1970

QUEENSLAND

ANNUAL REPORT

OF THE

DEPARTMENT OF FORESTRY

FOR THE

YEAR 1969-70

PRESENTED TO PARLIAMENT BY COMMAND

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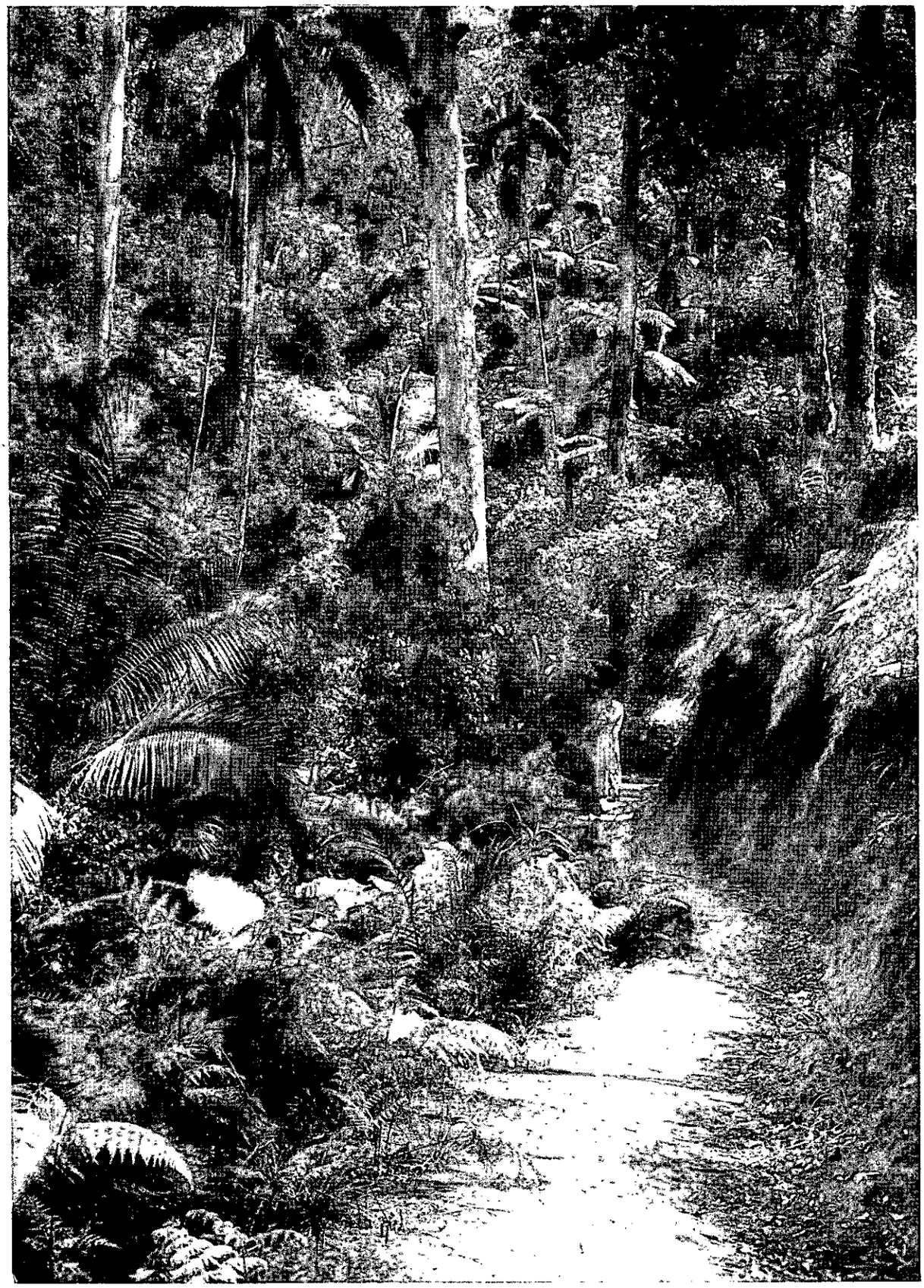


TYPICAL NATIONAL PARK WALKING TRACK.

REPORT OF THE CONSERVATOR OF FORESTS

For the Year ended 30th June, 1970

TO THE HONOURABLE THE MINISTER FOR LANDS

INTRODUCTION

By far the most important development in Forestry in Queensland during the past year has been the Government's acceptance of the proposal submitted by Woodland Sawmills Pty. Ltd. for the establishment of an industrial complex to utilize pulpwood becoming available from the State's major softwood plantation project in the Tuan–Toolara State Forests of the Gympie and Maryborough Districts. This proposal entails the early establishment of Particle Board plants in Brisbane and Gympie and a Kraft pulp mill in the Gympie region by the year 1982 when it is expected that pulpwood supplies will be adequate to justify commencement of operations. In addition the proposal provides for diversion of suitable logs to saw-milling and for the preservative treatment of round timbers. Membership of the consortium that is to develop the project is such to inspire confidence in its success by reason of the long and successful participation of each in the timber industry and, more particularly, in the fields of activity appropriate to this venture. As was pointed out in last year's report these developments are most opportune because of the need for Queensland to capitalise on the advantage conferred by the nucleus of established plantations in this area in advance of similar projects which will develop in areas of other States with programmes of more recent origin. It must be stressed however that to meet the requirements of raw material for a modern Kraft Pulp mill as well as those of the ancillary Particle Board plants will need the pulpwood production of practically the entire area available for planting in the Tuan–Toolara State Forests and it is absolutely essential to maintain the rate of planting in this region at somewhere near the current level of activity which saw 7,800 acres of softwood planted on these State Forests during the 1970 winter.

Another advance which should have far reaching effects on the economic well-being of the Timber Industry in Queensland has been the establishment of the Timber Research and Development Advisory Committees after years of patient work by those who saw the need for such organisation and the benefits that can accrue from a united effort particularly in the field of product promotion. It is hoped that unity of effort will be achieved by the appointment of a Common Chairman (Mr. A. R. Trist, the former Conservator of Forests) to each of the two Committees representing South and Central Queensland and north of Townsville. Already good progress is being made and joint projects planned some of which will be developed with the co-operation of similar organisations which have been operating for some time in New South Wales and Victoria. Funds are being provided by a levy of 5 cents per 100 super. feet on all mill timber logged from Crown Lands within the State. It is unfortunate that it is not possible to exact similar contributions to the fund from millers of private timber who will benefit equally from the work but it is hoped that these benefits will be so marked and patent that millers of private timbers will provide substantial financial support on a voluntary basis.

During the year Sawmillers throughout the State took advantage of the new policy that permits amalgamation of sawmills within well defined zones. So far 30 mills have been involved in amalgamation action and this has resulted in the closure of 16 mills. The process is continuing and from enquiries received it is clear that many additional amalgamations are under consideration.

Regular meetings of the State Committee of the Australian Timber Industry Stabilisation Committee were held during the year and these were pervaded by a spirit of good will and co-operation that is so necessary for fruitful consultation between the Department and Industry. It is considered that this helpful spirit greatly assisted in the smooth implementation of a number of changes introduced during the year in the assessment of felling and haulage rates with the object of bringing the basis of calculations into line with present day practice. These involved the adoption of the chain saw in assessment of felling tasks, of tractors instead of horses for snigging plantation thinnings and of new truck and trailer equipment for haulage. With a continuation of this kind of co-operation it is hoped to introduce a number of other minor changes aimed at effecting a saving of effort which will enhance the value of the raw material without economic disadvantage to the miller or to ensure a fuller utilization of the product of the forest.

The market for Cypress Pine has remained bouyant and is being increasingly met by the operation of timber from private sources which has been augmented as a result of freeholding action throughout the Cypress belt. To meet the position so created and increase the opportunities for Freeholders to dispose of the merchantable timber crop within the period of ten years allowed to them for payment it has been necessary to issue additional sawmill licensed capacity restricted to the operation of private timber only. The principle on which the appropriate new capacity was calculated involved examination of existing capacity both unrestricted and private timber only and allotting additional capacity adequate to permit the total volume freeholded or expected to be freeholded to be milled within the period of 10 years. As a result of this approach requests for such additional capacity resulted in approval for the issue of 6 licenses for new mills involving an annual capacity of 6,784,000 super. feet and an increased capacity for existing mills amounting to 5,080,000 super. feet per year.

Once again the funds provided by the Commonwealth under the Softwood Agreement Act permitted a further increase to be made in the area planted during the year which amounted to 12,633 acres and was 631 acres more than for the previous year. Some appreciation of the way in which the planting programme has been assisted by the availability of these funds and of the effective way in which they have been used is conveyed by the following figures covering the four years before and after the inception of the scheme.

	Acres
Area of Plantations established 1962-63–1965-66	= 20,193
Area of Plantations established 1966-67–1969-70	= 42,094
Area on which Commonwealth Funds are paid ..	= 12,000

These figures have been achieved with increased State allocations that have been largely related to the rises in basic wage and allowances. Moreover claims made on the Commonwealth have been kept below those submitted in estimates before the introduction of the 1967 Act. Reasons for this highly satisfactory condition are to be found in reduced costs associated with increased use of machines and of herbicides together with greatly reduced overheads directly related to size of programme in areas where the major expansion has occurred. The 1970–71 year is the last of the five years covered by the Softwood Agreement Act and consideration is at present being given to its extension for the next five years. It is of the utmost importance to the State that there should be no reduction in the approved programme and a case has been submitted for an increase that would permit the development of a substantial planting programme with Caribbean Pine in the Ingham District where adequate land is available. Should this increase not be provided for it will be necessary for an approach to be made to the Commonwealth for assistance to be provided for as a special project for northern development.

The mill log cut from Crown Lands increased by about 6·5 million super. feet but this was insufficient to compensate for a drop of 25 million suger. feet in the cut from private lands. The annual yield from the State's plantations continues to increase and for the first time the volume sold during the year from such areas exceeded the 50 million mark. The demand for Hoop Pine from plantations remained firm but there has been a marked improvement in the interest in the utilization of the Exotic Pines, in particular of Slash Pine. This interest has been stimulated to a degree by the promising results achieved by high temperature kiln drying experiments conducted at the Department's Rocklea depot with the co-operation of C.S.I.R.O. and of section of the Industry. This interest was reflected in the keen competition that occurred for the purchase at auction of lots that carried rights to continuing supplies amounting to 2·5 million super. feet per year.

Of recent years more attention has been paid to the importance of habitat preservation in the selection of new areas for reservation. With one trained officer engaged almost wholly on this work steady progress is being made in the reservation of areas representative of major ecological associations within the State and in this regard the co-operation of the Land Administration Commission is gratefully acknowledged. In all a further 93,564 acres were added to the area of National Park reservations to bring the total area to 2,462,680 acres. This includes a fine area of Brigalow at Southwood which is a timely and very important addition to the National Park estate and together with Dipperu and Lonesome Holding as well as undisturbed areas within the confines of State Forests will provide in the ultimate a reasonable representation of Queensland's Brigalow associations. Despite this progress however a study of the map of Queensland in relation to National Park reservations discloses the total lack of reservations in Cape York Peninsula, the Gulf Country and most of the inland sections of the State. Acceleration in the rate of pastoral and other development of the northern and gulf areas makes this a matter of urgent concern and efforts to meet the situation are being intensified. During the year the first declaration was made of special purpose areas under section 40A of the Forestry Act and action is in hand for further declarations. The urgent needs in this field together with those associated with new reservations place an increasing demand on the time of the National Park officers and during the year a university trained officer was transferred to the section from forestry work and provision is being made for the recruitment of university trained staff through the Scholarship scheme.

Once again there has been an improvement in the position regarding valuations of timber required in connection with the freeholding of Crown holdings and this has been assisted to some extent by a slight drop in the rate at which applications for conversion have been made. However, the rate is still high and the areas covered are widely scattered so that no early relief is foreseen from the strain placed on the Department in keeping up with this work.

Except in North Queensland favourable conditions made the fire season of the past year a pleasant relief from the severe experience of 1968-69. As a result expenditure on firefighting, patrol and detention was just under $95,000 and about one-third of that of the previous year. It is gratifying to find that only 67 acres of plantation or less than 0·05 per cent. of the planted area was covered by fire and that no loss of planted area has resulted. The seasonal conditions in South-East Queensland permitted the programme of research into prescribed burning of Slash Pine plantations as a measure of protection and full reduction to be resumed and valuable data is being assembled which can have an important influence on procedures and on net area available for planting.

The retirement during the year of the Department's two top officers who had between them more than 100 years of service was a severe loss and it is fitting that an appreciation of their contribution to Forestry over those years should be placed on record. Mr. A. R. Trist who retired as Conservator of Forests was highly regarded in State, Commonwealth and International spheres and played an important part in the development of the Department's policies and practices in all fields of Forestry endeavour. In this he was ably assisted by his Deputy Conservator, Mr. L. J. Rogers, and the State is the poorer by their loss.

MANAGEMENT

General

The area of State Forest as at 30th June, 1970, was 7,499,777 acres a net increase of 238,983 acres.

Expenditure

Expenditure under the Reforestation Vote was $5,130,000 compared with $5,142,755 in 1968-69. Expenditure from Trust Funds on projects associated with the Reforestation Vote was $116,337.

Expenditure is itemised as follows:—

Item	Expenditure	Percentage of Total
Direct Expenditure of Projects—	$	
Plantations	1,286,138	24·5
Natural Regeneration	216,139	4·1
Nursery Expenses	195,771	3·7
Research	152,615	2·9
Protection	692,140	13·2
Surveys	95,048	1·8
New Construction	194,231	3·7
Seed Collection	24,861	0·5
Maintenance of Capital Improvements	112,068	2·2
Total direct expenditure	$2,969,011	56·6
Indirect Expenditure—		
Wet Time, Holidays and Leave	513,917	9·8
Supervision, Tools, Cartage, &c.	1,048,077	20·0
Camp Allowance	333,292	6·4
Pay Roll Tax	84,364	1·6
Workers' Compensation	57,426	1·1
Administration	168,421	3·2
Miscellaneous	71,829	1·3
Total indirect expenditure	$2,277,326	43·4
Total expenditure	$5,246,337	100·0

Employment

The number of men engaged on Reforestation work was 1,175 as at 1st July, 1969, compared with 1,331 at the end of June, 1970.

The average level of employment on this work was 1,280 compared with 1,343 in 1968-69.

Average expenditure per man per year was $4,008 compared with $3,822 in 1968-69.

Timber Assessment

Assessment work on State Forests was continued on all the major forest types: plantations, North Queensland rain forest, coastal hardwood and cypress pine.

A total of 143 permanent plots were established covering an area of 30,000 acres and part of this area was sampled with temporary plots as well. In addition two State Forests with an area of 55,000 acres were covered by strip survey.

Remeasurement work in plantations and a major cypress pine group of Reserves was also undertaken covering 460,000 acres.

Areas that merit acquisition as State Forests and assessed by temporary plots or strip survey include a large Pastoral Holding of 200,000 acres and a number of selections totalling 280,000 acres.

Aerial reconnaissance was continued and covered 94 selections with a total area of 1,600,000 acres bringing the five years total of areas inspected to more than 600 selections and holdings covering nearly 10,000,000 acres.

Valuation of Timber on Land for Conversion of Tenure

There has been a slight drop in the rate at which applications for conversion have been received, but the rate of applications is still high, and very widely scattered in location.

The number of applications on which field work remains to be done is again fewer than the applications received during the year and outstanding applications requiring field work represent only 6 per cent. of all applications received while valuations on 83 per cent. of all applications have been completed.

In addition to the routine freeholding applications in the table below, the Department has been asked to value seventy-two blocks in the Brigalow Development Area No. III totalling 1,720,000 acres and sixty-three are now completed with only nine blocks totalling 155,000 acres being outstanding.

FREEHOLDING POSITION IN RELATION TO PREVIOUS YEARS

	As at 30th June, 1968		As at 30th June, 1969		As at 30th June, 1970	
	No.	Area	No.	Area	No.	Area
		Acres		Acres		Acres
Total applications made	2,371	18,425,000	2,601	20,775,000	2,784	22,692,000
Withdrawn before valuation	27	188,000	24	171,000	27	256,000
Total requiring valuation	2,344	18,237,000	2,577	20,604,000	2,757	22,436,000
Valuation complete and determined by Land Court	1,063	5,363,000	1,464	9,183,000	1,842	13,038,000
Valuation complete and awaiting Land Court determination	676	6,316,000	684	6,349,000	544	4,960,000
Field assessment complete but not yet valued	358	3,914,000	257	2,898,000	216	2,441,000
Awaiting field assessment	247	2,644,000	172	2,174,000	155	1,997,000
Totals	2,344	18,237,000	2,577	20,604,000	2,757	22,436,000

Protection

SEASONAL CHARACTERISTICS. The fire season in south-east Queensland was relatively quiet with the mild winter followed by adequate rainfall during the summer months. Grass was thus growing and in a green condition during the normal fire season.

In North Queensland the fire season was more severe than experienced for several years. Forty-six fires occurred in Atherton district as against twelve in the 1968-69 fire season.

With the mild 1969-70 fire season, good summer rainfall on the coast and the cold dry 1970 winter, the 1970-71 fire season could be as severe as that of 1968-69.

FIRE INCIDENCE. The number of fires attended by departmental employees was 119, as against 440 in 1968-69 and 212 in 1967-68. Sixteen fires were in excess of 1,000 acres each, compared with 86 in 1968-69. This year six successful prosecutions for offences involving fire in contravention of the Forestry Act or of the Rural Fires Act resulted in fines totalling $184. Four demands met for costs of fire-fighting reduced departmental expenditure by $388. Ten letters of warning were issued.

Number of Fires by month and size are set out in the table following:—

Month	Number of Fires	Size of Fires in acres (Private and other Crown Lands as well as Forest Reserves)				
		0–10	11–100	101–1,000	1,001–10,000	10,001+
July	..	..	..	..	..	..
August	5	2	1	2	..	..
September	41	15	15	5	6	..
October	15	9	4	..	2	..
November	25	9	5	7	3	1
December	15	6	4	4	1	..
January	10	..	6	3	1	..
February	5	4	..	1	..	..
March	2	1	..	1	..	..
April	..	..	..	..	..	..
May	1	..	1	..	..	..
June	..	..	..	..	..	..
Total	119	46	36	23	13	1

Only three of the 119 fires were in softwood plantations. The total area burnt over by these three fires was sixty-seven acres which is less than 0·05 per cent. of the total softwood plantation area. The largest of these three fires was in the Maryborough sub-district in a Slash Pine plantation at Tuan. This fire resulting from a spot over from ten-day old burning operations in an included swamp burnt over sixty-one acres of plantation thirteen years old. The fact that 427 points of rain fell in the two weeks prior to the fire points to the very fire hazardous nature of Slash Pine forest fuel. The fuel quantity was eight tons per acre and had an average vertical distribution of twelve inches (because of suspension of needles by the undergrowth) which allowed rapid fuel drying. Rate of spread was twelve chains per hour with an average flame height of twelve feet. The fire intensity was 390 B.T.U. per second per foot.

Of the largest three hardwood forest fires (in terms of area and expenditure) two were in the Atherton district, one covering an area of 13,200 acres and costing $778 to suppress. The other covered 137 acres and cost $2,047 to suppress. The third fire in Bundaberg sub-district covered 10,588 acres, cost $2,819 to suppress and caused $12,000 damages.

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

District	No. of Fires	Area Burnt Over (acres)			
		Crown Timber Areas		Private	Total
		Inside Protection Systems	Partly Protected or Unprotected		
Atherton	46	6,583	12,271	15,280	34,134
Brisbane	7	45	30	51	126
Dalby	10	194	..	..	194
Gympie	9	2,516	..	57	2,573
Mackay	6	404	..	33	437
Maryborough	14	11,105	7,240	350	18,695
Monto	3	1,900	800	..	2,700
Murgon	7	356	115	216	687
Warwick	7	..	281	1	282
Yarraman	4	1	48	20	69
National Parks—All Districts	6	1	1,803	30	1,834
Total	119	23,105	22,588	16,038	61,731

Major known causes of fire outbreaks by percentage were:—

Unauthorised burning off	26·9%
Smoking materials	8·4%
Government, Semi-Government Authorities and bush workers	18·5%
Escapes from permit fires	8·4%
Relights of old fires	5·0%
Lightning	6·7%
Camp and billy fire escapes	1·7%
Incendiarists	5·0%
All other known causes	3·4%
Unknown causes	16·0%
Total	100·0%

Communications

Despite shortage of skilled technical staff which hampered progress all mobile equipment purchased to date have been installed and in addition 50 mobile units, 20 VHF FM portables, 20 handphones and 8 single sideband high frequency mobile/base units are being supplied.

Five more bases have been installed. Forty-one bases and 318 mobiles are now in operation.

Planning of six ultra high frequency link controlled bases is progressing.

Arrangements are in hand for the establishment of a Communication Head Quarters in North Queensland to handle installations and maintenance now carried out from Brisbane.

Detection

All fire towers in the Beerburrum sub-district were renovated and one at East Nanango was increased in height. A three-legged tower over 130 feet in height to the floor is being constructed on the Great Dividing Range in the Barakula State Forest.

After several delays the three steel towers (one eighty feet and two sixty feet) in North Queensland have now been completed. Their value in early fire detection has already been demonstrated.

Aircraft were again used in fire detection in the Cypress Pine areas of the west, but only limited use was necessary on the coast.

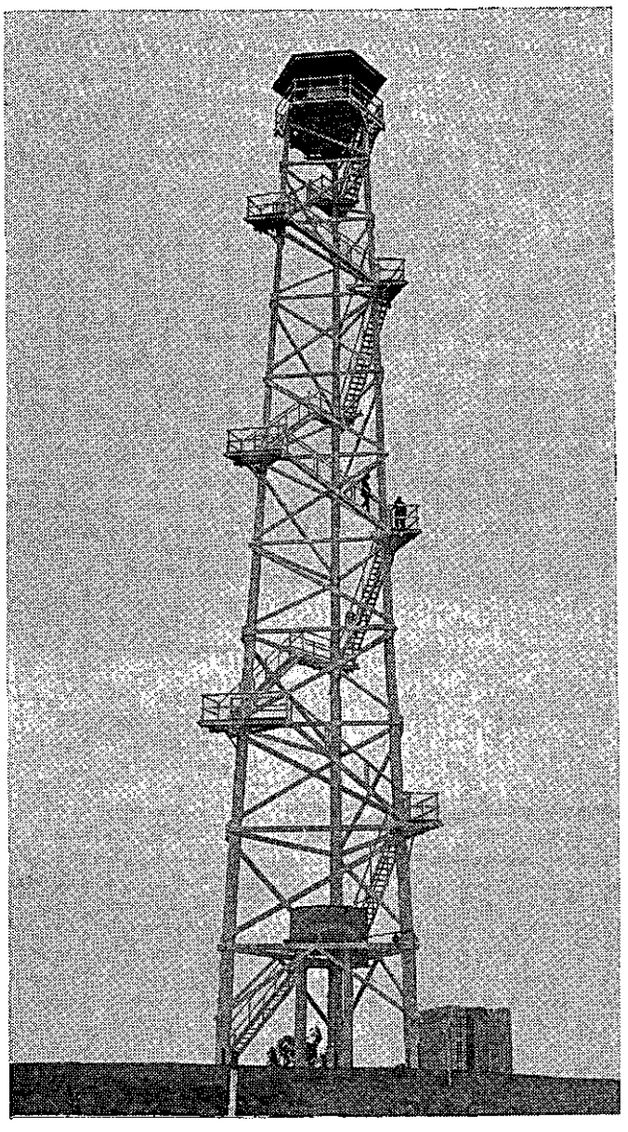
Equipment

During the year eighteen slip-on units were constructed and despatched to districts; ten were of 275 gallon and eight of 475 gallon capacity.

An attempt has been made at development of a "multi-flailer" drawn by a light wheel-tractor for use on fire-line construction in western areas. Modifications to the original design are still being tested.

Fire Research

In the early stages of the fire research programme, considerable attention has been directed to research on fire behaviour and fire effects in Slash Pine plantations.



BARAKULA FIRE TOWER—Commissioned by the Minister for Lands on 29th August, 1970. Height 144 feet.

Plots established in a 30 acre area of twelve year old Slash Pine plantation (average height 32 feet) burnt by a wild-fire in January, 1969, indicate that whereas the species may be fairly tolerant to severe fire as regards actual mortality and physical damage to the stem, increment losses do occur; these losses are related to the degree of defoliation caused by the fire:—

Crown Damage Class	Increment in Ensuing 12 months
Crown burnt off by crown fire or flare-up	70% mortality. Nil increment on surviving 30%, but crown recovery is good
Completely defoliated by scorch	No mortality. Crown recovered, but only 8% of normal growth
Less than 5 feet of green crown left after the fire	Increment 36% of normal
More than 5 feet of green crown left after the fire	Increment 60% of normal

Increment plots on an area burnt experimentally in June, 1967, substantiate this loss of increment due to crown scorch and subsequent defoliation. Evidence indicates that this loss may persist for two years or more after defoliation.

Basal area increments, expressed as percentages of standing basal areas have been:—

Treatment	Percentage Basal Area Increment		
	First Year	Second Year*	Third Year
	%	%	%
Unburnt Plots ..	6·4	1·37	3·4
Burnt—No scorch ..	5·9	1·20	3·3
Total crown scorch ..	0·3	1·41	1·8

(* The second year increment figures are seriously drought affected.)

A total of thirty-two experimental fires have been run in Slash Pine fuel types to document fire behaviour in relation to seasonal and daily atmospheric conditions. The rapid dissipation of rainfall effects compared with Eucalypt fuels has been a major finding. This phenomenon has restricted work to burning immediately following rain to produce low intensity fires.

The Minister for Lands (Mr. V. B. Sullivan, M.L.A.) Addressing the Gathering at the Opening of the Barakula Fire Tower.

Burning in 10–14 year old plantation should become a *fairly simple operation, effecting 80 to 90 per cent. fuel* reduction, and producing negligible scorch. Burning in younger plantation appears practicable, and as distinct from research findings in Radiata Pine fuel types, total ground pruning would appear unnecessary in Slash Pine. Experimental burning has indicated considerable differences in fire behaviour in pruned and unpruned stands, particularly as regards flaring, but these differences are of more interest as a prediction of anticipated wild-fire behaviour, since the extent of flaring increases with fire intensity.

General

Expenditure on fire fighting, patrol and detection was $94,397 (compared with $265,978 in 1968-69 year). Direct suppression costs were $10,910 ($120,577). Prescribed burning to reduce fuels prior to the fire season cost $8,981 ($9,889) and covered 74,841 acres (84,983 acres). Burning of logging debris cost $6,019 ($3,216). Co-operative burning with neighbours cost $7,176 ($14,797). Construction of new protection roads and fire breaks cost $264,556 ($320,647) and maintenance of existing protection roads and fire breaks cost $271,586 ($251,866).

Industrial Safety

The accident frequency rate for the year was similar to that for 1968-69. Details since 1961 are:—

Year	Frequency Rate (Accidents per 1,000,000 man hours worked)
1961–62	*150·6*
1962–63	150·1
1963–64	132·6
1964–65	120·5
1965–66	93·3
1966–67	*101·6*
1967–68	101·1
1968–69	119·9
1969–70	119.0

Again the high yearly rate was largely due to the final quarter of *1969. The frequency for this quarter at 168·7* was very close to the 170·5 for the corresponding period in 1968. The high 1968 figure was felt to be a reflection of the severe 1968-69 fire season inducing fatigue among employees, however the mild conditions of the 1969-70 fire season have not been a contributing factor this year.

During the year two foresters in North Queensland were trained as safety officers.

MECHANICAL EQUIPMENT

General

The maintenance programme on motor vehicles showed that vehicles receiving correct and regular maintenance are capable of sustained operation under severe fire-fighting conditions. The overall figures showed a record mechanical availability of 95·6 per cent. for the year. The lowest availability for a 28-day period was 93·9 per cent. and the highest 96·7 per cent. Delays in having insurance repair work on motor vehicles carried out quickly is still causing loss of working time.

In-service training has been continued with the attendance of the Department's Mechanics at Services Schools conducted by major suppliers.

The new Maryborough Workshop is now fully operational. Extension of the facilities at Gympie is under way, and a new workshop is under construction at Toolara. A workshop is being rented at Ingham pending construction of a permanent workshop. Extension to the Atherton Workshop is under consideration.

Initial reports on the use of a motor cycle in conjunction with a utility, where a 4-wheel drive vehicle was previously used, record its success. This combination is very flexible and it is envisaged that more motor cycles could be used to advantage.

A junior wagon drill and compressor unit was purchased for use in road construction in North Queensland and has proved successful.

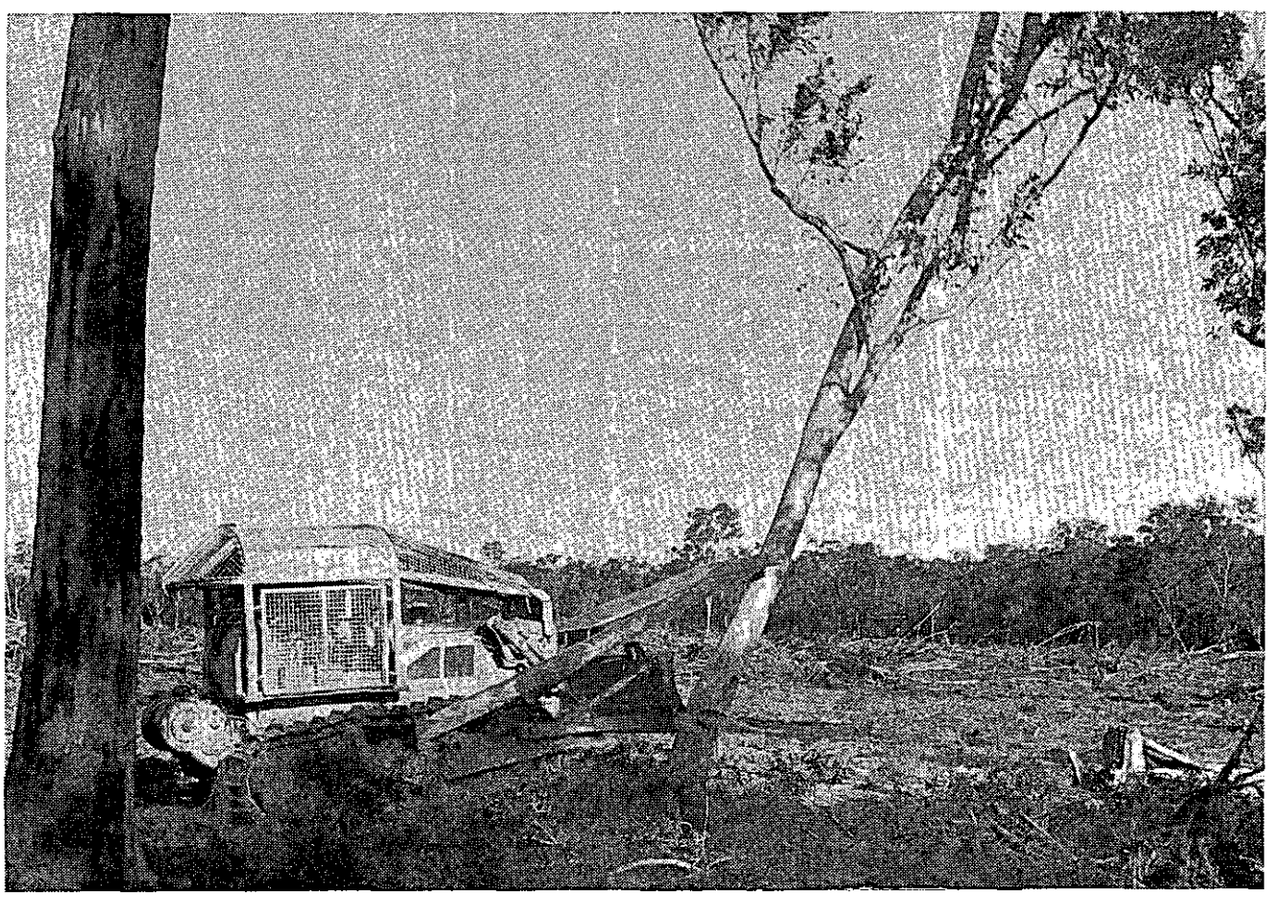
Current staff consists of:—

Mechanical Equipment Officer
6 Plant Inspectors
3 Clerks
2 Clerk Typists
34 Mechanics
5 Driver Instructors.

Receipts and Expenditure

Details are:—

	1968–69 $	1969–70 $	Difference $
Trust and Special Funds—			
Reforestation Trust Fund—			
Purchase of Plant ..	499,108	669,174	+170,066
Forestry and Lumbering Fund—			
Maintenance of Plant ..	813,599	817,836	+4,237
Plant Hire Credits ..	1,240,655	1,173,866	−66,789
Excess of Plant Hire over Maintenance of Plant	427,056	356,030	−71,022
Sale of Plant	38,168	77,590	+39,426



Machine Clearing of a typical area for Establishment of Exotic Pine Plantation. State Forest 611, Beerwah.

Purchase of Plant:—Major Items of Plant purchased during the year were:—

11 Tractor/dozers
7 Rubber-Tyred 4-Wheel Drive Tractors
3 Rubber-Tyred 2-Wheel Drive Tractors
58 Replacement Motor Vehicles
7 Additional Motor Vehicles.

Maintenance of Plant—Main items for the years 1968-69 and 1969-70 were:—

	1968–69 $	1969–70 $	Difference $
Fuel	133,537	123,833	−9,704
Oils	23,133	18,581	−4,552
Tyres and Tubes ..	37,056	28,994	−8,062
Repairs	479,976	457,349	−22,627
Registration, Insurance	12,568	52,851	+40,283
Travelling expenses	7,732	7,565	−167

Census of Major Plant as at 30th June, 1970:—

Motor Vehicles and Trucks		443
Crawler Tractors—		
Up to 50 H.P.	11	
50 to 100 H.P.	27	
Over 100 H.P.	25	
		63
Rubber Tyred Tractors ..	42	42
Power Graders—		
40 to 80 H.P.	6	
80 to 100 H.P.	12	
Over 100 H.P.	15	
		33

ACQUISITION OF LAND

During the year 1969-70 an amount of $27,204.99 was expended on the acquisition of land for Forestry purposes as follows:—

	$
Purchase of Land	5,688.88
Survey Fees	20,414.40
Real Property Fees and Lands Department Charges	767.45
Miscellaneous	334.26
	$27,204.99

The expenditure of $5,688.88 represents the purchase of three parcels of land with a total area of 295 acres 3 roods 14 perches which, except for 16 acres purchased for a nursery site, will be added to existing State Forests.

FOREST SURVEYS

Twenty-eight survey parties operated during the year ending 30th June, 1970.

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

Parties	Type of Surveys
3	Theodolite Control Surveys (to provide a framework for other type Forestry Surveys)
13	General plantation management surveys associated with reforestation programme or general native forest management surveys
6	Forestry Inventory and Assessment Surveys to provide basic management data
6	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 Traverses	Connections and Relocating Old Traverses	Level Surveys	Stripping and Assessment
173	1,369	638	12	3,295

Total mileage of surveys for period, 5,487.

Personnel

SURVEY.—At the end of the period the total strength of survey parties consisted of 121 members. These members were comprised of following Officers:—

Foresters	Forest Surveyor	Survey Rangers	Survey Overseers	Survey Leading Hands	Survey Labourers	Cooks
7	1	11	24	8	60	10

MAPPING.—Drafting Branch comprises 33 officers of whom 14 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.—As in previous years four Survey Training Courses were conducted in the Beerburrum area for periods ranging from one week to three weeks duration. The following officers attending these courses, 4 Foresters, 8 Survey Leading Hands, 32 Forest Trainees.

AUTOMATIC DATA PROCESSING

The main effort has been in connection with the Harvesting and Marketing Project–Log Timber Accounts.

Detailed investigation of the Department's requirements was completed and a proposed system for the production by computer, of stumpage accounts for Natural-grown timbers and associated reports has been outlined. Detail of the system has to be finalised before the proposal is submitted for approvals.

Extensive trials of the basic source document on which log details will be transmitted to Head Office for processing, were conducted in six south Queensland Districts and reports from field officers indicate that, with adequate training, no major problems will be entailed in its use.

The Plantation Register System has been redesigned for transfer from the Queensland University computer to a magnetic tape system, at the Treasury Department Installation. Considerable improvement is expected due to improved data capture methods.

The operation of the Plant Accounting and other systems has continued satisfactorily.

Staff at present consists of four trained male officers and five punch verifier operators. Punch room activity has levelled out following the reduction of backlag in Forest Resources data processing.

REFORESTATION

General

1969-70 weather conditions were somewhat erratic. Overall annual rainfall figures, as shown by the figures below for some of the main plantation centres, are only slightly below average for centres in Southern Queensland but are from 10 inches to 21 inches below average in Central Queensland. The Kalpowar area which received only 17·46 inches in 1968-69 is still in the grip of a prolonged drought with annual rainfall over 10 inches below average.

RAINFALL IN POINTS

	Hoop Pine Centres			Exotic Pine Centres		
—	Yarraman	Imbil	Kalpowar	Beerwah	Tuan	Bowenia
1969–70	3,050	4,374	2,471	6,141	4,132	4,227
Average	3,153	4,632	3,504	6,177	5,164	6,335

Following very heavy unseasonal rains in May, 1969, which allowed the planting of Exotic pines to proceed, winter rainfalls were only fair. The advent of the early summer storms in October gave promise of good summer rains but these did not extend to the late summer. Autumn rains were also below average and soil moisture conditions were poor for the start of the 1970 winter planting. Conditions for open

root planting were harsh and planting had to be suspended on several occasions. Monthly figures for typical winter and summer planting areas were as follows:—

RAINFALL IN POINTS

Month	Hoop Pine Centre Yarraman (summer planting)		Slash Pine Centre Tuan (winter planting)	
	1969–70	Average	1969–70	Average
July	69	163	127	245
August	142	125	153	184
September ..	143	129	12	156
October	516	286	619	339
November ..	460	315	647	357
December ..	360	392	575	547
January	677	424	910	780
February ..	276	427	631	780
March	199	355	125	794
April	106	200	197	343
May	55	181	2	321
June	47	156	134	318
Total ..	3,050	3,153	4,132	5,164

Reports of losses to date have been minor. Losses have occurred in second year Hoop Pine plantations at Goodnight Scrub, south-west of Bundaberg, on dry exposed ridges. This is the driest Hoop Pine plantation area. Localised heavy losses have occurred in the early 1970 plantings of Slash Pine at Tuan, Toolara and Beerburrum. In general these losses are associated with soft stock at the commencement of planting and drying out of sandy soils on the ridges.

Cyclone Ada which battered the coastal area around Proserpine in North Queensland was distant from the major planting areas and the only plantation affected was that of *Pinus caribaea* at Cathu to the south-west of Proserpine where 1,230 acres of plantations had been established at an annual rate of about 120 acres per year. The main blow struck the area on the 18th January, 1970, with winds reaching 120 m.p.h. Rainfall of just over 43 inches fell in 48 hours with the highest reading of 19·82 inches on 19th January, 1970. Cyclonic blows are expected in North Queensland but it was thought this particular area would be reasonably protected since it lies in a valley with a mountain range on both its western and eastern sides. Direction of the cyclonic blow was initially south-east and later, following a calm, from the north-west. Though the mountain ranges undoubtedly reduced the wind effects, the worst damage occurred where winds tended to funnel down drainage channels and creeks. Windthrow was aggravated by the soaked ground conditions but considering the force of the wind, damage was not as serious as expected. One- and two-year-old areas were not seriously affected and the leaning trees could be easily corrected. Damage was most severe in three- to seven-year-old areas and consisted of blowdown and severely leaning trees. Very little breakage of stems occurred. Due to the saturated soil, damage to lateral roots and instability associated with young fast grown stems, it was impossible to take any practical remedial measures in these stands. They will be inspected later this year to check on effective stocking to see whether replanting is necessary. The area seriously affected covered about 300 acres.

In older areas, the damage was remarkably light and the older the area, the less the damage. Some small amount of top damage occurred and trees were severely stripped of their needles. A few trees were broken off near ground level and some where blown over but, in general, the small amount of windthrow must be attributed to the well developed root system of *Pinus caribaea* var. *hondurensis*. What effects such blows have on wood structure in the standing stems will have to be checked.

Field Operations

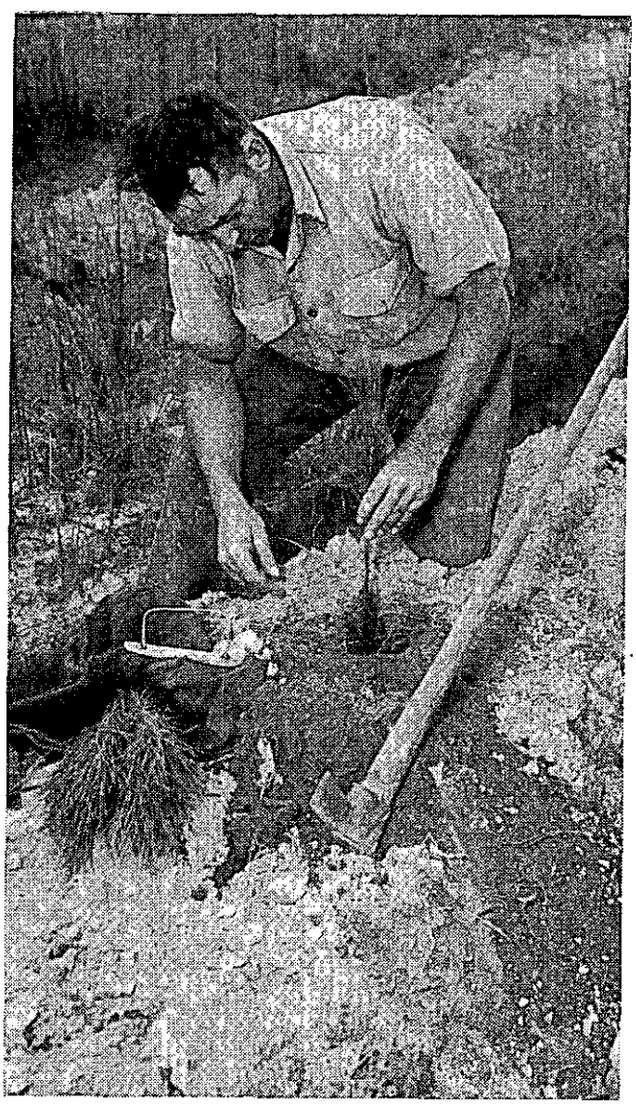
Actual expenditure in the field, excluding overheads, in 1969-70 on silvicultural operations amounted to $1,793,095 compared with $1,767,819 in 1968-69.

The following summary shows the areas covered in the main silvicultural operations for the year and also in 1968-69:—

Operation	1968–69	1969–70
	Acres	Acres
Area of plantations established	12,002	12,633
Area of plantations covered in pruning ..	13,467	11,836
Area of plantations tended	80,975	62,840
Area of plantations thinned merchantably	9,765	9,334
Area of plantations thinned unmerchantably	1,403	1,599
Area of natural forest treated	28,769	33,072

The availability of labour affected operations in particular districts in the western and northern parts of the State and operations were increased in other districts where labour was more readily available. In times of severe labour demand, it becomes difficult to retain and obtain adequate suitable labour for work in more distant and less attractive areas where amenities are limited, but Districts such as Yarraman and Murgon with long established plantation centres reported increasing difficulties in obtaining satisfactory labour. Lack of suitable labour naturally affects costs. Forestry employment in plantation centres tends to be seasonal peaking during November–December in the summer planting areas involving Hoop Pine and *P. caribaea* spp. and during May to July in the Slash Pine–Loblolly Pine winter planting areas. In between times at these centres, tending and pruning with some protection work sustain a reduced hard core staff.

Treatment work in native forests involving hormone injection and some cut stump hormone spray treatment can be done at any time of the year. This is the position in our western areas and areas distant from plantation operations. Where natural stands suitable for treatment are close to plantation areas, the trend now is to integrate the work on natural stands with plantation operations under group management to provide continuous employment for more of the staff. This will not only improve efficiency due to their knowledge of forestry work and feeling of security, but will also allow the department to plan for the establishment of forestry control centres in towns. This will assist with the retention of better staff due to the more attractive living conditions in the towns. During the year, the headquarters for a large number of reserves around Pomona was established in Pomona township with the construction of a new office building, store rooms and garages. Staff will be transported to work from Pomona each day. Similar action is to be taken in regard to other main forestry areas and should assist in building up the community spirit in the small towns affected.



Planting of Slash Pine on Mounded Site. State Forest 561, Bribie. In all, some 5896 acres of Mounded Area was planted throughout the State during the year.

Planting

Total planting in 1969–70 included—

	Acres
(i) New plantations	12,633
(ii) Replanting failed areas ..	328
(iii) Underplanting	622
	13,583

The acreage of new pantations established was again a record being an increase of 631 acres over 1968–69. The table below shows the acreages of particular species planted in 1968–69 and in 1969–70:—

Species	1968–69	1969–70
	Acres	Acres
Native Pines (mainly Hoop Pine) ..	3,293·1	3,556·6
Slash Pine	7,055·9	7,002·5
Loblolly Pine	94·8	140·2
Caribbean Pine	1,137·4	1,532·0
Radiata Pine	240·7	282·1
Patula Pine	71·1	20·0
Others	108·8	99·8
Total	12,001·8	12,633·2

The increase was largely made up in increased planting of Hoop Pine and Caribbean Pine.

Replanting of the Kauri Pine plantations which were devastated by the Kauri Pine coccid (*Conifericoccus agathidis*) continued but completion of the planting has been delayed due to lag in clear logging of the areas. Replanting of all Kauri Pine areas should be completed in 1971.

Surplus Hoop Pine stock not required for underplanting exotic pines on frost sites in the Yarraman and Murgon areas was used to underplant high quality coastal plantations which had been reduced by thinning to 300 stems per acre. Underplantings were carried out at Beerburrum under Slash Pine and at Byfield under *Pinus kesiya.*

As was pointed out in the previous annual report, the major plantings were concentrated along the coastal belt at Tuan, Toolara and Beerburrum to build up available log supplies quickly for pulp-paper and particle board industries.

A sale has been made involving presently available pulpwood thinnings and increasing quantities becoming available from the exotic pine plantations at Tuan and Toolara. The species planted in these areas are largely Slash Pine with some Caribbean Pine.

Caribbean Pine is superior to Slash Pine in volume production and will be planted in greater quantity when seed of improved source becomes available from seed orchards, plus stands and good trees in the plantations.

The total acreages planted at Tuan, Toolara and Beerburrum are shown in the following tables:—

Centre	Acreage Planted 1969–70	Total Acreage Planted to 31–3–70
	Acres	Acres
Beerburrum	1,701	22,790
Toolara	2,495	17,370
Tuan	2,776	19,624
Totals	6,972	59,784

Increased planting in the Tuan–Toolara area is planned for 1970–71 but continuance at this level will depend upon the continued availability of funds under the Commonwealth Softwood Agreements Act after the end of the first five-year period.

The period for open-root planting is limited to the four months May to August and full use must be made of favourable soil moisture conditions during this period. Should labour avaiability deteriorate it may become necessary to use machine planting to complement the method of handplanting now employed. To secure experience with machine planting a planting machine has been hired from A.P.M. Forests Pty. Ltd. for trial at Tuan. Machine planting has the advantage that it permits mechanical application of fertilizer at time of planting with resultant economy.

Large scale routine trials are being carried out with the late winter plantings of Slash Pine to test the effect of dipping of the roots in a clay slurry and a solution of a chemical called agricol. Experiments carried out using a clay slurry showed an improvement of about 30 per cent. in survival over control under fairly severe soil moisture conditions. There was no significant difference under good soil moisture conditions in early plantings.

Areas of plantations established by districts and species are shown in Appendices F and G from which the following table has been derived:—

Species	Acreage Planted 1968–70	Total Acreage Planted to 31–3–70
	Acres	Acres
Native Conifers (chiefly Hoop Pine) ..	3,556·6	72,352·9
Exotic Conifers (chiefly Slash, Caribbean, Radiata and Patula Pine)	8,983·0	85,412·9
Eucalypts	..	3,701·7
Other Broadleaved species	3·2	1,246·0
Miscellaneous Experimental	90·4	371·4
Total	12,633·2	163,084·9

Rain Forest areas which are planted with Hoop Pine are cleared from May to September, burnt on a suitable burning day, after the timber has dried out the unburnt timber lumped where necessary and planted from October to December. In dry years, when weather conditions are good for drying and burning of the felled scrub, little cost is involved in preparing the area for planting. If by reason of a wet season or for other cause the burn is poor, considerable expense is involved in stacking and burning the debris to bring the area to a condition that facilitates planting and efficient tending of the prolific weed growth characteristic of rain forest.

In an effort to obviate the effects of poor burns and reduce the risk of fire escapes several tenders were accepted on a push and heap basis. These will enable comparison of costs with those on areas pushed or felled. Small trials conducted to date show that costs of burning areas on a push and heap basis have been very low and the extra cost involved in heaping would be more than recouped overall through reduced costs of lumping, planting and tending. There is greater control over weed growth and the burning of the heaps can be timed with safety to suit the work in hand.

Approval was also granted during the year to use a nominal 10 feet x 9 feet spacing except in grassed areas in Hoop Pine planting areas at Kalpowar, Mackay and Atherton where there is no pulp market. This will obviate the need for unmerchantable thinning in these areas. Consideration is also being given to changing planting espacement of Hoop Pine in pulp areas in Southern Queensland. Present spacing is 9 feet x 8 feet. Any change to say 8 feet x 8 feet would need forward planning as Hoop Pine is a two-year nursery crop.

Present planting espacement is 9 feet x 9 feet for Slash Pine and 9 feet x 8 feet for Caribbean Pine. With the advent of pulp markets in the Beerwah–Beerburrum and Tuan–Toolara areas and to permit machine thinning on a complete row basis, consideration is being given to the most appropriate spacing to be adopted.

The dry conditions which have prevailed through the year have been very favourable for clearing of areas required for planting with exotic pines, particularly those areas which are poorly drained. Ease of working the areas is reflected both in departmental and contract clearing costs and tenders received for the clearing of areas have been very satisfactory This has been contributed to by a lack of work for scrub clearing contractors in western grazing areas as a result of prolonged drought conditions.

The work to bring large areas of swamp into plantable condition by construction of drains with a ditch digging machine was extended and advantage was taken of the dry conditions to complete the preparation of much of these areas for planting.

At present, line mounds about 3 feet wide are ploughed at 10 feet centres. Planting is done at 8 feet centres along the mounds to give the equivalent of a 9 feet x 9 feet nominal spacing. Mounding is done at 10 feet centres instead of 9 feet centres to save mounding costs. This leaves a strip about 7 feet wide unploughed. In order to test the effect of overall ploughing on tending costs, several areas have been completely ploughed to depths of 8 inches and 12 inches then line mounded at 10 feet centres.

TRENCH DIGGER constructing Drainage Channel in preparation of area for planting. State Forest, 561, Bribie.

Pruning

Acreages of plantations pruned in 1969–70 compared to 1968–69 were:—

Year	Stage of Pruning				Total
	1st	2nd	3rd	4th	
	Acres	Acres	Acres	Acres	Acres
1968–69 ..	3,659	3,829	3,829	2,150	13,467
1969–70 ..	3,489	3,828	3,145	1,374	11,836

Slash Pine is ground pruned to 8 feet and carried up in two further lifts to 21 feet whereas other species are carried up in three further lifts.

Tending

The total area of plantations tended during the year compared to previous years was:—

Year	1967–68	1968–69	1969–70
	Acres	Acres	Acres
Area covered in tending ..	72,866	80,975	62,840

Though increased planting is being maintained, the total acreage of plantations tended has decreased. This has been due largely to the dry season and the use of hormones. It was expected that total annual tendings would reach a peak as the treatment of all old exotic pine areas with hormone was effected. These areas were tended before the advent of hormones on a brush basis over many years with the result that there was a very large acreage of old areas carrying coppice growth from many previous brushings. Hormone Foliar spray treatment is very effective and little follow-up treatment is necessary. In exotic plantations if pre-plant spraying is properly applied little tending is required subsequent to the fourth year.

Thinning

The area of plantations thinned merchantably during 1969–70 was 9,334 acres slightly less than the 9,765 acres thinned in 1968–69 even though the total cut from plantations increased to a record quantity of 50·4 million super. feet. Average yields per acre have been higher due to a larger proportion of late thinnings and an effort to avoid operations on compartments that will not yield more than 3,000 super. feet per acre.

Fertilising

The acreage of plantations fertilised in 1969–70 was 8,275 acres compared with 8,984 acres fertilised in 1968–69. The only areas fertilised on a face are the exotic pine areas at Tuan, Toolara, Bingera and Beerburrum which receive 2½ cwt. of rock phosphate per acre following planting. It was stated in the last annual report that all ploughed or mounded exotic pine plantations would in future be given an initial starter application of an NP mixture equivalent to 5 ozs. superphosphate and 1 oz. urea per tree. This NP mixture is being applied to the 1970 winter plantings of Slash Pine which have been ploughed or mounded.

As well all Pinus caribaea stands at Byfield of site index below 100 are treated with a fertiliser mixture of 1 cwt. super and 3 cwt. rock phosphate per acre.

Following foliar analyses of some *P. taeda* areas planted at Beerburrum in 1950 it was approved to apply a booster dose of phosphate consisting of 1 cwt. superphosphate and 2½ cwt. Nauru rock phosphate to limited areas. Further checks with foliar analyses are continuing on other localised areas which may require a further application of phosphate. In general the areas at Beerburrum requiring booster doses of phosphate are soils shallow to clay and areas planted with *P. taeda.*

Treatment of Natural Forest

The acreage of natural forest treated in 1969–70 for all types exceeded the total for 1968–69 by 4,303 acres. Figures for the various forest types treated are shown in the following table:—

Forest Type	1968–69	1969–70
	Acres	Acres
Eucalypt Forest	10,337	15,152
Cypress Pine Forest	16,719	16,775
Tropical Rain Forest	1,713	1,145
Natural Hoop Pine	Nil	Nil
Total	28,769	33,072

The increase in total treatment during 1969–70 was largely due to increased treatment of 3,886 acres of Hardwood forest in the Maryborough district and small increases in other districts. Maryborough district excluding Fraser Island has about 350,000 acres of State Forests in the Bundaberg and Maryborough sub-districts reserved for Hardwood production, over half of which would be suitable for treatment. There is therefore considerable scope for treatment work in the Maryborough district.

Treatment work has been concentrated on—

(i) Areas which have been recently logged.

(ii) Areas which contain advanced regeneration.

Treatment of areas recently logged removes poor trees of desirable species and undesirable species to assist in the regeneration of the areas from seed of good trees and desirable species. Treatment of advanced regeneration advances the time when stems will attain marketable size and support industry. This type of treatment is associated with earlier returns from money expended and is expected to alleviate the supply position particularly in the case of the hardwoods in South-East Queensland.

Hormone treatment during the year has been quite effective in Forest Hardwood and Cypress Pine treatment except in the Monto district where results were affected by severe drought. As soon as it was apparent the "kill" was being reduced by the dry conditions hormone treatment was changed from the usual injector treatment to frilling with knapsack spray application. A check on trees which had been injected showed that translocation had been inadequate to kill the living tissue between the injector cuts. It will be necessary to take sap flow into consideration in western areas when injection treatment work is done during drought conditions.

The amount of treatment work done in Cypress Pine and Hardwood areas in the Western and Central regions was affected by shortage of labour. Operations ceased on the reserves along the Dawson Range outside Duaringa due to staff shortage.

Nurseries

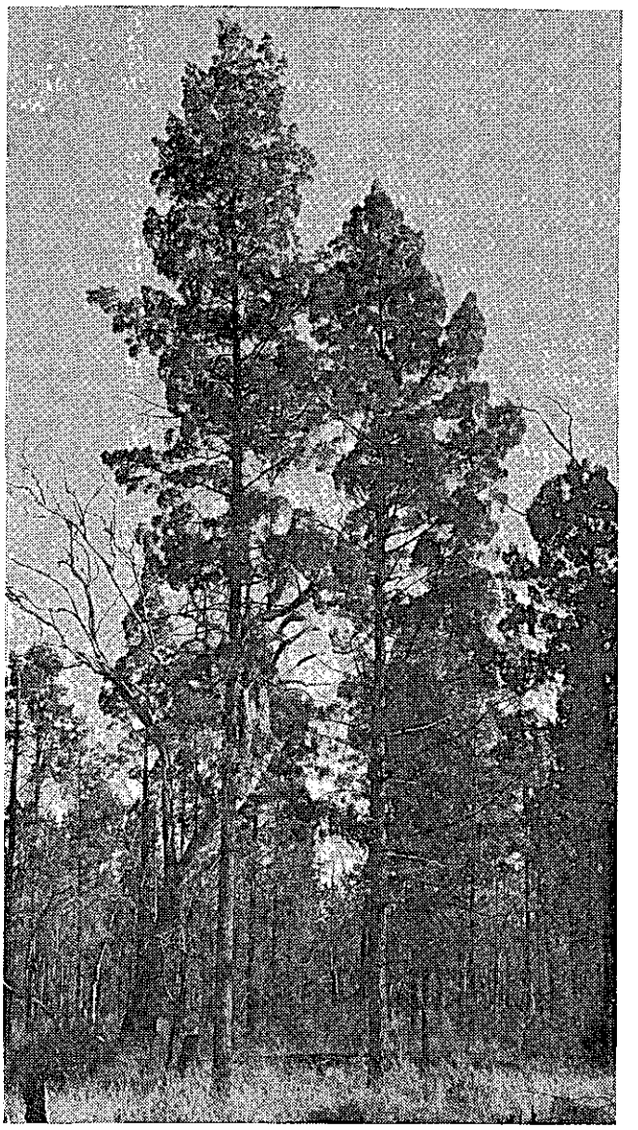
The Department maintains a total of 23 nurseries classified as follows:—

12 Hoop Pine
4 Caribbean Pine
3 Slash Pine
2 Radiata Pine
2 Amenity nurseries

The work at one of the Hoop Pine nurseries is performed by prison labour at the Palen Creek Prison Farm. The assistance of the Prisons Department in raising the Hoop Pine stock for the planting programme on State Forest 200 Palen nearby is greatly appreciated.

The Nanango Hoop Pine nursery was closed down during 1969 and its production taken up by the remaining nurseries in the Yarraman district.

Production to the field from all nurseries totalled about 7,500,000 plants during 1969–70 which was slightly in excess of the 1968–69 production.



CYPRESS PINE STAND after Silvicultural Treatment involving the use of Tordon. State Forest 167, Badgery.

Fungal diseases were reported from several nurseries. *Phytophthora cinnamomi* was reported from Slash Pine sowings at Toolara and Radiata Pine sowings at Passchendaele. *Rhizoctonia* was reported from Hoop Pine nurseries at Jimna and Kenilworth.

Control of such fungi is difficult and costly so greater care is necessary to ensure that infected stock is not brought into nurseries to introduce pathogens and improved quarantine practices are necessary within the nursery to prevent the spread of disease when it does occur.

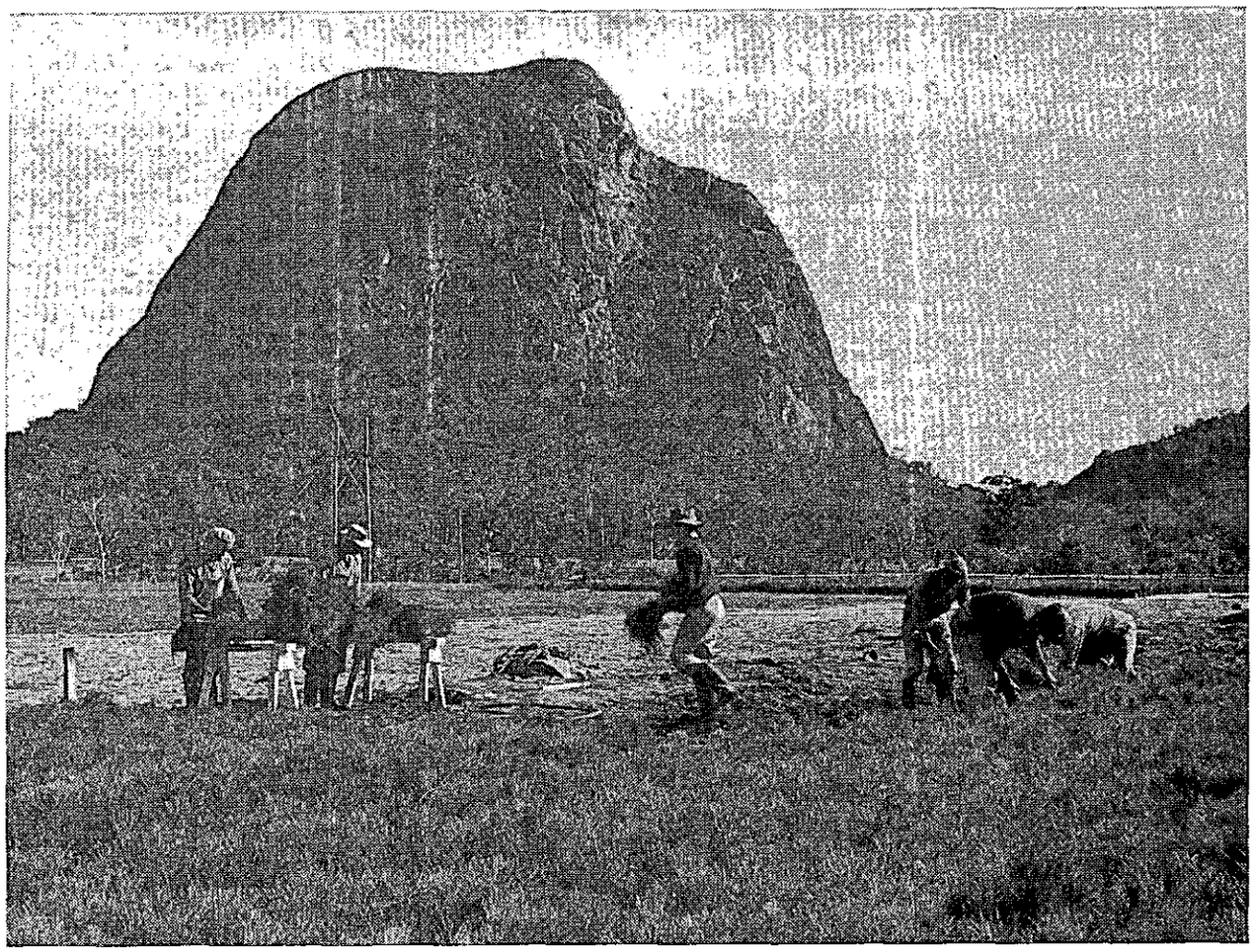
The renewed outbreak of *Phytophthora* at Toolara, the need to expand the nursery to enable fallowing to be done at least two years out of three and the limited area with suitable soil have necessitated consideration of shifting the nursery to a new site. If this is done consideration will also be given to amalgamating the Tuan and Toolara nurseries as the planting areas on both reserves could be served by a central nursery. This would also save having to expand the Tuan nursery.

Work is in progress to establish the Department's main amenity nursery at State Forest 69 Bunya just north of Brisbane.

Seed Collection

Seed collection during 1969–70 compared to 1968–69 is shown in the following table:—

Species	1968–69	1969–70
	pounds	pounds
Hoop Pine	23,368	3,372
Bunya Pine	6,543	Nil
Slash Pine	2,403	4,733
Caribbean Pine	37	66
Radiata Pine	54	78
Patula Pine	Nil	21
Total	32,405	8,270



Mount Tibrogargan looks over the area of the new Slash Pine Nursery which replaces the old Beerwah and Beerburrum Nurseries.

As pointed out in previous reports a major Hoop Pine fruiting occurs at intervals of three to five years. The viability of light crops between major fruitings is generally unsatisfactory but occasional good crops occur in restricted localities.

The Hoop Pine crop was poor in 1969–70 but effort was made to locate seed at satisfactory viability in provenances from which seed in cold storage was in short supply. The bulk of Hoop Pine seed in cold storage is from Monto, Maryborough and Yarraman districts. As trials have shown that stock raised from seed from the Jimna and Gallangowan provenances is superior in vigour to other provenances in Southern Queensland, special efforts will be made to build up seed supplies from this provenance.

Considerable progress has been made with the establishment of Hoop Pine seed orchards at Imbil and Benarkin, but it will be many years before they make any significant contribution to supply. Hoop Pine plantations now contribute a large percentage of seed requirements but good native stands have been retained specifically for seed purposes.

Annual sowings of Hoop Pine seed take 10,000 to 12,500 lb. of seed depending on viability.

Production from the two Slash Pine seed orchards was again more than adequate for the Department's requirements and no other collection would have been necessary had it not been for an order from Brazil for 4,400 lb. of seed. To meet this amount a substantial collection was made from selected high pruned stems of good form and vigour and this together with surplus seed of better quality made up the consignment.

Such a large order taxed our drying facilities at Beerwah and stressed the need for a drying kiln, extractor, cleaner and grader at Beerwah. This is fully justified by the continued interest from overseas in the purchase of improved seed of species the subject of tree-breeding work.

The Caribbean Pine seed crop was again poor in 1970 but as a result of special efforts a greater collection was made than in the previous year at costs approaching those of imported seed.

Seed collections of *P. caribaea* from plantations, seed gardens and seed orchards are expected to be adequate for Departmental requirements but field observations indicate that no surplus will be available for sale before 1973.

The total value of all seed sold in 1969–70 amounted to $66,032.12 which greatly exceeded the 1968–69 total of $11,877.47. The sale of Slash Pine seed to Brazil brought $48,004 for 4,364 lb. of seed.

Sale of Trees

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

Forest Plots	179,432
Schools and Government Departments	10,074
Other private plantings	86,658
Total	276,164

Forest Plots sales involved—	
Slash Pine	65,540
Caribbean Pine	43,086
Hoop Pine	12,610
Miscellaneous	58,196
Total	179,432

Considerable interest is still evident in the establishment of private forest plots on farms and small holdings. It is expected that there will be considerable impetus to private plantings as soon as there is a substantial market for early thinnings for conversion to pulp. The recent sale of a large quantity of thinnings from the Tuan and Toolara area to a consortium of Queensland and American interests initially for the production of particle board and later for pulp-paper production and similar developments in the Caboolture area based on A.P.M. Forests Pty. Ltd. and Departmental plantations are expected to stimulate private plantings in these areas.

The Department provides a free extension service to persons interested in establishing and maintaining plantations. Departmental officers will inspect the soils on the area proposed for planting and provide advice on site preparation, species to be planted and management.

As stated in previous reports plants are made available for approved forest plots at concessional rates of $2.50 per 100 for open root stock and $5.00 per 100 for tubed stock.

Amenity Nurseries

The Rocklea and Dalby amenity nurseries made sales of the following number of plants for windbreak, shade and ornamental plantings:—

Nursery	Plants Sold	Value
		$
Rocklea	69,034	10,650.37
Dalby	15,316	2,962.45
Total	84,350	13,612.82

Christmas Trees

5,291 Christmas trees were sold for a total of $2,482.95.

Diseases and Pests

(*a*) INSECTS, BIRDS AND ANIMALS

An unusually low level of activity of insect pests of trees in nursery, plantation and natural forest has obtained throughout the year. In contrast, enquiries from the general public indicate a very high level of pest activity on ornamental trees, particularly in the Metropolitan area. The most frequent pests have been *Phylacteophaga* spp., the leaf mining sawflies but there has also been considerable activity by the gum tree scale *Eriococcus coriaceus* and the giant wood moths (*Cossidae*).

This existing low level of activity of insect pest species in the field has enabled effort to be concentrated on laboratory studies on some of the more serious pests.

Progress has been made on the testing of soil insecticides for the control of white grubs (*Scarabaeidae*) in nursery beds where these insects may cause considerable losses of young plants. The problems of testing are complex, even under laboratory conditions, and this work is expected to extend over a considerable period of time.

Some laboratory studies have been undertaken on the Hoop Pine branch pruning longicorn *Coptopterus decoratus*. This is the major species of a number that have caused damage to plantations of Hoop Pine in the Mary Valley. Collection and breeding studies have indicated that five species of insects are involved. Initial studies have shown that *C. decoratus* can be cultured in the laboratory and this will permit more intensive studies.

Failure of Hoop Pine to produce a seed crop during the past season has interrupted field investigations on the control of seed destroying insects and curtailed laboratory investigations. It is likely to be at least a further year before this work can be recommenced.

The breeding programme to supply numbers of the powder post beetle *Lyctus brunneus* for testing of wood treatment has proved satisfactory. This will enable testing work to be undertaken at short notice.

Investigations on *Cryptotermes brevis*, a West Indies drywood termite were continued during the year. This serious pest of timber in buildings was found to be established in Maryborough in 1966 and it is believed that it has not become established elsewhere in Australia. Measures have been adopted which should lead to its eventual eradication. A considerable increase in the rate of progress was achieved through the co-operation of the Department of Works who made available an experienced tradesman carpenter for inspection work.

Though serious damage in 1969 was confined to a few plantations only native rats continue to be the most serious pest of the Hoop Pine plantations. *Rattus culmorum* occurs in many pine plantations of the highland areas of South-East Queensland, whilst *Rattus assimilis* and *Rattus lutreolus*, the two other species associated with damage, are more isolated in their occurrence.

Little rat damage occurred in 1969 thus making control measures, in most areas, unnecessary for the winter of 1970. Serious damage was fortunately restricted to only a few plantations. However, this damage was quite severe.

Research by the Zoologist is continuing into the biological and ecological aspects of the problem. Suggested improvements in methods of control, as a result of this research, will be implemented in the forthcoming year.

(*b*) FUNGI—

Root rot of *Pinus* spp., caused by *Phytophthora cinnamomi*, was recorded for the first time for some years from nurseries operated by the Department. This follows regular soil fumigation, since 1963, in nurseries where the fungus had been recorded. Root rot of Radiata Pine occurred at Passchendaele, one of the nurseries where fumigation has been used regularly. The other occurrence was in Slash Pine at Toolara. In 1960–61 this nursery was relocated because of severe root rot losses in shallow soil. This year's losses were in the third sowing in part of the area re-used after eight years under grass.

During summer, Hoop Pine root rot caused by a species of *Rhizoctonia*, similar to *R. crocorum*, again occurred at Jimna. This year, fungal fruiting bodies, tentatively identified as *Helicobasidium compactum* which is probably the perfect stage of the root rotting fungus, were found on some of the affected seedlings. Falling soil temperatures have been shown to be responsible for the disappearance of the disease in April or May.

Sclerotium rolfsii was also recorded on Hoop Pine in the Jimna nursery but was readily controlled with P.C.N.B.

Methyl bromide cannot be used as a soil fumigant for Hoop Pine because of an adverse effect, possibly due to mycorrhizal problems, on seedlings grown in treated seedbeds. A series of trials were initiated this year to investigate whether any other soil fumigants can be used in Hoop Pine nurseries. The trials have not been established long enough to give a definite answer but it appears that chloropicrin may be suitable.

In continuation of studies made several years ago two more Hoop Pine seed dressing trials were undertaken. Once again it has been shown that several fungicides, particularly Captan and a liquid mercurial seed dressing preparation result in greatly improved germination. Captan is being used for routine sowings rather than the mercurial preparation.

Root and butt rot losses have continued in the Imbil Hoop Pine plantations without any great increase in incidence. It has not yet been possible to identify the fungus, believed to be *Fomes noxius*, which is apparently responsible for many of the losses. A series of study plots have been established to investigate various aspects of the disease in the field.

As reported last year *Fomes annosus*, the serious root and butt rot pathogen of conifers in the Northern Hemisphere, occurs in a small isolated Hoop Pine plantation on the Atherton Tableland as a saprophyte on thinning stumps and debris but no deaths of trees from this cause have been recorded. *F. annosus* was found this year on Hoop Pine stumps in the Imbil plantations. It has been suggested that the strain or strains of the fungus in Queensland may be non-pathogenic. Until this has been proved, this occurrence at Imbil close to the Toolara exotic plantations must be viewed with concern as both Slash and Loblolly Pines are killed by *F. annosus* in the south-eastern United States of America.

Although little is known of the fungal flora of *Pinus* spp. needles, the needle cast fungus *Naemacyclus niveus* is not common. This fungus was apparently responsible for severe needle cast and a two-thirds reduction in girth increment of a few stems in an experimental planting at about 3,300 feet elevation in Southern Queensland.

SILVICULTURAL RESEARCH

A conference of officers engaged in routine forestry work and officers engaged in forest research was held in July, 1969. A number of papers were presented outlining the results of past research, together with recommendations for some changes in current techniques based on this work. New lines of research to meet the needs of our expanding reforestation programme were formulated.

The reports for the four regional research stations and for 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 prescriptions 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 latitude 18° 10′ S while some research effort is still being directed to the Hoop Pine plantation programme on the Atherton Tableland.

(i) *Rain Forests.*—New experiments commenced during the year included:—

A trial in recently logged forest on State Forest 194 Western involving the 1967 prescription, the 1954 prescription and an untreated control.

A study on State Forest 607 Dinden of the effect of intensity of canopy opening on seedlings, underplants and advanced growth.

Application of four treatments to an area of Maple on State Forest 310 Gadgarra. Treatments were applied following logging of the stand which resulted from an enrichment planting in 1930.

Enrichment planting with Queensland Maple, Northern Silky Oak, Hoop Pine, Blackbutt, Tallowwood and Rose Gum along the Mulgrave River in State Forest 310 Gadgarra.

Conversion to detailed yield plots of two Forest Inventory Survey Plots on State Forest 1073 Smithfield to supplement data from five detailed plots on each of the State Forests 185 Danbulla and 605 Ramleh.

The gathering of information for the preparation of the rain forest key, based on bark and leaf characters only, was continued during the year. To date, 2,500 trees of 584 species have had their leaf and bark characters listed and incorporated in the key. The processing of the key for publishing is now proceeding. The key adequately covers the species encountered in the majority of North Queensland rain forests.

Seven plus trees of Queensland Maple were located during the year and successfully propagated by grafting. The g.b.h.o.b. limit of acceptance for plus trees has been dropped from 18 feet to 15 feet to increase the number of trees available for selection. Growth of grafted stock established in the seed orchard has been satisfactory, the mean height increment for the year being 3·8 feet. The tallest tree in the orchard is 22 feet, three years after outplanting. Nine of the trees flowered during the year and some of these set fruit which should ripen at the end of 1970. To date there is no evidence of incompatibility in any of the grafted stock in the orchard.

Preliminary trials, using Maple Silkwood stock and scions, failed. One of the difficulties is the nature of the grafting stock which is very slender when compared with Queensland Maple. Some modification of the terminal wedge technique may be required and more work will be done on this valuable species.

The area damaged by a first logging was assessed on two blocks, one 25 acres and the other 50 acres in extent, the assessment being based on a point quadrat system using a one-chain grid. Three types of snig track were recognised. These were (i) main snig tracks which are completely bared of vegetation; (ii) first order snig tracks, which branch from the main snig tracks and are generally completely bared of vegetation; (iii) second and higher order snig tracks on which tree vegetation is flattened but the ground is not bared of vegetation. Away from the snig tracks four categories of felling damage were recognised. These were (i) severe damage; (ii) moderate damage (iii) very slight damage; (iv) forest completely undamaged. The percentage of the area in each of the damage categories is shown in table:—

PERCENTAGE OF LOGGED AREA BY DAMAGE CATEGORIES

Type of Damage	Area A 25 acres	Area B 50 acres
Snig Tracks—		
Main	4·5	7·5
1st Order	10·7	7·2
2nd Order	5·1	7·0
Felling Damage—		
Cat. 1	15·8	17·5
Cat. 2	15·4	11·0
Cat. 3	16·0	22·0
Cat. 4	32·5	27·7
Total	100·0	100·0

Overall 21 per cent. of the two areas has been occupied by snig tracks and on a further 30 per cent. of the area standing trees have been moderately or more severely damaged. Removals from area A were 11,400 super. feet per acre while removals from area B were 12,400 super. feet per acre.

It has been shown that a simple wedge prism can give all the data required for specifying a silvicultural treatment, except seedling stocking, more easily and at less cost than linear sampling systems. The prism used has a basal area factor of 40 which has been found to give a satisfactory compromise between visibility in the rain forest and area sampled at each sampling point. It is always used with a table of limiting distances. It is recommended that a sample be taken every two chains on a cut line and that bookings be by species groups in size classes. It is then a simple matter to determine basal area of the stand by groups and sizes and from this to determine the most appropriate silvicultural treatment to apply.

Further observations were made in the experiment to determine the response of underplanted Queensland Maple to the rapid removal of all canopy with the aid of arsenic, the slow removal of all canopy by ringbarking and brushing, the removal of saplings to 6 inches g.b.h.o.b. only and the rapid removal of high canopy only. Mean heights of the best 40 stems per acre at 42 months from planting were 23·9 feet, 20·0 feet, 17·5 feet, and 21·1 feet respectively. Growth has been good in all treatments. There has been a greater response to the removal of high canopy than to brushing the undergrowth. No tending work has been done since establishment.

Observations from a number of increment plots established prior to 1930 were summarised during the year. They provide increments of selected dominant trees in the natural forest. As stand parameters were not recorded no further measures will be made. In logged but untreated forest Queensland Maple maintained a girth increment of about 0·7 inches per annum in the girth class range of 60 inches to 120 inches. Red Cedar grown on red soils in relatively sheltered situations gave an average girth increment of 1·0 inches per annum to 120 inches g.b.h.o.b. in uneven aged mixed species stands and 1·5 inches per annum in even aged single species stands. Increments for Cairns Hickory were of the order of 0·15 inches per annum, Blue Kauri 0·2 inches per annum and North Queensland Kauri 0·4 inches per annum.

In a heavily ring-barked forest Red Cedar enrichments outplanted in the period 1914–1916, averaged 75 inches g.b.h.o.b. at age 50. In another heavily ring-barked forest Northern Silky Oak, Queensland Maple, Maple Silkwood, Silver Quandong and Black Pine showed increments of better than one inch per annum for the period 1929 to 1948 over a range of girth classes from 6 inches to 84 inches. Increments for Silver Ash and Silver Silkwood have been low since the trees attained 36 inches g.b.h.o.b. It is thought this is a result of mistletoe parasitism.

Experiments summarised during the year showed that the girth increment response of Rose Butternut to treatment is unsatisfactory. It is concluded that this species should be logged to the minimum cutting girth and replaced by a more productive species.

A check on the accuracy of volume tables used for rain forest species showed that the Maple Silkwood and Silver Ash volume tables were accurate within the range ±10 per cent. for gross volume of all the prime cabinet species and that the Rose Butternut volume table gave an estimate of similar accuracy for other rain forest species. The Queensland Maple and Forest Inventory Survey No. 1 volume tables tend to give too high a volume while Forest Inventory Survey No. 2 volume table consistently underestimates volume. In the case of buttressed trees girth measurements should be read on the cylindrical section of the bole one foot above the buttresses.

(ii) *Tableland Plantations.*—New work included:—

Trial of dichlobenil in the nursery as a pre-emergent and in the field as a preplant weedicide. Applied at 5·3 lb. per acre in the nursery results are promising but at 10·7 lb. per acre in the field it was ineffective.

Establishment of trial plots on State Forest 185 Danbulla with Tenasserim, Montezuma, and Pringles Pines and on State Forest 194 Western with Tallowwood and Blackbutt in the wet sclerophyll ecotone.

Initiation of studies of rate of spread of root rot (*Fomes* spp.) in plantations of Hoop Pine.

In the older species trials Honduras Caribbean Pine has generally been the most productive species. Benguet Pine is also very productive. Mexican White Pine appears to be more suited to Atherton Tableland conditions than to conditions elsewhere in Queensland. Height growth is good but stems are crooked. Aleppo Pine after 3 years 6 months in the field appears to be off site. The Timor Mountain Gum collected at 4,000 feet in Timor has a top height of 10 feet after 28 months in the field. Trees collected from higher altitudes have made poorer growth. This species clearly requires a fertile soil. New Guinea Hoop Pine has a small height advantage over Hoop Pine of South Queensland origin after 30 months in the field. Bahaman Caribbean Pine of Abaco and Grand Bahama origin are as vigorous as Honduras Caribbean Pine at 42 months while the New Providence and Andros strains are somewhat behind. Provenance trials of Benguet Pine and Ocote Pine were established on State Forest 1073 Smithfield and State Forest 185 Danbulla in March, 1968. At both locations Ocote Pine from Belice source has tended to outgrow Honduras Caribbean Pine and stem straightness to date is satisfactory. Benguet Pine has grown satisfactorily on the well drained sites but has been very slow on areas of poorer drainage. In the mixed plantings of Hoop Pine and Caribbean Pine on grassed rain forest sites dating back to 1961, Hoop Pine continues to grow more rapidly than in pure stands on similar sites. Studies on underplanting Hoop Pine to Honduras Caribbean Pine in these grassed rain forest sites are continuing. The objective is to find a stage in the development of the Honduras Caribbean Pine canopy when the grass is debilitated but the light intensity is still adequate for the successful growth of Hoop Pine underplants. Findings to date are inconclusive.

(iii) *Coastal Plantations.*—New work on State Forest 461 Glenbora included—

Establishment of trial plot of Montezuma Pine.

Outplanting of a provenance trial of Tenasserim Pine involving seed of Philippine, Indonesian, Cambodian and Vietnam sources provided by the courtesy of the Commonwealth Forestry Institute, Oxford. Plants from mainland sources were healthy and vigorous. Those from the islands were unthrifty and spindly.

Experiments on season of sowing, tubing and planting with Honduras Caribbean Pine.

An experiment to determine if the unhealthy condition of many Honduras Caribbean Pines in the tube is associated with the mycorrhizal fungi in the tubing soil. Soils studied were (i) standard tubing soil; (ii) soil from the bed in which plants were raised; (iii) soil from a plantation with healthy regeneration of Honduras Caribbean seedlings and abundant mycorrhiza. Plants were tubed or potted.

Height increments in the eight months following tubing or potting did not vary with soil type in this experiment. Potted plants grew substantially better than tubed plants. It was concluded the trouble was not mycorrhizal. In another experiment application of complete fertilisers to the tubed plants did not alleviate the trouble. There was some positive response to the shading of the plants.

A type of cover experiment for broadcast sowing of Honduras Caribbean Pine showed no difference between sand and sawdust with ½-inch depth of cover.

With the advice and assistance of the Department of Primary Industries investigations were commenced on the growing of perennial Stylos in plantation areas. Seed was sown under four different plantation conditions. These were a newly cleared and burned sclerophyll forest, a 1969–70 plantation following double discing, the 1966–67 seed orchard after one discing and a 1966–67 plantation thinned to 300 stems per acre and double disced. All were fertilised with 2 cwt. per acre superphosphate. Germination was satisfactory at all sites and two months after sowing a ground cover of 40 per cent. has been achieved.

In the trial plots established for over ten years Honduras Caribbean Pine has been the most productive species. Its performance has been relatively poor on sites with impeded drainage. The response of Honduras Caribbean Pine to soil preparation treatments on an ill-drained site on State Forest 461 Glenbora is being observed. At twenty-six months from planting mean heights by treatments were:—mound—10·5 feet; rip and mound—9·0 feet; rip—8·6 feet; control—7·0 feet.

Benguet Pine of Philippines origin has also been highly productive to age 15 years on well drained sites. In the 1967–68 provenance trial with Benguet Pine height growth has been satisfactory though somewhat less than that of the Honduras Caribbean Pine controls. Assam provenance shows the poorest height growth while the Philippines provenance shows the best height growth.

A further three acres of new plantation were established at Weipa in co-operation with Comalco and a considerable amount of refilling was carried out. New species established were *Chlorophora excelsa, Pterocarpus cambodianus, Terminalia ivorensis, T. superba* and Ocote Pine. It is becoming clear many species will grow well on mined areas if the overburden is carefully replaced, retaining the top soil on the surface. This should not be done in the wet season as this leads to severe soil compaction.

A number of species used at Weipa have also been established in an arboretum on State Forest 461 Glenbora. These are Red Cedar, Teak, Hoop Pine, Mexican Cedar, *Khaya senegalensis, Chukrasia tabularis, Pterocarpus angolensis, Swietenia macrophylla, S. mahogani, Acrocarpus fraxinifolius* and *Terminalia brassii.*

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.—Nursery trials aimed at developing a reliable plant grading system for Slash Pine, and to determine optimum season of sowing, optimum sowing rates and lifting methods were continued during the year.

In the grading trials seedlings from a number of experiments and from routine nursery stock have been measured prior to planting for shoot and root length, root-collar diameter, type of root system, and then further classified in subjective grades of hardness based on bud condition and needle development. From the trials outplanted in the 1969 winter positive correlations of first-year survival and height increment with each of the parameters measured have been obtained; detailed analysis of the interactions between all factors is proceeding.

From the season of sowing and density of sowing trials there is evidence to suggest that there could also be a strong interaction between nursery treatment and optimum grade of seedling. The 1968 season of sowing trial showed that whi'e November sowings produced small soft seedlings for outplanting in the following winter, these seedlings survived and grew as well as normal-sized hard seedlings from August sowings. The 1968 density of sowing trials indicated that it is possible to increase bed yield with increasing sowing rates. However, without grading, this is at the expense of lower survivals, and a slight reduction in first year height growth, as evidenced from data in the following table:—

BED PRODUCTION AND FIRST-YEAR FIELD GROWTH OF SLASH PINE FROM SOWINGS AT RATES OF 10–40 SEED PER LINEAL FOOT

Sowing Rate (Seed/lin. ft.)	Total Yield (Seedlings per lin. ft.)	Field Survival March, 1970		Height Inct. July 69 to March 70
		Percentage	Per Foot	
10	7·8	92·4	7·2	1·40
20	15·3	82·0	12·5	1·05
30	20·0	71·1	14·5	1·00
40	27·7	62·3	17·3	0·81

These data show clearly the importance of defining optimum grades of seedlings if nursery production is to be maximised. It is hoped that further outplantings in 1970 from similar trials sown in 1969, and from graded nursery stock in routine nurseries at Beerburrum, Toolara and Tuan will permit implementation of a reliable grading system within several years.

The development of large Slash Pine nurseries, amenable to mechanized working, will permit revised techniques for root pruning and lifting of seedlings. To compare various watering regimes at time of lifting a trial was carried out in 1969 to evaluate the effect of watering at 24, 48 and 72 hours prior to lifting against current procedures involving puddling at lifting. For each of the watering regimes the effect of dipping of roots in a clay slurry immediately after lifting was also tested. Plants from each treatment were outplanted on both ridge and swamp sites during good (June, 1969) and adverse (September, 1969) planting conditions. Assessments of first-year survivals in March, 1970, are shown in table:—

PERCENTAGE SURVIVAL OF SLASH PINE WITH VARYING LIFTING METHODS

Watering Regime	Without Clay Slurry Dip					With Clay Slurry Dip				
	Ridge		Swamp		Mean	Ridge		Swamp		Mean
	June	Sept.	June	Sept.		June	Sept.	June	Sept.	
A. Puddling	95	92	95	64	86	..	..	..	..	..
B. 24 hours	95	75	87	77	83	99	90	85	90	91
C. 48 hours	95	75	87	71	82	99	85	93	91	92
D. 72 hours	99	90	91	58	84	99	86	95	91	93
Mean B, C, D	96	80	88	69	83	99	87	91	91	92

Time of watering before lifting has not materially affected survival, but under adverse planting conditions dipping roots in a clay slurry has significantly improved survival from 74 to 89 per cent. over all treatments. A continuance of these trials is proposed.

A great deal of current research at Beerwah is being concentrated to derive techniques for open-root planting of Honduras Caribbean Pine. Past research has shown that consistently good survivals have been obtained only with the use of tubed planting stock. An experiment sown in late 1969 aims at producing physiologically harder, and well-balanced plants with vigorous root systems through severe root wrenchings at weekly, fortnightly and monthly intervals on which topping treatments have been superimposed. It is also proposed to test the use of growth retardants, anti-transpirants and clay slurry root dips in these experiments. Screening trials to assess the possibility of planting the Caribbean Pines in jiffy pots have also been initiated. Work on open root planting of Caribbean Pine was also carried out at Byfield and Gregory during the report year.

The recent review of older species trials has indicated the tremendous growth potential of Honduras Caribbean Pines even in the sub-tropical coastal region and it is proposed to establish further trial plantings of Honduras Caribbean Pine, Bahaman Caribbean Pine, and Cuban Caribbean Pine in association with Slash Pine and South Florida Slash Pine to cover all major soil types occurring within each important planting locality within this region. The first planting in this series was carried out on a ground water podsol at Tuan during the year.

All long term spacing, pruning and thinning trials were maintained and measured during the year, and work is continuing on the transformation and analysis of the data accumulated. A further spacing experiment is being established at Toolara to compare the growth of Slash Pine planted at stockings from 450–900 stems per acre in both square and rectangular patterns designed to permit row thinning with mechanical tree harvesters. This trial, located on a completely cultivated ridge site will be repeated on a swamp site next year. It is proposed to supplement these more basic growth studies with large trial plantings at varying rectangular spacings to provide a pool of material for later economic studies on row thinning and harvesting methods, and for associated pruning studies.

(*b*) Tropical Coastal Region, Latitude 23° S.—Hoop Pine was underplanted in November, 1962, on ten widely differing sites under overwoods of thinned Honduras Caribbean Pine, Slash Pine and Benguet Pine aged from 7–11 years. Stand development at six years after underplanting is shown in the accompanying table.

GROWTH OF HOOP PINE UNDERPLANTED TO HONDURAS CARIBBEAN, SLASH AND BENGUET PINES AT BYFIELD

Site	Overwood			Hoop Pine Underwood (6 yr.)		
	Age (Years–Months)	Site Index*	Standing B.A./acre (Sq. ft.)	Stems per Acre	Height (ft.)	
					Mean	PAI 65/69
Honduras Caribbean Pine—						
Good	14–11	12	207	686	14·3	2·8
Average	14–11	9	92	570	6·1	1·2
Swamp	15–2	8	114	550	4·2	0·8
Rocky	13–0	8	112	500	3·1	0·4
Slash Pine—						
Good	14–8	9	114	616	9·6	1·7
Average	14–6	7	76	590	5·4	1·1
Swamp	16–7	6	70	626	6·4	1·2
Rocky	18–6	6	103	610	4·4	0·8
Benguet Pine—						
Good	17–5	8	120	650	10·6	2·0
Average	17–5	7	76	630	7·4	1·5

* Site index is anticipated predominant height at age 25 years divided by 10. Predominant height is the average height of the tallest trees taken one from each twentieth acre.

Growth of the Hoop Pine has been highly satisfactory under all three *Pinus* species on the good sites. Best growth has occurred under the Honduras Caribbean Pine, despite the high density of the overwood. With each of the *Pinus* species growth of the Hoop Pine underplants declines rapidly with decrease in site index. Average and poorer sites must at this stage be regarded as marginal for underplanting with Hoop Pine.

(*c*) *Inland Southern Tablelands.*—The staff position restricted work to maintenance and measurement of species trials and thinning and spacing experiments. It is hoped to continue with investigations into nursery techniques and stock handling procedures with Radiata Pine when the staff position improves.

An experiment was established in 1962 to investigate survival, growth and form of oversized Radiata Pine nursery stock afforded the following treatments:—(A) Overgrown stock, normal planting, (B) Overgrown stock, lifted and heeled-in for two weeks before planting, (C) Overgrown stock, topped (about 6 inches of the leader removed) before planting, and (D) Normal sized stock, normal planting. Overgrown stock comprised those larger than about 15 inches. Growth data at assessment at termination of this trial at age 7 years is presented below:—

SURVIVAL AND GROWTH OF RADIATA PINE, 1969—SEVEN YEARS IN FIELD

Outplanting Stock	Percentage Survival	Percentage Useful Stems	Mean G.B.H. (ins.)	Mean Height (ft.)
A—Overgrown	91	91	13·6	25·8
B—Overgrown, heeled	79	79	13·1	25·3
C—Overgrown, topped	91	87	11·7	23·7
D—Normal	88	84	11·6	23·8

Best growth and survival has been given by the untopped overgrown stock. Topping of the stock appears to be detrimental to the eventual growth of the resulting stand, reducing it to that of normal sized planting stock; topping, however, has not had any significant adverse affect on the form of the plants, maximum defect being the production of 8 per cent. of stems with double leaders, but not all of these were useless. The poorer survival of the heeled-in stock was attributed to the double handling shock with only a short heeling-in period.

(ii) *Tree Breeding.*—The Officer in Charge of the Department's Tree Breeding Section is located at the Beerwah Regional Research Station. The work with *Pinus* species is conducted from Beerwah, while the breeding of Hoop Pine, reported under the heading "Imbil and Yarraman Research Stations", is supervised from Beerwah.

(*a*) Slash Pine.—Seed orchard No. 1, located on State Forest 108 Bribie, is 10·5 acres in extent and was planted up with potted grafts between 1953 and 1959, and a few were added in 1964. Yields of clean seed in lb. have been:—1963—8; 1964—5; 1965—110; 1966—200; 1967—484; 1968—475; 1969—642; 1970—763. Seed orchard No. 2, located on State Forest 589 Beerwah, is 17·9 acres in extent and was planted with potted grafts between 1958 and 1963. Yields of clean seed in lb. have been:—1963—2; 1964—6; 1965—112; 1966—420; 1967—948; 1968—885; 1969—1,464; 1970—1,456.

Progeny from the very small 1963 and 1964 collections were planted on some 200 acres at Beerburrum (in 1965) and on a similar area at Toolara (in 1966) respectively. It was observed recently that a small percentage of trees in these plantations showed malformation of stem, branches or needles of a similar type to that sometimes seen in progeny from self pollinations of Slash Pine trees and controlled hybridisation of Slash and Loblolly Pines. Such symptoms were extremely rare, however, in plantations derived from the much larger collections of orchard seed made in 1965 and subsequently. It is considered that the symptoms were

a result of an unusual incidence of self fertilisation and hybridisation in the seed orchards in the early years when very few clones produced pollen. The large seed orchard harvests are giving excellent stock which is fulfilling the expectations of high genetic gain that have been forecast as result of studies on long-established progeny trials (see Annual Report for 1969). In one such trial of 12 full-sib families and commercial stock, estimates were made of family mean basic densities and stem dry weight after 14 years in the field. Values ranged from 25·18 to 31·20, with a mean of 28·43 lb. per cubic foot for basic density, and from 31·07 to 40·44, with a mean of 34·15 tons per acre for stem dry weight. The respective values of these traits for the control (commercial stock) were 28·60 lb. per cubic foot and 28·81 tons per acre. That is, the mean basic density of the progeny population was the same as that of the commercial stock. The gain of 18·5 per cent. in dry weight of wood was due to the increased volume production of the full-sib progeny.

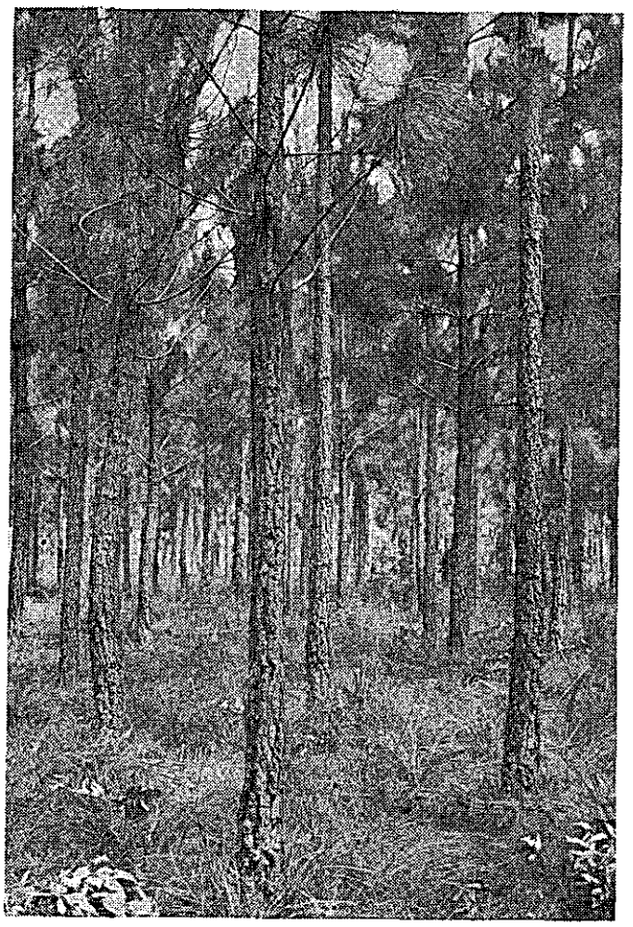
The numerous progeny tests established at Beerburrum are useful for several purposes. Data collected recently have been used to predict genetic gains obtainable using alternative procedures that could be adopted in a second breeding cycle. Initial studies suggest that, under the assumptions made, a further gain of about 8 per cent. in volume production at age 15 years (in addition to the 20 per cent. gain realised in the F1 progeny from the first cycle of selection and controlled breeding) might be achieved by culling the poorer half of the clones in Seed Orchard No. 1. An alternative procedure, involving establishment of a new orchard using the best 1 in 200 individuals within the best 1 in 6 of some 100 families available, would be expected to give a gain of about 14 per cent. in the second cycle.

Experiments have been designed for investigation of the importance of genotype-by-environment interactions of Slash Pine. The first trials, with six full-sib families from parents selected on well-drained sites at Beerwah–Beerburrum, were planted at Beerburrum and Byfield in 1962. They indicate that the ranking of individual families may vary drastically with outplanting locality, but in most cases families appear to be rather stable in relative yield. Further trials were planted in 1968 and 1969 involving many more families, and additional localities and sites. This year a start was made at Beerburrum and Tuan on selection of superior trees growing on poorly-drained sites. The work is limited by the relatively small areas of suitable plantations available for selection at present, but several excellent phenotypes have been found at both centres. A population of about 20 superior individuals has been chosen from each of the following four sources: poorly-drained sites at Beerburrum and Tuan, and well-drained sites at the same two centres. It is planned to cross pollinate several trees in each population using pollen from other trees within the same population, and also to produce interspecific hybrid populations using pollen from each of the three varieties of Caribbean Pine. Progeny will be outplanted on both well-drained and swampy sites.

(*b*) Caribbean Pine.—The yield of improved seed from grafted seed production areas and a progeny test of Honduras Caribbean Pine at Byfield amounted to 26 lb. 3 oz. this year. This was some 3 lb. more than the yield last year, despite the application of a light thinning in all the clonal stands following cone collection in 1969. It is anticipated that the 1971 harvest will be the largest since 1966, but the crop of mature cones in 1972 will be very light.

Some losses of ramets have occurred in the seed orchard of Honduras Caribbean Pine at Kennedy in North Queensland (field grafted in February, 1968) due to stock scion incompatibility, an accidental fire, and other causes. When regrafting at the failed positions is undertaken early in 1971, it is planned to introduce several excellent clones found recently. This orchard is expected to produce improved stock that is well adapted to the coastal lowlands of Central and South Queensland, since it is comprised of clones that were selected in plantations located in that area. Selection of superior trees in the tropical lowlands of Queensland's north-eastern coast was continued. As a reasonable total area of suitable, small stands is now available for searching it is anticipated the rate of finding plus trees will increase. An area has been prepared at Kennedy for establishment of these clones in a small orchard which can be expected to yield stock that is well-adapted to the region.

Honduras Caribbean Pine continues to display more rapid growth than Bahaman and Cuban Caribbean Pines in all varietal trials established along the coast between Beerburrum and Cairns. Although Cuban is the slowest growing variety, it appears to be superior in form, drought hardiness and resistance to wind damage. In cool upland areas of south-eastern Queensland, Bahaman Caribbean Pine makes very rapid growth and it can withstand mild frosts. It appears, therefore, that the Bahaman and Cuban varieties may have considerable utility in the future, although the Honduras variety will be the most important taxon. Individual selection has been initiated within the Bahaman and Cuban varieties with the aim of establishing small clonal seed production areas as soon as possible.



Routine stock of Honduras Caribbean Pine. Seed was collected from Natural Stands in Belice. Seven trees in eight have unsatisfactory stem straightness at age 7. State Forest 20, Maryvale.

Improved Honduras Caribbean Pine. Seed was derived from crossing two superior parents C10H and C53H. Two trees in three have satisfactory stem straightness at age 7. State Forest 20, Maryvale.

The detection of important geographic variation within the Bahaman variety was reported last year, and the conclusion drawn then was confirmed in another set of trials measured this year after 3·5 years in the field. These studies show that stocks from sources within Andros Island are slower growing than stocks from Grand Bahama, Abaco and New Providence at this stage.

Local selection and controlled breeding of superior individual trees of the Honduras variety have proved that the base population derived from imported seed can be improved greatly (see table and photographs). There is also large variation of volume and stem quality among (and within) full-sib families, which indicates that progeny-test selection among the parents and combined selection (among and within families) would both yield additional genetic gain.

ASSESSMENT OF IMPROVED AND ROUTINE HONDURAS CARIBBEAN PINE AT AGE 6·5 YEARS (MEANS OF 4 REPLICATIONS)

Treatment	Height (feet)	G.B.H. (inches)	Stem Straightness*	Trees with fox-tails
var. *hondurensis* full-sib family C10 x C53	37·1	18·3	66	0%
var. *hondurensis* from imported native seed	33·9	18·2	13	21%

* Percentage of trees with little or no straightness defect.

(*c*) Hybrids.—Many *P. elliottii* x *P. caribaea* hybrid families have been established at Beerwah and Byfield since 1958. They have grown faster than *P. elliottii* on both well-drained and poorly-drained sites. For example, 11-year-old *P. elliottii* x var. *hondurensis* F1 hybrids exceeded *P. elliottii* in mean height and girth by more than 20 per cent. Some individual families of this hybrid combination have made exceptional growth. Thus family G23 x mix. had a mean height of 33·3 feet and basal area of 170 sq. ft. per acre at 7 years of age when grown on a well-drained site at Beerburrum. Even so, the hybrids are not likely to be chosen for reforestation of well-drained sites because selected families of var. *hondurensis* can outyield them. On poorly-drained sites, however, growth of the hybrids (to 12 years of age at least) exceeds that of both parental species. Under these conditions the use of hybrids would be highly desirable if they could be produced easily—unless a strain of var. *hondurensis* that is adapted to these sites can be selected, or the sites can be ameliorated greatly at low cost. At this stage it appears that any one of the three hybrids combinations of *P. elliottii* and the three varieties of *P. caribaea* would be satisfactory for reforestation of swampy sites. But the relative difficulty in producing hybrid seed varies with the hybrid combination due to important differences of flowering times and of cross compatibilities of the varieties. Therefore a study is being made of seed production possibilities of the various F_1, F_2 and backcross hybrids by means of small clonal orchards that are being established at Byfield.

F_2 seed of *P. elliottii* x var. *hondurensis* hybrids resulting from crosses between selected, unrelated F_1 trees was obtained for the first time this year. Seed from two families was sown in three nurseries and it gave germination capacities of 63 and 79 per cent. These values are much higher than those for F_1 seed.

(*d*) Loblolly Pine.—Establishment of the 2·5 acre seed orchard was completed during the year. This was accomplished by field grafting. The orchard comprises some 270 ramets of 20 clones. Spacing is 20 feet by 20 feet. Three of the clones were selected on the basis of progeny performance, and five were chosen within the progenies of superior phenotypes of the first cycle of selection, which was carried out some 25 years ago. The remaining 12 clones were derived from selections made recently within commercial plantations at Imbil, Crohamhurst, and Beerburrum.

(*e*) Radiata Pine.—Evidence of selection gains is accumulating from progeny trials of local "plus" trees and a few New Zealand selections established at Pechey. A number of full-sib families from local trees and three from the New Zealand selection PR55 display very good health, vigour and stem straightness, superior to local control material to 7·25 years of age. In older, wind-pollinated progeny trials, several Pechey and Passchendaele selections have demonstrated superior breeding values. The choice of parents for a seed orchard is being made by reselection on the basis of progeny performance, as well as combined family and individual selection within the progeny tests. Establishment of the orchard to supply improved seed for use at Pechey, will be possible in the near future when a large enough population of superior parents is available.

Further field grafting was carried out in a preliminary seed orchard at Passchendaele. The parents used comprised selections made in routine stands and progeny trials, and one tree which has proved its superior breeding value in progeny tests. A co-operative progeny test of 30 A.C.T. clones in the Tallaganda, N.S.W., seed orchard and six local clones was established in the field at Pechey and Passchendaele.

(*f*) Miscellaneous Tropical Pines.—Seed was sown of several provenances of Benguet and Ocote Pines (by courtesy of FAO and EAAFRO respectively), and extensive outplantings are being planned.

A voluntary paper on "Increased Volume and Dry Weight Yield and Improved Stem Straightness obtained through Selection within a Population of *Pinus elliottii* Englem" has been accepted for publication in the Proceedings of the Second World Consultation on Tree Breeding, Washington D.C. August, 1969. The Officer in Charge, Tree Breeding Section, visited several forest research and tree breeding stations in North America, Hawaii and New Zealand whilst overseas to attend the Second World Consultation on Forest Tree Breeding, and a report was prepared on his visits. Several contributions were made to the Second Meeting of Australian Forest Research Working Group No. 1 which met at Beerwah in April, 1970, and a Chairman's report was prepared by Officer in Charge, Tree Breeding Section.

(iii) *Nutrition.*—The work of this section is directed chiefly towards the determination of optimum fertilizer regimes for the exotic pine plantations established on the coastal lowlands of south-east Queensland. More recently there has been considerable expansion in exotic pine nursery nutrition work as well as foliar analysis, as a means of diagnosing nutritional disorders.

The results of numerous past glasshouse and field trials have shown that the early response of both Slash Pine and Loblolly Pine to applications of superphosphate, depends on the nitrogen status of the plant as affected by cultivation of the site and the application of nitrogenous fertilizers. The response to nitrogen is ephemeral and persists only for the first three years after planting. In order that the plants can take advantage of this interaction, it has been recommended that a "starter" dose of nitrogen with five ounces of superphosphate be applied to the individual tree at planting, on cultivated sites. A large scale cost trial has been established to clarify the economics of this procedure. Results after one year in the field show a definite growth advantage to the cultivated plots treated with individual tree applications of a mixture of superphosphate and ammonium sulphate.

The response of the Caribbean Pines to nitrogen fertilizer is somewhat confused. On a low humic gley soil type at Beerwah Slash Pine has exhibited a response to nitrogen; however Honduras Caribbean Pine, Cuban Caribbean Pine, hybrids of these species and their hybrids with Slash Pine have shown no positive response to nitrogen dressings by age four years and in some taxa there has been a slight depression in growth. On a ground water podsol soil type at Gregory where the three varieties of Caribbean Pine, as well as Slash Pine are being tested for responses to fertilizers under three methods of site preparation, all three varieties have shown a greater response to nitrogen by age 18 months than has Slash Pine. This is shown in the following table as also is the marked response to phosphorus:—

MEAN HEIGHT (FEET) AT AGE 1½ YEARS
(Means of 6 plots)

Fertilizers*	Slash Pine	Honduras Caribaea	Bahaman Caribaea	Cuban Caribaea	Mean
Nil	1·36	1·38	1·19	0·86	1·20
P	2·11	2·16	2·26	1·68	2·05
P + N	2·61	3·01	3·05	2·36	2·76
P + N + K ..	2·87	3·08	3·33	2·54	2·96
P + N + K + T	3·02	3·01	3·59	2·29	2·98
Mean ..	2·39	2·53	2·68	1·95	..

* P as superphosphate 5 cwt./acre
N as urea 1 cwt./acre
K as Muriate of Potash 2 cwt./acre
T a mixture of Copper, Zinc, Boron, Molybdenum
All fertilizers applied as four split dressings.

There is no marked response by any species or variety to either potassium or the trace element mixture at this stage. At the time of the measure, the various methods of site preparation (mounding, ploughing and ripping and ploughing) have shown no significant differences. In a small adjacent trial on the same soil type, South Florida Slash Pine has shown quite a marked response at age 18 months to nitrogen applied in the presence of basal phosphorus. This response is however confounded with a possible response to either potassium or the trace element mix.

In an omission type trial in a 1966 Slash Pine plantation at Toolara on an ill-drained low humic gley soil there has been a marked response to the addition of superphosphate, and a phosphorus-nitrogen interaction for the first two years in the field. This interaction faded in the third year in the field. There was no response to the addition of potassium, calcium, magnesium, zinc, copper, boron, molybdenum and manganese. These findings are similar to those reported from Beerburrum, Tuan and Gregory.

Since the collation and publication of the results of past nursery research work carried out in the old nurseries at Beerwah and Beerburrum it has become standard practice to sample Slash Pine nursery soils for chemical analysis. Having established "optimum soil levels", for the various nutrients and knowing the quantity of nutrients removed in a crop, it is a matter of simple calculation to determine the quantities of various nurients to be added to the soil. In order to check on these "optimum soil levels" of the various nutrients and to investigate alternative methods of nursery soil management, long term nursery trials have been designed for establishment in the new Beerburrum nursery during the coming year; these will test various levels of inorganic and organic amendments as well as crop-rotation systems and the use of cover crops.

In some areas outside Queensland where *Pinus* spp. are grown in plantations, a decline in productivity is experienced during the second rotation. Queensland's plantations of exotic pines have not as yet reached an age where they are to be clear-fallen. In order to anticipate any problems that may be encountered during the second rotation, an area of ten acres of average size quality Slash Pine planted in 1934 was clear-fallen. Estimates of nutrients removed are shown in Table form.

DRY WEIGHTS AND NUTRIENTS REMOVED IN FINAL LOGGING OF A 30-YEAR-OLD SLASH PINE STAND (pounds per acre)

——	Wood	Bark	Total
Dry Weight	115,864	19,191	135,055
Total Nitrogen ..	130·6	31·9	162·5
Total Phosphorus ..	1·9	1·7	3·6
Total Potassium ..	42·3	11·8	54·1
Total Calcium ..	83·2	27·9	111·1
Total Magnesium ..	24·6	6·9	31·5

The area concerned has now been given various site preparation treatments and will be planted in 1970 with stock raised from seed collected from the area prior to clear felling. A fertilizer experiment will be included in the area but the main aim will be to compare the growth of the second rotation crop with the growth of the first rotation.

Short term field experiments established on a deep lateritic krasnozem at Pechey have shown that phosphorus is the major nutrient limiting growth of Patula Pine on a cultivated site. Cultivation by rotary hoeing has produced a large response by age three years and dressings of superphosphate have by this age shown an additional response of 7·8 per cent. in terms of mean height. A large scale trial using as test species both Patula Pine and Radiata Pine was established early in 1970 to provide data on cultivation and fertilizing on a routine basis.

During 1964 an attempt was made to stabilise a lateritic krasnozem soil in the Childers district on a 20 degree slope from which about three feet of soil had been eroded under sugar cane cropping since clearing the original rain-forest. Contour banks were established at 100 feet intervals and planting lines were ploughed along the contour at six-foot intervals. Predominant heights of the trial species five years from planting were Gympie Messmate 33 feet; Spotted Gum 30 feet; Lemon Scented Gum 31 feet; Patula Pine 25 feet; Slash Pine 17 feet; Hoop Pine 5 feet. Honduras Caribbean Pine was 16 feet after four years. All except Hoop Pine have now stabilised the site. In the first three to four years grass controlled erosion better than the trees. For the best erosion control dual establishment of grass and trees appears to be desirable. There was a marked response to the addition of urea on this site in the first year. All plots were accordingly fertilised with urea in the second year.

Experiments established over the period 1953 to 1955 to test methods of establishing Slash Pine plantations on ill-drained heath sites in the Tuan area have been terminated. They have shown that drainage of these sites is essential to successful plantation establishment and that addition of phosphorus is also essential. Mounding improves growth rates for the first eight years but is not essential to the establishment of well-stocked plantations. There is no response to the addition of lime.

Experiments established at Tuan on well-drained sites in 1953 and 1954 Slash Pine plantations to test response to the addition of several levels of Nauru rock phosphate have shown a response in volume production to the addition of 2 cwt. Nauru rock phosphate per acre. This response has been barely adequate to cover the cost of fertilising. Higher application rates are not justified by results to date.

Fertiliser experiments at Byfield consistently show no response by Honduras Caribbean Pine to age 17 years to the addition of phosphatic fertiliser in plantations of site index 10 or above. Experiments on poorer sites show a response to the addition of phosphorus and support the routine application of 3 cwt. Nauru rock phosphate and 1 cwt. superphosphate per acre to such sites.

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

Further trials in raising Blackbutt stock in jiffy pots for use in enrichment planting operations were conducted during the year. The use of vermiculite as a seed cover against proved superior to using sand or soil. In the Beerwah trial a marked stimulus to growth in the nursery was obtained by placing 0·75 gm. of blood and bone in the bottom of the pots before filling but once again no benefit was obtained on Fraser Island through the addition of solid inorganic fertilizer. For fast nursery growth of Blackbutt in small 1¼-inch square pots more frequent light watering and "aquasol" application appear necessary than is the case with the large 2¼-inch square pots. Experiments to test the effect of pot size on field survival and growth principally for Blackbutt, were established during the year at Mt. Glorious and Fraser Island. Survivals of Blackbutt stock one year after planting for a range in size of square jiffy pots and in length of plastic bullets are given in table form.

PERCENTAGE SURVIVAL OF BLACKBUTT TWELVE MONTHS AFTER OUTPLANTING BY CONTAINER TYPE

Location	Jiffy Pots			Plastic Bullets		
	1½″	1¾″	2¼″	2½″	4½″	5½″
Fraser Island ..	88	78	98	39	55	73
Bellthorpe	88	80	88	39	55	73

The performance of the plastic bullets, which are planted by a "planting gun", has been poor and, with the difficulty in raising plants to above three inches in such containers in the nursery, there is little prospect for their use in routine.

In September, 1969, a milliacre assessment, on a 4 chain x 1 chain grid, was made to gauge the success in securing regeneration on the 1969 burn area in Blackbutt on Fraser Island. Leaving an increased number of Blackbutt seed trees so that the crowns were generally not more than 40–50 feet apart at the time of the regeneration burn has produced good results. Logging and hormone injection of useless stems immediately after the burn with the object of leaving two vigorous trees per acre has not caused any serious loss of regeneration, 67 per cent. of milliacres being stocked at six months after the burn. Experimental results indicate that 50 per cent. of milliacres with 1–3 seedlings six months after the burn will be stocked with established plants at two years; percentages stocked for 4–9 and 10 or more seedlings are 80 and 100 respectively. These percentages predict a satisfactory 44 per cent. stocking at two years from the 1969 burn.

An enrichment planting of Blackbutt and Gympie Messmate following tractor disturbance of a mixed Blackbutt, White Mahogany and Tallowwood forest was made during the year. Mineral soil was exposed on 65 per cent. of the area and plants were placed over that area at approximately 12 feet x 12 feet to give a stocking of 182 per acre over the whole area. The planting rate with jiffy pot stock of 51·7 plants per man hour compared favourably with a rate of 24·6 plants per man hour achieved with tubed stock in another enrichment planting operation.

Browsing by marsupials has caused severe damage in some sections of enrichment planting operations. In two 1968–69 plantings the use of "sapitect", a systemic liquid repellent applied before planting, was tested on a number of species. Heavy browsing did not occur but results were encouraging. The percentage of unsprayed control plants browsed was 8·4 as against 2·1 for the sapitect sprayed plants. Survival and height increment at six months after planting were 70·3 per cent. and 1·68 feet for the plants in the control plots and 82·5 per cent. and 1·93 feet for the plants in the sprayed plots.

Thinning and growth plots for several species are maintained in a number of evenaged stands of plantation and seedling origin. Some species such as Blackbutt and Gympie Messmate have been found to respond strongly in girth growth to thinning, but with some other species such as Rose Gum and Red Mahogany response is not so marked. Details from a Gympie Messmate stand planted at 10 feet x 10 feet in the Gympie district in 1951–52 and thinned at

age 3·5 years illustrate the effect of early unmerchantable thinning in this species. At age 16·5 years the average predominant height was around 90 feet and the stocking of the unthinned plots was 380 stems per acre. Volumes to 6 inches diameter under bark were calculated for stems of 24 inch + g.b.h.o.b. Stand parameters are shown in table.

STAND PARAMETERS PER ACRE AT AGE 16½ YEARS IN GYMPIE MESSMATE PLANTATIONS UNMERCHANTABLY THINNED AT AGE 3½ YEARS

Stand Data	Unthinned	Thinning Treatment		
		16′ x 16′	20′ x 20′	25′ x 25′
Whole stand—				
basal area (sq. ft.)	115·0	89·6	80·1	65·6
g.b.h.o.b. (in.)	23·35	30·63	34·50	37·83
merch. vol. (cu. ft.)	1,007	1,580	1,579	1,417
25′ x 25′ selects—				
basal area (sq. ft.)	32·9	44·8	55·9	65·6
g.b.h.o.b. (in.)	26·75	31·2	34·86	37·83
merch. vol. (cu. ft.)	437	815	1,171	1,417

A 5 per cent. solution of 2,4,5-T amine in water applied to cuts two inches apart at 2 c.c. per stem up to 24-inch g.b.h. and 4 c.c. for larger stems is normally effective in killing unwanted Blackbutt. However, during the 1968 drought some disappointing levels of kill were recorded particularly for large trees. A further trial on large Blackbutt was therefore established testing 4 c.c. of 5 per cent. and 2 c.c. of 10 per cent. 2,4,5-T amine applied as waist high and basal injections 2 inches apart; and 4 c.c. of Tordon, containing 1 per cent. picloram and 4 per cent. 2,4,5-T, as basal injections 3 inches apart. Early results from all treatments have been very good. Indications are that distance between injections should not exceed those recommended.

Plots for a Blackbutt control burning experiment have been located at Bellthorpe, Peachester and Fraser Island. Treatments proposed are nil burning and burning at two- and four-year intervals. Pre-burn data on growth, understory development, fuel weights and soil and foliar nutrient levels are being gathered. The initial burns are planned for winter 1971. The long term study of effects of annual control burning in Spotted Gum forest is being continued.

It has been shown that the development of Spotted Gum from lignotubers is retarded within 75 links of standing trees. Beyond the canopy influence development from lignotubers is rapid. In one large gap lignotubers at six years after release from overwood suppression achieved an average height of 37 feet. Thinning to 30 feet x 30 feet in such young regrowth gave a good response in girth growth though basal area of the unthinned was only 11 sq. ft. per acre. Girth increments of the stems selected at 30 feet x 30 feet in each plot for the first year after thinning were 2·40 inches in the thinned plot and 1·98 inches in the unthinned plot, which carries 192 stems per acre. Average girth of the select stems at thinning was approximately 12 inches. Observations on the effect of early spacing on clean bole length are being made.

Counts on regeneration plots (each 1/400 acre in area) on detailed yield plots in coastal Spotted Gum-Ironbark forests of southern Queensland indicate that 77·1 per cent. of plots are stocked. The average stocking exceeds 1,000 per acre but most regeneration is held in the lignotuberous or straggling shoot stage by the overwood competition. Comparative figures for inland Spotted Gum forests in the Dalby district are 17·7 per cent. stocked and 85 per acre. Indications are that while regeneration of coastal Spotted Gum forests requires only the removal of sufficient overwood, regeneration burning may be necessary in the drier areas.

It has been found that straggling growth from lignotubers and coppice development after treatment have an adverse effect on growth of dominant stems in Spotted Gum-Ironbark forests. On Wolvi State Forest in the Gympie district, removal of coppice regrowth (about 600 stems per acre with a basal area of 24 square feet per acre) by injection of a 5 per cent. solution of 2,4,5-T amine in water resulted in average girth increment on the 140 stems per acre left in previous treatments of 0·50 inch per year as against 0·36 inch per year where the coppice was not removed. Girth increment per year on stems visually selected at 30 feet x 30 feet in the two treatments were 0·72 inch and 0·43 inch respectively. The cost of treatment (hormone and wages), however, was high at $11.80 per acre over a small test area of 8·5 acres.

Routine treatment of Spotted Gum-Ironbark forests is now effected by hormone injection aiming at retaining stems at an average spacing of 25 feet x 25 feet with a minimum distance of 20 feet between any two retained stems. During the year an experiment was laid down in the Maryborough district to test the effect on growth and economic return of the routine prescription, a 40 feet x 40 feet spacing and no treatment.

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 the rain forests and sclerophyll forests on the Dividing Range east of Warwick where the rainfall generally exceeds 50 inches per annum.

All White Cypress Pine spacing experiments were remeasured during the year and the results indicated a continuation of the low growth increments which have occurred regularly since 1963. Abnormally low rainfall has fallen in each growing season for the period.

A study of standing basal area – basal area increment relationships of these spacing experiments indicates that there is a pronounced seasonal effect on increment. A graphical presentation of the data showed that, even in the adverse climatic periods, there is a steady increase in basal area increment with increase in standing basal area up to 113 sq. ft. per acre, the maximum recorded. However, value increment culminates at a much lower basal area level.

Deaths have generally been infrequent in these young stands and do not appear to be related to severe drought conditions or to excessive rainfall. In addition, it was concluded from a count of seedling regeneration in one large scale thinning trial that there is an increase in regeneration numbers with wider spacings of the overstory, and that the largest increase in numbers occurs between the 16 feet x 16 feet and 20 feet x 20 feet spacings.

A thinning trial in relatively large size material at Western Creek which was remeasured during the year also showed the increase in regeneration numbers with spacing increase from 16 feet x 16 feet to 20 feet x 20 feet, with the latter having developed towards a selection forest structure over a period of 30 years while the former has retained its evenaged structure. The area adjoining each plot in this experiment has been reserved for a trial to investigate the relative advantages of selection and evenaged management.

Remeasure of 34 detailed yield plots at State Forest 328 Yuleba was carried out during the year. Girth increments for the six year period 1963–1969 for the 4,040 stems measured are shown in table.

MEAN ANNUAL GIRTH INCREMENTS IN INCHES—WHITE CYPRESS PINE—1963–69—YULEBA

G.B.H.O.B. Class (inches)	0–12	12–24	24–36	36–48	48+
G.B.H.O.B. Increment	0·26	0·18	0·15	0·14	0·14

These increments are well down on those for the previous period and are considered to be a reflection of the poor growing seasons. The magnitude of the girth increment was shown to be related to the percentage of the height of the tree which was taken up by the green crown, and also to the dominance of the tree over its neighbours.

Trial plots of Northern Cypress Pine were outplanted at Barakula and Inglewood during the year to observe the growth and behaviour of this provenance compared with that of White Cypress Pine which has been planted in the same areas. In the nursery the seedlings of the White Cypress could be easily distinguished from those of the Northern Cypress but no differences were apparent between the Western Australian, Northern Territory, and Cape York strains of Northern Cypress.

Planting of Cypress and exotic pines along striplines cleared in dense wattle was carried out in 1968 at State Forest 150 Dunmore as part of a trial restocking programme for an area devastated by a wildfire in 1964. All Cypress Pine were eaten off at ground level by wallabies soon after planting and replanted stock showed no better survival when covered with a felled wattle head or when a coloured tape was attached. The exotic pines were badly affected by the wattle competition and only Aleppo Pine was surviving in 1970. Some Cypress are still alive although badly affected by the grazing.

A considerable part of the area burnt in 1964 at State Forest 150 Dunmore has produced natural Cypress regeneration but this is being grazed by wallabies. A trial was established during the year to study the response of the damaged Cypress

to fencing against wallabies. Plots were located under heavy wattle and in a relatively clean area. Early results indicate that where the wattle is heavy, protection from grazing is necessary for a number of years to allow the seedlings to grow to a safe level.

Following a good pollen crop, seed was collected from four year old, plantation grown Cypress Pine during 1969. Nursery sowing proved the seed to be more than 40 per cent. viable.

Plots were established in 1968 to measure the rate of growth and fruiting intensity of the Moonlight Cactus (*Eriocereus tortuosa*) at State Forest 154 Vignoles under various growing conditions. It was found that under a Brigalow canopy plants with about five years of tendril growth irrespective of their size in 1968, had doubled their total tendril length by 1969. Plants on a Poplar Box flat grew less but produced more fruit.

INCREASE IN TENDRIL LENGTH IN INCHES—MOONLIGHT CACTUS—1968–69

Tendril Length 1968	0–12 inches	12–24 inches	24–36 inches	36 inches +
Brigalow ..	8·2	16·5	31·2	55·2
Poplar Box ..	4·5	15·4	24·1	59·1

Two seasons of basal injection experiments in Spotted Gum and Smooth Barked Apple were finalised after six years of treatment and observations. Results for both species with 2,4,5-T formulations were better in winter than in summer and there was a rapid decrease in kill with increase in size of the treated stem above 30 inches g.b.h. A feature of the trials was the absence of basal coppice shoots from surviving stems. Stems living three years after treatment commonly retained a portion of their original green crown.

Narrow Leaved Ironbark lignotubers, known to be 16 years old, responded with vigorous height growth to the destruction of arboreal vegetation in a strip two chains wide.

An analysis was made of seven years of growth observations in rain-forests on the Dividing Range east of Warwick. Good quality virgin stands have a standing basal area of about 250 sq. ft. per acre. Girth increments of commercial species are about 0·1 inches per annum for trees less than 48 inches g.b.h.o.b. and about 0·3 inches per annum for larger trees; regeneration of commercial species is almost non-existent. In logged stands commercial species of all size-classes had increments of about 0·4 inches per annum and regeneration of commercial species is abundant.

Further trial plantings were established in sclerophyll forest and rain-forest sites in this area. New species introduced were Parana Pine, Chile Pine, Western Yellow Pine, Tenasserim Pine, Scrub Pine, *Pinus lutea* and *Pinus taiwanensis*. Average heights attained by earlier plantings on rain-forest sites at age four years have been:—Radiata Pine 22·7 feet; Patula Pine 17·6 feet; Loblolly Pine 15·3 feet; *Pinus tenuifolia* 12·2 feet; Benguet Pine 10·1 feet; Hoop Pine 7·1 feet.

Mexican White Pine, which was growing well, has been devastated by 'possums which stripped off almost all the bark from stems and branches.

On a heavily grassed Eucalypt forest site Radiata Pine attained an average height of 10·4 feet at age four years. Benguet Pine failed. On a similar site which had been well cultivated some hybrid Poplars exceeded 10 feet in height in less than twelve months. In heavily logged and treated rain forest in which the canopy had been reduced by more than 50 per cent. Hoop Pine underplants have grown in height over a period of seven years, at 1·75 feet per annum. Southern Kauri Pine at 1·5 feet per annum and Queensland Maple at 1·2 feet per annum.

Imbil and Yarraman Research Stations

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

(i) *Plantation Silviculture.*—Experiments have been commenced at both Imbil, and the nearby Kenilworth nurseries, to test the response of 11-month Hoop Pine seedlings to the application of ammonium sulphate at rates varying from 50 lb. to 200 lb. of added nitrogen per acre. In one treatment urea was used to supply 150 lb. added nitrogen per acre. There have been responses to the added nitrogen but these have yet to be assessed.

Experiments investigating the use of selected triazines and substituted ureas as post-emergence wedicides in Hoop Pine nurseries were continued and tolerance levels studied. Earlier indications have been that bromacil and diuron are the most effective formulations. Although the experimental stock has not yet been graded at tubing it is clear that 1 lb. (a.i.) applied in 100 gallons of water per acre was beyond the tolerance of Hoop Pine. In 1969-70 season, at both the Imbil and Kenilworth nurseries, experiments were carried out to investigate the efficiency of lower levels of bromacil and diuron in controlling weeds. There has been good weed control by bromacil applied at 0·5 lb. (a.i.) per acre in 100 gallons of water. In a routine application of bromacil at 0·3 lb. (a.i.) per acre good weed control was achieved. Levels below 0·5 lb. (a.i.) per acre will be studied in the coming year.

Frost areas delineated by the Yarraman regression method in 1967–68 and 1968–69 Hoop Pine plantings at Yarraman, Jimna and Gallangowan were assessed following the 1969 winter and frost sites in 1969–70 planting areas were delineated.

The winter of 1969 can be regarded as a testing winter. The winter was very mild but late frosts occurred in September when Hoop Pine plants were soft and showing new growth. Results to date at Yarraman indicate that delineation of frost sites by the regression method has been quite successful where gullies are regular and well-defined. It is suspect where gullies are basin like with an ill-defined water channel. However it will require some years of observation to draw firm conclusions.

At Jimna and Gallangowan there was little frosting outside the regression lines in 1967-68 plantings but there was considerable frosting outside the regression lines in 1968-69 plantings. Examination of older plantings at Jimna and Gallangowan indicates that severe frosting will occur at these places on slopes which would be regarded as safe from frost at Yarraman.

Further data were collected in co-operation with the Bureau of Meteorology on gully temperature profiles and air flow characteristics. Temperature and wind measurements were also made on the east and west slopes of Cooyar Range to determine whether such a major change of aspect affected night temperatures in the winter.

Following last year's report of no growth response six months after the application of nitrogen as ammonium sulphate to two-year Hoop Pine on a *Eucalyptus* site at Imbil, there has been a marked response during this report year. Height increments 20th December, 1968, to 15th May, 1970, have been:—Control 2·8 feet; 27 lb. nitrogen per acre, 3·1 feet; 54 lb. nitrogen per acre, 3·3 feet; 160 lb. nitrogen per acre, 3·5 feet; 270 lb. nitrogen per acre, 4·0 feet. This response level is similar to that in earlier experiments and is probably not sufficient to warrant the cost of treatment.

For the pre-plant treatment of plantation weeds, using a mist application, certain low volatile esters with E95 as an emulsifying agent and an amine preparation with formula 10/27 as a wetting agent were tested against the hormone weed-killer treatment regarded as giving the best control of weeds at Imbil—16 oz. 2,4-D ester + 20 oz. 2,4,5-T ester + 1 pint E95 made up to 2½ gallons with water and applied to one acre. From a preliminary examination of the results it appears that the low volatile esters give the same weed control as the more volatile esters. The addition of E95 does not improve weed control by the esters. The amines, tested at a higher concentration than adopted in the past, have again been less successful than the esters.

The effectiveness of 16 oz. 2,4-D ester + 20 oz. 2,4,5-T ester + 1 gallon E95 made up to 20 gallons with water as a post-plant weedicide, when applied with a knapsack spray, was tested at Imbil against mixtures containing lesser quantities of 2,4,5-T, a formulation containing 2,4-D amine and 2,4,5-T ester and an all amine formulation. The ester formulations gave weed control superior to that of the all amine formulation. It appears that concentrations of esters lower than quoted above will be adequate.

At Yarraman three weedicide mixes were tested for control of inkweed (*Phytolacca octandra*) and wattle (*Acacia* spp.) when applied as a mist. These were (A) 16 oz. 2,4-D ester + 20 oz. 2,4,5-T ester + 1 pint E95 (Considered to be the best formulation by Imbil research staff); (B) 25 oz. 2,4-D amine + 10 oz. 2,4,5-T amine + 6 oz. 10/27 (adopted as routine formulation at Yarraman); (C) 20 oz. 2,4-D amine + 6 oz. 2,4,5-T amine + 4 oz. 10/27 (a generally approved formulation). All were made up to 2 gallons with water and applied at the rate of 2 gallons

per acre. Inkweed ranged from 1 inch to 12 inches in height at time of application while the wattle was about 1 inch in height. Percentage kill is shown in table.

PERCENTAGE KILL OF INKWEED AND WATTLE BY HERBICIDE MIXES

Weed	Herbicide mix*		
	A	B	C
Inkweed	92	94	91·5
Wattle	97	85	81·0

* For details of mix, see text.

Treatment B had a slight advantage in inkweed control while A had a marked superiority in control of wattle.

Further cost trials were carried out at Imbil using diuron and bromacil as a pregermination mist applied in 4 gallons of water per acre to control weed growth in the field. Costs per acre for first year weed tending were as follows:—16 oz. diuron per acre $16.00; 24 oz. diuron $16.95; 12 oz. bromacil $16.27; manual tending (no weedicide used) $11.87. These results are anomalous as manual tending would normally be in excess of $20.00 per acre. The control plot was apparently located by chance in an area with a low incidence of harmful weeds.

"Yarraman disease" is a name applied to a disorder of Hoop Pine first noticed in late 1967 in a 1965–66 plantation on Dean Logging Area, State Forest 289 Neumgna and subsequently found to be fairly widespread in young plantations in the Yarraman area and elsewhere. Symptoms of the disorder are severe twisting of stems and branches; leader dieback associated with canker development; weak apical bud with tendency to dieback and multileadering; new growth soft and lush, pinkish in colour with tendency to burn off; general foliage colour yellowish in some areas.

A number of trials have been set out in an attempt to establish the cause of the disorder. It is too early to draw conclusions from most of this work. Decapitated crooked stems are producing new leaders which are also crooked. A grafting trial has given no indication that the trouble is viral in nature. Weedicides applied to young plants have produced some of the symptoms of the disorder, but results cannot be regarded as conclusive.

The weight of evidence points to some soil deficiency or toxicity as being the cause of the trouble. Soil and foliage analyses carried out by the Department of Primary Industries indicate a low soil PH and high foliar aluminium levels in association with symptoms of the disorder. The effect of the addition of lime to raise soil PH and of aluminium sulphate to lower soil PH is being studied. Foliage levels of copper were found to be lower at Yarraman than at Imbil, though the Yarraman levels are not regarded as low when compared with critical levels in horticultural crops and *Pinus*. Additions of copper in various forms are being tested. Foliar analyses by the Forestry Commission of New South Wales point to boron and sulphur deficiencies. Following these analyses, Dr. Gentle inspected the Yarraman plantations and expressed his opinion that the disorder was caused on some sites by boron deficiency, on other sites by sulphur deficiency and elsewhere by a combination of both.

Densiometer readings and tree damage assessments have shown that there has been some recovery by trees suffering from attack by the Hoop Pine branch pruner (*Coptopterus decoratus*) at Imbil. This is thought to be largely the result of improved seasonal conditions. Recovery has been greater in the fertilised plots than in the unfertilised plots.

A series of observation plots has been established in the Imbil area as part of a wide-scale study of root rots and butt rots in Hoop Pine plantations. These will provide information on mortality rates and rate of spread of the disease.

(ii) *Tree Breeding.*—A detailed study was made this year of one of five local tests of south-eastern Queensland provenances of Hoop Pine, which were planted between 1934 and 1956. The 16-year results of this study are summarised in the accompanying table.

Simple analyses of variance for the latin square design revealed significant differences between provenances for basal area, total volume and branch angle. The low yield of Imbil stock was consistent with results obtained in older experiments. But the poor performance of Builyan stock in this experiment was unexpected, and this is believed to be due in part to an early unmerchantable thinning which has a more adverse effect in plots of this relatively vigorous but crooked provenance. The best provenance in this trial has so far yielded nearly 33 per cent. more volume than stock from Imbil, and two others show a difference of over 20 per cent. Studies on the established trials suggest that the Jimna–Gallangowan region and some other localities are good seed sources for plantation establishment throughout south-eastern Queensland, while certain provenances in the Mary Valley are much less desirable.

To further our knowledge of geographic variation seed collections were made in 1966, 1967 and 1968 from 45 stands sampling the range of Hoop Pine in Queensland, New South Wales and New Guinea. Sowings have been made in south-east Queensland in spring in 1968 and 1969 and in north Queensland in autumn 1970. A further sowing in the north is planned for 1971. Stock from the 1968 sowings of several wind-pollinated families in each of 40 provenances was tubed recently for transfer to the field in 1970–71. A review paper on geographic variation of Hoop Pine was prepared for the Beerwah meeting of Australian Forest Research Working Group No. 1.

Seed supplies for the routine plantation programme are obtained, in good crop years, from selected sources. These sources comprise the better individuals of particular provenances in natural stands, and superior trees and plus stands in plantations. Based on observations on pollen production, and frequency of pollen tubes within conelets of the 1970–71 and 1971–72 crops, the next good seed crop is not expected before 1972–73 in most regions.

MEAN VALUES OF TRAITS MEASURED OR SCORED ON SAMPLE TREES IN A 16-YEAR-OLD PROVENANCE TRIAL OF HOOP PINE GROWING AT IMBIL

Seed Source		Predominant height (ft.) *	Girth over bark (inches) †	Basal Area per acre (sq. ft.)	Total Volume per acre (cu. ft.)	Branch Thickness (inches) ‡	Branch angle from vertical (°) ‡	Internode length in top (feet) §	Straightness of butt §
Local Area	State Forest (No.)								
Gallangowan	673	61·0	20·9	138·0	2,811	3·51	65·3	3·93	6·29
Mount Stanley	329	58·6	20·5	132·5	2,586	3·36	68·9	4·37	5·58
Goodnight	169	58·0	20·5	134·4	2,572	3·58	70·3	3·43	5·60
Elginvale	154	56·6	20·1	129·9	2,443	3·26	68·5	3·47	6·09
Builyan	67	54·3	20·7	124·6	2,290	3·53	68·1	3·49	5·69
Imbil	135	54·7	19·8	116·6	2,119	3·25	69·5	4·05	5·64

* Based on the two tallest trees per plot of 0·07 acre.

† All trees measured in plots which each contained 42 trees originally.

‡ Measured on all branches in the two clusters above and below a point 20 feet from tree top, on 60 trees per provenance.

§ "Top" is the section above 20 feet; "butt" the section below this; straightness assessed on a scale of increasing merit from 1 to 10.

Completion of the study of a means to predict seed viability up to two years before seed fall awaits further sampling after a season of good flowering. Meanwhile, the following preliminary equation and curve relating P (percentage of ovules with pollen tubes in sample conelets) to LGC (laboratory germination capacity per cent.) has been developed:

$$\text{Log LGC} = 0{\cdot}28 + 0{\cdot}40 \log P + 0{\cdot}008\ P.$$

Further progress has been made in the selection of individual seed trees and of plus stands in plantations, and in the establishment of seed orchards. The improved seed sources that are or will be available for seed collection are shown by regions in the following table, which includes approximate acreages already planted and current annual programmes of establishment. In addition some seed is also available from native stands in all regions.

	Area planted (acres)		Sources of improved seed		
	Annually	Total to date	Plantations		Clonal Orchards
			Seed Trees	Plus Stands	
1. Brisbane Valley	1,000	27,000	+	+	+ *
2. Jimna–Gallangowan	800	14,000	+	+	+ *
3. Kalpowar–Builyan	300	5,300	+	–	+ *
4. Mary Valley	600	21,000	+	+	+ †
5. Maryborough	300	1,200	–	–	–
Totals	3,000	68,500	900	68 acres	27 acres

* A single orchard of 17 acres is being established in the Brisbane Valley to supply seed for Regions 1, 2 and 3; field grafting commenced in 1970.

† Establishment period for this 10-acre orchard was 1965–1969.

An initial collection was made of 48 lb. of orchard seed resulting from hand pollination in 1967–68 of flowers on ramets of seven of the twenty clones in the Imbil orchard. Viability of the seed was low, possibly because the pollen used was not fresh, but more than 2,000 germinants have been obtained.

Field grafting commenced in 1970 in one section of the Taromeo seed orchard. Thirty early-flowering "plus" trees have been chosen for inclusion. Some 1,100 grafts were made and 99·2 per cent. have "taken" successfully. Twenty late-flowering "plus" trees are being chosen for establishment at 1,200 positions in the second section of the orchard and field grafting will be undertaken in the spring of 1970.

A detailed review paper, "Grafting of Hoop Pine in Queensland", was completed for limited distribution. In it particular attention was given to results of work undertaken since the discovery of serious stock-scion incompatibility in the species in 1963. It was found that the field "patch grafting" technique introduced in 1959 is quite satisfactory for compatible clones. Variations of that technique tried later are less satisfactory initially, but the successful ramets perform well once union is established. "Top cleft" grafting, which was introduced only recently, has distinct advantages, but it has limited application with Hoop Pine because commonly only a few suitable scions are available per clone. The review disclosed that damp weather conditions at the time of grafting have an adverse effect on percentage success. Causes of failure in grafting Hoop Pine were considered to be due to two forms of incompatibility and to defective unions. The only factors significantly affecting stock-scion incompatibility were thought to be scion clone and stock genotype. Future lines of investigation suggested were screening seedlings for compatible root stocks, or the development of a method for rooting cuttings of the incompatible clones.

Methods of striking cuttings of both young and old trees of Hoop Pine have been under study. In past years unsuccessful attempts were made to propagate mature Hoop Pine trees by induction of juvenile coppice near the base, collection and division of the coppice shoots and placement of the cuttings in humidified sand beds. During the year several cuttings of a 40-year-old tree were propagated by these steps. This provides a method for propagating old "plus" trees subject to severe stock-scion incompatibility. Investigations were commenced of the feasibility of the propagation on a commercial scale of young Hoop Pine trees by means of rooting cuttings.

Good progress was made in the establishment of progeny trials. At Imbil a progeny trial of 37 full-sib families and routine control was outplanted, and at Yarraman a trial of 34 full-sib families and routine control was established. Eight full-sib families are common to both trials. Two major trials involving half-sib families were outplanted during the year. In one of these, 35 families drawn from two districts were outplanted at Imbil, Yarraman, Gallangowan and Kalpowar. The dual objectives of this trial are determination of family-by-environment interaction and of the breeding values of individual parents. The second trial comprised some 40 families of 9 provenances likely to display superior resistance to frost. The trial was established at Yarraman in line plots running across the contour and the expected "frost line".

Mensuration and Biometrics

The resignation of one biometrician and the absence of another overseas for advanced training at Oxford has resulted in the suspension of a number of projects. However, analysis of results of important experiments has been maintained as far as possible. A probit analysis programme has been adapted for use on the Treasury computer and a new programme written to provide for plotting of data prior to regression analysis.

A new set of volume tables for Radiata Pine was prepared and issued for use in research, and for thinning sales in the younger, more uniform plantations. A point of interest is that the occurrence of dead tops in this species is reflected in the greater variation in total volume as compared with merchantable volume to 3 inches d.u.b. However, predominant height is still quite satisfactory as a volume table parameter. The sapwood volume table was extended to cover sapwood thickness of ¼ inch to 2 inches. This table is used to estimate the volume of sapwood in a batch of poles for control of pressure impregnation with preservatives.

In preparation for a projected revision of standing values for application to hardwood experiments, an equation relating girth under bark (G.U.B.) at a given height (H) to g.b.h. overbark (G.B.H.) has been developed for Blackbutt.

$$\text{G.U.B.} = -4{\cdot}005 + 1{\cdot}122\ \text{G.B.H.} + 0{\cdot}0575H - 0{\cdot}00224H^2 - 0{\cdot}2348\ \text{G.B.H.}\ \text{Log}_{10}H$$

This provides an excellent description of the stem over the merchantable part of the bole for girths of 48 to 96 inches and heights of 5 to 85 feet. White Cypress Pine bark thickness measurements from logs cut in the Mitchell area were examined, and found to be comparable with those from the eastern part of the range of this species.

Basal area increment data for all major Hoop Pine experiments measured on an annual basis at Imbil were assembled for the development of a growth prediction function. Preliminary analysis shows that standing basal area, age, stems per acre, site index and rainfall for the measurement period are all significant in predicting the current basal area increment, and that development of adequate prediction equations is likely to prove a lengthy task. In Slash Pine, the overall relationship between basal area increment and standing basal area is one of increasing increment up to a "limiting basal area", above which the increment remains relatively constant. However, in Hoop Pine there is a sharp maximum in basal area increment, associated with a standing basal area of about 130 square feet per acre at age 15, with increments falling at higher basal areas. With increasing age, this maximum becomes broader until at about age 30 the Slash Pine type of relationship is reached.

Computer processing of experiment measures has formed an increasing part of the section's activities, and generally the systems have worked well. A number of enhancements have been made to the programmes used in this work, and more are under development. The data layout used for experiments has also been adopted by Forest Resources Branch for plantation Forest Inventory Survey plots, with resultant economics in data preparation and programming. Programmes developed for coastal hardwoods detailed yield plots are also used for appropriate experiments, while White Cypress Pine experiments are handled in a manner similar to plantation experiments. A new programme was developed to compute girth increments by size classes for White Cypress Pine experiments. Good progress has been made with the computer system for White Cypress Pine detailed yield plots, and programmes are now operating for data input and validation, and computation of girth increments by size, crown dominance, crown depth, crown density and site quality classes. All past measures for detailed yield plots on Yuleba State Forest have now been punched and used to provide increments for management purposes. Millmerran data will be processed in the near future. Recognition of potentially fast growing trees is important during logging and silvicultural treatment of White Cypress Pine, and analysis of the detailed yield plot data clearly shows that a strong correlation exists between crown depth and increment. It is hoped to extend this work to the stage of producing a growth prediction function for individual trees of White Cypress Pine for use in simulation studies.

Preliminary investigations have been made into a possible computer system for north Queensland rain-forest yield plot data. Particular problems here are the large number of species involved and the unsuitability of field measurement forms as data preparation documents. It is at present envisaged that computer processing will commence after preliminary checking and sorting into species groups in the office. The grouping of species for volume table purposes has also received attention and suggests that some modification of the simple groups currently used in Forest Inventory Survey will be necessary.

Additional data have been incorporated in the rain-forest species card key, and a new programme written for computer simulation of the process of using the feature cards for species identification. This has been used to test the key, and could easily be extended to diagnose deficiencies in the key, by using further observations on known specimens. The programme was also modified to simulate the operation of the Hansen and Rahn angiosperm family key for checking in co-operation with the Government Botanist.

Several seminars were conducted for officers of the Department covering various programming techniques and use of standard programmes. One officer attended a PLAN programming course and two officers a course in the use of PLAN for direct access.

FOREST HYDROLOGICAL RESEARCH—NORTH QUEENSLAND

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

A sedimentation experiment in Scrubby Creek Catchment within State Forest 194, Barron, was commenced during 1968-69 and is continuing. This is planned to test the effectiveness of special conditions applied to logging operations in effecting control of sediment level in stream water within catchment areas.

Logging of the catchment has not yet commenced, but is now planned for late 1970. Samples of stream water were collected during the 1969-70 wet season to obtain a measure of the suspended sediment level in the stream with the catchment in an undisturbed condition.

A new experiment was established to investigate the water usage by different aged Hoop Pine plantations, by rain-forest and by tropical pastures grown in a similar environment. 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. This equipment was purchased during 1969 from an equipment grant of $5,000 made available to the Department by the Australian Water Resources Council.

For soil moisture measurements at depth it is necessary to insert aluminium tubing into the soil to provide access tubes for the probe. This necessitated the development of special augers and reamers to enable correctly dimensioned holes to be dug.

Field calibration of the probe is complete, and minor mechanical problems which plagued the initial usage have been overcome. Soil moisture recharge of all profiles occurred to a depth of greater than nine feet during February, 1970, and water usage has been followed at weekly intervals since then. It is still too early to draw any conclusions regarding the relative water usage by the different vegetation types.

An experimental catchment project east of Babinda, to investigate the hydrological consequences of converting lowland rain forest to pastures, was established during the year. Compound "V" notch and triangular weirs and Leupold Stevens water level recorders were constructed on two streams by the Irrigation and Water Supply Commission.

Considerable effort was expended during the wet season to obtain a stage-height relationship for each of these weirs by carrying out current-metre stream gaugings. The rating curve thus obtained is reasonably satisfactory for low flows, but information is lacking in the high flow range (above two cusecs). However, it is hoped to secure this during the 1970–71 wet season. An accurate rating curve is essential before stream discharge data can be interpreted.

The meteorological instrumentation was strengthened during the year by the installation of a recording raingauge which provides on a monthly basis reliable rainfall data related accurately to time of fall. Meterological instrumentation will be further improved by the supply of a C.S.I.R.O. digital event recorder with rainfall and evaporation sensors provided by a further grant of $2,200 from the Australian Water Resources Council. Soil moisture access holes are also being prepared in each of the catchments to enable the neutron probe to be used to monitor changes in the soil moisture regime.

Measurements are continuing to study the effects on run off of prescribed burning in eucalypt forest. Experimental burns were carried out on eight of the plots during 1969. Very little surface run off occurred during the wet season as little heavy rain fell. The surface run off that did occur confirmed the trend which was apparent during 1968–69, viz., the burnt plots showed a marked increase in surface run off from the first few rains of the wet season, but this increase diminished in magnitude as the ground cover (mainly native grass) recovered.

NATIONAL PARKS

Queensland's Future Park Requirements

Perhaps the most urgent task confronting the Department in its National Parks responsibilities is to secure sufficient areas to provide a park system adequate for the minimum requirements of future generations. There are two main aspects—outdoor recreation and habitat preservation—which must be considered.

In the past recreation has received some priority but there is increasing realisation of the importance of habitat preservation. The current upsurge of interest in conservation and natural history has given an added dimension to its significance in that more and more visitors to National Parks are finding that an appreciation of the many and varied forms of wildlife and the range of plant communities comprises a major part of the recreational benefits they enjoy when visiting a National Park. To cater for these needs, it is important that as wide a range as possible of natural habitats be included in the park system.

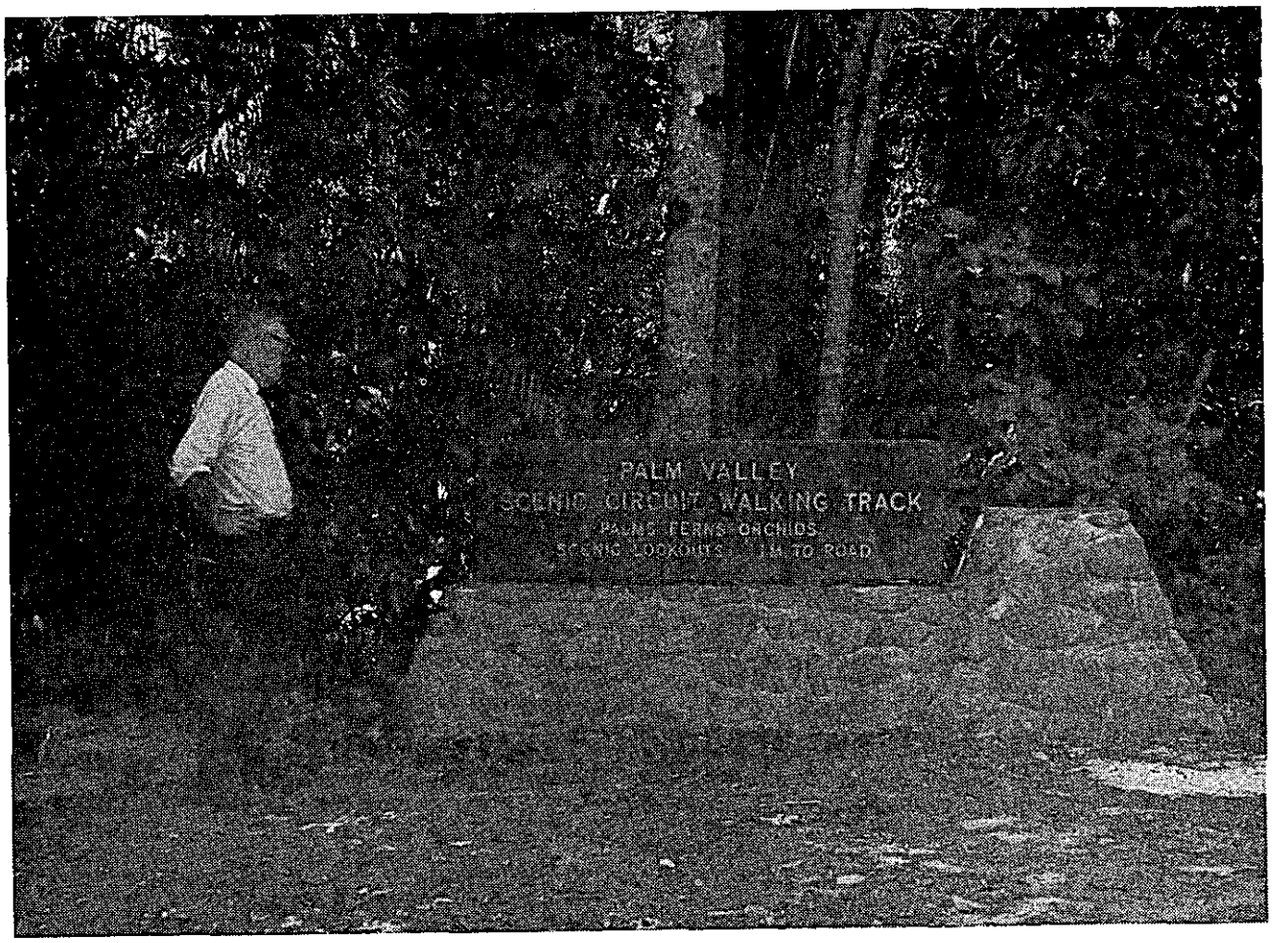
During the past year a number of new parks were created and samples of several important habitats have thereby been preserved. One National Parks officer has been engaged almost full-time for the past three years on the task of selecting new areas for reservation with priority being given to habitats considered to be in greatest danger of being lost.

Brigalow Areas

The two proposals referred to in the previous annual report are now National Parks: 27,000 acres in the parish of Cockenzie, and 17,000 acres in the parish of Southwood.

Wallum Lands

Decision is still awaited on the Department's proposals for a series of reserves to represent the range of habitats of the Wallum lands.



The Secretary of the Department (Mr. W. Wilkes) and a Typical National Park Sign. Eungella National Park.

Rain Forest Areas

Though many of Queensland's earlier parks were largely of rain forest, there are in fact major gaps in the representation of rain forest habitats in the park system. It is hoped systematically to cover the remaining rain forests of the State and select suitable areas for reservation. During the past year action was taken to map from aerial photos. the rain forests of south-east Queensland as a preliminary to field inspection.

The Department has been fortunate in obtaining the advice and assistance of the C.S.I.R.O. Rain Forest Ecology Section in this work and it is desired to express appreciation of the action of the C.S.I.R.O. Executive in approving the work.

Fauna Survey of a Timber Reserve

Advice was sought from the C.S.I.R.O. Division of Wildlife Research on a suggestion that a Timber Reserve in the parish of Pluto was of importance as habitat for the Grey Kangaroo. This resulted in an offer to carry out a survey of the fauna of the area—an offer which was gratefully accepted.

A survey was carried out in April 1970 by three officers of C.S.I.R.O. and the National Parks Zoologist. It is felt that the survey was of value to C.S.I.R.O. in its Australia wide interests, as well as to the Department of Forestry, and it is hoped that further surveys will be possible in the future.

Tropical Lowlands

The series of 20 reserve proposals selected by Dr. Webb of C.S.I.R.O. has been mentioned in previous reports. The Department supported Dr. Webb's proposals for all except two areas. During the past year a further five of the areas were reserved at least in part, and the situation is now as follows:—

5 areas reserved in toto
6 areas reserved in part
1 area considered too small to warrant National Park status
1 area not reserved because of mineral interests
3 areas not rseerved—other land use interests
4 areas—no final decision yet.

Public Interest

There is a greatly increased public interest in National Parks and in particular in proposals for new reserves. As opportunity offers these proposals are fully investigated by officers of the Department and their reports given careful consideration. Legislation requires that any other Government Department concerned with land useage be consulted before submitting firm recommendation.

Special Purpose Areas

Declaration of several areas as special purpose areas under Section 40A of the Forestry Act was made during the year. These included Hoskyn and Fairfax Islands in the Bunker Group which were declared Scientific Areas in toto.

The coral cays of the Capricorn and Bunker Groups are of immense importance as sea-bird rookeries. During a survey of Lady Musgrave Island in 1966 the National Parks Biologist estimated the population of nesting white-capped noddies at approximately 100,000. Over 200 nests were counted in a single tree. In addition mutton birds were nesting in burrows under the ground, while silver gulls, banded landrails and several species of terns nested on the ground. Virtually the whole island was occupied by nesting birds.

Within the Capricorn and Bunker Groups, Hoskyn and Fairfax Islands are of particular significance as the only ones used for nesting by the brown gannet (*Sula leucogaster*). These gannets nest on the ground and are readily disturbed by any human activity in or near the nesting area, leaving the eggs or chicks exposed to predation by the ever-watchful silver gulls.

The coral cays, and especially Hoskyn and Fairfax Islands, present particular problems of management. At some time in the future it will be essential to provide a suitable boat so that they can receive close supervision. Meanwhile their declaration as Scientific Areas is an important step in enabling them to be managed so as to preserve their natural condition and ensure the continued existence of the large population of sea-birds.

Exchange of Views

Much value can be gained from the interchange of views between officers of organisations with similar interests and problems. During the past year there have been visits to Queensland by officers wishing to see the Queensland set-up and Queensland officers have made trips out of the State to see other organisations.

International Short Course

During a private trip to the United States the National Parks Zoologist (Mr. P. Ogilvie) attended the International Short Course on National Park Administration at which

lectures were given by Parks personnel, other Government officers and University staff. The course covered all aspects of National Parks including Park Administration, Wildlife Management, Law Enforcement, Concessions, and the development of roads, camping areas, &c. The course was attended by representatives from thirty-two different countries and visits were made to a range of important National Parks in Canada and the United States.

Arid Zone Conference

National Parks are not confined to the wetter areas and the Department has responsibilities in this direction in the dry interior of the State. Mr. J. P. Stanton of the National Parks staff represented the Department at the Arid Zone Conference held at Broken Hill.

V.S.F.A. Travel Award

The 1969 Travel Award of the Victorian State Foresters Association was granted to Mr. R. D. Cowley of the Forests Commission of Victoria to study the organization and management of National Parks in Queensland. Mr. Cowley spent three weeks in Queensland during November, 1969, visiting nine National Parks in south eastern Queensland and discussing park management with staff in Head Office and in the field.

Visit by Dr. Page

Dr. C. N. Page of the University of Newcastle-on-Tyne in England is a specialist in the taxonomy and the evolution of species of ferns. While working in the Botany Department of the University of Queensland he visited many parts of the State including a number of parks, to the mutual benefit of his own work and the work of the National Parks staff in identifying and listing the fern species of the various parks.

Ranger Training School

As in previous years the Department was able to take advantage of the invitation to send officers to the Ranger Training School in New South Wales, and gratefully acknowledges the courtesy of the New South Wales Government and its National Parks and Wildlife Service in issuing the invitation. This school meets an important need and officers privileged to attend have benefited considerably and are the better qualified to serve the National Parks of the State.

Interstate Conferences

Mention was made in the previous annual report of the invitation extended by Victoria to hold the fourth Ministerial Conference on National Parks in that State. This conference is being held in August, 1970, and thus does not come within the period covered by this report.

Wildlife Preservation Society

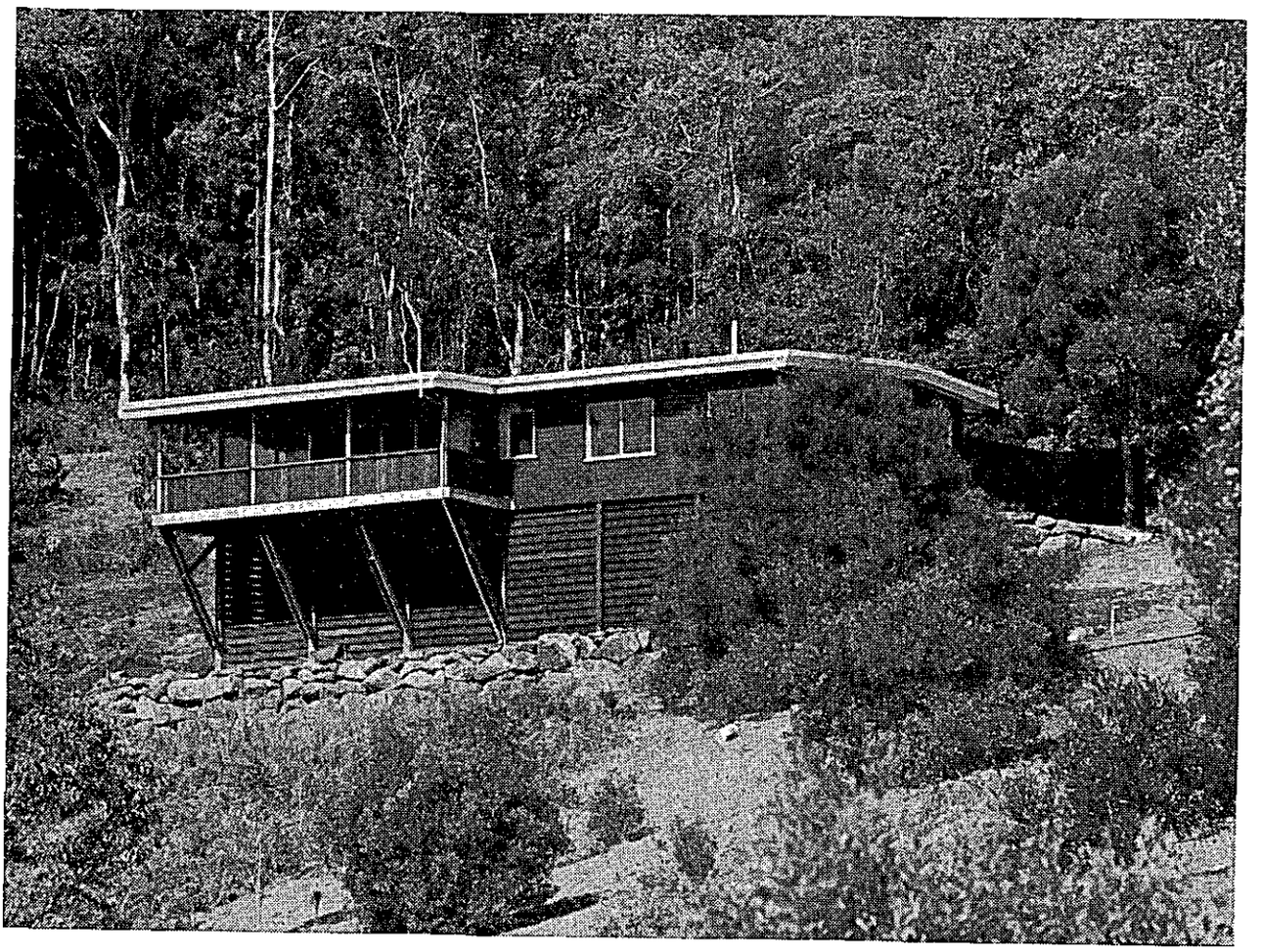
National Parks officers assisted at two schools run by the Wildlife Preservation Society of Queensland at Lamington and Carnarvon National Parks.

Literature

During the year a leaflet on the Bunya Mountains National Park was produced.

Lamington Headquarters

The construction of a residence for the Senior Overseer at Lamington is a first step in the development of administrative headquarters for the Park. Design and supervision of construction were carried out by the Department of Works and it is desired to express appreciation for this work.



View of Overseer's Residence. Lamington National Park.

Eungella Residence

Major expenditure on Eungella National Park during the last year was for the construction of an appropriate house for the resident Overseer.

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, picnic areas and the like. Work during the past year included—

Chillagoe Caves—Construction of new concrete pathways, bridges, ladders and hand rails.

Palmerston—Two picnic tables and a fireplace constructed, water supply improved.

Lake Eacham—New picnic table and provision of improved electric lighting.

The Crater—Construction of concrete paths, steps, platform and safety rails.

Mossman Gorge—Provision of hand rails on existing concrete steps, construction of causeway across a creek.

Green Island—Two tables constructed and thirteen direction signs erected.

Millstream Falls—Concrete steps and hand rails from car park to lookout were constructed.

Dunk Island—About ¾ mile of new track constructed.

Mound Island (Purtaboi Island)—New picnic area established with fireplace and two tables.

Wallaman Falls—Track completed to the bottom of the falls—a difficult task involving the construction of some five hundred stone steps in forty-nine chains of track. In addition the picnic facilities above the falls were expanded with six new tables, three fireplaces, an extra 2,000 gallon tank and a new footbridge on the track.

Jourama—Twenty-seven chains of new track constructed.

Alligator Creek—New tracks, additional picnic facilities, new signs and improvement to the road access.

Magnetic Island—Improvements to lookouts, new signs and a fireplace and picnic table were provided.

Little Crystal Creek—Construction of a new parking area and picnic ground near the masonry arch bridge on the Mt. Spec Road has been commenced.

Cape Hillsborough—Forty-nine chains of new track were constructed completing a two mile circuit walk, and new signs, and tables were provided.

Conway—Completion of storeroom/boatshed and extension of picnic ground.

Bunya Mountains—A shower block, a toilet block and a water supply system were installed at Dandabah.

Cunningham's Gap—A new shelter shed, water supply and six picnic tables were provided.

Tamborine Mountain—A wooden footbridge was built across Cedar Creek in Joalah National Park.

Girraween—New 5,000 gallon concrete tank was installed to improve the previously inadequate water supply.

New Reservations

The following new reservations were proclaimed during the year ended the 30th June, 1970:—

(*a*) NATIONAL PARK 1357, RUSSELL. Gazetted on 27th September, 1969, this park covers an area of about 227 acres in the parish of Russell. It embraces a swamp area east of Babinda which contains excellent examples of mixed forest dominated by palms, pandanus, melaleuca and marginal mesophyll vine forests. It is one of a series of proposed reserves intended to preserve representative samples of the tropical wet lowlands.

(*b*) NATIONAL PARK 1351, BELLENDEN KER. This park was gazetted on 27th September, 1969, and covers an area of 202 acres in the parish of Bellenden Ker. The area embraces the attractive Josephine Falls and is another of the tropical wet lowland reservations.

(*c*) NATIONAL PARK 1353, BELLENDEN KER. Another of the tropical wet lowland reservations this park covering an area of about 850 acres in the parish of Bellenden Ker was gazetted on 27th September, 1969. The area was described by Dr. Webb as the most extensive remnants of nearly pure palm vine forests in the Babinda area.

(*d*) NATIONAL PARK 72, COCKENZIE. Covering an area of about 27,420 acres in the parish of Cockenzie, this park was gazetted on 15th November, 1969. Formerly part of the Dipperu Pastoral Holding in the Mount Flora region which formed part of Area 3 in the Land Development (Fitzroy Basin) Scheme, the Park consists mainly of brigalow scrub and associations of brigalow with other tree species. It is an excellent example of this type of country north of the Central Queensland Railway. Apart from its scientific interest, the Park has a 13-mile frontage to a large creek and contains extensive areas that are periodically flooded as well as permanent lagoons providing a valuable habitat for prolific wildlife including water birds, emus and kangaroos.

(*e*) NATIONAL PARK 1359, PARISH OF GRAFTON. On 29th November, 1969, an area of about 100 acres in the parish of Grafton was declared a National Park. Formerly a small timber reserve, it links the Bellenden Ker National Park to the Mulgrave River and thus provides that Park with a short river frontage.

(*f*) NATIONAL PARK 56, SOUTHWOOD. On 21st March, 1970, an area of about 17,483 acres in the parish of Southwood was declared a National Park. The Park is situated on the northern side of the Moonie Highway about fifteen miles past the Moonie Motel. It contains a complex mosaic of various types of country which comprised brigalow scrubs and associated communities of this general region before it was developed.

(*g*) NATIONAL PARK 16, MINNEMORE. Covering an area of about 11,414 acres, this Park was gazetted on the 6th June, 1970. The park covers part of an area known as the 40 mile scrub located on the Great Dividing Range about 40 miles from Mt. Garnet. The area carries a low dry scrub including Burdekin Plum, Kurrajong and Bottle Trees with an understorey of shrubs and hard corky barked vines. The area has considerable scientific interest because of an unusual floristic composition and the implications of the area for historical studies of tropical vegetation.

(*h*) NATIONAL PARK 1392, BELLENDEN KER. Gazetted on 6th June, 1970, this Park covers an area of about 205 acres in the parish of Bellenden Ker. Being one of the representative samples of the tropical wet lowlands, this area covers the only relatively intact lowland area known which has typical complex mesophyll vine forest on well drained outwashed soils of granitic origin and on flat topography. Unfortunately it was possible to reserve only part of Dr. Webb's original proposal.

(*i*) NATIONAL PARK 155, WHYANBEEL. One of the tropical wet lowlands reservations, this Park covering an area of about 2,330 acres was gazetted on the 6th June, 1970. The area embraces both the eastern and western slopes of the Dagmar Range and varies in altitude from 50 to 800 feet. Its vegetation takes the form of mixed mesophyll vine forest in valleys and lower slopes while grassy eucalypt woodland is found elsewhere. The vine forests are of a drier type than those encountered near the Daintree and around Mossman and have separate floristic affinities with those of the Bloomfield area further north and with the Cardwell Range to the south and form an important intermediate habitat of a somewhat drier type. The adjacent Eucalypt woodlands provide widely contrasting habitats for comparative study.

(*j*) NATIONAL PARK 1934, BELLENDEN KER. Gazetted on 13th June, 1970, this Park covers an area of about 2,860 acres in the parish of Bellenden Ker. The Park embraces a steep windswept country, the soils are of granite origin and any disturbance of vegetation would cause erosion. Its reservation provides essential protection to the steep lower slopes of the existing Bellenden Ker National Park.

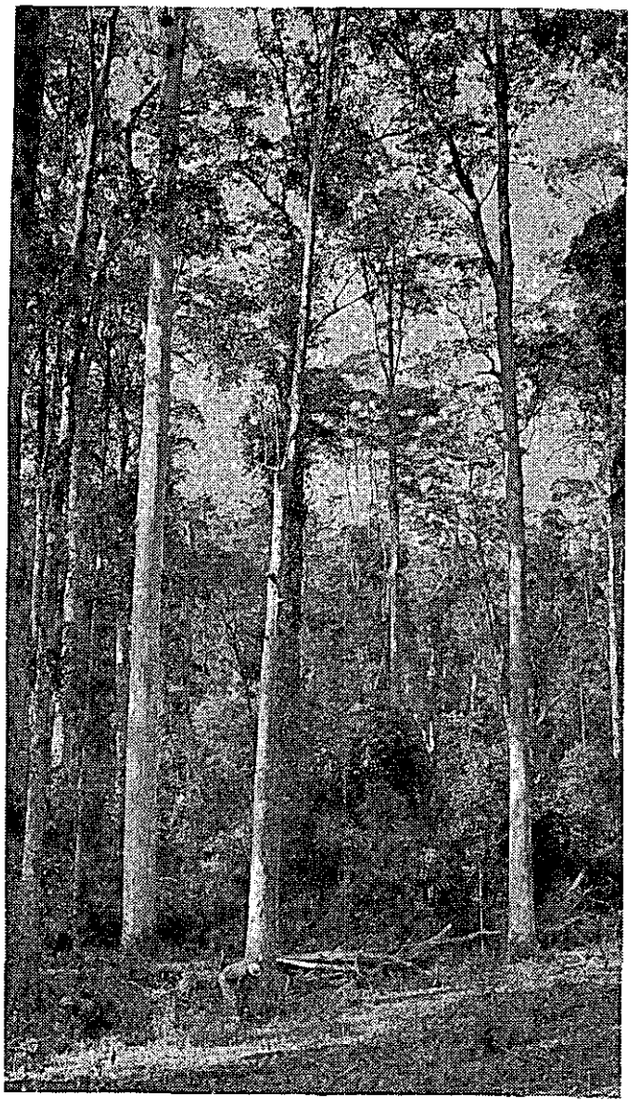
(*k*) NATIONAL PARK 176, MONKHOUSE. Gazetted on 27th June, 1970, this Park covers an area of about 2,500 acres in the parish of Monkhouse. Formerly part of Timber Reserve 165, parish of Monkhouse, this National Park is located along the Mount Finlayson Range and has Mt. Finnegan as its central feature with the lesser peak of Mt. Shipton towards its south west corner. Principally the area was reserved on account of its abundant unique fauna and flora, however high up on the western slopes of Mt. Finnegan magnificent views can be had of the Bloomfield River Valley.

Additions to Existing Parks

Additions totalling 28,026 acres have been made to various parks during the year, the most notable being the addition of 22,720 acres to National Park 545, parish of Niagara (Yamanie Falls) and 5,170 acres to National Park 24, parish of Erie.

Area of National Park Reservations

As at 30th June, 1970, there were 271 National Parks covering an area of approximately 2,462,680 acres.



Marking of Hardwood Stand for Logging in South Summer Logging Area. State Forest 274, Conondale.

HARVESTING AND MARKETING

General

Although the total Crown and private mill log cut for the year is estimated to be 18¼ million superficial feet Hoppus measure below that for last year the cut from Crown Lands of 233,541,000 superficial feet Hoppus measure has only been exceeded once in the last ten years, viz., in 1965–66 when the cut was 241 million superficial feet Hoppus measure.

The cut of Crown plantation timber was the highest ever being 43·2 million superficial feet Hoppus of mill logs and 8·8 million superficial feet Hoppus of pulp wood.

Compared with the previous year the greatest variations were:—

- Natural Hoop and Bunya down by 5 million super. feet or about 20 per cent.;
- Forest Hardwoods down by 22 million super. feet or about 10 per cent.;
- White Cypress Pine up by 6 million super. feet or about 10 per cent.;
- Plantation Thinnings up by 4 million super. feet or about 10 per cent.

Work on computerisation of accounting and statistics has progressed and some rationalising of practices has been carried out and more are proposed.

The most significant event of the year was the offering by the Department of plantation pulpwood on the Tuan–Toolara State Forests between Gympie and Maryborouh.

Proposals were called for the purchase, harvesting and utilization of pulpwood, the quantity available being about 19 million superficial feet Hoppus measure per annum during the years 1970–74 rising to 85 million in the year 1985 and at least this amount in following years.

The proposition accepted was one from a Queensland company, Woodland Holdings Ltd., whose principals are Woodland Sawmills Pty. Ltd., Brisbane, Hyne and Sons Pty. Ltd., Maryborough, and Weyerhaeuser (Australia) Pty. Ltd. The parent company of the latter firm has large plantations with sawmilling, pulp and paper operations in America using the same species—Slash Pine.

It is planned that this multi-million dollar operation will commence with a particle board factory operating in Brisbane by September, 1971, followed by a second particle board factory and sawmill within 4 years and a paper mill by 1982 located near the forests.

This enterprise which will be the first fully integrated wood using industry in Queensland will be of great economic value to the South East of the State and assist in reducing Australia's import of wood products.

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 Hardwood	Scrub Hardwood	Cabinet Woods	Miscellaneous	Plantation Thinnings	Pulpwood		
	(1,000 superficial feet Hoppus)										
1964–65	27,059	2,058	55,447	219,397	Previously Included with Forest Hardwood	22,646	43,862	37,761	3,637	12,088	423,955
1965–66	26,247	1,529	50,402	229,805		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 Estimated	19,000	1,900	60,000	188,000	18,000	21,000	45,000	44,000	9,000	12,000	417,900

Hewn Timbers—Rates payable to Suppliers

During the year supply commenced of the Railway Department's requirements of larger sleepers for the construction of the Goonyella–Hay Point Railway; these larger sleepers measure 7 feet x 9 inches x 6 inches as against the normal size of 7 feet x 9 inches x 4½ inches.

Rate (per hundred sleepers) payable to suppliers was originally fixed at $276.00 as from 2nd December, 1969. This rate was increased to $326.00 as from 13th April, 1970.

Incidentally, this rate has since been increased to $396.00 from 13th July, 1970.

There have been no other variations over the period under review.

Rosewood

Approximately fifty tons of Rosewood was 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 1960-61:—

	Super. feet (hoppus)		Super. feet (hoppus)
1960–61	219,000,000	1965–66	241,000,000
1961–62	187,000,000	1966–67	212,000,000
1962–63	194,000,000	1967–68	227,000,000
1963–64	212,000,000	1968–69	227,000,000
1964–65	229,000,000	1969–70	234,000,000

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)								
1965–66	22,769	1,681	26,425	72,947	16,478	20,389	37,881	38,116	3,918
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

The Timber Business

	1968–69	1969–70
(*a*) **Mill Logs—**		
Hoop and Bunya Pine	20,211,000 super. feet	16,832,000 super. feet
Forest Hardwoods	65,257,000 super. feet	68,576,000 super. feet
Scrub Hardwoods	13,834,000 super. feet	15,383,000 super. feet
White Cypress Pine	27,933,000 super. feet	28,428,000 super. feet
Kauri Pine	1,811,000 super. feet	1,799,000 super. feet
Cabinet Woods	17,866,000 super. feet	17,745,000 super. feet
Miscellaneous Species	30,864,000 super. feet	32,752,000 super. feet
Plantation Timbers	42,996,000 super. feet	43,182,000 super. feet
Pulpwood	6,341,000 super. feet	8,821,000 super. feet
Limb Logs, Head Logs, Stumps and Flitches	29,000 super. feet	23,000 super. feet
	227,142,000 super. feet	233,541,000 super. feet
(*b*) **Construction Timbers—**		
Headstocks, Transoms, Crossings, Braces, &c.	455,506 super. feet	349,323 super. feet
Sleepers	693,024 pieces	452,819 pieces
Girders, Corbels, Piles, Sills, and Girder Logs	58,990 lineal feet 495,493 super. feet	64,761 lineal feet 211,564 super. feet
Poles	294,443 lineal feet	230,261 lineal feet
House Blocks	15,678 lineal feet	14,003 lineal feet
Mining Timbers—Round	216,652 lineal feet	318,742 lineal feet
Mining Timbers—Split	488 pieces	Nil
Mining Timbers—Sawn	22,859 super. feet	Nil
Gross receipts from Timber Sales, &c.	$4,840,696.63	$4,428,975.31
Net Revenue	$2,689,955.15	$2,391,178.05

Timber Felling and Timber Getting Award—State

The Award now includes minimum weekly rates which the average competent cutter should be enabled to earn whilst using a suitable portable mechanised saw.

These rates were increased during the year, increases varying from $3.20 to $3.85 per week—depending both on the species of timber and the areas defined and were applicable from 22nd December, 1969.

Logging Roads—1969–70

The Department's Road programme for the year constituted 79 miles of construction.

Location and working surveys covering 55 miles were carried out.

Expenditure from Forestry votes was as follows:—

	$
New Construction	371,745
Maintenance	155,345
Subsidies to Shire Councils	36,888
Workers' Compensation	4,935
Pay Roll Tax	6,385
Surveys	2,760
Freights and Fares	1,686
	$579,744

Logging

The table below shows the quantities of log timber hauled during 1969–70 by contractors to the Department and the payments made to them for this work:—

Class	Quantities	Payments
South Queensland—	Super. feet	$
Hoop and Bunya Pine	10,907,016	
Forest Hardwoods	2,978	
Scrub Hardwoods	104,729	274,862.75
Miscellaneous	94,003	
Red Cedar	22,602	
	11,131,328	274,862.75
North Queensland—		
Cabinet Woods	821,590	19,362.51
Totals	11,952,918	294,225.26

Constructional Timbers—Departmental Contracts

Below are shown quantities of constructional timbers obtained from Crown Lands for year 1969–70, in comparison with those for the previous two years:—

Class of Timber	1967–68	1968–69	1969–70
Sleepers	349,770 pieces	403,379 pieces	216,493 pieces
Crossings	53,250 super. feet	93,388 super. feet	49,110 super. feet
Transoms	77,194 super. feet	96,824 super. feet	133,624 super. feet
Bridge Timbers—Girders and Piles	24,286 lineal feet	27,549 lineal feet	14,086 lineal feet
Girder Logs	457,666 super. feet	495,493 super. feet	211,564 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 to the Conservator of Forests.

The average number of mills in active operation for the first three quarters of the year was 460, a drop of about 24 on the average for the preceding year.

The following table shows the position in regard to Sawmill Licenses as at the 30th June, 1970.

The reduction in the number of current licenses to some extent reflects the response of industry to the alteration in policy which now allows transfer of sawmills for the purpose of amalgamation, under certain specified conditions. Sixteen of the licenses shown as having been relinquished were in fact incorporated in existing licenses by amalgamation.

Number of Licenses as at 30–6–69	Classification	New Licenses Issued	Changes in Classification		Licenses not Renewed			Current Licenses as at 30–6–70	Total Licenses as at 30–6–70
			Plus	Minus	Refused	Relinquished	Under Consideration		
472	General mills	3	2	..	1	23	2	451	453
6	Case mills	..	..	..	..	..	..	6	6
27	Sleeper mills	1	..	1	..	..	..	27	27
12	Other restrictions	1	..	1	1	..	..	11	11
517		5	2	2	2	23	2	495	497

Offences

During the year ended 30th June, 1970, officers reported one hundred and forty-one breaches of the Act and Regulations administered by the Department.

Proceedings were successfully instituted against eight persons and fines totalling $282.50 imposed.

In fifty-one cases of unauthorised timber operations where it was considered the offence did not warrant proceedings, the value of the timber was collected and warnings issued. Appropriate action was taken in other cases.

In addition, eighteen 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 $6,124.23 was recovered by the Crown in timber revenue.

FOREST PRODUCTS RESEARCH

General

During the year the work of the branch has continued at about the same level as in the previous year. Laboratory facilities particularly are severely limited and this restricts the carrying out of work in several fields.

With the increasing technology of the timber industry generally, and also the move towards new and more sophisticated wood-using industries which is already becoming evident, particularly those associated with the expanding utilisation of our plantation timber asset, there is a growing demand for technical services and for research in these fields. In order to meet these requirements adequately there is an urgent need for the integration of the sections of the branch in improved accommodation currently being planned.

In addition to the work outlined below, officers of the branch have been active on technical committees and subcommittees of the Standards Association of Australia working on the preparation and revision of timber standards. The importance of these standards to promote the orderly marketing and utilisation of timber and to assist in meeting intensifying competition from other materials is becoming increasingly apparent. In this and other work the branch has enjoyed close co-operation with interstate timber research authorities and with the timber industry generally.

Officers of the branch attended the annual conference of the Australasian Pulp and Paper Industry Technical Association during the year and attended a meeting of the Research Working Group on Tree Improvement and Introduction. Papers were presented at both meetings. Staff also provided lectures to various educational institutions at the tertiary level.

Timber Users' Protection Acts

The Department administers The Timber Users' Protection Acts and during the year twenty-five complaints were received and investigated; of these five showed no breach of the Acts, ten were satisfactorily resolved between the parties concerned following departmental investigation and ten are under investigation. One conviction was secured on a complaint from the previous year, while two further cases are awaiting hearing by the Court.

The practice of random inspection of building operations in metropolitan and country areas for compliance with the Acts continues and there appears to be some decline in the amount of untreated Lyctus-susceptible timbers being used. This is the result of awareness in the building trade of the requirements of the Timber Users' Protection Acts and also the increasing number of timber treatment plants. With the high Queensland usage of timber from northern New South Wales there is need for continued liaison with the controlling authority in that State to ensure a uniform standard of timber treatment.

The work of the various sections of the Branch is as follows:—

1. Timber Conversion Section

(i) *Sawmill Economics.* During the year, further work was carried out on the sawing characteristics of plantation species, with emphasis on the larger stems now becoming available.

The introduction of an Australian standard for grading sawn products from Australian-grown conifers has provided a firm basis of comparison of material from different species and from stems of varying sizes and straightness.

Sawing studies carried out during the year at the Department's research mill at Rocklea involved Slash Pine from the Beerwah area, Caribbean Pine from the Byfield area near Rockhampton and also a small quantity of plantation grown Silky Oak from Nanango.

Studies were also undertaken at various commercial mills including a series of short studies on pruned and unpruned stems of slash pine at Beerwah to parallel and supplement the studies at Rocklea. A substantial study on sawn recovery from Cypress Pine in the Mitchell area was also carried out over a four-week period.

In conjunction with sawing studies in plantation species, a study has been initiated in collaboration with the Silvicultural Research Branch to relate both stem and log form to sawn recovery and timber quality. It is proposed to accumulate data on these aspects to define the limits of acceptance of stems of merchantable size and, in the longer term, to endeavour to relate this to minimum acceptance standards for stems at the age at which silvicultural selections for pruning and thinning are made.

Sawn timber from studies at the experimental mill continues to be utilised in departmental building operations to provide a further check on the in-service suitability of various species and grades of this material, and to promote the use of plantation softwood material in a wider field of suitable uses.

Arrangements are in hand for the installation of a larger band saw at the experimental mill during the coming year to permit the sawing of larger logs. It is proposed initially to operate larger stems from plantations of both Hoop Pine and exotic species to provide additional information in these size classes.

Various log pricing studies have been carried out during the year associated with the Department's schedules of depot log prices. In this and allied fields the data extracted from the 10 per cent. sample of all logs harvested continues to provide useful information on occurrence and distribution of species, log size, grade and also defect at various centres.

(ii) *Seasoning and Engineering.* The increasing volume of plantation softwood timber becoming available to industry combined with a decreasing availability of hardwood is focussing attention on the utilisation of this material for a wider range of uses. In addition changing trends in the building industry have accentuated the problem of shrinkage associated with unseasoned hardwood for some uses, notably framing, and there has been increasing interest in the use of seasoned timber, both hardwood and softwood.

Experimental work was undertaken aimed at reducing degrade from distortion associated with the seasoning of sawn material from small sized plantation stems. Initially this dealt with scantling sizes cut from young Slash Pine. In co-operation with C.S.I.R.O. and with the full assistance of the sawmilling industry, trials were commenced involving the high temperature drying of the sawn product from the green-off-saw stage to equilibrium moisture content. The work is being carried out on a semi-commercial scale in the Department's kiln at Rocklea and although evaluation of the data is not yet completed, preliminary results indicate that distortion, particularly twist can be markedly reduced by drying the timber under heavy restraint at a dry-bulb temperature of 250° F.

Drying time is considerably reduced and, with a wet bulb depression of 90° F, it was possible to complete the seasoning process for 3 inch x 2 inch and 4 inch x 1½ inch material in a little over twenty-four hours. The study is being continued to provide information on optimum kiln schedules and on the effect of the drying procedures on the physical properties of the timber.

In view of these encouraging early results, High Temperature Drying opens a wide field for research, and it is proposed to expand work along these lines.

Industry continues to make use of the extension service offered on seasoning and during the year a detailed study was made of problems in the Mackay area. Laminated scaffolded planks were also examined in some detail and it was found that the problem was associated with moisture absorption in service and can be minimised by the application of water repellent transparent coatings.

The section has continued to provide a moisture testing service to industry and to housing authorities. The demand for this service is considerable with a monthly average of about 200 determinations being made.

During the year, installation was completed of a 10-ton "Amsler" universal strength testing machine and studies have begun on the determination of strength properties of local timbers. To date, most of this work has centred on the testing of plantation softwood material dried at high temperatures for comparison with more conventionally dried timber. At the same time, data for visual and for machine stress grading is being accumulated.

The machine has also been used for the glue-line shear testing of plywood samples, and methods are being developed for obtaining standard strength properties of small clear timber specimens to allow more detailed evaluation to be made of the properties of timbers, particularly plantation species, than has previously been possible locally.

2. Wood Chemistry and Preservation Section.

During the year there was an increase of two in the number of vacuum/pressure plants registered and these employed water-borne multi-purpose salts. Of the thirty such plants now installed throughout the state, twenty-three employ multi-purpose salts and seven use Boron salts for immunisation only.

One plant capable of using oil-borne preservatives is operative and more will be introduced if the demand for this type of treatment increases; to date only test material has been treated and experimental trials on 1,000 railway sleepers were carried out. It appears that this type of treatment will permit acceptance for railway use of species of lower durability and also of sapwood of higher durability species.

Treatment of poles in substantial numbers by vacuum/pressure plants continued during the year, mainly for electrical authorities. After some seven year's use of treated poles by authorities, attack by insects and fungal decay has been at a very low level and examination of any attacked material reported has generally indicated that the insect attack has been limited to minor boring for egg-laying and that any fungal infestation had probably occurred prior to treatment.

Further instances have been recorded of attack by Teredinid borers in some C.C.A.-treated hardwood piles in service for two years or less. By contrast, C.C.A.-treated pine test specimens are still generally sound after nearly eleven years' exposure to attack by Nausitora. Heavy creosote still shows an inhibitory effect in pine after a similar period but all creosoted specimens in the test now show some attack.

Since the failure of C.C.A.-treated hardwood piles in some locations, checks made at other sites, together with information received from other parts of the world, indicate that further investigation is needed not only in tropical waters but throughout Australia. Not only is it necessary to look further into the reaction of the various preservative components to varying marine environments, but to investigate the biological factors which determine the mode of attack. It appears that some conflict of opinion exists on the roles that bacteria and soft-rot fungi may play in initial attack by marine borers. Meanwhile some caution is required in the use of this preservative treatment for marine purposes.

Trials are continuing on the use of preservatives added to plywood glue-lines and into the methods of using spray applications instead of momentary dip treatments of veneers.

Numerous inspections of treatment plants were carried out during the year and a laboratory analysis service to the preservation industry was continued. Some 7,000 such individual samples were processed through the laboratory during the year. While the general standard of treatment control was satisfactory, there were some cases where negligence or lack of knowledge gave rise to faulty plant control. With the growth in importance of the preservation industry, the need for improving operator training and competence is apparent.

With the continuing large inflow into south-eastern Queensland of timber from northern New South Wales, a close contact has been maintained with the forest authority in that State and with major local using authorities in order to ensure efficient operation of treatment plants involved.

3. Wood Structure and Utilization Section

WOOD STRUCTURE AND TIMBER PHYSICS

Timber Identification. A record number of 6,780 wood samples were identified during the year from a range that widens year by year.

WOOD QUALITY ASSESSMENT AND IMPROVEMENT PROGRAMME

(*a*) *Seed Orchard Tree Assessment.* Assessment of cores from an additional 27 trees, preselected on the basis of superior vigour, form and branching characteristics for inclusion in the Taromeo Hoop Pine seed orchard, yielded twenty-four with acceptable wood quality.

Sampling of trees preselected for the Loblolly Pine orchard was commenced.

(*b*) *Progeny Trials.* The evaluation commenced last year of the wood quality of twelve 13 year-old control-pollinated progenies of Slash Pine has now been completed.

Comparisons of these with 14-year-old open-pollinated progenies and routine stock showed gains in dry-wood weight production of 7·2 per cent. and 18·5 per cent. respectively for the half-sib and full-sib families without any significant reduction in basic density overall. However, within the full-sib group, faster grown families did have significantly lower basic density than slower grown families.

The completed data confirms early indications reported last year that, while stock raised from open-pollinated seed trees selected for form and vigour may have some wood characteristics adversely affected, there need be no concern regarding overall wood quality of stock from seed orchards established from ortets selected on these criteria.

(c) *Heritability Estimates and Selection Indices.* Observations have been completed on a wide range of anatomical and physical characteristics and volume parameters in sixteen 14-year-old control-pollinated families of parents preselected for vigour, form and branching features, in a study aimed at determining genetic parameters for these traits. Results to date are generally similar to those from an open-pollinated progeny test previously reported, and, from the combined data, it seems that characteristics of stem straightness and wood properties in general are much more highly heritable than those of volume production and branching in such populations. The potential for improvement in wood quality could, thus, be given more emphasis in second-stage selection.

(d) *Species Evaluation.* In conjunction with work on selection weighting factors, the wood quality of five 41-years old trees each of *P. radiata* and *P. patula* from Benarkin is being evaluated.

The average basic density of the *P. radiata* was 27·9lb./cu. ft. and of the *P. patula* 27·8 lb./cu. ft. This is similar to values for Hoop Pine and also for East African *P. patula*, and is only slightly below that for South Australian *P. radiata* of comparable age.

By contrast the percentage of late wood averaged 18 per cent. for *P. patula*, well below that of East African material, while that for the *P. radiata* averaged 26·8 per cent., well above that for South Australian *P. radiata*.

Spiral grain patterns and values in both species were similar to those for the comparative material and cell wall organisation (micellar angle) was very good in the *P. patula*, reaching mature values of about 8° by age of six to ten years. Work on other features is continuing.

In order to allow a preliminary assessment of the pulping potential of various hardwoods, a study of the anatomical characteristics of the more commonly occurring open-forest and rain forest species has been commenced.

(e) *Pitch Streaks, Heart Shakes and Growth Stresses.* Work has been initiated to determine any influence of branching characteristics and pruning on pitch streak and heart shake development in Slash Pine and the economic effect on these defects. Detailed field observations have been completed on the crown characteristics and visible log end defects in eighty 30–38-year-old pruned and unpruned trees in four main branch size and angle categories. These will now be sawn to determine the incidence and extent of internal defects with a view to relating them to external features.

4. Pulping Trials

Pulping trials with Queensland-grown Slash, Loblolly, Caribbean and Hoop Pines have been completed by the Division of Forest Products of C.S.I.R.O. Unbleached sulphate pulps from two age classes and several localities, as well as from individual trees of each species selected to cover a range of combinations of basic density and tracheid length and ages from 11 to 27 years, were compared with a *P. radiata* pulp processed to the same schedule.

All four species were capable of collective processing and yielded pulp of good strength properties quite suitable for general kraft application.

Although *P. caribaea* has closer affinities to *P. radiata* and *A. cunninghamii* in wood characteristics, its paper properties resembled more closely those of *P. elliottii* and *P. taeda*. These three species exhibited almost identical properties and, at constant commercial freeness levels, developed a slightly lower burst strength but markedly higher tear than did the Hoop and radiata.

Hoop and radiata showed similarity in bonding characteristics but the tear values for Hoop were somewhat higher than those for radiata.

Paper properties of the four species generally conformed to accepted relationships with the various wood properties with the exceptions that, in Hoop Pine, the bond strength was not related to basic density and, in Caribbean Pine, tear strength was independent of tracheid length.

Differences due to age or locality were not evident in the study and work on other features is continuing.

5. Utilisation

The level of requests from all sections of the timber industry for advice on the properties and uses of local and imported timbers and of minor forest products was maintained at over 900 for the year.

GENERAL BUILDING. Because of the lower shrinkage values of softwood timber, the local building industry has shown a sustained interest in plantation grown pine as an alternative to unseasoned hardwood for framing. Recommendations for its most effective use in buildings have been made to industry and building authorities.

Modern construction methods can be expected to lead to even greater pressure from users for stable seasoned framing in the future. Unless this demand can be satisfied in seasoned hardwood or softwood, there will be increasing competition in this field from alternative materials and this is already becoming evident.

Suppliers and designers have not yet capitalised fully on the availability of standard grading rules for Queensland-grown pine published this year by the Australian Standards Association.

Utilisation of rain-forest timbers for seasoned flooring and mouldings has increased during the year and finger jointed pine is being favourably received.

Protective measures commonly adopted against termite attack in timber in dwellings based on concrete slabs on the ground are apparently often ineffective, judging by the increasing number of complaints received. This mode of construction poses serious problems in this regard.

ENGINEERING AND STRUCTURAL TIMBERS. To meet a projected heavy demand for railway sleepers for new and heavier lines, negotiations with the Railway Department have led to the acceptance of over thirty additional species suitable for use untreated, without reducing previous high strength and durability standards. Another eight have been proposed for use after a hot/cold dip treatment to ensure comparable service life.

Market limits for structural and constructional hardwoods are extending with development in more remote areas such as the Weipa area and the Northern Territory. Enquiries have been received for cross-arms, sleepers and general constructional materials.

FURNITURE, JOINERY AND PLYWOOD. The trend in furniture and joinery continues towards darker timber generally plain or ribbon-figured. However, southern produced mountain ash is being actively promoted and is entering the local joinery and veneer market despite a relatively high price for this type of material.

The demand for structural and marine grade plywood is increasing. Protective surface films are gaining consumer confidence for exposed structural use, but, despite excellent quality control in the production of marine-grade ply, there is a need for more selectivity in species used for this purpose.

6. Minor Forest Products

Extensive collections of some twenty species of Queensland Gymnosperms, some quite rare, have been made for the Division of Applied Chemistry, C.S.I.R.O. for cancer research. Several are from genera which have yielded promising new types of tumour inhibitors in earlier work.

The value of minor forest products in the medical field is illustrated by the fact that the export value of Duboisia leaf is some $300,000 per annum, mainly coming from private plantations.

TECHNICAL AND FIELD STAFF TRAINING

(i) A further five State Scholarships in Forestry were allotted to new matriculants in 1970 to enable them to complete the four years of the degree course in forestry, comprising one year at the University of Queensland, and a further three years at the Australian National University, Canberra. The numbers of undergraduates holding State Forestry Scholarships as at 30th June, 1970, were:—first year, 5; second year, 2; third year, 4; fourth year, 8.

Three State Scholarship Holders graduated at the end of the 1969 academic year and took up duty as foresters within the Department in January 1970. Of these, Mr. G. J. Bacon was awarded first class honours and Mr. P. H. Forster was awarded the Timbind Medal for outstanding achievement in Wood Science subjects. In addition two foresters resumed duty after completing National Service.

(ii) Fourteen Forest Trainees completed three years' practical field training in January. Two were subsequently appointed Technical Assistants, one in Forest Products Research Branch, and the other in the Forest Research Branch. The remaining 12 trainees, following short probationary periods as gangers or leading hands, have been or will be appointed field overseers.

A further 34 trainees, selected from applicants with at least Junior Examination passes, commenced training in 1970. At the end of June the total number in training was 67.

(iii) During the year, two Technical Assistants completed the requirements of the Timber Technician course and one the Forest Technician course.

(iv) To supplement the Forest Trainee Scheme and provide an avenue of advancement for older employees with the necessary potential ability a system of Adult Training of eighteen months' duration was instituted during the year. In the initial intake, six Adult Trainees were appointed and commenced training in June.

STAFF

As at 30th June, 1970, there were 509 salaried officers on the staff comprising 227 in Head Office and 282 at District centres. This represents an increase of 10 on the number of staff as at 30th June, 1969. The number of wages staff employed was 1,776.

Forty-three salaried officers left the Department during the year, including five officers who retired after long and meritorious service, namely:—

Mr. A. R. Trist (Conservator of Forests, 50 years' meritorious service)

Mr. L. J. Rogers (Deputy Conservator of Forests, 49 years' meritorious service)

Mr. W. F. Steinke (Forest Ranger Division II, 36 years' meritorious service)

Mr. H. E. Thompson (Forest Ranger Division II, 24 years' meritorious service)

Mr. G. W. Hauritz (Clerk, 27 years' meritorious service)

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

ACKNOWLEDGEMENT

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

C. HALEY,
Conservator of Forests.

APPENDICES

APPENDIX A

Return of Timber, &c., removed from Crown Lands during the Year ended 30th June, 1970

Species	Quantity Super. feet	Super. feet
Milling Timber—		
(*a*) Native Forests—		
Hoop and Bunya Pine—		
Ply	1,722,658	
Logs	8,141,854	
Tops	6,967,434	
		16,831,946
Kauri Pine	1,799,405	
White Cypress Pine	28,427,552	
Forest Hardwoods	68,576,133	
Scrub Hardwoods	15,383,090	
Cabinet Woods	17,744,564	
Miscellaneous Species	32,751,840	
Limb Logs, Head Logs, Stumps and Flitches	23,007	
		164,705,591
(*b*) Plantation Thinnings—		
Hoop Pine	31,970,789	
Bunya Pine	95,231	
Kauri Pine	1,369,497	
Slash Pine	4,983,790	
Loblolly Pine	2,087,902	
Patula Pine	1,957,976	
Radiata Pine	691,224	
Caribbean Pine	15,033	
Pinaster Pine	2,592	
Palustris Pine	7,710	
		43,181,744
Pulp Wood—		
Hoop Pine	4,378,285	
Slash Pine	4,439,950	
Loblolly Pine	3,195	
		8,821,430
		233,540,711
		Expressed as Superficial feet (Hoppus) Log Measure
Other Classes—		
Sleepers Sawn—5 ft.	106,245 pieces	2,974,860
Sleepers Sawn—7 ft.	225,787 pieces	8,579,906
Sleeper Blocks (as Sleepers contained)	120,787 pieces	4,348,332
Transoms, Crossings, Headstocks, Longitudinals	349,323 superficial feet	349,323
Girders, Corbels, Piles, Sills, Kerb Logs	64,761 lineal feet	1,165,698
Girder Logs	211,564 superficial feet	211,564
Poles	230,261 lineal feet	1,611,827
House Blocks	14,003 lineal feet	84,018
Fencing Material—Round	108,776 lineal feet	271,940
Fencing Material—Split	128,860 pieces	1,115,740
Mining Timbers—Round	318,742 lineal feet	637,484
		21,350,692

Other Classes—*continued*	
Fuel	21,816 tons
Quarry Material—Sand, Gravel, Soil, &c.	701,704 cubic yards
Freestone	2,316 cubic feet
Fibre, Bark, Dry Leaves, Reeds	99 bags
Duboisia	1,468 pounds
Flora	1,517 pieces
Peat	396 bags
Mulga Wood	12 tons
Poling Timber (Copper Refining)	3,368 tons
Lawyer Cane	2 tons
Boat Knees	362 pieces
Bee Hives	17 hives
Black Wattle	2,708 stems
Tea-tree	50 stems
Tea-tree Bark	—
Trees and Plants (Number)	276,164 plants

APPENDIX B

Total Receipts, Department of Forestry, for the Year ended 30th June, 1970

Receipts from Districts	Totals $
Group 1—South Queensland (Brisbane, Beerburrum, Beerwah, Benarkin, Bundaberg, Fraser Island, Gallangowan, Gympie, Imbil, Jimna, Kalpowar, Maryborough, Monto, Murgon, Yarraman)	1,999,374.87
Group 2—North Queensland (Atherton, Cairns, Cooktown, Charters Towers, Herberton, Hughenden, Ingham, Innisfail, Port Douglas, Ravenswood, Townsville)	1,187,252.63
Group 3—Dalby, Roma, Taroom, Charleville, Mitchell, Quilpie	279,982.95
Group 4—Warwick, Goondiwindi, Inglewood, St. George, Stanthorpe, Cunnamulla	167,709.60
Group 5—Mackay, Rockhampton, Clermont, Bowen, Proserpine, Emerald, Springsure, Theodore, Winton	157,421.09
Group 6—Barcaldine, Blackall, Jundah, Longreach, Muttaburra, Stonehenge, Aramac, Isisford, Jericho	244.77
Group 7—Cloncurry, Boulia, Kynuna, Mackinlay, Richmond	687.82
Group 8—Burketown, Coen, Croydon, Georgetown, Normanton, Thursday Island	264.70
	$3,792,938.43
Other Receipts	
Forestry and Lumbering	324,612.22
Sales of Plants, Materials, &c.	101,965.71
Licenses† (see note after Appendix C)	20,460.45
Rents	23,925.93
Grazing dues	47,548.15
Miscellaneous (Salisbury Area Timber Account, Forfeit Wages, Expenditure Recoveries, &c.)	31,851.29
Sale of U.S. tractors, trucks, &c.	85,673.13
	$4,428,975.31
	$
Plant Hire—	
Charged Loan Fund Projects	1,056,479.38
Trust Fund Projects	117,386.53
	1,173,865.91
	$5,602,841.22
The above receipts were disposed of as follows:—	
To Consolidated Revenue Fund as repayment of previous expenditure	827.92
To Loan Fund as repayment of previous expenditure and surplus plant hire	324,316.83
To Forestry and Lumbering Fund:—	
As expenditure on marketing of log timber, maintenance of access roads, capital improvements and plant, &c.	2,696,858.46
As Interest and Redemption on Loans	2,509,779.35
To Timber Research and Development Advisory Councils	35,529.33
Balance in account	35,529.33
	$5,602,841.22

APPENDIX C

Proceeds of Sales of Timber, &c., for the Period 1st July, 1966, to 30th June, 1970

Groups*	1966–67	1967–68	1968–69	1969–70
	$	$	$	$
Group 1	2,082,015.22	1,996,563.12	2,096,203.72	1,979,622.36
Group 2	727,344.54	1,122,548.51	1,240,764.03	1,180,982.07
Group 3	262,199.37	314,039.38	292,793.77	275,058.08
Group 4	163,554.98	195,825.58	201,687.92	165,452.07
Group 5	125,449.88	134,006.20	168,566.71	154,905.07
Group 6	453.88	381.85	689.36	244.77
Group 7	398.75	585.15	771.30	687.82
Group 8	..	336.00	138.40	264.70
	$3,361,416.62	$3,764,285.79	$4,001,615.21	$3,757,216.94
Timber Research and Development Advisory Council	Nil	Nil	Nil	35,721.49
	$3,361,416.62	$3,764,285.79	$4,001,615.21	$3,792,938.43
Receipts—Forestry and Lumbering	402,527.38	464,468.53	639,829.35	324,612.22
Sale of Plants, Material, &c.	47,297.77	43,980.56	37,501.34	101,965.71
Licenses†	18,762.00	18,662.17	18,403.65	20,460.45
Rents and Grazing Dues	39,278.71	50,624.71	67,514.35	71,474.08
Miscellaneous (Salisbury Area Timber Account, Forfeit Wages, Expenditure Recoveries, &c.)	74,914.13	12,122.75	37,664.23	31,851.29
Sale of U.S. Tractors, Trucks, &c.	36,248.34	52,376.76	38,168.50	85,673.13
	$3,980,444.95	$4,406,521.27	$4,840,696.63	$4,428,975.31

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

APPENDIX D

Constructional Timbers Supplied During Financial Year 1969–70 under Forestry and Lumbering Operations

Class of Timber	Quantity	Sales Value
		$
Crossings	33,937 super. feet	3,846.48
Headstocks and Braces	15,175 super. feet	2,911.14
Transoms	133,624 super. feet	17,548.58
Piles	8,944 lineal feet	10,994.27
Girders—Dressed	5,142 lineal feet	11,397.42
Sleepers	95,706 pieces	147,374.12
Sleeper Blocks (as sleepers contained)	120,787 pieces	122,473.14
Round Fence Posts	4,949 lineal feet	2,082.90
Split Posts and Rails, &c.	3,741 pieces	1,264.47
Total		$319,892.52

APPENDIX E

Comparative Statement of Expenditure for Years 1968–69 and 1969–70

——	1968–69	1969–70
	$	$
REVENUE—		
Salaries	1,808,364	1,998,837
Cryptotermes brevis Investigation	490	1,375
Fares, Printing, Stores, &c.	11,150	11,101
Travelling Expenses and Incidentals	98,997	108,614
National Parks	69,997	69,908
Cash Equivalent of Long Service Leave	10,404	34,021
LOAN—		
National Parks	159,841	205,000
TRUST—		
Reforestation Trust Fund—		
Reforestation	5,142,755	5,130,000
Land Acquisition	28,950	27,205
Purchase of Plant	499,109	669,174
Access Roads	344,734	381,363
Purchase of Radio Equipment	29,592	39,815
Purchase of Firefighting Equipment	19,991	19,963
Forestry and Lumbering Fund—		
Interest and Redemption on Loans	2,689,955	2,509,779
Hardwood Supplies to Railway Department and others	534,049	291,770
Harvesting and Marketing Timber	1,339,461	1,272,342
Access Roads—Maintenance and Subsidies	226,836	198,381
Maintenance of Plant	813,600	817,836
Maintenance of Capital Improvements	136,138	116,337
Expenses—Timber Research and Development Advisory Councils	Nil	192
Total $	13,964,413	13,903,013

APPENDIX F

Net Area of Plantation Established 1st April, 1969, to 31st March, 1970

Species	Brisbane	Gympie	Mackay	Maryborough	Monto	Murgon	North Queensland	Warwick	Yarraman	Totals
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
1. Conifers										
A. Native Conifers—										
Hoop Pine	246·1	881·9	49·7	396·8	170·6	678·4	97·4	..	1,034·1	3·555·0
Kauri Pine	..	..	..	..	..	..	..	..	..	..
Bunya Pine	..	..	..	..	..	..	1·6	..	..	1·6
Other Native Conifers	..	..	..	..	..	..	..	..	..	..
Total—Native Conifers	246·1	881·9	49·7	396·8	170·6	678·4	99·0	..	1,034·1	3,556·6
B. Exotic Conifers—										
Slash Pine	1,529·5	2,679·1	..	2,724·5	..	..	..	..	69·4	7,002·5
Loblolly Pine	108·3	31·6	..	..	..	..	..	0·3	..	140·2
Patula Pine	..	..	..	..	..	..	..	..	20·0	20·0
Caribbean Pine	63·7	63·1	558·0	520·7	..	..	326·5	..	..	1,532·0
Radiata Pine	..	..	..	..	..	..	..	161·3	120·8	282·1
Long Leaf Pine	..	..	..	..	..	..	..	..	..	..
Other Exotic Conifers	..	..	..	..	..	..	6·0	0·2	..	6·2
Total—Exotic Conifers	1,701·5	2,773·8	558·0	3,245·2	..	..	332·5	161·8	210·2	8,983·0
Total—Conifers	1,947·6	3,655·7	607·7	3,642·0	170·6	678·4	431·5	161·8	1,244·3	12,539·6
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	..	0·7	..	..	..	..	..	..	..	0·7
Red Cedar	..	2·5	..	..	..	..	..	..	..	2·5
Others	..	..	..	..	..	..	..	..	..	..
Total—Other Broadleaved Species	..	3·2	..	..	..	..	..	..	..	3·2
Total—Broadleaved Species	..	3·2	..	..	..	..	..	..	..	3·2
Miscellaneous Experimental	60·9	..	22·9	..	..	..	..	6·6	..	90·4
Total—All Species	2,008·5	3,658·9	630·6	3,642·0	170·6	678·4	431·5	168·4	1,244·3	12,633·2

APPENDIX G

Net Area of Effective Plantation Classified into Forestry Districts to 31st March, 1970

Species	Brisbane	Gympie	Mackay	Maryborough	Monto	Murgon	North Queensland	Warwick	Yarraman	Totals
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
1. Conifers										
A. Native Conifers—										
Hoop Pine	1,681·3	21,207·3	150·9	1,393·5	5,125·7	13,919·1	1,699·5	3·7	25,734·0	70,915·0
Kauri Pine	5·3	389·1	2·5	69·7	3·6	4·9	292·3	0·8	7·4	775·6
Bunya Pine	0·9	519·6	..	0·8	1·2	53·0	3·3	..	70·7	649·5
Other Native Conifers	2·8	7·4	0·5	1·9	..	..	0·2	..	..	12·8
Total—Native Conifers	1,690·3	22,123·4	153·9	1,465·9	5,130·5	13,977·0	1,995·3	4·5	25,812·1	72,352·9
B. Exotic Conifers—										
Slash Pine	18,056·7	18,069·1	2,450·9	21,807·4	52·0	1·4	11·5	794·6	891·5	62,135·1
Loblolly Pine ..	3,665·3	230·2	7·3	54·8	2·7	83·5	14·0	237·0	21·5	4,316·3
Patula Pine	18·9	37·7	8·1	8·2	24·0	96·0	35·0	461·7	3,429·8	4,119·4
Caribbean Pine ..	306·1	357·6	6,802·3	1,386·1	1·4	5·4	1,279·9	..	4·3	10,143·1
Radiata Pine ..	0·5	..	..	..	..	14·5	..	3,189·6	880·1	4,084·7
Long Leaf Pine ..	237·9	2·1	7·3	1·0	..	..	..	8·8	2·8	259·9
Other Exotic Conifers	58·5	28·1	118·4	19·1	9·5	4·3	27·2	34·2	55·1	354·4
Total—Exotic Conifers	22,343·9	18,724·8	9,394·3	23,276·6	89·6	205·1	1,367·6	4,725·9	5,285·1	85,412·9
Total—Conifers ..	24,034·2	40,848·2	9,548·2	24,742·5	5,220·1	14,182·1	3,362·9	4,730·4	31,097·2	157,765·8
2. Broadleaved Species										
A. Native Forest Hardwoods—										
Rose Gum	277·3	1,212·7	0·1	0·2	..	17·7	1·1	..	185·4	1,694·5
Grey Ironbark ..	209·6	182·3	0·1	0·1	..	18·6	37·8	..	469·5	918·0
Tallowwood	123·5	19·0	..	0·7	..	..	28·2	..	5·0	176·4
Blackbutt	239·5	235·0	..	58·3	..	..	..	..	0·5	533·3
Gympie Messmate ..	..	258·6	..	0·1	..	..	..	..	..	258·7
Others	29·0	76·8	..	0·9	..	..	11·3	..	2·8	120·8
Total—Native Forest Hardwoods ..	878·9	1,984·4	0·2	60·3	..	36·3	78·4	..	663·2	3,701·7
B. Other Broadleaved Species—										
Silky Oak	..	94·3	..	0·4	..	25·0	26·5	..	625·3	771·5
Queensland Maple ..	..	71·5	..	..	0·6	..	249·3	..	..	321·4
Red Cedar	..	7·8	..	..	..	..	31·4	..	..	39·2
Others	0·1	77·5	0·3	0·4	0·2	..	34·3	..	1·1	113·9
Total—Other Broadleaved Species ..	0·1	251·1	0·3	0·8	0·8	25·0	341·5	..	626·4	1,246·0
Total—Broadleaved Species	879·0	2,235·5	0·5	61·1	0·8	61·3	419·9	..	1,289·6	4,947·7
Miscellaneous Experimental	121·9	44·6	83·5	..	..	0·1	11·8	27·2	82·3	371·4
Total—All Species ..	25,035·1	43,128·3	9,632·2	24,803·6	5,220·9	14,243·5	3,794·6	4,757·6	32,469·1	163,084·9

APPENDIX H

Areas of Natural Forest Treated

A.—EUCALYPTS

Sub-District	Treated 1969–70	First Treatment 1969–70	Total as at 30th June, 1970
	Acres	Acres	Acres
Brisbane	396	396	31,704
Beerburrum	826	..	20,528
Gympie	..	..	20,242
Imbil	..	..	404
Mackay/Emerald/ Rockhampton	1,408	1,408	48,848
Maryborough	4,222	264	108,513
Bundaberg	2,869	420	38,272
Fraser Island	1,423	1,228	24,445
Monto	1,171	1,121	24,862
Murgon/Jimna	2,063	1,023	45,101
Atherton	..	..	3,712
Ingham	..	..	2,985
Warwick	..	..	10,462
Inglewood	..	..	15,697
Yarraman	..	..	6,414
Benarkin	..	..	2,067
Dalby/Chinchilla	774	574	82,155
Total—Eucalypts	15,152	6,434	486,411

APPENDIX H—continued

B.—CYPRESS PINE

Sub-District	Treated 1969–70	First Treatment 1969–70	Total as at 30th June, 1970
	Acres	Acres	Acres
Bundaberg	..	..	2,152
Fraser Island	..	..	4,424
Monto	..	..	2,496
Inglewood	5,778	3,313	103,203
Dalby/Chinchilla/ Roma	10,997	5,049	243,227
Total—Cypress Pine	16,775	8,362	355,502

APPENDIX H—*continued*

C.—RAIN FOREST

Sub-District	Subsequent Treatment 1969–70	First Treatment 1969–70				First Treatment Completed 1969–70	Total as at 30th June, 1970
		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	..	..	1,145	5,999	..	1,145	9,793
Ingham	..	..	..	3,500	..	..	1,364
Warwick	..	..	..	..	..	..	21
Total—Natural Rain Forest	..	..	1,145	9,499	..	1,145	11,178
Total—Rain Forest	..	..	1,145	9,499	..	1,145	21,216

APPENDIX H—continued

Grand Total—	Acres
Eucalypts	486,411
Cypress Pine	355,502
Rain Forest	21,216
	863,129

APPENDIX I

State Forests, Timber Reserves and National Parks listed by Forestry Districts and Sub-Districts as at 30th June, 1970

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	26	102,919 2 23·6	12	3,203 3 23	11	4,091 3 28
	Brisbane	36	189,077 1 26	17	25,997 0 3	34	92,558 1 11·1
	Total	62	291,997 0 9·6	29	29,200 3 26	45	96,650 0 39·1
Dalby	Chinchilla–Barakula	16	863,817 0 38	3	17,911 0 0	1	26,000 0 0
	Dalby	22	518,969 2 0	5	5,977 0 39	2	30,628 2 0
	Roma	17	425,915 0 22	4	103,602 0 0	1	4,385 0 0
	Total	55	1,808,701 3 20	12	127,490 0 39	4	61,013 2 0
Gympie	Gympie	36	288,975 2 13	3	2,513 1 8	4	2,132 0 0
	Imbil	11	145,712 3 0	2	148 2 3	1	640 0 0
	Total	47	434,688 1 13	5	2,661 3 11	5	2,772 0 0
Mackay	Emerald	3	132,358 3 35	9	193,866 2 10	3	1,379,400 0 0
	Mackay	8	166,656 0 0	19	100,491 2 19·1	90	314,709 1 38
	Rockhampton	38	805,893 3 28	14	112,559 2 22	15	13,124 0 0
	Total	49	1,104,908 3 23	42	406,917 3 11·1	108	1,707,233 1 38
Maryborough	Bundaberg	16	203,616 2 15	21	84,260 2 10	..	..
	Fraser Island	1	371,890 0 0	..	..	..	..
	Maryborough	38	369,455 0 13	15	28,476 0 37	6	13,933 0 0
	Total	55	944,961 2 28	36	112,736 3 7	6	13,933 0 0
Monto	Kalpowar	5	37,079 1 0	14	59,127 2 35	..	..
	Monto	28	522,577 2 35	21	76,731 3 8	6	4,932 0 0
	Total	33	559,656 3 35	35	135,859 2 3	6	4,932 0 0
Murgon	Gallangowan	3	38,250 0 0	..	..	..	..
	Jimna	12	114,660 0 34	..	..	..	..
	Murgon	12	126,843 0 0	9	28,099 1 3	..	..
	Total	27	279,753 0 34	9	28,099 1 3	..	..
North Queensland	Atherton	35	846,852 3 6	33	816,455 3 13	59	304,548 3 17
	Ingham	13	522,032 0 0	5	8,509 0 8	30	244,078 0 0
	Total	48	1,368,884 3 6	38	824,964 3 21	89	548,626 3 17
Warwick	Inglewood	31	442,281 0 37	3	5,722 0 8	..	..
	Warwick	14	81,076 3 37	4	5,958 3 28	6	15,819 3 0
	Total	45	523,358 0 34	7	11,680 3 36	6	15,819 3 0
Yarraman	Benarkin	4	70,842 0 0	3	4,442 2 26	..	..
	Yarraman	16	112,023 2 0	9	14,978 2 25	2	11,699 3 0
	Total	20	182,865 2 0	12	19,421 1 11	2	11,699 3 0
	Grand Total	441	7,499,776 2 2·6	225	1,699,033 2 8·1	271	2,462,680 2 14·1

At 30th June, 1970—

Total area set apart as—

	A.	R.	P.
State Forests	7,499,776	2	2·6
Timber Reserves	1,699,033	2	8·1
National Parks	2,462,680	2	14·1
Total Reservations	11,661,490	2	24·8

APPENDIX J

Reservations for the Year ended 30th June, 1970

1st July, 1969, to 30th June, 1970

STATE FORESTS

	No.	A.	R.	P.
At 1st July, 1969	428	7,260,793	3	2
Proclaimed 1–7–69 to 30–6–70	14	177,235	0	25
Crown Land added to Existing State Forests		14,150	2	5·7
Proclaimed Converted Timber Reserves	4	45,877	2	11·6
State Forests amalgamated with existing State Forests	−5	..	..	
Areas released		−283	1	3
Recomputation of boundary		2,002	3	1·3
Total at 30th June, 1970	441	7,499,776	2	2·6

TIMBER RESERVES

	No.	A.	R.	P.
At 1st July, 1969	235	1,752,077	2	0·1
Reserves Converted to State Forests or National Parks	−8	−48,483	3	32
Crown Land added to existing Timber Reserves		2	0	0
Reserves cancelled	−2	−4,562	0	0
Areas released		..	..	
Total at 30th June, 1970	225	1,699,033	2	8·1

NATIONAL PARKS

	No.	A.	R.	P.
At 1st July, 1969	261	2,369,116	1	27·1
Proclaimed 1–7–69 to 30–6–70	9	63,000	0	38
Crown Land added to existing National Parks		27,996	3	8
Recomputation of boundary		11	0	21
Areas released		−44	0	0
National Parks amalgamated with existing National Parks	−1	..	..	
Proclaimed converted Timber Reserves	2	2,600	0	0
Total at 30th June, 1970	225	2,462,680	2	14·1

APPENDIX K

Distribution of Personnel, 30th June, 1970

Salaried officers	509
Other employees	1,776
	2,285

APPENDIX L

Tree Species Mentioned in Annual Report

Botanical Names

A. NATIVE CONIFERS

Black Pine	*Podocarpus amarus*
Blue Kauri	*Agathis* sp.
Hoop Pine	*Araucaria cunninghamii*
North Queensland Kauri	*Agathis palmerstoni*
Northern Cypress Pine	*Callitris columellaris* syn. *intratropica*
South Queensland Kauri	*Agathis robusta*
White Cypress Pine	*Callitris columellaris* syn. *glauca*

B. EXOTIC CONIFERS

Aleppo Pine	*Pinus brutia*
Bahaman Caribbean Pine	*P. caribaea* var. *bahamenisis*
Benguet Pine	*P. kesiya*
Chile Pine	*Araucaria araucana*
Cuban Caribbean Pine	*P. caribaea* var. *caribaea*
Honduras Caribbean Pine	*P. caribaea* var. *hondurensis*
Loblolly Pine	*P. taeda*
Mexican White Pine	*P. strobus* var. *chiapensis*
Montezuma Pine	*P. montezumae*
Ocote Pine	*P. oocarpa* and var. *ochoterenai*
Parana Pine	*Araucaria angustifolia*
Patula Pine	*P. patula*
Pringle's Pine	*P. pringlei*
Radiata Pine	*P. radiata*
Scrub Pine	*P. virginiana*
Slash Pine	*P. elliottii* var. *elliottii*
South Florida Slash Pine	*P. elliottii* var. *densa*
Tenasserim Pine	*P. merkusii*
Tropical Pine	*P. tropicalis*
Western Yellow Pine	*P. ponderosa*

C. EUCALYPTS

Blackbutt	*E. pilularis*
Grey Ironbark	*E. drepanophylla*
Gympie Messmate	*E. cloeziana*
Narrow Leaved Ironbark	*E. crebra*
Poplar Box	*E. populneum*
Red Ironbark	*E. fibrosa* sub. sp. *fibrosa*
Red Mahogany	*E. resinifera*
Rose Gum	*E. grandis*
Scented Gum	*E. citriodora*
Spotted Gum	*E. maculata*
Tallowwood	*E. microcorys*
Timor Mountain Gum	Unknown
White Mahogany	*E. acmenioides*

D. OTHER BROADLEAVED SPECIES

Brigalow	*Acacia haropohylla*
Brush Box	*Tristania conferta*
Cairns Hickory	*Flindersia ifflaiana*
Maple Silkwood	*F. pimenteliana*
Mexican Cedar	*Cedrela odorata*
Northern Silky Oak	*Cardwellia sublimis*
Queensland Maple	*Flindersia brayleyana*
Queensland Silver Ash	*Flindersia bourjotiana*
Queensland Walnut	*Endiandra palmerstoni*
Red Cedar	*Toona australis*
Rose Butternut	*Blepharocarya involucrigera*
Rosewood	*Eremophila mitchellii*
Sandalwood	*Santalum lanceolatum*
Silver Quandong	*Elaeocarpus grandis*
Silver Silkwood	*Flindersia acuminata*
Smooth-Barked Apple	*Angophora costata*
Teak	*Tectona grandis*