were proclaimed during the year ended 30th June, 1971:—

(*a*) NATIONAL PARK 2, GALAH—This park was gazetted on 24th October, 1970, over an area of about 7,260 acres in the parishes of Korugan and Galah north of Hughenden and embraces the Porcupine Creek Gorge. The gorge is quite spectacular with sheer walls rising 400 feet or more from the bed of the creek. Within the gorge are permanent water holes and a vegetation richer than on the surrounding plains. The area is of scientific interest in its fresh-water and fossil faunas.

(*b*) NATIONAL PARK 1324, DINDEN—Gazetted on 5th June, 1971, this area of about 1,200 acres includes the Davies Creek Falls near Mareeba. Davies Creek has a year-round stream flow and the falls, over 300 feet in height, provide the spectacle of water cascading over huge granite boulders.

Several attractive picnic sites with small swimming holes are located on both sides of the creek downstream from the falls. Away from the creek the Park is steep rough open Eucalypt country.

(*c*) NATIONAL PARK 142, COOK—Gazetted on 12th December, 1970, this Park covers an area of about 1,220 acres being the former Timber Reserve 142, parish of Cook. The main topographic feature is Mt. Cook, a granite hill of 1,423 feet named after Captain James Cook, and situated about one mile south of Cooktown Harbour. This Park therefore has historical significance as well as ecological importance and will preserve a small portion of the country and coastline south of Cooktown as it was when Cook first saw it.

Mt. Cook and Grassy Hill are both featured in the drawing, the first known landscape of Australia, by Francis Parkinson, the young artist who accompanied Cook on the "Endeavour".

Additions to Existing Parks

Additions totalling 133 acres have been made to various parks during the year.

Area of National Park Reservation

As at 30th June, 1971, there were 273 National Parks covering an area of approximately 2,472,494 acres.

Tropical Lowlands

The position with respect to the 20 reserve proposals selected by C.S.I.R.O. was outlined in the previous annual report when it was stated that four areas were still under consideration. As a result of further inspection and discussion with local authorities during the year, the way has been cleared for reservation action for three of these and it is anticipated that these will be finalised during 1971-72.

Rain-Forest Survey, South-East Queensland

A joint survey of remaining rain-forest areas in South-East Queensland was continued with the co-operation of officers of the C.S.I.R.O. Rain Forest Ecology Section. This work is proceeding at a slower rate than is desirable because of the limited time which the C.S.I.R.O. staff can devote to it. The urgency of the work is continually highlighted as it progresses by the fact that most of the areas so far examined that are likely to prove of biological significance are under threat of destruction from various sources.

It is the intention of the survey to classify rain-forest areas on the basis of species composition and structural features and ultimately to make recommendations for reservation of viable samples of each significant type. Ecological information obtained during the survey is being recorded on an objective and systematic basis and the final analysis of it will be made using computer techniques developed by C.S.I.R.O.

Survey of Coastal Lands

In May, field work was commenced on a systematic survey of coastal areas from Tweed Heads to Cape Melville with the object of defining areas of coastline and adjacent lowlands with outstanding scenic and scientific significance which have major recreational interest to present or future generations.

Earlier work south of Bundaberg, together with the work done in this survey completes the field examination of coastal areas from Shoalwater Bay to the New South Wales border and although specific proposals for this region were not formulated during 1970-71, this will be done early in the new financial year.

The survey disclosed that opportunities for reservation of the coastline have decreased greatly in recent years and stressed the need for early action if a system of significant parks is to be obtained in this region. In many cases desirable areas are now available only by repurchase and future generations will have to face this cost.

Marine National Parks

As mentioned in the introduction, the Forestry Act has been amended to provide for the establishment of Marine National Parks in waters under the jurisdiction of the State of Queensland.

This is an important step forward in the field of conservation. To quote the Minister for Lands from the final paragraphs of his first reading speech:

> "It recognises the need for the application of additional conservation measures to offshore areas, and it recognises the recreation potential and the scientific and historic values which exist in such areas.
>
> In essence it recognises the immeasurable value of our National Parks and opens up new horizons to them."

As yet very few maritime countries have extended their conservation philosophy to the sea and its inhabitants. Where action has been taken, the emphasis has been very largely on coral reefs and early moves in Queensland will be similarly directed. However it is intended to include such diverse habitat types as mud flats, mangroves and rocky shorelines in the Marine Park system.

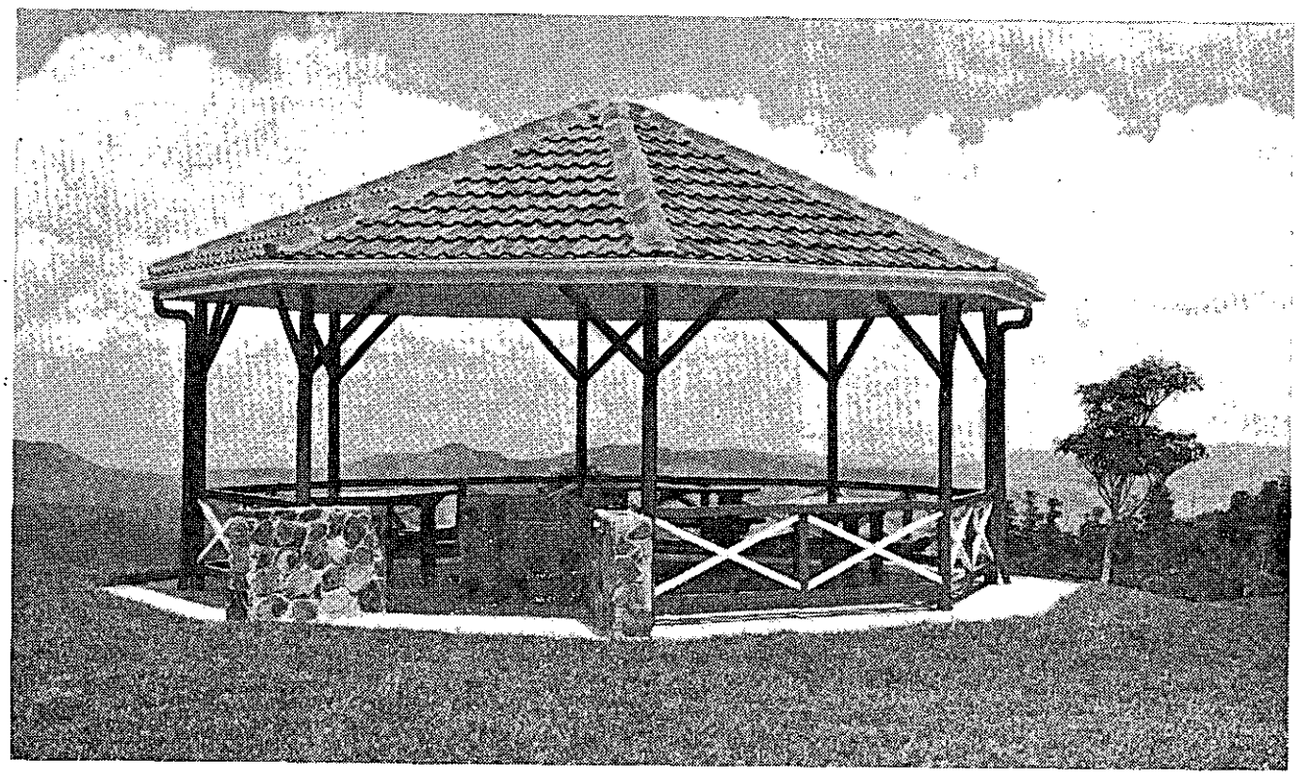
The National Parks Zoologist, Mr. P. Ogilvie, whilst inspecting National Parks in eight African countries during his recreation leave, was provided with the opportunity to visit existing Marine Parks in South Africa and Kenya and to discuss future moves in this field with the Park Services in Tanzania and South-West Africa.

Definition "National Park"

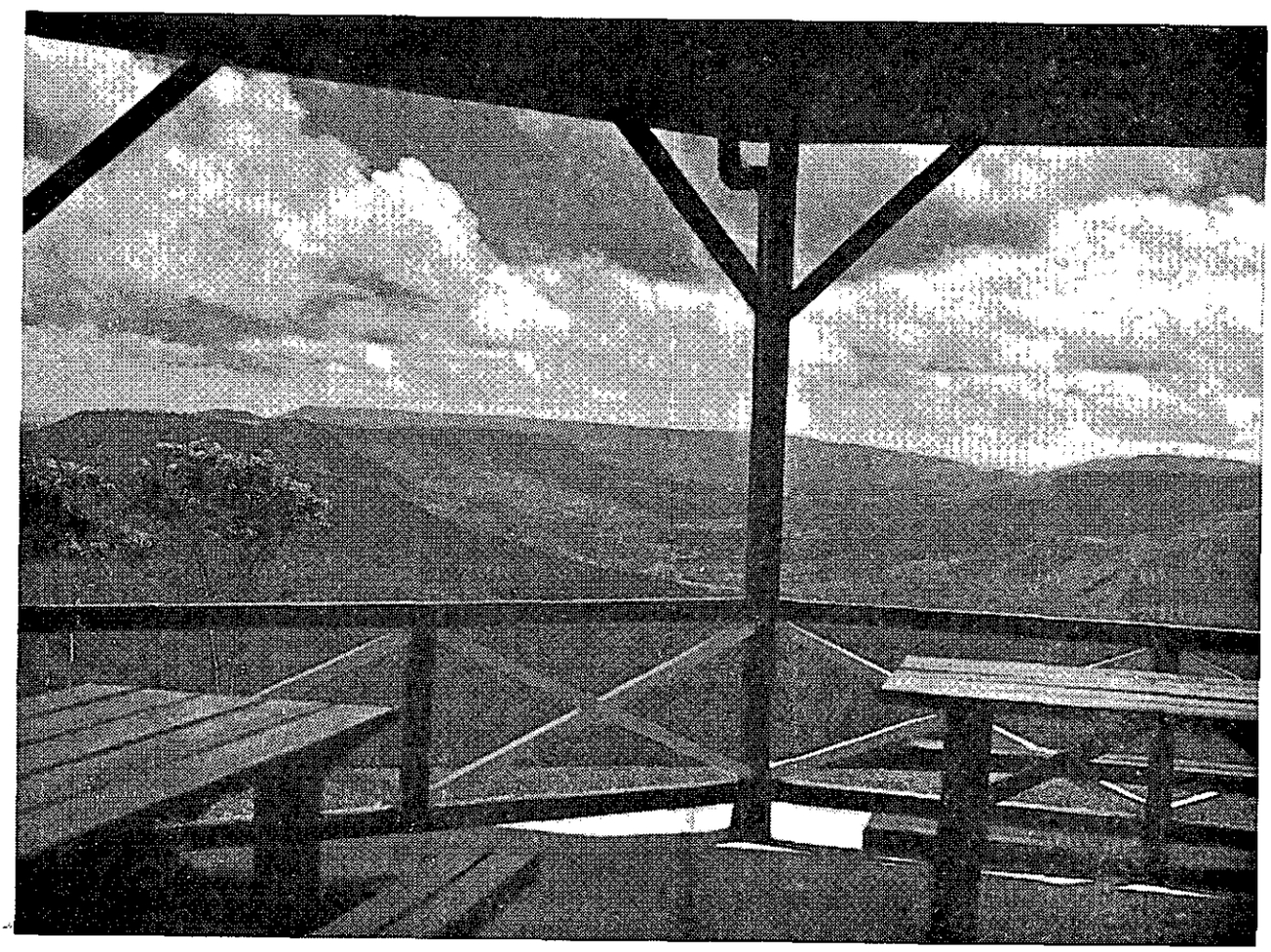
The fourth annual conference of Ministers responsible for National Parks in Australia adopted the following definition:—

> "A National Park is a relatively large area, set aside for its features of predominately unspoiled natural landscape, flora and fauna, permanently dedicated for public enjoyment education and inspiration and protected from all interference other than essential management practices, so that its natural attributes are preserved".

This definition is substantially the same as that adopted by the International Union for the Conservation of Nature.



Kamarun Lookout—Sarabah Range, Lamington National Park, on the road to O'Reilly's Guest House. This lookout was erected on land donated by the late Romeo Lahey, M.B.E., and takes advantage of a magnificant full circle view.



View north from Kamarun Lookout to the Tamborine Mountain Plateau.

"Kamarun" is derived from the language of the Wangariburra people of the Lamington area. It means "head man" and was also used as a term of honour for a white man of high standing. It is therefore most appropriate that the name be associated with the memory of Romeo Lahey.

Maps

The 1969 Annual Report referred to a new map of Lamington. This proved so popular that it was necessary to reprint it in 1971 and the opportunity was taken to revise and up-date the map. During the past year, new maps were published for Noosa and Mt. Barney, and also a photo-mosaic map of Magnetic Island. These maps are of very high standard and are a credit to the skill of the cartographer. Their production is made possible by the existence in the Department of a competent Drafting Branch which would be very costly to duplicate as part of an independent National Parks organisation.

Brigalow National Parks

The two Brigalow National Parks mentioned in the previous report are presenting certain management problems. In the case of Southwood, the Department has been required to fence the boundary and at Dipperu the occurrence of Harrisia cactus is giving cause for concern. Apart from the cost of the fence ($40,000) problems could arise with respect to the macropod fauna as a result of these animals being unable to move in and out of the area. Research on this aspect is being undertaken.

Known areas of Harrisia cactus have been treated and will be kept under observation. It is further proposed to check the rest of the park for other infestations by means of a strip survey. At the same time details of vegetation and fauna will be recorded.

Albert Lyrebird

The C.S.I.R.O. Division of Wildlife Research have for a number of years, been studying the four species (two Lyrebirds and two Scrub-birds) in the sub-order Menurae, a group confined to Australia which appears to have no close relative in the avifauna of the world. Three of these species occur in Queensland and the Department has been co-operating with C.S.I.R.O. in a study of the vocal behaviour of one, the Albert Lyrebird.

The presence of distinct song dialects in several localities has been demonstrated and in the course of studying the species the display of the male has been photographed. As far as is known, this is the first time that this has been done.

The work which is yielding interesting information about the species will ultimately provide the basis for assessing the viability of populations in localities where the habitat has been seriously reduced, and for managing these areas.

It is not possible to consider every native species in determining the management of a reserve, but management based on the ecology of one major species can be expected to prove sound for a wide spectrum of species where an essentially natural area is concerned.

Park Visitation

While it is apparent that each year more and more people are visiting the National Parks, accurate statistics are generally not available. However, at Chillagoe Caves a record is kept of visitors taken on guided tours of the caves. During the last year, the figure was 6,642 which is 11 per cent. higher than the previous year. This is likely to be exceeded with the more accessible parks and in one such region there was a 25 per cent. increase in the number of people camping under permit.

Chillagoe has had Cairns Regional Electricity Board power for approximately 12 months. Two motels have been erected within the last year. The town is clearly receiving a boost from tourist activities which have followed the improvement work done by this Department in the National Parks of the area.

The Cairns Regional Electricity Board have been most helpful in carrying out investigations with respect to the possibility of illuminating some of the caves. Such a development would provide a further boost to the tourist industry of the area but shortage of funds may delay the implementation of the scheme.

Visitor Facilities

A major part of the expenditure on National Parks in Queensland is on the construction and maintenance of facilities such as walking tracks and picnic areas. Maintenance of existing facilities accounts for the greatest proportion of available finances.

Work in addition to normal maintenance during the past year included:—

Chillagoe Caves—Construction of concrete pathways, bridges and ladders were continued in the Doona and Royal Arch Cave Systems.

Bowden Island—Picnic facilities were established on this small island National Park.

Mossman Gorge—Picnic facilities were improved and the entrance road was reconstructed following flood damage.

Brown Booby or Brown Gannet Birds—Fairfax Island—Scientific Area.

Lake Eacham—Picnic and barbecue facilities, protective fences and workshop storeroom and garage were constructed.

The Crater—Protective fences and pathways at the crater edge were completed making it safe for public use.

Palmerston—Safety fences were provided at two lookouts.

Alligator Creek—Picnic area has been established, 5 new fireplaces and 3 new tables provided.

Magnetic Island—Improved access with safety rails were constructed to the Forts area.

Little Crystal Creek—A piped water supply, septic toilets and an extension of the parking area were provided.

Eungella—The picnic area was extended and five chains of walking track were constructed to give safe access from it to the swimming pool.

Conway—Access roads were improved and a water supply was obtained for the camping and picnic areas. Sixty chains of walking track was constructed towards Mount Roper.

Noosa Heads—New septic toilets were constructed.

Girraween—A combined shower/toilet block was constructed to form the nucleus for a new camping area that is being developed.

Numinbah—Septic toilets have been constructed.

Lamington—A shelter shed was constructed on land adjacent to the road to O'Reilly's which was donated to the Crown by the late Mr. R. W. Lahey. The building is of octagonal construction giving unrestricted access to the full circle view obtained from this valuable site.

HARVESTING AND MARKETING

General

The total Crown and private log cut for the year was about 20 million superficial feet (Hoppus) less than for the previous year. The drop in production of Crown log timber only was about 10·9 million superficial feet of which about 3·6 million superficial feet was of plantation timber.

The major reason for this marked reduction was the unusually long period of heavy rainfall extending from November to March in South East Queensland, which adversely affected log timber extraction.

Although there was a minor reduction in pulpwood operation mainly because of better usage of sawmill waste it is expected that with the operation early in 1971-72 of an additional particle board factory, the pulpwood harvest for 1971-72 will be greatly increased.

The harvest of exotic conifers for sawn timber production was the greatest on record at 9·9 million superficial feet Hoppus, the volume of Slash Pine alone being a record for this species at 5·2 million. This record cut follows the establishment in January, 1971 of a modern plantation timber mill at Caboolture with a licensed capacity of 8·88 million superficial feet (Hoppus) log volume per annum. Of this capacity 2·4 million superficial feet was secured by the purchase at open auction in August, 1970 of 2 million superficial feet of exotic pine plantation timber in the Beerburrum area. There was keen bidding for this lot, the purchase of which conveyed the right to continuing supplies without further competition.

The dwindling resources of natural Hoop and Bunya Pine in the Brisbane Valley rain-forests contributed to the 2·0 million superficial feet decline in the yield for 1970-71. The major remaining stands of these species are now in the Miriam Vale area where some large logging contracts were let during the year.

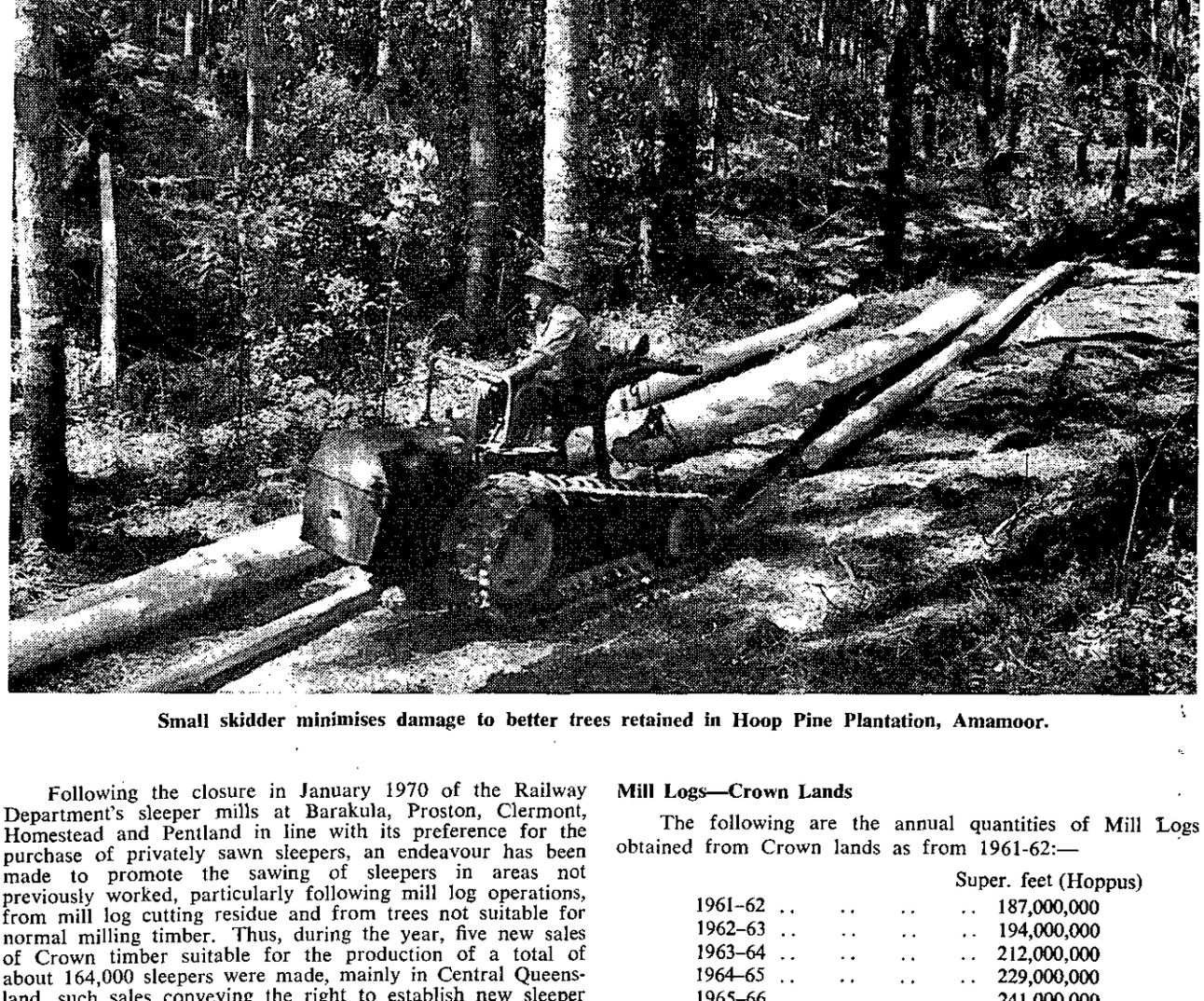
Of the 13·7 million superficial feet drop in the harvest of Forest Hardwood logs from 1969-70 to 1970-71, about 70 per cent of the reduction was in private log timber.

Despite the increasing competition from concrete slab flooring and from other flooring timber the total harvest of Cypress Pine was within 1 million superficial feet of the record 60 million superficial feet in 1969-70. A strong demand from fast developing mining towns in Central Queensland, together with significant quantities taken by road to Darwin, have led to requests for greater supplies of Crown and private Cypress log timber, particularly in the Roma Sub-District.

The increasing availability of private Cypress Pine log timber as a result of freeholding of Grazing Leases has caused a slight reduction of 1·9 million superficial feet in the Crown Cypress log harvest but there was keen competition for two lots of additional Crown Cypress log supplies totalling 1·5 million superficial feet per annum made available during the year in the Injune sector of the Roma Sub-District. The effect of these new supplies should be more significant in 1971-72.

The use of the relatively light, stable and termite resistant Cypress Pine as house framing is increasing in Brisbane and adjacent coastal areas. This is helping to offset the declining supplies of hardwood and compensating for the loss of some of the flooring market to other species.

The Horse is still used in some steep or rocky places to extract Plantation Hoop Pine Thinnings—Amamoor.



Small skidder minimises damage to better trees retained in Hoop Pine Plantation, Amamoor.

Following the closure in January 1970 of the Railway Department's sleeper mills at Barakula, Proston, Clermont, Homestead and Pentland in line with its preference for the purchase of privately sawn sleepers, an endeavour has been made to promote the sawing of sleepers in areas not previously worked, particularly following mill log operations, from mill log cutting residue and from trees not suitable for normal milling timber. Thus, during the year, five new sales of Crown timber suitable for the production of a total of about 164,000 sleepers were made, mainly in Central Queensland, such sales conveying the right to establish new sleeper sawmills. Of the 430,174 sleepers produced from Crown timber areas during the year, 36,141 were of the larger 7′ x 9″ x 6″ size of sleeper for the new Hay Point–Goonyella Line construction for the export of coal.

During the year the construction of the Umolo–Blackdown Tableland access road was completed to the top of the Range, a distance of about 14 miles from Umolo which is about 96 miles west of Rockhampton. This road now provides access to a substantial volume of Hardwood milling timber for the continued sustenance of sawmills west from Rockhampton.

Rosewood

Approximately 58 tons of Rosewood were purchased and exported to Hong Kong during the year.

No Sandalwood was purchased or exported.

Mill Logs—Crown Lands

The following are the annual quantities of Mill Logs obtained from Crown lands as from 1961-62:—

	Super. feet (Hoppus)
1961–62	187,000,000
1962–63	194,000,000
1963–64	212,000,000
1964–65	229,000,000
1965–66	241,000,000
1966–67	212,000,000
1967–68	227,000,000
1968–69	227,000,000
1969–70	234,000,000
1970–71	223,000,000

Hewn Timber Prices—Rates Payable to Suppliers

Rate (per hundred sleepers) payable to suppliers was increased as from 13th July, 1970 and 1st July, 1971.

Increased rates are shown hereunder:—

	13–7–1970	1–7–1971
7′ x 9″ x 6″	$396.00	$420.00
7′ x 9″ x 4½″ ..	$155.00	$200.00

Mill Logs Cut—Crown and Private Lands

This table shows logs cut by all mills in the State annually, for the periods indicated:—

Year	Queensland Grown									Imported	Total
	Hoop and Bunya Pine	Kauri Pine	White Cypress Pine	Forest Hardwoods	Scrub Hardwoods	Cabinet Woods	Miscellaneous	Plantation Thinnings	Pulpwood		
	(1,000 superficial feet Hoppus)										
1965–66	26,247	1,529	50,402	229,805	Previously Included with Forest Hardwoods	23,167	45,579	36,271	3,918	8,024	424,942
1966–67	24,009	1,627	49,261	224,073		19,550	40,176	36,668	4,889	8,962	409,215
1967–68	21,936	1,582	56,803	216,679		20,743	42,770	40,284	5,000	11,598	417,395
1968–69	24,229	1,877	54,313	210,693	19,245	21,271	45,189	42,878	6,341	11,062	437,098
1969–70	19,452	1,855	60,024	188,094	17,934	21,236	45,231	43,772	8,821	12,383	418,802
1970–71	16,096	2,872	59,043	174,416	16,298	20,682	42,602	41,957	8,185	16,679	398,830

A comparison of quantities of various species of log timber cut from Crown Forests during the past five years is illustrated hereunder:—

Year	Hoop and Bunya Pine	Kauri Pine	White Cypress Pine	Forest Hardwoods	Scrub Hardwoods	Cabinet Woods	Miscellaneous Species	Plantation Timbers	Pulpwood
	(1,000 superficial feet Hoppus)								
1966–67	21,144	1,598	25,197	68,648	11,191	14,538	26,970	37,450	4,889
1967–68	19,644	1,601	29,178	69,298	14,183	17,412	31,652	39,000	4,938
1968–69	20,211	1,811	27,933	65,257	13,834	17,866	30,864	42,996	6,341
1969–70	16,832	1,799	28,428	68,576	15,383	17,745	32,752	43,182	8,821
1970–71	14,813	2,401	26,508	64,783	15,749	17,204	32,570	40,397	8,185

Hoop Pine—Compartment 4, Western Creek.

The Minister for Lands (Mr. V. B. Sullivan, M.L.A.) and the District Forester, Gympie (Mr. R. H. Doggrell) examine sawn product from an average tree harvested at age 36 for product study.

The Timber Business

	1969–70	1970–71
(*a*) Mill Logs—		
Hoop and Bunya Pine	16,832,000 super. feet	14,813,000 super. feet
Forest Hardwoods	68,576,000 super. feet	64,783,000 super. feet
Scrub Hardwoods	15,383,000 super. feet	15,749,000 super. feet
White Cypress Pine	28,428,000 super. feet	26,508,000 super. feet
Kauri Pine	1,799,000 super. feet	2,401,000 super. feet
Cabinet Woods	17,745,000 super. feet	17,204,000 super. feet
Miscellaneous Species	32,752,000 super. feet	32,570,000 super. feet
Plantation Timbers	43,182,000 super. feet	40,397,000 super. feet
Pulpwood	8,821,000 super. feet	8,185,000 super. feet
Limb Logs, Head Logs, Stumps and Flitches	23,000 super. feet	53,000 super. feet
	233,541,000 super. feet	222,663,000 super. feet
(*b*) Construction Timbers—		
Headstocks, Transoms, Crossings, Braces, &c.	349,323 super. feet	361,411 super. feet
Sleepers	452,819 pieces	430,174 pieces
Girders, Corbels, Piles, Sills	67,512 lineal feet	64,732 lineal feet
Girder Logs	211,564 super. feet	96,174 super. feet
Poles	230,261 lineal feet	146,081 lineal feet
House Blocks	14,003 lineal feet	8,821 lineal feet
Mining Timbers—Round	318,742 lineal feet	427,329 lineal feet
Mining Timbers—Split	Nil	Nil
Mining Timbers—Sawn	Nil	223,900 super. feet
Gross receipts from Timber Sales, &c.	$4,428,975.31	$4,590,756.41
Net Revenue	$2,391,178.05	$2,393,014.29

Timber Felling and Timber Getting Award—State

The minimum weekly rates which the average competent cutter should be enabled to earn whilst using a suitable portable mechanised saw were increased during the year.

Increases varying from $3.69 to $4.46 and $4.21 to $5.05 per week—depending both on the species of timber and the area defined and were applicable from 4th January, 1971, to 5th May, 1971, respectively.

Logging Roads—1970-71

The Department's Roads program for the year constituted 45 miles of construction.

Location and working surveys covering 23 miles were carried out.

Expenditure from Forestry votes was as follows:—

	$
New Construction	336,359
Maintenance	239,969
Subsidies to Shire Councils	49,463
Workers' Compensation	5,956
Pay Roll Tax	7,157
Surveys	3,690
Freights and Fares	5,644
	648,238

Logging

The table below shows the quantities of log timber hauled during 1970-71 by contractors to the Department and the payment made to them for this work:—

Class	Quantities	Payments
South Queensland—	Super. feet	$
Hoop and Bunya Pine	8,574,712	229,476.83
Forest Hardwoods	1,461	
Scrub Hardwoods	61,868	
Miscellaneous	54,713	
Red Cedar	10,545	
	8,703,299	229,476.83
North Queensland—		
Cabinet Woods	656,426	17,764.71
Totals	9,359,725	247,241.54

Constructional Timbers—Departmental Contracts

Below are shown quantities of constructional timbers obtained from Crown lands for year 1970–71, in comparison with those for the previous two years:—

Class of Timber	1968–69	1969–70	1970–71
Sleepers	403,379 pieces	216,493 pieces	241,887 pieces
Crossings	93,388 super. feet	49,110 super. feet	166,666 super. feet
Transoms	96,824 super. feet	133,624 super. feet	106,505 super. feet
Bridge Timbers—Girders and Piles	27,549 lineal feet	14,086 lineal feet	19,781 lineal feet
Girder Logs	495,493 super. feet	211,564 super. feet	96,174 super. feet

SAWMILLS LICENSING

The Sawmills Licensing Committee met at regular intervals during the year to consider matters relating to Sawmills Licensing and submitted recommendations as required.

The average number of mills in active operation for the first three-quarters of the year was 441. Figures are not yet available for the final quarter.

The following table sets out the position in regard to Sawmill Licenses as at 30-6-71.

It will be noted that the Industry has continued to take advantage of the Department's policy permitting amalgamations within zones with the result that 25 licenses were withdrawn following participation of sawmills in amalgamations.

Current licenses are shown dissected into two classifications only. These classifications relate to the amalgamation policy. Mills in each category are permitted to amalgamate only with mills similarly classified.

Number of Licenses as at 30-6-70	Classification	New Licenses *Issued*	*Licenses Not Renewed*			Total Licenses as at 30-6-71
			Withdrawn for Amalgamation	Refused	Relinquished	
452	General Purpose Mills	3	25	2	7	421
45*	Other than General Purpose Mills	8	..	1	3	49
497	..	11	25	3	10	470

* Other than general purpose mills comprise mills wholly or mainly restricted to production of sleepers and/or mining timbers.

Offences

During the year ended 30th June, 1971, Officers reported 190 breaches of the Act and Regulations administered by the Department.

Proceedings were successfully instituted against 13 persons and fines totalling $445 imposed.

In 25 cases of unauthorised interference with timber and other forest products where it was considered the offence did not warrant proceedings, the value of the timber or other forest product was collected and warnings issued. Appropriate action was taken in other cases.

In addition, 28 breaches of the Rural Fires Act, investigated by Officers of the Department in their capacity as Fire Wardens, were the subject of further appropriate action.

As a result of action taken in all cases, an amount of $6,268.21 was recovered by the Crown in timber revenue and a further $866.02 by way of fines, miscellaneous and investigation costs.

FOREST PRODUCTS RESEARCH

General

The level of work carried out by the Department in the field of forest products research has been maintained but cannot be increased because of limitations imposed by available laboratory space on staff and facilities. The needs of the timber industry for a technical and advisory service have probably never been greater as a result of rising economic pressures and the increasing sophistication and technological requirements in timber utilisation. Recent changes in the structure of the C.S.I.R.O. forest products research organisation and also the better co-ordination of local industry requirements, through the recently constituted Timber Research and Development Advisory Councils, have highlighted the need for an adequate local organisation for applied research and technical advice. It is therefore hoped that the more adequate facilities envisaged for this branch of the Department can be provided in the near future.

The Department's officers have continued to be active on technical committees drafting Australian standards for a wide range of timber products, and the extent of our involvement in this work reflects the importance ascribed to standards in promoting the orderly and efficient utilisation of timber products.

Work has continued in an endeavour to eradicate the small infestation of the very destructive West Indian Drywood Termite, *Cryptotermes brevis*, which has been found at Maryborough. This is the only known occurrence in Australia and in other countries where it has been introduced it has caused much greater damage than experienced in Australia from native species of termites. Earlier surveys detected several infested houses in a small area of the city of Maryborough and these were fumigated; resurvey is now in progress and evidence to date suggests that it is likely that the infestation is still confined within the original area. If this is so complete eradication may be practicable, but could well be costly.

Three officers of the branch attended the Fifteenth Forest Products Research Conference in Melbourne in June. This Conference is held biennially and is attended by representatives of Forest Services, research organisations and industry from Australia and New Zealand to discuss research results and their application in the field of forest products, and to assess future work needs. One officer also represented the Department at the annual conference of the Australasian Pulp and Paper Industry Technical Association held in New South Wales.

The Timber Users' Protection Acts

The year saw a slight increase in the number of formal complaints lodged under the provisions of the Timber Users' Protection Acts and there was also an increase in the number of enquiries received from timber suppliers, builders and the public regarding the provisions of the Acts.

Of the 27 complaints lodged with the Department, investigation revealed that two were outside the time limitations of the legislation and a further seven were found to involve borers other than Lyctus and therefore not subject to the provisions of the Acts. Following Departmental investigation, seven complaints were withdrawn after the matters had been satisfactorily resolved between the parties concerned and legal proceedings were instituted by the Department in two cases. A conviction was secured in one of these and the other was withdrawn prior to hearing following an independent action by the complainant. Nine complaints are still being investigated.

Staff changes during the year reduced the amount of on-site inspection of building operations which it was possible to carry out, particularly outside the metropolitan area, but inspectorial staff now available should enable greater emphasis to be placed on this aspect during the coming year. It is also evident that there is a need for a wider education of the public and of the timber using industry into the requirements of the legislation if it is to fully achieve its aims.

With regard to control of the use of Lyctus susceptible timber, a major problem exists in the growing practice of major project builders employing specialised sub-contract construction gangs. Timber is frequently delivered direct from mill to the job site and its rapid use by these gangs is often largely unsupervised. In some instances this has resulted in a disturbingly high incidence of susceptible material being detected, particularly on large-scale building projects. This aspect will require close attention in future and the timber industry itself must also adopt a responsible attitude and seek to eliminate such material if the image of timber as a popular building material is not to be damaged.

The work for the year of the various sections of the Branch is outlined below.

Wood Chemistry and Preservation Section

A further two pressure treatment plants were installed during the year bringing to 32 the total number of such plants registered for use in the State. The need for constant supervision of treatment plant practices to ensure correct application of techniques has still to be stressed. Although control of operations is generally satisfactory there have been problems with some plants failing to comply fully with their conditions of registration, particularly with regard to submission to the Department of solution test samples and reconciliation statements.

The pressure treatment of supply poles for electrical and other authorities has continued at a satisfactory level and the service records of poles treated by this method continues to be good over a wide range of climatic conditions.

Problems relating to the preservative treatment of hardwood piles, however, particularly in a marine environment, resulted in an investigation into the problem by Dr. Ruth Turner, a world authority on marine borers. The Department joined with other Australian Authorities in sponsoring Dr. Turner's visit and her report is at present being prepared. Meanwhile further work is proposed along lines suggested by Dr. Turner, possibly by endowment of a post graduate research fellowship.

Trials with oil-borne preservatives on railway sleepers have given encouraging results and give every indication that timbers possessing satisfactory strength properties but a lower natural durability will be able to be used quite satisfactorily for this important end-use. Large scale service trials are proposed for material treated by these methods.

Investigation work is being carried out on Copper–8–Quinolinolate for use here as a timber preservative and work is also current in development of protective treatments for softwood plantation species for light timber framing uses. In this latter field, high-temperature and air seasoned Slash Pine gave variable penetration with short term immersion in Copper Naphthenate, with air dried material giving the better result. However overnight soaking gave comparable results for both. Investigation work is current on new analytical methods and techniques relating particularly to preservative and resin distribution in the high-temperature-seasoned timber.

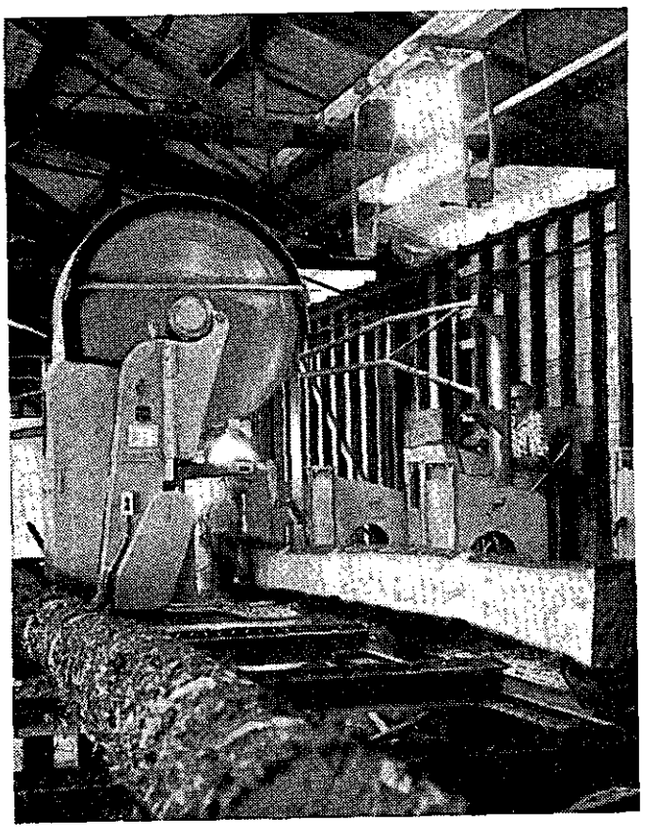
During the year a report on the preservative treatment of Zambian species was prepared and supplied to that country following an extensive investigation program by preservation staff of the Department on samples supplied.

A total of 6,500 analytical determinations were carried out by the laboratory during the year, including 1,250 for silvicultural research purposes and 1,050 spot tests of timber samples for the governmental housing authority and the timber industry. The testing of these samples and analysis of samples for purposes of the Timber Users' Protection Acts continues to occupy a substantial proportion of laboratory time.

This section, possibly more than any other, suffers considerably from lack of adequate space and this affects both normal laboratory work and the ability to instal and use to best advantage modern equipment which would allow most effective use of available staff.

Timber Conversion Section

(i) *Sawmill Economics.*—During the year a new 60-inch bandsaw was installed at the Department's experimental sawmill at Rocklea to replace an old and smaller bandsaw previously in use; this now better enables recovery studies to be carried out on larger logs, particularly those becoming available in increasing quantity from the softwood plantations. An anti-sap-stain spray was also constructed and installed by mill staff and is operating satisfactorily.



Experimental Sawmill—Rocklea.
New 60-inch Bandsaw cutting pruned stems of plantation grown Hoop Pine.

Work has commenced at the mill on a comprehensive sawing study with Hoop Pine logs drawn from the select fraction of some of the older plantations. This study will complement earlier work which has been carried out, mainly on unpruned stems, and is intended to allow comparison of stem values at the various stages of thinning envisaged in the management of the plantations. Stems have been derived from areas of both high and low site indices, and have been selected to cover the range of size classes occurring in the stand fractions to be removed in the following stages of thinning:—

160 to 120 stems per acre
120 to 80 stems per acre
Final crop 80 stems per acre.

Grading of the sawn product in accordance with the Australian Standard grading rules at the green-off-saw and seasoned stages will allow value comparisons to be made both between pruned and unpruned stems and also between pruned stems in the various stand fractions.

A sawing study was also carried out on larger stems of Slash Pine from the Passchendale plantations to investigate the incidence and effect on graded recovery of pitch streaking and heart-shakes which appeared to be troublesome in the species in this area. Passchendale is an area of higher altitude and lower rainfall than the principal Slash Pine plantation areas in the State and these factors may accentuate any anatomical characteristics associated with stem stresses that cause these log defects. Analysis of the results of this study is not yet complete but preliminary evaluation confirms that the incidence of the defects in this area is somewhat higher than normal for this species and has some adverse effect on sawn board recovery.

In co-operation with the Hardwood Association a series of studies is presently in progress on Brush Box, the purpose of which is twofold—

(*a*) to investigate the graded recovery of sawn material related to external characteristics of both the log and the standing tree,
(*b*) to explore avenues for utilisation of this species alternative to the present almost exclusively board market.

Brush Box is a most important component of the transition forests of South Queensland and its utilisation is vital to the sustenance of hardwood supplies for mills in this region. Its wood has many desirable properties but is subject to serious degrade in seasoning. With the reduced demand for boards as a result of trends in building design, there exists an urgent need to direct some of the sawn output of this important species to other uses.

The studies are being carried out at five sawmills covering the main areas of occurrence of the species in this State and incorporate sawing into board and scantling sizes and also into wide planks. It is also proposed that grading will be carried out at the seasoned stage and that comparison be made of the recovery obtainable from normal sawing with that from resawing of wide slabs after seasoning. While these studies will not reach finality for some time, it is hoped that they will yield interim information which will be of immediate assistance to the industry.

During the year the basis of pricing adopted for logs of plantation pines was revised and new prices have now been adopted based on individual girths by predominant height classes, rather than on girth class groups and stem volume groups as used previously. The new prices result in a considerable simplification in application. Proposals by purchasers for early commencement of integrated logging of sawlogs and pulpwood in Hoop Pine led to determination of a log price to 6 inches top diameter for this species as an alternative to the usual 4" T.D.U.B. Similar prices will be required for other plantation species as the integrated operation of log and pulp material progresses.

(ii) *Seasoning and Timber Engineering.*—Following the success reported last year of early work at Rocklea on the high temperature seasoning of young plantation softwood to reduce seasoning degrade, further work in this field has confirmed the previous results.

Using this technique of accelerated drying under heavy restraint it was shown that 3" x 2" and 4" x 1½" Slash Pine material can be fully seasoned from the green-off-saw stage in a little over 24 hours under the following conditions:—

(*a*) Temperature 250°F Dry Bulb and 160°F Wet Bulb,
(*b*) Air Circulation rate 800–1,000 cubic feet/minute,
(*c*) Stack weights in excess of 100 lb./sq. ft.,
(*d*) Use of a sloped base under the stack to induce a degree of twist in the opposite direction to the natural twist of the timber. In this regard Hoop Pine normally exhibits a natural clockwise twist whereas Slash Pine twists in an anticlockwise direction.

Studies have indicated that by using this method the total energy requirements for drying are reduced and that the dried material is not only straighter but exhibits improved stability under changing conditions of atmospheric moisture, while its strength properties are not appreciably impaired. In conjunction with the Hoop Pine sawing studies mentioned elsewhere, further high temperature seasoning work

is being carried out aimed at refining still further the combination of drying conditions required to produce the most desirable results and to study the effect of the high temperature/humidity conditions on kiln operation and maintenance.

As mentioned previously, the sawing studies on Brush Box are being extended to investigate also the seasoning behaviour of this species. The entire sawn output from the study at one mill has been acquired by the Department for this work which will involve both air and kiln seasoning in boards, scantling sizes and also in wide planks 2" and 1½" in thickness which will subsequently be re-sawn. This work is now in progress.

Advice to industry on seasoning and saw-milling problems has received increasing attention and must continue to do so as log supplies and markets for sawn timber change.

Amalgamation of sawmills into larger units is resulting in an increasing interest by mills in the possibilities of re-equipping or of up-dating existing plant.

Determination of moisture content in samples submitted by industry and by housing authorities has continued at a higher level than previously with a monthly average of 230 determinations.

Strength testing work using the 10 ton "Amsler" machine has proceeded although limited somewhat by availability of technical staff. It aims initially at determining the standard strength properties of our plantation timbers and data so obtained is being accumulated and will be progressively refined as more information becomes available for the various species. Static bending tests were carried out on a wide range of material from high temperature drying trials to check on any adverse effect on its strength properties. Glue-line shear testing of plywood and some testing of glued laminated and finger-jointed material was also undertaken.

Wood Structure and Utilisation Section

(i) Wood Structure and Timber Physics

Timber Identification.—6,055 wood samples of local, interstate and international origin were identified during the year. The range of species being encountered reflects utilisation associated with development in the Cape York Peninsula, the marketing here of an extended range of Northern New South Wales hardwoods, and continued expansion of timber imports. This is a time-consuming but most important service which is widely used by specifiers, suppliers and users of timber.

(ii) Wood Quality Assessment and Improvement

(a) Seed Orchard Tree Evaluation.—Assessment has continued of the wood quality of individual plantation trees which had been selected for possible inclusion in seed orchards because of their superior external characteristics. Five of six candidates tested for the Taromeo Hoop Pine orchard had acceptable wood quality. Of 106 trees evaluated to date for the two Hoop Pine orchards, 17 per cent. have been excluded because of unacceptable wood quality.

Wood quality screening of fifteen trees recently selected to supplement the existing *Pinus caribaea* orchard at Kennedy has also been commenced.

(b) Species Evaluation.—In a continuing project on selection-weighing factors, the wood properties of several exotic conifers are being evaluated. Supplementing preliminary results reported last year, it has been found that, in 41-year-old trees at Benarkin, tracheid length values and trends for *Pinus radiata* compare favourably with those for southern Australian material, while those for *P. patula* were superior to *P. radiata*. The cell wall organisation (micellar angle) analysis also indicated a smaller core of juvenile wood for *P. patula*, while the average basic density and percentage latewood of *P. taeda* were much higher than for the other two species. From this and other work, Slash and Loblolly Pines have been shown to have similar basic densities with the latter having somewhat more uniformly textured wood with a lower percentage latewood at comparable ages.

(c) Species and Hybrid Trials.— Work is in progress to compare the wood properties and dry-wood production of Slash Pine, Honduras Caribaea and a Slash x Caribaea F1 hybrid using material from a series of 13-year-old plots in south-east Queensland.

Results to date indicate that this hybrid may be of considerable value; it exhibits a degree of hybrid vigour with its growth rate exceeding that of either parent on both ridge and swamp sites. In wood properties its basic density lies closer to Caribaea while its per cent. latewood is generally intermediate. Expressed on the basis of constant stocking, the dry-wood weight production per acre of the hybrid is significantly superior to either parent on both types of site.

This hybrid therefore gives promise not only of being able to outproduce either parent, but also of yielding a wood of more uniform texture than either Slash or Loblolly, which, to date have been the main exotic plantation species in southern areas of the State. The effective utilisation of the high productivity potential of the hybrid should be facilitated by its reasonably good form, superior to that of *P. caribaea*,, although this cannot be properly tested by sawing studies until the stock is older.

(d) Provenance Trials.—An evaluation of the average wood quality of Hoop Pine "provenances" represented in seed orchard preselections is being undertaken. The seed source of 69 of the 106 trees assessed to date is known and these 69 have been divided into three broad original seed sources. On present indications, Mary Valley seed sources may be inferior and those of Gallangowan/Jimna/Murgon superior to Yarraman sources. There are high and low rating trees in both Mary Valley and Yarraman sources, but those from Gallangowan/Jimna/Murgon have been consistently high.

The Gallangowan and Jimna "provenances", in particular, are not only giving good volume production, but good general wood quality of above average density, which is an encouraging prospect for tree improvement.

Between-provenance differences in wood properties could be more effectively exploited than at present. Differences of up to 19 tons per acre in dry wood weight productivity have been found between different provenances at constant stocking at 25 years of age. Much of this was due to volume differences, but density differences alone, even in this relatively uniform species, have accounted for increases of up to 3½ tons per acre.

(e) Ecological Influence on Wood Quality and Productivity.—The effect of a considerable number of ecological factors on wood quality parameters, tree growth and dry wood weight productivity per acre is being studied on *P. Caribaea var. hondurensis, P. kesiya* and *Araucaria cunninghamii*. The geographic range considered covered eleven locations from northern New South Wales to North Queensland and Fiji, and also ranged from coastal to higher elevation location.

One hundred and fifty-five trees have been sampled and observations on basic density, percentage latewood and percentage false ring latewood have been completed. From results to date, for all three species, there has been some general tendency towards increased basic density and percentage latewood as latitude and elevation decrease.

The importance of investigating growth rate/wood property/ecological factor relationships has been highlighted in this study. In comparing the relative volume and wood weight per acre productivity potential of *P. caribaea, P. kesiya* and *P. elliottii* throughout this State, the adaptability and superiority of *P. caribaea* as a high cellulose yield crop over an extremely wide range of ecological conditions seems well indicated, from preliminary examination of the data.

P. kesiya, although inferior in productivity to *P. caribaea* at all locations studied, compares quite favourably, even at Beerburrum, with the average productivity expected of routine *P. elliottii* in South Queensland. The wood of this species was somewhat lower in basic density than that of *P. caribaea* at the same locations ranging from 23·0 to 28·5 lb./cu. foot. This, together with its even lower percentage latewood than for *P. caribaea* makes it a very uniformly textured and potentially useful wood, if of good form when grown under favourable conditions.

Observations on other wood features and detailed analysis of the results to date are proceeding, and it is planned to extend the study to other locations not yet sampled.

(f) Pitch Streaks and Heart Shakes.—Work has continued in a study aimed at determining the economic effect of pitch streaks and heart shakes in Slash Pine and any influence of branching characteristics, pruning and growth rate on their incidence and extent.

Grading and special defect classification of sawn boards from the eighty 30- 38-year-old study trees from Passchendaele have, in general, tended to confirm the results of previous pilot studies. Heart shakes were the major cause of rejection from the lowest marketing grade, reducing saleable recovery by 4 per cent. on gross Hoppus volume. An additional 7 per cent. was depreciated in grade because of pitch streaks, although this latter figure almost certainly underestimates the real effect of pitch streaks on utilisation.

A previous study on comparable Beerwah stems indicated a lower incidence of shakes and streaks than in this Passchendaele material.

Detailed examination of the Passchendaele stems showed that pitch streaks were often free from shakes, but no shakes were found independent of streaks; shakes also tended to be associated with longer streaks. This supports the previous contention that streaks are precursors to shake development.

Although the results indicate a disturbingly high incidence of pitch streaks and shakes in Slash Pine in this particular area, the very large between-tree variability suggests the feasibility of reducing the problem by silvicultural and/or genetic means if reasonably reliable field indicators of streak-prone trees can be found and these are being studied.

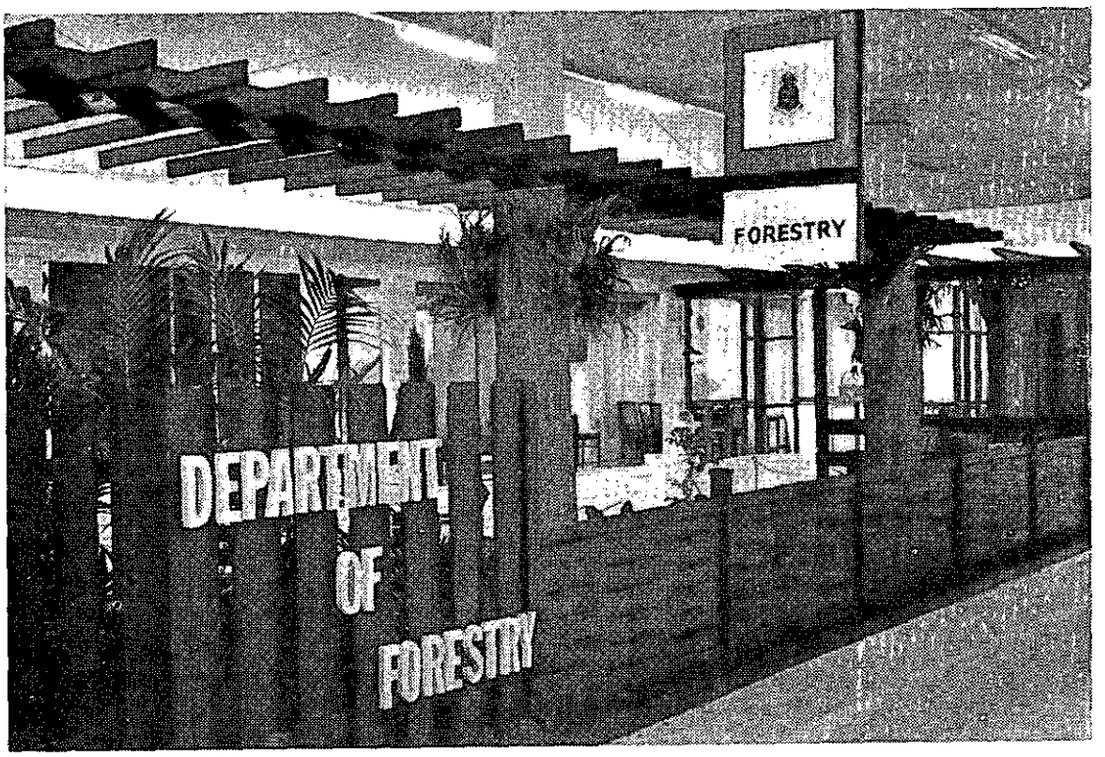
(iii) *Utilisation.*

Eight hundred and seventy requests were received during the year, from all sections of the timber industry, for advice on the properties and uses of local and imported timbers and minor forest products.

(*a*) *General Building.*—There has been a welcome improvement in the production of seasoned solid and glued laminated framing, ranging in size from studs to deep beams. Sections to 12 inches x 3 inches are now available in both rain-forest timbers and Brush Box at prices competitive with substitute materials. The material is being seasoned in flitches and resawn later into the required sizes for use as solid sections or as 1½ inch or 2 inch laminae for deep sections. This is approaching the low-priced utility framing urgently needed to overcome shrinkage problems, but costs must, and can, be further reduced by paying less attention to finished appearance for general framing use.

Seasoned pine framing is also being produced (some finger-jointed), but mostly for wall framing for which use it is felt the benefits of seasoning are not as great. Interest is being exhibited in the wider production of seasoned Brush Box framing, preferably in 1½ inch stock, to replace some of the strip flooring market being lost by timber. Cypress Pine producers are likewise considering seasoning but as a means towards increasing f-ratings and reducing unfavourable cross-sectional differences between this and competitive timbers in the framing market. There has been an increase in the use of Cypress Pine framing in general.

In a recent report, the metropolitan demand for hardwood framing to 1975 was predicted to increase at a faster rate than the supply. If this is so, it can be expected to promote a more ready acceptability of pine and rain-forest timber framing and to induce a greater flow of hardwood from northern New South Wales.



Departmental Exhibit—1971 Brisbane Exhibition illustrating the variety and utility of timber for home building. The display was arranged in collaboration with TRADAC (Timber Research and Development Advisory Council).

Cypress Pine interests have had to look to expanded Queensland utilisation of their products following a decrease in their southern board market. To assist an expanded use of this species as framing, a revision has been prepared of the present one-grade Australian Standard and it is hoped to provide three general framing grades and one stud grade.

The strength properties of our plantation-grown Slash and Loblolly Pines have proven gratifyingly high in preliminary evaluation by the Forest Products Laboratories, C.S.I.R.O.

The trend in external cladding continues to be away from timber towards substitute materials. This situation is not being helped by the supply of untreated Pine or unsuitable profiles to this use by some sections of the industry.

The roof truss market is showing a marked increase, and now holds 32 per cent. of all construction.

With increasing availability of softwood from maturing plantations, it is necessary that the requirements for preservative treatment for this material in various situations be critically reviewed in order that no unnecessary costs will be imposed on the building industry. To this end it is proposed to examine the performance of softwood framed houses which were imported after the war and have now been in service for some 25 years. This should provide a reliable guide to the extent to which treatment is required. Similar surveys will be carried out in other States.

The "Standard Code of Recommended Practice for Light Timber Framing" which was published during the year is already being used to advantage by some sections of local industry and its wider use should effect a more rational utilisation of timber. Efforts are also being made by means of a series of talks and demonstrations to bring into use the Australian Standard grading rules for Queensland grown pines. These rules have now been available for two years but have not yet been applied by industry.

(*b*) *Structural Engineering.*—Pole users continue to demand high durability species for treated poles in this State, apparently considering breaching of the treated zone in service to be a limiting factor. This is understood to be contrary to southern experience.

For marine piling, specifiers have tended to revert to the use of bark-on naturally resistant species rather than treated hardwood piles which have given variable results in service.

With the expanding development of the Cape York area of the State there has been increasing interest in the utilisation of the largely untapped resource of structural and constructional hardwoods in that area, including several species previously not used to any extent.

(*c*) *Panel Products and Joinery.*—A new particle board plant using Hoop Pine will begin production in October. Particle board utilisation is expanding into areas of more intensive competition with plywood, fibreboard and solid timber.

The range of plywood products available is being considerably extended, as shown by the availability of structural plywood up to 2 in. thick. A wider range of interior sheeting is also being presented, with random-grooved sheet panelling popular. Care needs to be exercised in the marketing of thick, routed-patterned plywood exterior doors in the joinery field. The service life of plywood without an integral bonded surface film in exposed situations is suspect and the routing exposes end-grain, posing a greater potential risk of early failure.

(*d*) *Pulp and Paper.*—Interest continues in the export potential of chips from hardwood and rain-forest species for pulping, with three feasibility studies current in North Queensland. There seems no doubt that the species available have marketing potential. In fact, the market value of higher density hardwoods, with their higher weight of recoverable fibre per unit volume, may have been underestimated in the past. Prices offering for hardwood pulpwood have been rising on the world market, and this trend seems likely to continue.

Consideration has been given to problems associated with species segregation and the storage, handling, sampling and wider utilization of chips.

(*e*) *Minor Forest Products.*—The profitable export market in *Duboisia* leaf for pharmaceutics has continued to rise steeply since last year, increasing by 40 per cent to a value approaching $500,000. Over 500 tons of dry leaf were exported, mainly from private plantations. This forest product is now an appreciable income earner for the State.

TECHNICAL AND FIELD STAFF TRAINING

(i) A further six State Scholarships in Forestry were awarded in 1971, four to new matriculants, and two to students who had completed the first year of the degree course in forestry. The first year of the course is taken at the University of Queensland or the James Cook University of North Queensland. A further three years are then taken at the Australian National University, Canberra. The numbers of undergraduates holding State Forestry Scholarships as at 30th June, 1971, were:—First year, 4; second year, 7; third year, 2; fourth year, 4.

Seven State Scholarship Holders graduated at the end of the 1970 academic year and took up duty as foresters within the Department in January, 1971. One of these, Mr. R. D. Beck, who graduated with first class honours, was awarded the Schlich Memorial Medal as the outstanding graduate in forestry at the Australian National University in 1970. One further student who completed the fourth year in 1970 was granted a six months extension of his scholarship to enable him to complete degree requirements.

(ii) Thirteen forest trainees completed three years practical field training in January. Ten of these have subsequently completed probationary periods as gangers or leading hands and been appointed field overseers. Three have resigned since January.

A further 33 trainees, selected from applicants with at least Junior Examination passes, commenced training in 1971. At the end of June the total number in training was 69.

(iii) The system of Adult Training introduced in 1970 to supplement the Forest Trainee Scheme and provide an avenue of advancement for older employees with the necessary potential ability was continued in 1971. The number of adult trainees as at 30th June totalled 14, including the initial group of six due to complete the eighteen months' training course in December, 1971.

(iv) During the year two Overseers, who had previously completed the forest trainee course, were appointed Technical Assistants in the Forest Research and Forest Resources Branches respectively. Both are undertaking the Training Course for Forest Technicians.

STAFF

As at 30th June, 1971, there were 522 salaried officers on the staff comprising 236 in Head Office and 286 at District Centres. This represents an increase of 13 on the number of staff as at 30th June, 1970. The number of wages staff employed was 1,696.

Thirty-nine salaried officers left the Department during the year, including eight officers who retired after long and meritorious service, namely:—

Mr. W. Wilkes (Secretary to the Conservator of Forests, 49 years).

Mr. W. E. Kerr (Accountant, 47 years).

Mr. C. C. Colthorpe (Clerk-in-Charge, Stores Section, 46 years).

Mr. S. J. Allery (Forest Ranger, Division I, 44 years).

Mr. F. A. Targett (Forest Ranger, Division I, 31 years).

Mr. E. Martin (Forest Ranger, Division II, 33 years).

Mr. L. C. Powell (Clerk, District Office, Dalby, 37 years.)

Mr. T. J. Carey (Temporary Clerk, 35 years).

We wish these officers many years of good health and much happiness in their retirement.

ACKNOWLEDGEMENTS

I desire to record my appreciation of the loyal and efficient service of all members of the staff during the past year.

C. HALEY,
Conservator of Forests.

APPENDICES

APPENDIX A

Return of Timber, &c., removed from Crown Lands during the Year ended 30th June, 1971

Species	Quantity Super. feet	Super. feet
Milling Timber—		
(*a*) Native Forests—		
Hoop and Bunya Pine—		
Ply	1,226,031	
Logs	7,302,981	
Tops	6,283,734	
		14,812,746
Kauri Pine	2,401,195	
White Cypress Pine	26,508,219	
Forest Hardwoods	64,783,507	
Scrub Hardwoods	15,748,594	
Cabinet Woods	17,204,072	
Miscellaneous Species	32,569,826	
Limb Logs, Head Logs, Stumps and Flitches	53,326	
		159,268,739
(*b*) Plantation Thinnings—		
Hoop Pine	29,346,337	
Bunya Pine	107,001	
Kauri Pine	1,011,713	
Slash Pine	5,204,563	
Loblolly Pine	2,286,415	
Patula Pine	1,589,421	
Radiata Pine	754,681	
Caribbean Pine	23,362	
Maritime Pine	1,459	
Longleaf Pine	2,156	
Southern Silky Oak	43,614	
Shortleaf Pine	3,957	
Mexican Cypress	75	
East African Juniper	190	
Chir Pine	17,478	
Pond Pine	1,771	
Teocote Pine	2,517	
		40,396,715
Pulp Wood—		
Hoop Pine	4,125,897	
Slash Pine	3,737,888	
Loblolly Pine	204,618	
Patula Pine	13,928	
Caribbean Pine	102,753	
		8,185,084
		222,663,284

Other Classes—		Expressed as Superficial feet (Hoppus) Log Measure
Sleepers Hewn	350 pieces	13,308
Sleepers Sawn—5 ft.	104,217 pieces	2,918,076
Sleepers Sawn—7 ft.	253,957 pieces	9,650,366
Sleeper Blocks (as Sleepers contained)	71,650 pieces	2,579,400
Transoms, Crossings, Headstocks, Longitudinals	361,411 superficial feet	361,411
Girders, Corbels, Piles, Sills, Kerb Logs	64,732 lineal feet	1,165,176
Girder Logs	96,174 superficial feet	96,174
Poles	146,081 lineal feet	1,022,567
House Blocks	8,821 lineal feet	52,926
Fencing Material—Round	131,420 lineal feet	328,550
Fencing Material—Split	89,844 pieces	808,596
Mining Timbers—Round	427,329 lineal feet	854,658
Mining Timbers—Sawn	223,900 superficial feet	223,900
		20,075,108

Classes—*continued*

Fuel	9,174 tons
Quarry Material—Sand, Gravel, Soil, &c.	924,135 cubic yards
Freestone	1,772 cubic feet
Fibre, Bark, Dry Leaves, Reeds	81 bags
Duboisia	5,074 pounds
Flora	2,118 pieces
Peat	352 bags
Mulga Wood	39 tons
Poling Timber (Cooper Refining)	2,868 tons
Lawyer Cane	4 tons
Boat Knees	690 pieces
Bee Hives	6 hives
Black Wattle	1,785 stems
She-Oak Bark	60 bushels
Caustis Gahnia	550 pounds
Trees and Plants (Number)	421,375 plants
Brush Material (Bush Fences)	655 tons
Boomerang Blanks	43 pieces

APPENDIX B

Total Receipts, Department of Forestry, for the Year ended 30th June, 1971

Receipts from Districts	Totals $
Group 1—South Queensland (Brisbane, Beerburrum, Beerwah, Benarkin, Bundaberg, Fraser Island, Gallangowan, Gympie, Imbil, Jimna, Kalpowar, Maryborough, Monto, Murgon, Yarraman)	1,891,058.72
Group 2—North Queensland (Atherton, Cairns, Cooktown, Charters Towers, Herberton, Hughenden, Ingham, Innisfail, Port Douglas, Ravenswood, Townsville)	1,313,220 50
Group 3—Dalby, Roma, Taroom, Charleville, Mitchell, Quilpie	286,781.83
Group 4—Warwick, Goondiwindi, Inglewood, St. George, Stanthorpe, Cunnamulla	166,289.32
Group 5—Mackay, Rockhampton, Clermont, Bowen, Proserpine, Emerald, Springsure, Theodore, Winton	160,543.01
Group 6—Barcaldine, Blackall, Jundah, Longreach, Muttaburra, Stonehenge, Aramac, Isisford, Jericho	214 17
Group 7—Cloncurry, Boulia, Kynuna, Mackinlay, Richmond	610 50
Group 8—Burketown, Coen, Croydon, Georgetown, Normanton, Thursday Island	38.50
	$3,818,756 55

Other Receipts	
Forestry and Lumbering	488,348 17
Sale of Plants, Materials, &c.	44,970 94
Licences† (see note after Appendix C)	19,917 00
Rents	28,010 19
Grazing dues	51,580.68
Miscellaneous (Salisbury Area Timber Account, Forfeit Wages, Expenditure Recoveries, &c.)	53,075 91
Sale of U.S. tractors, trucks, &c.	86,096.97
	$4,590,756 41

	$	$
Plant Hire—		
Charged Loan Fund Projects	1,256,379.83	
Trust Fund Projects	139,597.69	1,395,977.52
		$5,986,733.93

The above receipts were disposed of as follows:—	
To Consolidated Revenue Fund as repayment of previous expenditure	797.20
To Loan Fund as repayment of previous expenditure and surplus plant hire	478,231.37
To Forestry and Lumbering Fund:—	
As expenditure on marketing of log timber, maintenance of access roads, capital improvements, plant, TRADAC &c.	3,079,171.56
As Interest and Redemption on Loans	2,393,013 80
To Timber Research and Development Advisory Councils	35,519.00
	$5,986,733 93

APPENDIX C

Proceeds of Sales of Timber, &c., for the Period 1st July, 1967, to 30th June, 1971 (Financial Years)

Groups*	1967–68	1968–69	1969–70	1970–71
	$	$	$	$
Group 1	1,996,563.12	2,096,203.72	1,979,622.36	1,842,022.79
Group 2	1,122,548.51	1,240,764.03	1,180,982.07	1,282.363.10
Group 3	314,039.38	292,793.77	275,058.08	275,084.64
Group 4	195,825.58	201,687.92	165,452.07	161,610.61
Group 5	134,006.20	168,566.71	154,905.07	153.329.05
Group 6	381.85	689.36	244.77	214.17
Group 7	585.15	771.30	687.82	610.50
Group 8	336.00	138.40	264.70	38.50
	$3,764,285.79	$4,001,615.21	$3,757,216.94	$3,715,273.36
Timber Research and Development Advisory Council	Nil	Nil	35,721.49	103,483.19
	$3,764,285.79	$4,001,615.21	$3,792,938.43	$3,818,756.55
Receipts—Forestry and Lumbering	464,468.53	639,829.35	324,612.22	488,348.17
Sale of Plants, Material, &c.	43,980.56	37,501.34	101,965.71	44,970.94
Licences†	18,662.17	18,403.65	20,460.45	19,917.00
Rents and Grazing Dues	50,624.71	67,514.35	71,474.08	79,590.87
Miscellaneous (Salisbury Area Timber Account, Forfeit Wages, Expenditure Recoveries, &c.)	12,122.75	37,664.23	31,851.29	53,075.91
Sale of U.S. Tractors, Trucks, &c.	52,376.76	38,168.50	85,673.13	86,096.97
	$4,406,521.27	$4,840,696.63	$4,428,975.31	$4.590,756.41

* For Districts within the groups, see Appendix B.
† Includes the following licence fees :—Fuel, Quarry, Sawmill, Apiary, Forest Products, Sales Permit.

APPENDIX D

Constructional Timbers Supplied During Financial Year 1970–71 under Forestry and Lumbering Operations

Class of Timber	Quantity	Sales Value
		$
Crossings	166,666 super. feet	18,999.93
Headstocks and Braces	5,316 super. feet	746.17
Transoms	106,505 super. feet	13,313.00
Piles	12,105 lineal feet	11,424.27
Girders—Dressed	7,676 lineal feet	19,923.58
Sleepers	170,237 pieces	355,338.32
Sleeper Blocks (as sleepers contained)	71,650 pieces	75,403.54
Round Fence Posts	..	..
Split Posts and Rails, &c.	13,471 pieces	5,827.30
Total	..	$500,976.11

APPENDIX E

Comparative Statement of Expenditure for Years 1969–70 and 1970–71

——	1969–70	1970–71
	$	$
REVENUE—		
Salaries	1,998,837	2,323,060
Cryptotermes brevis Investigation	1,375	4,647
Fares, Printing, Stores, &c.	11,101	10,968
Travelling Expenses and Incidentals	108,614	113,829
National Parks	69,908	75,208
Cash Equivalent of Long Service Leave	34,021	25,948
LOAN—		
National Parks	205,000	198,949
TRUST—		
Reforestation Trust Fund—		
Reforestation	5,130,000	5,784,232
Land Acquisition	27,205	38,276
Purchase of Plant	669,174	636,584
Access Roads	381,363	353,225
Purchase of Radio Equipment	39,815	24,870
Purchase of Firefighting Equipment	19,963	29,976
Forestry and Lumbering Fund—		
Interest and Redemption on Loans	2,509,779	2,428,543
Hardwood Supplies to Railway Department and others	291,770	458,197
Harvesting and Marketing Timber	1,272,342	1,272,997
Access Roads—Maintenance and Subsidies	198,381	295,013
Maintenance of Plant	817,836	864,244
Maintenance of Capital Improvements	116,337	120,756
Expenses—Timber Research and Development Advisory Councils	192	67,964
Total $	13,903,013	15,127,486

APPENDIX F

Net Area of Plantation Established 1st April, 1970, to 31st March, 1971

Species	Brisbane	Gympie	Mackay	Mary-borough	Monto	Murgon	North Queens-land	Warwick	Yarraman	Totals
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
1. Conifers										
A. Native Conifers—										
Hoop Pine	168·9	912·8	..	422·5	222·6	825·1	54·6	6·4	1,119·9	3,732·8
Kauri Pine	..	..	..	..	..	..	..	..	..	..
Bunya Pine	..	28·3	..	..	..	36·9	..	..	25·0	90·2
Other Native Conifers	..	..	..	..	..	..	..	0·9	..	0·9
Total—Native Conifers	168·9	941·1	..	422·5	222·6	862·0	54·6	7·3	1,144·9	3,823·9
B. Exotic Conifers—										
Slash Pine	1,271·6	4,400·4	..	3,538·8	..	..	..	..	..	9,210·8
Loblolly Pine	110·0	..	..	..	..	..	..	..	42·0	152·0
Patula Pine	..	..	..	..	..	..	..	..	65·6	65·6
Caribbean Pine	93·1	43·6	434·6	475·9	..	..	474·0	..	..	1,521·2
Radiata Pine	..	..	..	..	..	..	..	183·5	141·5	325·0
Long Leaf Pine	..	..	..	..	..	..	..	..	..	..
Other Exotic Conifers	..	..	..	..	..	..	4·1	4·1	..	8·2
Total—Exotic Conifers	1,474·7	4,444·0	434·6	4,014·7	..	..	478·1	187·6	249·1	11,282·8
Total—Conifers	1,643·6	5,385·1	434·6	4,437·2	222·6	862·0	532·7	194·9	1,394·0	15,106·7
2. Broadleaved Species										
A. Native Forest Hardwoods—										
Rose Gum	..	..	..	..	..	..	..	..	..	..
Grey Ironbark	..	..	..	..	..	..	..	..	..	..
Tallowwood	..	..	..	..	..	..	..	..	..	..
Blackbutt	..	..	..	..	..	..	..	..	..	..
Gympie Messmate	..	..	..	..	..	..	..	..	..	..
Others	..	..	..	..	..	..	..	..	..	..
Total—Native Forest Hardwoods	..	..	..	..	..	..	..	..	..	..
B. Other Broadleaved Species—										
Silky Oak	..	..	..	..	..	..	..	..	..	..
Queensland Maple	..	..	..	..	..	..	..	..	..	..
Red Cedar	..	..	..	..	..	..	..	..	..	..
Others	..	..	..	..	..	..	..	..	..	..
Total—Other Broadleaved Species	..	..	..	..	..	..	..	..	..	..
Total—Broadleaved Species	..	..	..	..	..	..	..	..	..	..
Miscellaneous Experimental	..	..	3·7	..	..	..	9·2	..	15·6	28·5
Total—All Species	1,643·6	5,385·1	438·3	4,437·2	222·6	862·0	541·9	194·9	1,409·6	15,135·2

APPENDIX G

Net Area of Effective Plantation Classified into Forestry Districts to 31st March, 1971

Species	Brisbane	Gympie	Mackay	Mary-borough	Monto	Murgon	North Queens-land	Warwick	Yarraman	Totals
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
1. Conifers										
A. Native Conifers—										
Hoop Pine	1,841·8	22,269·0	162·9	2,007·7	5,348·7	14,809·6	1,788·1	10·1	27,264·6	75,502·5
Kauri Pine	5·3	191·2	2·5	69·7	3·6	4·9	291·2	0·8	7·4	576.6
Bunya Pine	0·9	551·0	..	0·8	1·2	106·3	3·0	..	106·6	769·8
Other Native Conifers	2·8	7·3	0·5	1·9	..	..	14·4	0·9	..	27·8
Total—Native Conifers	1,850·8	23,018·5	165·9	2,080·1	5,353·5	14,920·8	1,096·7	11·8	27,378·6	76,876·7
B. Exotic Conifers—										
Slash Pine	19,392·0	22,455·8	2,463·0	25,430·6	52·0	1·4	11·3	746·6	879·0	71,431·7
Loblolly Pine ..	3,800·4	230·2	7·3	45·1	2·7	14·6	14·0	236·8	63·5	4,414·6
Patula Pine	18·9	22·6	8·1	8·2	24·0	93·7	35·0	469·2	3,445·3	4.126·0
Caribbean Pine ..	414·9	405·6	7,236·0	1,862·0	1·4	0·7	1,618·6	..	4·3	11,543·5
Radiata Pine ..	0·5	..	..	..	..	12·0	..	3,091·9	1,044·9	4,149·3
Long Leaf Pine ..	237·9	2·1	7·3	1·0	..	..	..	8·5	2·8	259·6
Other Exotic Conifers	61·0	28·1	106·4	18·9	9·5	3·5	42·1	39·6	56·3	365·4
Total—Exotic Conifers	23,925·6	23,144·4	9,828·1	27,365·8	89·6	125·9	1,721·0	4,592·6	5,497·1	96,290·1
Total—Conifers ..	25,776·4	46,162·9	9,994·0	29,445·9	5,443·1	15,046·7	3,817·7	4,604·4	32,875·7	173,166·8
2. Broadleaved Species										
A. Native Forest Hardwoods—										
Rose Gum	277·3	1,212·7	0·1	0·2	..	8·8	0·9	..	187·4	1,687·4
Grey Ironbark ..	209·6	182·2	0·1	0·1	..	8·9	37·8	..	469·5	908·2
Tallowwood	123·5	18·9	..	0·7	..	..	28·2	..	5·0	176·3
Blackbutt	239·5	235·0	..	58·3	..	..	..	..	0·5	533·3
Gympie Messmate ..	..	258·6	..	0·1	..	..	..	..	..	258·7
Others	29·3	76·6	..	0·9	..	..	10·0	..	2·8	119·6
Total—Native Forest Hardwoods ..	879·2	1,984·0	0·2	60·3	..	17·7	76·9	..	665·2	3,683·5
B. Other Broadleaved Species—										
Silky Oak	..	94·3	..	0·4	..	25·0	26·5	..	596·1	742·3
Queensland Maple ..	..	71·5	..	..	0·6	0·6	248·5	..	..	321·2
Red Cedar	..	7·8	..	..	..	..	31·7	..	..	39·5
Others	0·1	77·3	0·3	0·4	0·2	..	34·1	..	1·1	113·5
Total—Other Broadleaved Species ..	0·1	250·9	0·3	0·8	0·8	25·6	340·8	..	597·2	1,216·5
Total—Broadleaved Species	879·3	2,234·9	0·5	61·1	0·8	43·3	417·7	..	1,262·4	4,900·0
Miscellaneous Experimental	74·2	43·1	89·2	..	..	0·1	21·1	23·4	100·7	351·8
Total—All Species ..	26,729·9	48,440·9	10,083·7	29,507·0	5,443·9	15,090·1	4.256·5	4,627·8	34,238·8	178,418·6

APPENDIX H

Areas of Natural Forest Treated

A.—EUCALYPTS

Sub-District	Treated 1970–71	First Treatment 1970–71	Total as at 30th June, 1971
	Acres	Acres	Acres
Brisbane	524·5	246·0	31,950
Beerburrum	705·0	69·0	20,597
Gympie	..	..	20,242
Imbil	..	..	404
Mackay/Emerald/ Rockhampton	..	..	48,848
Maryborough	1,197·0	533·0	109,046
Bundaberg	735·0	..	38,272
Fraser Island	1,115·0	435·0	24,880
Monto	668·0	624·0	25,486
Murgon/Jimna ..	1,114·0	65·0	45,166
Atherton	..	..	3,712
Ingham	..	..	2,985
Warwick	..	..	10,462
Inglewood	..	..	15,697
Yarraman	..	..	6,414
Benarkin	5·0	..	2,067
Dalby/Chinchilla ..	183·0	183·0	82,338
Total—Eucalypts	6,246·5	2,155·0	488,566

APPENDIX H—continued

B.—CYPRESS PINE

Sub-District	Treated 1970–71	First Treatment 1970–71	Total as at 30th June, 1971
	Acres	Acres	Acres
Bundaberg	..	..	2,152
Fraser Island	..	..	4,424
Monto	..	..	2,496
Inglewood	4,417·0	3,077	106,280
Dalby/Chinchilla/ Roma	10,221·0	4,000	247,227
Total—Cypress Pine	14,638·0	7,077	362,579

APPENDIX H—continued

C.—RAIN FOREST

Sub-District	Subsequent Treatment 1970–71	First Treatment 1970–71				First Treatment Completed 1970–71	Total as at 30th June, 1971
		Brushed	Ringbarked and Thinned	Logged under Treemarking *Conditions*	Trees Interplanted		
	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Natural Hoop Pine—							
Maryborough	..	..	..	..	..	..	65
Bundaberg	..	..	..	..	..	..	9,973
Total—Natural Hoop Pine	..	..	..	..	..	..	10,038
Natural Rain Forest—							
Atherton	..	..	488	4,780	..	488	10,281
Ingham	..	..	..	..	..	..	1,364
Warwick	..	..	..	..	..	..	21
Total—Natural Rain Forest	..	..	488	4,780	..	488	11,666
Total—Rain Forest	..	..	488	4,780	..	488	21,704

APPENDIX H—continued

Grand Total—	Acres
Eucalypts	488,566
Cypress Pine	362,579
Rain Forest	21,704
	872,849

APPENDIX I

State Forests, Timber Reserves and National Parks listed by Forestry Districts and Sub-Districts as at 30th June, 1971

District	Sub-District	State Forests		Timber Reserves		National Parks	
		No.	Area	No.	Area	No.	Area
			A. R. P.		A. R. P.		A. R. P.
Brisbane	Beerburrum	27	104,049 2 23·6	11	2,197 0 3	11	4,088 0 8
	Brisbane	36	191,160 0 26	17	25,997 0 3	34	92,648 1 11·1
	Total	63	295,209 3 9·6	28	28,194 0 6	45	96,736 1 19·1
Dalby	Chinchilla–Barakula	16	863,817 0 38	3	17,911 0 0	1	25,970 0 0
	Dalby	23	524,651 3 0	5	5,977 0 39	2	30,628 2 0
	Roma	21	528,194 3 18	4	103,602 0 0	1	4,350 0 0
	Total	60	1,816,663 3 16	12	127,490 0 39	4	60,948 2 0
Gympie	Gympie	31	290.490 0 10	2	1,436 0 8	4	2,132 0 0
	Imbil	11	145,712 3 0	2	148 2 3	1	640 0 0
	Total	42	436,202 3 10	4	1,584 2 11	5	2,772 0 0
Mackay	Emerald	4	142,306 0 35	9	186,741 2 10	3	1,379,400 0 0
	Mackay	8	166,646 0 0	19	100,491 2 19·1	90	314,734 1 38
	Rockhampton	43	866,959 0 38	14	112,559 2 22	15	13,124 0 0
	Total	55	1,175,911 1 33	42	399,792 3 11·1	108	1,707,258 1 38
Maryborough	Bundaberg	17	205,339 0 15	21	84,260 2 10	..	..
	Fraser Island	1	371,890 0 0	..	..	..	..
	Maryborough	35	370 381 2 1	15	28,476 0 37	6	13,933 0 0
	Total	53	947,610 2 16	36	112,736 3 7	6	13,933 0 0
Monto	Kalpowar	7	41,452 2 0	14	59,127 2 35	..	..
	Monto	36	560,184 1 35	20	61,933 1 8	6	4,932 0 0
	Total	43	601,636 3 35	34	121,061 0 3	6	4,932 0 0
Murgon	Gallangowan	3	38,250 0 0	..	..	..	..
	Jimna	12	114,660 0 34	..	..	..	..
	Murgon	13	128,643 3 0	9	28,099 1 3	..	..
	Total	28	281,553 3 34	9	28,099 1 3	..	..
North Queensland	Atherton	35	864,333 3 6	33	807,849 3 13	62	314,315 3 17
	Ingham	14	566,969 0 0	5	8,280 1 8	30	244,078 0 0
	Total	49	1,431,302 3 6	38	816,130 0 21	92	558,393 3 17
Warwick	Inglewood	34	458,309 1 37	2	182 0 8	..	..
	Warwick	14	81,076 3 37	4	5,958 3 28	6	15,819 3 0
	Total	48	539,386 1 34	6	6,140 3 36	6	15,819 3 0
Yarraman	Benarkin	4	70,852 0 0	3	4,442 2 26	..	..
	Yarraman	16	112,023 2 0	9	14,898 2 25	2	11,699 3 0
	Total	20	182,875 2 0	12	19,341 1 11	2	11,699 3 0
	Grand Total	461	7,708,354 0 33·6	221	1,660,571 0 28·1	274	2,472,493 2 34·1

At 30th June, 1971—

Total area set apart as—

	A.	R.	P.
State Forests	7,708,354	0	33·6
Timber Reserves	1,660,571	0	28·1
National Parks	2,472,493	2	34·1
Total Reservations	11,841,419	0	15·8

APPENDIX J

Reservations for the Year ended 30th June, 1971

1st July, 1970 to 30th June, 1971

STATE FORESTS

	No.	A.	R.	P.
At 1st July, 1970	441	7,499,776	2	2·6
Declared	29	187,576	3	19
Declared and added to existing Forests		6,249	0	14·1
Timber Reserves declared State Forests	1	900	0	0
Timber Reserves declared State Forests and amalgamated with existing State Forests		21,415	3	0
Recomputation of boundary		1,623	0	7·9
Areas released	−1	−9,187	0	10
	470			
Amalgamation of existing State Forests	9			
Total at 30th June, 1971	461	7,708,345	0	33·6

TIMBER RESERVES

	No.	A.	R.	P.
At 1st July, 1970	225	1,699,033	2	8·1
Declared	1	5,000	0	0
Declared and added to State Forests, National Park	−5	−23,635	3	0
Declared and added to existing Timber Reserve		140	2	24
Recomputation of boundary		−7,204	1	27
Areas released		−12,762	3	17
Total at 30th June, 1971	221	1,660,571	0	28·1

NATIONAL PARKS

	No.	A.	R.	P.
At 1st July, 1970	271	2,462,680	2	14·1
Declared	2	8,460	0	0
Declared and added to existing National Parks		222	3	0
Timber Reserves declared National Parks	1	1,220	0	0
Recomputation of boundary		−5	3	0
Areas released		−83	3	20
Total at 30th June, 1971	274	2,472,493	2	34·1

APPENDIX K

Distribution of Personnel, 30th June, 1970

Salaried officers	522
Other employees	1,696
	2,218

APPENDIX L

Tree Species Mentioned in Annual Report

Botanical Names

A. NATIVE CONIFERS

Bull Kauri	*Agathis microstachya*
Bunya Pine	*Araucaria bidwillii*
Cypress Pine	*Callitris columellaris* syn. *glauca*
Hoop Pine	*Araucaria cunninghamii*
Northern Cypress Pine	*Callitris columellaris* syn. *intratropica*
North Queensland Kauri	*Agathis palmerstonii*
Sand Cypress	*Callitris columellaris* syn. *arenosa*
Southern Kauri Pine	*Agathis robusta*
White Cypress Pine	*Callitris columellaris* syn. *glauca*

B. EXOTIC CONIFERS

Bahamas Caribbean Pine	*Pinus caribaea* var. *bahamensis*
Benguet Pine	*Pinus kesiya*
Caribbean Pine	*Pinus caribaea* (3 varieties)
Chir Pine	*Pinus roxburghii*
Cuban Caribbean Pine	*Pinus caribaea* var. *caribaea*
East African Juniper	*Juniperus procera*
Honduras Caribbean Pine	*Pinus caribaea* var. *hondurensis*
Loblolly Pine	*Pinus taeda*
Longleaf Pine	*Pinus palustris*
Maritime Pine	*Pinus pinaster*
Mexican Cypress	*Cupressus lusitanica*
Montezuma Pine	*Pinus montezumae*
Ocote Pine	*Pinus oocarpa*
Patula Pine	*Pinus patula*
Pond Pine	*Pinus serotina*
Pringle's Pine	*Pinus pringlei*
Radiata Pine	*Pinus radiata*
Scrub Pine	*Pinus virginiana*
Shortleaf Pine	*Pinus echinata*
Slash Pine	*Pinus elliottii* var. *elliottii*
Sugi	*Cryptomeria japonica*
Tenasserim Pine	*Pinus merkusii*
Teocote Pine	*Pinus teocote*

C. EUCALYPTS

Blackbutt	*E. pilularis*
Grey Ironbark	*E. drepanophylla*
Gympie Messmate	*E. cloeziana*
Ironbark	*E. drepanophylla* / *E. fibrosa sub* sp. *fibrosa*
Kamerere	*E. deglupta*
Killarney Ash	*E. dunnii*
Red Mahogany	*E. resinifera*
Spotted Gum	*E. maculata*
Sydney Blue Gum	*E. saligna*
Tallowwood	*E. microcorys*

D. OTHER BROADLEAVED SPECIES

African Mahogany	*Khaya sengalensis*
American Mahogany	*Swietenia macrophylla*
Black Wattle	*Acacia* sp.
Brigalow	*Acacia harpophylla*
Brush Box	*Tristania conferta*
Bull Oak	*Casuarina luehmanii*
Carrol	*Backhousia myrtifolia*
Maple Silkwood	*Flindersia pimenteliana*
Queensland Maple	*Flindersia brayleyana*
Queensland Silver Ash	*Flindersia bourjotiana*
Red Cedar	*Toona australis*
Rosewood	*Eremophila mitchelli*
Sandalwood	*Santalum lanceolatum*
She Oak	*Casuarina* sp.
Silver Silkwood	*Flindersia acuminata*
Southern Silky Oak	*Grevillea robusta*
Turpentine	*Syncarpia glomulifera*