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AN EVALUATION OF BRITISH AID TO ASSIST FOREST DEVELOPMENT IN THE SOLOMON ISLANDS 1965-1980

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PREFACE

Each year the Overseas Development Administration (ODA) commissions a number of ex-post evaluation studies with two aims in mind; firstly, to assess the effectiveness of its aid activities and secondly, to learn lessons for improving the effectiveness of future aid activities.

This evaluation is one such study.

Evaluation studies are undertaken by individuals or by teams especially recruited for their particular knowledge with regard to the subject under study. Sometimes these teams will include personnel from ODA (increasingly teams are a mix of ODA and external personnel).

In all cases the reports and conclusions are attributable to the authors, who are finally responsible for their contents, and not to ODA.

Evaluation Unit
Manpower and Evaluation Department

SUMMARY

The forest industry of the Solomon Islands contributes about 10% of its GDP and provides about 7% of the total wage and salary employment. However, current rates of logging will exhaust the existing forests before the year 2000 unless replanting takes place. From 1966-75, British Aid amounting to approximately £30,000 assisted SIG in a programme of pilot trials of replanting techniques, and based on the results of this work a project aiming to replant 15783 ha of Government-owned land was financed from 1976-79. The cost to British Aid of this project was £1.84 million. (1.1 - 1.3).

The present study was carried out in 1982 to report on project design, execution and impact. The main findings and conclusions are:-

1. The project was entirely appropriate to national objectives. (3.1).
2. Project design was soundly based on information available from studies by SIG officers and visiting specialists. (1.4, 2.1, 3.2).
3. The technical specificationsof the project were in general scientifically and managerially sound. (3.21, 3.22).
4. The project was in general successful, and has an estimated financial yield of 7.6% and an Economic Rate of Return of about 8%. (5.4, 5.43).
5. Project achievements included:-

   Establishment of 13143 ha of plantations (4.01)
   Construction of new forestry camps (4.05)
   Creation of over 700 jobs in rural areas (5.3)
   Training of forest staff at all levels (4.08, 5.3)
   Development of roads and communications (4.06, 5.2)
   Creation of a basis for further rural development (5.2)
   Institution of important research (4.13)

6. Problems encountered by the project included:-

   Over ambitious planting targets (4.01, 4.02)
   Unexpected changes in logging pattern and field survival of trees(4.02,4.17,5.1
   Lack of an integral research component (4.13, 4.02)
   Slow build-up of trained personnel (4.17, 4.09A, 4.08)
   Problems with vehicle procurement and servicing (4.06, 4.07)
   Allocation of plantations for cattle raising with insufficient experimental information (4.12)

7. Major recommendations for future projects in the Solomon Islands are:-

   (a) Projects should take account of vehicle procurement and servicing difficulties on islands remote from the main island of Guadalcanal. (6.4)

   (b) Where changes in project design occur e.g. in logging pattern or the use of cattle, effective monitoring and reporting to ODA is needed, so that targets can be modified if necessary. (6.5, 6.6)

   (c) If the recruiting of staff is likely to be delayed, planting targets may have to be restricted in the early stages of the project. (6.1, 6.3)

   (d) Timely and comprehensive training programmes are important. (6.3)

   (e) A large development project should include its own capability for field research. (6.2)

   (f) Where separate projects share resources, and can affect each other's outputs (e.g. cattle under trees), special management arrangements are called for. (6.5, 6.6).

CONTENTS

Summary
List of Acronyms and Abbreviations
Synopsis 1

Chapter 1 Importance of the Forest and Forest Industries Sector 6
1.1 Forest and Land Resources 6
1.2 National Forestry Objectives and Policies 6
1.3 Role of Forest and Forest Industries Sector 7
1.4 Forestry Plantation Research and Development 11
Tables 1.1 - 1.4 8 - 11

Chapter 2 The Reforestation Project Proposal 1975 12
2.1 Government Objectives and Strategy 12
2.2 Technical Basis of the Project 15
2.21 Line Planting Methodology 15
2.22 Species Selection 17
2.23 Rotation Length 17
2.24 Volume Estimates 18
2.3 Implementation Plan 18
2.4 Financial and Economic Appraisal of the Project 23
2.41 Financial Appraisal 23
2.42 Sensitivity Analysis for Financial Appraisal 27
2.43 Economic Appraisal 29
2.45 Other Non-Quantified Benefits 32
2.5 ODA Project Submission Undertakings 32
Tables 2.1 - 2.14 14 - 31

Chapter 3 Evaluation of Project's Objectives and Technical Basis 33
3.1 Validity of Original Objectives and Strategy 33
3.2 Validity of the Silvicultural Basis for the Project 33
3.21 Establishment Technique 33
3.22 Validity of Species Choice 33

Chapter 4 Analysis of Project Design and Implementation 35
4.01 Planting Targets 35
4.02 Reduced Survival 36
4.03 Permanent Inventory Plot Programme 38
4.04 Interplanting 38
4.05 Size and Location of Camps 39
4.06 Roads, Culverts and Bridges 39
4.07 Plant, Boats and Vehicles 39
4.08 Training 41
4.09A Staffing 42
4.09B Labour & Administration 44
4.10 Physical Productivity Targets for Operations 47
4.11 Accounting, Control and Reporting 52
4.12 The Cattle-under-Trees (CUT) programme 52
4.13 Research 54
4.14 Other Aid Donors 55
4.15 Costs and Cost Changes over the Project 55
4.16 Organisation and Implementing Authority 61
4.17 Effect of ODA Project Submission Undertakings 62
Tables 4.1 - 4.18 35 - 61

Chapter 5		Project Impact & Achievements	62
	5.1	Stocking and Growth Projections	62
	5.2	Rural Development	66
	5.3	Staff, Labour, Skills and Training	67
	5.4	Financial and Economic Evaluation of the Project	67
	5.41	Financial Evaluation	67
	5.42	Sensitivity Analysis for Financial Evaluation	72
	5.43	Economic Evaluation	76
	5.44	Sensitivity Analysis for Economic Evaluation	80
	Tables	5.1 - 5.12	64 - 79
Chapter 6		Lessons from the Project	81
	6.1	Planting targets	81
	6.2	Research	81
	6.3	Technical Expertise and Training	81
	6.4	Physical Resources	82
	6.5	Cattle under Trees	83
	6.6	Physical and Financial Reporting	84
	6.7	General Comments on the Project and its Benefits	85
Appendix A		Inventory data showing average stocking per ha and net areas by compartments	A1-A8
Appendix B		Permanent Inventory Plot Data	B1-B13
Appendix C		Growth Data for the Principal Plantation Species	C1-C20
Appendix D		A List of Forestry Division Technical Notes 1958-74	D1-D3
Appendix E		Itinerary	E1-E3
Appendix F		Terms of Reference for the Consultants	F1
Appendix G		Consultants' Personal Histories	G1-G2

List of Maps

Map 1	General Map of the Solomon Islands showing planted areas	M-1
Map 2	General location map showing paths of cyclones	M-2
Map 3	Kolombangara showing plantations and CUT areas, 1980	M-3
Map 4	Viru - showing plantation areas and Government land	M-4

List of Acronyms and Abbreviations

MAI	Mean annual increment. Total timber volume produced over a rotation, divided by the rotation age.
Rotation	The length of time between planting and harvesting trees.
CD & W	Colonial Development and Welfare Funds.
PWD	Public Works Department
FAO	Food and Agriculture Organisation of the United Nations.
UNDP	United Nations Development Program.
CUT	Cattle Under Trees Project (Australian Aid).
ADAB	Australian Development Assistance Bureau.
Stumpage	The estimated residual standing value of trees after subtracting estimated average production costs and profits from the delivered price of the log.
Beating up	Replacing trees that have died after planting.
Ha	Hectares (2.47 acres)
GDP	Gross Domestic Product
MAL	Ministry of Agriculture and Lands.
SIG	Solomon Islands Government

AN EVALUATION OF BRITISH AID TO ASSIST FOREST DEVELOPMENT IN THE SOLOMON ISLANDS 1965 - 1980

SYNOPSIS

Introduction

The forest resources of the Solomon Islands will be exhausted by the year 2000 if the current rates of logging are maintained. The forest industry contributes 10% GDP and provides employment for over 1500 people. Timber was the second largest export earner, after Copra, until 1979, and now occupies third place.(1.1 - 1.3).

Since 1965 SIG has carried out a programme of research and pilot trials on the replanting of logged-over areas. From 1966-68 the C.D. & W. fund D6665 contributed about £15,000 a year to this work. From 1968-71 the recurrent element of the work was transferred to the country's budget, and from 1971 onwards finance was provided under Project 37, expenditure being approximately 4.2 million S.I. Dollars(£1.84 million). (1.4).

ODA Project 14302 from 1976-79 was based on the earlier work and aimed at planting 15,783 ha of Government-owned land on 4 islands, using line planting techniques, building forest stations and providing capital equipment. (2.1).

The present study was carried out in January 1982 to report on project design, execution and impact. (Appendices F and G).

The main findings and conclusions are:-

1. The project's objectives matched those of SIG in aiming to replant logged-over natural forests (3.1).

2. The design of the project, growing utility hardwoods on a 20 year rotation was soundly based on information available from pilot trials, from international specialists, and took into account the prevalence of cyclones. (1.4, 2.1, 3.2).

3. The technical specification of the project, involving choice of species, line planting technology and forest management, were, in general, sound. (3.21, 3.22).

4. The project was, in general, successful, achieving over 80% of its planting target, and having an estimated financial yield of 7.6% and an Economic Rate of Return of over 8%. (5.4, 5.43).

5. The achievements of the project were considerable and included:-

   Establishment of 13143 ha of line plantations in logged-over forest. (4.01).

   The construction of four new forestry camps, with workshops,nurseries and other facilities. (4.05).

   The creation of over 700 jobs in rural areas. (5.3, 4.09A, 4.09B).

   Training of staff at all levels in reforestation and other skills, including research and management. (4.08, 5.3).

The maintenance and extension of a network of roads and transport. (4.06, 4.07, 5.2).

The creation of a basis for further rural development. (5.2).

The appointment of research officers to study urgent problems of forest entomology, weedgrowth and cattle/tree management. (4.13).

6. Some problems encountered by the project led to the slight shortfall in planting, and to uneven survival in some plantations. These included:-

The planting targets were over ambitious (and noted so by the ODA Forestry Adviser). The shortfall in planting was due to a variety of factors including heavier weed growth than expected, and some difficulties with production of planting stock from nurseries. (4.01, 4.02).

The planned logging pattern was intensified during the currency of the project, leading to soil damage and heavy growth of weeds especially climbers. This led to uneven survival of planted trees. (4.17, 4.02, 5.1).

There was no integral research component funded within the project. The existing SIG Forest Research Station at Munda had theoretical responsibilies for research for the project, and for supplying it with tree seed, but was not able to respond to the project's urgent needs, e.g. when forest nurseries found it difficult to provide sufficient seedlings for planting. (4.02, 4.13).

Although training for Range officers under New Zealand Aid was provided, and a local school for supervisors existed, there was a slow build up of trained personnel. The first new Rangers were not available until half way through the project. (4.08, 4.09A, 4.17).

Vehicle procurement and servicing was carried out under standard PWD contracts, but these proved unreliable on islands remote from the capital on Guadalcanal, where operating conditions are harsh. (4.06, 4.07).

Shortly after the project began, areas of plantations were put under joint management for cattle grazing (cattle under trees project) financed by ADAB. This change to the project was insufficiently backed up by research. There was also a lack of coordination in the management of these areas of joint land use. (4.12, 4.13).

7. Recommendations for future similar projects in the Solomon Islands are:-

(a) Projects should take account of difficulties in vehicle specification procurement and servicing on islands remote from the capital on Guadalcanal, and in particular to set up efficient workshops in good time if PWD cannot provide an adequate service. (6.4).

(b) It is inevitable that some changes in project design become necessary during the currency of a project, and frequent monitoring and reporting to ODA and needed so that targets can be altered and operational methods suitably modified if necessary. (6.5). This applies to all physical and financial reporting, which should be done at 6 months intervals. (6.6.).

(c) In circumstances where recruiting may be delayed it may be necessary to reduce targets until a full complement of staff is in post. (6.1, 6.3).

(d) Special attention to training is required, including the use of short, in-service courses at all levels. (6.3).

(e) Large specialized projects, in which techniques and methodologies are crucial to success, should incorporate their own capability for operational field research. (6.2).

(f) Where two or more separate projects share the same land and other resources, e.g. cattle with tree plantations, special arrangements for joint management responsibility are necessary. (6.5).

AN EVALUATION OF BRITISH AID TO ASSIST FOREST DEVELOPMENT IN THE SOLOMON ISLANDS 1965 - 1980

MAIN REPORT

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1. Importance of the forest and forest industries sector

1.1 Forest and land resources

The total land area of the Solomon Islands is about 2.8 million hectares of which almost 90% is covered with forest.

There are four main forest types, containing the following main species:

1. Campnosperma brevipetiolata - Calophyllum spp. - Dillenia salomonensis.

2. Pometia pinnata - Calophyllum kajewski - Vitex cofassus.

3. Terminalia brassii swamp forest.

4. Small areas of Kauri (Agathis macrophylla) in the Santa Cruz islands.

Most of the land is held under customary tenure, and only about 10% of the land is accessible. Of this there are about 165,000 ha of exploitable broad leaved tropical high forest of which about 64,000 hectares is on land held by the Government. Within this area about 80% is suitable for exploitation and regeneration by planting. The SIG long-term objective of developing the forestry sector is being met mainly on Government - owned land which it acquired, either by purchase or by transfer from expatriate companies during 1962-64, with the single objective of developing a large scale forest industry.

1.2 National Forestry Objectives and Policies

The forestry sector's objectives and policies have always been closely linked to the country's overall national objectives and policies. The first plan for the sector was drawn up in 1968 and it was revised in 1970 to coincide with the new national development plan which was being prepared. The salient features of that plan were to:-

(i) Progressively acquire timber rights rather than land itself prior to licensing for large scale commercial operations in the private sector.

(ii) Expand log exports from 230,000 cu metres in 1970 to 410,000 cu metres in 1973.

(iii) Encourage further processing of logs.

(iv) Complete a planting programme of approximately 2000 hectares per annum.

(v) Continuously review protection measures in water catchment areas.

In 1974 careful consideration was given to the relationship between the rate of utilising the existing resource and that of replacing it. It was recognised that there was no necessary link between the two since conceptually they can be analysed separately, but in practice, it was considered there were at least two links which might make it necessary. The first was where there was a need, if it was felt desirable, for continuity of a domestic forest industry built up on the liquidation and utilisation of the existing forest, and the second was where ecological conditions require reforestation, to follow closely behind logging.

The forestry policy was reviewed in 1975 taking into account these and other considerations, the main principles of which were:-

(1) Increasing the rate of timber cutting up to about 400,000 cubic metres log volume per year, of which not more than about 285,000 cubic metres to be exported as logs.

(2) Sawmilling and further processing within the country of about one-third of the timber production as quickly as possible.

(3) Locally processing more of the production, if market research and evaluation show this to be worthwhile.

(4) Promoting more widespread timber working throughout the country, especially where logging will assist agricultural development.

(5) Further studies to evaluate the most advantageous new types of forest crops to grow.

(6) Using of foreign capital, probably a mixture of grant aid, commercial investment and loans, for the reafforestation programme - subject to Government control of the new crops and their use.

(7) Replanting programmes by the Government on public land to reach 5,000 hectares a year as soon as possible.

(8) Arranging with customary land owners for continuing logging on customary land and for replanting on selected areas of customary land with landowner participation in the venture.

(9) Development of cattle grazing under forest crops.

(10) Extension and advisory services to small sawmills and plantations.

This policy is the one currently in existence and the objectives appear to coincide entirely with the National Development Plan Objectives for the period 1976 to 1979 which were:-

(1) Conservation of the environment and resources of the Solomon Islands.

(2) Increased employment, infrastructure and services in rural areas.

(3) Increased export earnings.

(4) Increased Government revenue; and

(5) Increased economic activity through linkage to other sectors.

1.3 Role of the forest and forest industries sector

The achievements in the forest and forest industries sector have been impressive and are based mainly on private investment in extraction by four main foreign companies. These developments may be judged by the figures in Table 1.1.

The sector is a major contributor to monetary GDP with its share accounting for between 5-7% of the total over the last 10 years, which has helped considerably to diversify sources of rural income beyond copra and fishing.

Table 1.1 Forestry - log Production and Utilisation (cubic metres)

Year	Total Log Production	Export Log Shipments	Sawn Timber				Veneer Sheets		
			Log Input	Sawn Timber Production	Sales		Log Input	Veneer Production	Sales Export
					Export	Domestic			
1970	234214	225588	8626	4313*	-	na	-	-	-
1971	266778	257773	9005	4502*	-	na	-	-	-
1972	246284	237032	9252	4626*	-	na	-	-	-
1973	250995	242195	8800	4400*	82	na	-	-	-
1974	235378	220678	14700	7350*	158	na	-	-	-
1975	228583	208294	19742	8111	1247	4978	547	181	181
1976	264117	241233	21902	9209	1936	4988	982	410	351
1977	258972	237584	20698	8215	1895	4736	690	362	267
1978	275225	247331	26213	11145	2666	6844	1681	788	897
1979	299142	258247	38032	16963	8328	7720	2863	1076	1112
1980	300283	252408	37779	19452	7302	12150	N/A	1113	N/A

* estimate

Source: 1970 - 1979 Data from Solomon Islands 1980 Statistical Year Book

1980 Figures supplied by Forestry Division of Ministry of Natural Resources

Table 1.2 Major Exports in Value Terms (SI $'000)

		1965	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
031.1	Fish, fresh & frozen	-	-	1238	3584	1339	2834	1271	5065	6375	4979	14588
031.2	Fish, smoked	-	-	-	-	-	116	319	[illegible]	388	736	438
032	Fish, canned	-	-	-	-	-	767	1188	1195	1520	1541	1906
042	Rice and Rice Products	-	4	63	2	4	18	2	12	297	807	950
072.1	Cocoa	19	45	45	33	51	65	112	201	553	596	648
122.31	Tobacco (manufactured)	-	109	77	68	27	28	53	78	117	94	67
221.2	Copra	4442	3633	3825	1815	2813	9012	4661	3634	7088	7856	16992
221.3	Palm Kernels	-	-	-	-	-	-	-	53	282	421	616
242	Wood in the Rough	196	2836	3283	2708	3794	4267	3026	6862	7725	6837	14721
243.3	Sawn Timber	-	2	-	-	-	7	15	116	196	178	1146
284	Scrap Metal	-	118	167	103	200	69	26	20	17	7	7
291.15	Marine Shells	27	127	77	93	120	82	163	203	179	165	178
422.2	Palm Oil	-	-	-	-	-	-	-	1140	2895	4653	6590
11.2	Gold	-	7	13	20	61	72	76	58	56	49	173
	TOTAL DOMESTIC EXPORTS	4758	5658	8847	8338	8827	17680	11282	19244	28886	29458	59282
	WOOD AS % OF DOMESTIC EXPORTS	4.1%	50.2%	37.1%	31.7%	43.1%	24.2%	27.8%	32.5%	27.4%	24.4%	26.8%

Source: Solomon Islands 1980 Statistical Year Book

Table 1.3 The Forestry Sector's Contribution to Central Government Recurrent Revenue

ITEM	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Timber Export Duty										
Value (SI $'000)	146	-	-	-	-	-	-	-	423	RNI
% of total Government Recurrent Budget	2.1	-	-	-	-	-	-	-	2.5	3.7
Timber Levy										
Value (SI $'000)	20	207	262	200	334	295	397	376	33	-
% of Total Government Recurrent Budget	0.3	2.8	3.6	2.7	3.4	3.2	3.9	2.7	0.2	-
Timber Royalty										
Value (SI $'000)	45	45	65	22	27	15	22	15	24	14
% of Total Recurrent Budget	0.7	0.6	0.9	0.3	0.3	0.2	0.2	0.2	0.1	0.1

Source: Solomon Islands 1980 Statistical Year Book

Note: from 1971-77 export duty was effectively incorporated in timber levy

It was also the country's second largest export earner until 1979 when earnings from fish reached the same level. The actual contribution (see Table 1.2), has fluctuated in the range of 24% to 32% of the country's total domestic export earnings between 1971 and 1979, which is the latest year for which statistics are available.

Contributions to the Government's recurrent revenue have also been impressive, forestry having been the third largest contributor after copra and fish in 1979. The principal components of this contribution are given in Table 1.3. Corporation Tax levied on logging companies' profits has not been shown although this could amount to over $400,000 (FAO/UNDP report to SIG, 1975).

The sector also provides an important number of jobs as the figures in Table 1.4 show , particularly since the population is currently increasing at a rate of approximately 3.4% per annum.

TABLE 1.4

Employment in the Forest and Forest Industries' Sector in 1972 and 1979

Year	Employment in the Forest and Forest Industries' Sector	% of Total Wage and Salary Employment
1972	1050	7.2
1979	1472 (ex. replanting programme)	7.3
	2051 (inc. " ")	10.3

Source: Forestry Division and 1980 Statistical Year Book

Most of these jobs are rurally based, and if the sector's employment including the replanting programme is expressed as a percentage of the wage and salary employment currently available outside Honiara, the figure rises to 16.8%. If the employment created by the replanting programme is excluded, the percentage falls to just over 12%.

Overall it is considered that forests and the industries which they support are a particularly important part of the Solomon Islands' economy. If the present rate of logging is continued, it has been estimated by the Forestry Division that by the year 2000, all the country's forest resources will be exhausted and the sector's significant contributions to the economy will cease. This fact was realised by the Forestry Division when logging began and it has correctly made every effort to find the ways and means to re-establish or re-plant the logged areas ever since. This long term planning is particularly important in forestry because of the relatively long time required, even in the tropics, to grow trees.

1.4 Forestry Plantation Research and Development up to 1975

British aid for research and development was continuous from 1966. From 1966-68 the contributions were from the CD & W fund and amounted to about £15,000 per year. During the country's Sixth National Development Plan (1971-75), £284,000 (S.I.$482,400) was provided for a programme of forest replanting; nearly 5,200 ha had been planted by 1975, much of it in the form of large scale pilot trials on a range of sites throughout the country.

The research element of this development work was carried out by the Research Section of the Forest Department. This Section had the responsibility of providing research services to both the Forest Department in general and to the project. It is also responsible for the collection and supply of tree seed for all replanting work, the major part of which was carried out under the project. The Section produced a large number of publications (see e.g. the Research Notes listed at Appendix D) and had compiled much information on the species used by the project by the 1970's (a summary of this from "Silvics of Species", a research report published in 1980, is given in Appendix C). Since the Research Section was not under the direction of the project, however, there was a tendency for it to continue with past research work, rather than to tackle the new problems as they arose. These problems were mainly related to

Seed collection, Storage and treatment
Nursery work
Plantation spacing trials
Weed control

The species and operational trials carried out before 1975 were carried out in slightly different conditions from those under which the project actually operated. Nevertheless many of these pilot trials were outstandingly successful especially on Gizo Island, weed growth was not a major problem, and hence it was thought unnecessary to try a large number of closer between-tree spacings than 10 x 3 metres.

2. The Reforestation Project Proposal 1975

2.1 Government objectives and strategy

A Forestry Division objective which was embodied in the 1975 forest policy was to ensure as far as possible the continuity of the forest industry and its contributions to the national economy by the re-establishment of the forest resource after logging. Considerable effort was directed at developing the techniques and securing funds for the re-stocking of logged forest areas from the time the logging of hardwoods started in the Solomon Islands in 1965.

Because of the practical links between the logging of the existing resource and investment in reforestation (section 1.2), both the areas and the upper limits to the rate of re-stocking the logged forest were determined. While in theory there was no reason why the rate of re-stocking should be the same as the rate of logging, and in practice there were good reasons to believe that it would be better for it not to be in terms of organisation and training, two factors were considered to make it essential:-

a. Weed and Creeper growth:- At the time of formulating the project in 1975, the available evidence suggested that costs would be reduced by re-stocking areas immediately after logging before weed and particularly *Merremia* had become fully established.

b. Road Costs:- It was considered that maintenance and repair work on roads and bridges was likely to be very expensive and therefore it was felt that these costs could be kept to a minimum if re-stocking followed immediately behind logging, since the companies

would need the same roads and would share the costs of maintaining them. It was originally projected that plantations would not need to be maintained from 3 years after the date of planting and it was estimated that most bridges would last for that length of time.

Research had shown that line planting techniques as well as complete clearing of logged areas would allow the following types of crops to be grown:-

(1) prime quality timber
(2) general purpose or utility timber
(3) pulpwood

An important question then arose as to which of these options would provide the country with the largest net benefits. The domestic market in the Solomon Islands was not considered to have any significant effect on the choice since it was extremely small (under 1000 m^3 log equivalent in 1973) compared with current or likely future production. The majority of any production was therefore likely to be destined to be exported to markets in the Far East, particularly Japan, Korea, and possibly China. Europe was also considered a possibility.

In developing a re-stocking strategy the Forestry Division were guided by the advice of A.J. Leslie who was then Chief of the Trend Studies and Economic Analysis Section of FAO, who advised in 1972 that it was desirable:-

(1) "for the Solomon Islands Government in the long run to own a substantial part of the new resource to avoid control by monopoly interests, and so that Government will be in a position to "shape the development of the forest industries".

. but, with the aim of securing relevant markets.

(2) "to have the ultimate users involved in the financing of plantations aimed at the pulpwood market".

There were a number of advantages in seeking to grow pulpwood crops, such as earlier returns, greater employment in the establishment stage, and less risk of cyclone damage because of the reduced rotation length. Therefore attempts were made to interest the pulp and paper companies in Japan, which was likely to be the main market for chips, in investing in the plantations. At that stage they were only prepared to finance some pilot trials on Kolombangara and it was considered that without a greater financial involvement and guaranteed markets, pulpwood production could not be justified.

In opting for sawlog production, the Forestry Division still had to choose between the production of prime (or cabinet) and utility quality sawlogs. From a marketing point of view, it was felt that there was a very strong attraction for growing prime quality sawlogs, provided the correct species were chosen, since future world supplies were likely to be of limited availability, and transport costs to European North American and Australian markets would only account for a small proportion of the total price. However the disadvantages of this option were considered to be sufficiently serious to justify growing primarily utility quality sawlogs. These were:-

- increased establishment costs, because the maintenance of cabinet wood species required weeding for a longer period because of their slower initial growth rates than those of utility species.

- cabinet woods require rotations of up to 45 years, compared with about 20 years for utility timbers. This entails a greater risk of cyclone damage (see Map 2).

- the existing forest resource was likely to be exhausted by about the year 2000, and by this time prime quality sawlog crops would not have reached a harvestable size. Therefore this option would not provide the continuity of employment which would be possible if utility quality sawlogs were grown.

There was however concern at the future markets for utility quality hardwoods, but on this, Leslie commented as follows:-

> "There will certainly be a large demand for general purpose (utility) timbers in sawn, veneer and plywood form. But this will be a highly competitive market for quite a long time. With a wide range - geographically as well as physically - of substitutable woods available any woods in this category would need to have a marked price advantage, unless, as for example with the dipterocarps, they have some physical advantages ..... For the most part, however, for successful expansion in this market, Solomon Islands' indigenous species or a number of the possible introductions will have to retain the present relative price advantage they hold. This applies whether the market is seen in terms of log exports, or as Japan swings towards processed wood imports, the outlet is visualised in terms of sawnwood or veneer or even plywood" .....
> ..... "the export market prospects for the B.S.I.P. forests could not be regarded as a limiting factor in the development of the sector, provided that any programme for expanded exports based on the indigenous species - either from natural forests or from plantations - recognises that the only market advantage these can have is that of lower prices".

Based on this analysis, the strategy put forward in 1975 was, in the absence of any indication of investment by the pulp and paper industry, to proceed with the establishment of plantations with the aim of growing utility timbers. However it was felt that there was also a good case for planting a small proportion of prime quality sawlogs.

For the reasons already given it was felt essential that re-stocking should keep pace with logging operations, and therefore estimates of the future rate of logging of Government land were made which then served as the basis for the long term re-stocking plan. This is shown in Table 2.1.

Table 2.1 Proposed Area (ha) Schedule for the Restocking of Public Land 1976-1985

Year	Viru	Kolombangara	Vangunu	Shortland	St. Cruz	Total
1976	1200	1800			300	3300
1977	1200	2400	400	400	400	4800
1978	1200	2800	400	400	400	5200
1979	1200	2800	800	400	400	5600
1980	1200	2800	800	800	300	5900
1981	1200	2800	800	800		5600
1982	1200	2800	800	800		5600
1983	1200	2600	800	800		5400
1984	1050			800		1850
1985				800		800
TOTAL	10650	20800	4800	6000	1800	44050

Source: SIG Forestry Division Technical Note No. 1/73

The project put forward for financing in 1975 was therefore only the first part of a much larger planned re-stocking programme.

The Project's objective and strategy

The project was included in the SIG's National Development Plan (1975-79) and was part of the larger continuing programme whose objective was:-

> "The replacement of the native hardwood timber resource after it has been logged out, with a new resource of hardwood timber from man-made plantations grown on public land, so that the S.I. timber industry and the benefits deriving from it may contine".
>
> (PC(76)(13)).

The strategy to achieve these objectives was to replant logged over areas by line planting over the period 1976-79 as follows:-

1976: 1620 ha
1977: 3644 ha
1978: 4858 ha
1979: 5668 ha

This strategy was regarded as ambitious by the Forestry Adviser, but was nevertheless accepted subject to the provisions outlined in Section 2.5 below. (see also Table 4.1). The areas were to be divided between Viru, Kolombangara, Allardyce, Santa Cruz and Gizo, using permanent and temporary workers housed in specially built forest stations. (see Map 1).

This was to be achieved at a cost of £1,837,205 to British Aid, of which British-made goods were to be approximately £150,000 and OSAS payments some £110,000. The balance was to cover local costs.

2.2 Technical Basis of the project

The technicel specifications of the project were based upon well established silvicultural methods (see below) and a choice of species based upon the results of silvicultural research carried out with British Aid in the preceding period.

2.21 Line planting methodology. The principles of this system were clearly set ou by Dawkins (1958) as follows:-

"..... line planting is the establishment of a tree crop to be closed at rotation age, in lines spaced at intervals equal to or slightly greater than estimated final-crop crown diameter.

There are five necessary conditions for line-planting in addition to the normal requirements of healthy plant establishment:

1) There must be little or no demand for thinnings in the area concerned. If thinnings are required the method is less productive than clear felling and planting; if large timber and veneer logs are in demand the system is suitable:

2) the species planted must be fast-growing (five feet of height per year as a minimum), naturally straight and self-pruning; i.e. generally of the colonising or gap-filling light-demanding type:

1/ Dawkins, H.C. (1958). The volume increment of natural tropical high forest and the limitations on its improvement. Quoted in Lamb (1958) Commonwealth Forestry Review, 48 (1).

3) there must be no upper canopy; only celar-felled, clear-poisoned or low secondary forest is suitable:

4) the regrowth between the planted lines must be non-inflammable:

5) browsing animals must be absent, scarce or of negligible effect on planted trees.

Provided all five conditions are met, the method can cut the cost of a final crop to less than a third of what would be incurred by close-planting. The technique then requires the following:-

6) planting lines should be spaced equal to or slightly more than - up to 20 per cent more is reasonable - mean crown diameter of healthy final-crop trees:

7) plants should be spaced along the lines at approximately 1/5th of the spacing between them to allow a selection of about one-in-four for the final crop. If poisoned overwood is likely to be abundant, as in very lightly felled natural forest being planted, then up to 30 per cent losses must be expected and spacing in the lines should be nearer 1/6th to 1/7th of spacing between lines:

8) planting lines must be well-cleared about six feet wide at first and made easy to move along, at least along one side of the planted trees by removal of most, if not all, woody snags. Once planted the lines must be kept clean and no over-hanging or threatening growth tolerated. Since this cleaning work is confined to a very small fraction of the area labour costs are low and several cleanings (sometimes up to six or seven are necessary) can be afforded in the first twelve months and are considered essential under most conditions:

9) plants must get away to a quick start. For most species this means using potted stock:

10) planting must follow immediately on clearing the planting lines. Poisoning of the upper canopy also should be timed to let in the light at the time of planting, not before. It is recognised, however, that this is not a precise possibility:

11) trees arising between the lines, unless superior in value to the planted species, must be cut or poisoned immediately they "threaten" the plants, i.e. before they overshadow them. The greatest threat is from Musanga, Trema and Macaranga. Similarly, climbers, over-arching from the bush regrowth beside the lines, must be vigorously cut back before they overshadow the plants, provide ladders for climbers or obstruct quick access along the lines:

12) thinning along the lines is a matter of selecting the stems of superior form and height.

The above five principles and seven technical guides must be taken very seriously. Line planting has very commonly failed and has a bad reputation among English-speaking tropical foresters because one or other of the principles has been flouted. If all the above are followed for a species sensibly chosen the technique has a very high chance of success in tropical forest conditions".

These guidelines have not been suspended, and most of their provisions were met in the early line-planting trials. However, provision 3 of Dawkins' list - there must be no upper canopy - is one of the most difficult to ensure. The absence of the upper canopy was noteworthy in the early line plantings on Gizo, but neglect of line opening and weed tree removal can very rapidly change the whole silvicultural site. The actual methods to be used were based upon the principles outlined above. Lines were to be cut 10 m apart, and trees planted at 3 m within the lines, giving a total maximum stocking of 330 per ha. Planting stock was mainly of potted stock raised from wildings collected by workers in the forest.

Thinning and natural mortality were expected to reduce the stocking to 110 per ha at age 4 years by which time the intensive weeding period of 3 years would have been over.

2.22 Species selection

The species selected were

Agathis macrophylla (in logged Agathis forest on Santa Cruz only).

Terminalia calamansanai

T. brassii

Campnosperma brevipetiolata

Eucalyptus daglupta

(Swietenia macrophylla)

These are all suited to short rotations (up to 15-30 years) and produce (except for Swietenia) utility grade wood with an accepted market, though prices are among the lowest of the main timber exported from the country:-

Table 2.2 Prices for SI timbers in 1979.

	US$/m^3
Gonostylus	175
Vitex	145
Pometia	135
Palaquim	105
Schizomeria	90
Calophyllum	82
Gmelina moluccana	80
Terminalia calamansanai	75
Campnosperma brevipetiolata	66
Terminalia brassii	60
Dillenia	54
Celtis	56

Source: F. Miller, private communication.

The choice of species was based on a large number of trials, the most relevant of which are on Gizo Island, Viru, Allardyce, Vanikolo, Rove. See para. 2.24 and Appendix C for further details.

2.23 Rotation length.

The rotation length for all species was set at 20 years, by which time logs of 40-50 cm diameter were expected.

2.24 Volume estimates

From the field trials, mean annual volume (MAI) increment estimates were obtained. The wide variety of sites and planting situations gave a range of values, but for the main species the growth rates were excellent by tropical standards. Table 2.3 below gives figures for mean diameter, height increment and individual tree volume increment. It should however be noted that the operational planting sites were mostly different from those of the trials.

Table 2.3 Growth figures from Silvicultural trials

Species	MAI diameter cm	MAI height m	Volume per tree (m^3) at 15 yrs	Volume (m^3/ha) assuming N = 110
Campnosperma brevipetiolata	2.2 - 3.1	1.2 - 2.1	0.6 - 0.9	66 - 99
Eucalyptus deglupta	2.2 - 4.8	1.4 - 4.2	0.7 - 0.8	77 - 88
Gmelina arborea	2.2 - 4.8	1. - 3.8	0.5 - 1.1	55 - 121
Swietenia macrophylla	1.4 - 2.6	0.9 - 2.3	0.4 - 0.8	44 - 88
Terminalia brassii	2.2 - 3.6	1.2 - 2.3	1.1 - 2.4	121 - 264
Terminalia calamansanai	1.5 - 1.9	2.6 - 3.1	0.4 - 0.8	44 - 88

Source: derived from figures in Marten and Thomson (1980) The Silvics of species.

The important points to note from these figures, most of which are derived from line planting experiments, are the minimum height increment of about one metre per year (but with frequent figures of 2-4 metres) and minimum diameter increments of about 2 cm. The average volumes per tree are an indication of final volume per hectare, depending on survival, but assuming that the planned final stocking of 110 stems/ha was achieved, total volumes per hectare could commonly attain 44m^3 to over 120 m^3 at age 15, and more at age 20. Most of the species could be expected to reach a diameter of 40 cm at 20 years old.

Swietenia macrophylla (Honduras mahogany) is a fine hardwood and its lower growth rate and longer rotation should be seen in this light. It is however susceptible to Ambrosia beetle in Fijian plantations.

2.3 Implementation Plan.

The programmes were implemented through Forest Division Staff, with planned planting targets as given in Table 2.1. As all the planting sites were on Government land, very few local inhabitants were available as forest workers, and the labour force of 150-200 was to be expanded to about 800 with the project fully operational.

Table 2.4 PHASING OF VEHICLE REQUIREMENTS

Required at	No	Type of Vehicle	Probable Source & Location NZ	NEW PWD STOCK	EXISTING PWD POOL
May 1976	2	5 ton tipper	1 Kol/1 Viru		
"	3	3-4 ton truck	1 Kol/2 Viru		
"	1	Grader (Ex LPT)	Kol		
"	2	Landrover/Pickups	1 Kol/1 Viru		
"	2	Tractors W.Front end loaders			
"	1	Tractor			1 Kol/1 Viru
"	3	Trailers			Allardyce 1 Kol/1 Viru 1A1
"	2	Towed Rollers			
"	1	Towed/attached Grader	?		1 Kol/1 Viru ?
"	8	Motor cycles			3 Kol/3 Viru 1AL/1 SC
"	1	3-4 Ton Truck/Tractor & Trailer			Santa Cruz (temporary)
Dec 1976 ? Early	2	3-4 ton trucks	2 Kol		
		3-4 ton trucks		1 Santa Cruz (replace T&T) 1 Vangunu	
	1	1 Tractor & Trailer		Vangunu	
	2	M/C		1 Van/1 SC	
Dec 1977 - 1978	2	3-4 Ton Trucks	2 Kol		
	1	3-4 Ton Truck		1 Santa Cruz	
	1	3-4 Ton Truck		1 Shortlands	
	1	Tractor Trailer		1 Shortlands	
	3	M/C		1 Kol/2 Shor	
1978	?5	Replace 2 Tippers 3 Trucks	2 Kol 3 VK		
Dec 1978	2	3-4 Ton Trucks	2 Kol		
	1	3-4 Ton Truck		1 Vangunu	
1979	?4	Replace 4 x 3-4 Ton trucks	2 Kol	1 Santa Cruz 1 Van	

Note: Replacement of Tractors & Trailers and Motor cycles after 2-3 years as necessary

Replacement of Trucks/Tippers after 40,000 miles either by withdrawal to pool or by sale locally

Source: PC(76)(13))

Vehicles. Vehicles were to be obtained specifically for the project but maintained under standard PWD conditions with a hire charge levied to cover maintenance and replacement cost. New Zealand aid provided some vehicles. The phased requirements for vehicles is given in Table 2.4.

Housing. Accommodation for workers was to be constructed using local timber on suitable sites in the main planting areas: Arara(Viru), Loloho, Poitete and Manigisi (Kolombangara) and Santa Cruz.

Staff and Labour

No details of the actual number of staff that it was estimated would be required over the period 1976 to 1979 were given in the project submission, although aggregated costs of salaries were. A provisional estimate of the staffing structure apparently envisaged by the Forestry Division was obtained from their files and is given in Table 2.5.

Table 2.5 Provisional Estimate of Project Staffing Structure

Post	Level	1976	1977	1978
Senior Forest Office	7	1	2	2
Forest Officer	6	3	3	4
Assistant Forest Officer	5	4	7	7
Forest Ranger I and II	3/4	19	24	29
Clark I and II	3/4	1	1	1
Junior Clark	2	5	5	5

Source: Draft Application for Development Aid 1974

The anticipated labour supervisory structure was for one Forest Ranger of eigh level 2 or 1 to be in charge of the following:-

1	Forest Worker	Level 2
3	Forest Workers	Level 1A
21	Labourers	Level 1B

No estimates of the anticipated number of mandays or forest workers who would be employed on the project were given in the project submission but these have been derived from the estimated labour costs given in the project submission and are given in Table 2.6.

Table overleaf/...

Table 2.6 Derived Estimated Mandays and Number of Men for Forest Regeneration Project 1976-1979

Location	Units	1976	1977	1978	1979
Kolombangara	M/days [1]	28650	56000	81150	91100
	No of men [2]	143	280	406	456
Viru	M/days	43400	43450	43450	43430
	No of men	217	217	217	217
Allardyce	M/days	4800	3750	1250	1250
	No of men	24	19	5	6
Santa Cruz	M/days	2370	10500	16050	17250
	No of men	12	53	80	86
Vangunu	M/days	-	8200	14200	23250
	No of men	-	41	71	116
Shortlands	M/days	-	-	8200	14200
	No of men			41	71
TOTAL	M/days	79220	121900	164306	190480
	No of men	396	610	821	952

Footnote: 1 Calculated by assuming a cost per productive Manday of $2 as indicated in project submission

2 Calculated by assuming 200 effective working days per year.

Training

No specific training element was included in the implementation plan, but the existing training structure was to be used in the normal way, and New Zealand aid was also to be used to train Forest Ranger recruits. Originally the proposal was for two batches of twelve rangers; the first to be ready for posting to the project in 1978.

Existing senior staff in the Forestry Division were to make use of the Commonwealth Forestry Institute Research and Management courses as required.

Implementing Authority

The implementing authority for the project for the Solomon Islands Government was the Forestry Division of the Ministry of Natural Resources since this was the organisation with the necessary skills and experience. However during 1974 the Forestry Division felt that this arrangement might not necessarily be the most appropriate for undertaking the project because of its size and the quasi-commercial nature of the investment. More specifically it was felt that the Government accounting and stores procedures, and staffing structures might not provide the flexibility or sufficient information for the successful implementation of the project. These possible limitations were not noted in the project submission to ODA. However the Government arranged for an FAO/UNDP Mission to visit the Solomons in 1975, to investigate the implications, and the advantages and disadvantages of setting up a statutory body to implement the project.

2.4 Financial and Economic Appraisal of the Project

2.41 Financial Appraisal

The financial appraisals were undertaken for the whole of the proposed re-stocking programme covering the period 1976 to 1985 even though the project was only for the period 1976 - 1979. The reasons given for this were that the area had to be large enough to be commercially viable; some of the fixed investment made during 1976 - 1979 will be used in the second stage and expenditure prior to 1976 was considered to be mainly research.

Costs

The costs used in the appraisal were those projected for 1976 to 1979 in the project document, and were based on 1975 prices. A detailed breakdown is given in Table 2.7. Further estimates were made at 1975 prices for planting and maintaining the whole of the remaining area of government land beyond 1979, and the results are shown in Table 2.8.

Volume projection

In the main appraisal it was assumed that the trees would be grown on a 20 year rotation and would yield 140 m^3/ha at the time of clearfelling on the basis of the line planting proposals outlined in section 2.2. It was recognised that both lower and higher yields might be achieved and probabilities were attached to the various outcomes as shown in Table 2.9, and this gave an expected outcome of 138 m^3 per ha. which was rounded to 140 m^3/ha.

Table 2.7 **Estimated Project Costs by Categories in 1975 Prices**

(S.I. $)

	1976	1977	1978	1979	Total
1 Wages (Field Operations)	159,000	244,000	329,000	382,000	1,114,000
2 Salaries	32,900	47,500	60,200	64,200	204,800
2a OSAS	33,050	30,200	47,100	22,900	133,250
3 Materials & Equipment	43,900	36,400	46,200	44,600	171,100
4 POL Diesel & MM	5,000	10,000	12,700	13,050	40,750
5 MPV (Depreciation?)	30,000	44,300	56,900	59,300	190,500
5a Workshop Equipment	10,000				10,000
6 Travelling & Transport	21,700	29,100	35,500	37,000	123,300
7 Buildings (includes Labour)	159,000	152,100	60,000	5,000	276,100
8 Boats and Outboards	3,150	2,600	4,050	1,200	11,000
9 Miscellaneous & Contingencies	4,050	6,800	8,250	8,350	27,450
Total	501,750	603,000	657,900	637,600	2,402,250

Table 2.8 **Estimated Cash Flow of Project at 1975 Prices for Restocking Government Land**

Year	Estimated Expenditure (SI $'000)	Estimated Income (SI$'000)
1971	501	
72	600	
73	657	
74	635	
1980	720	
81	736	
82	720	
83	565	
85	344	
1985	129	
86	104	
87	85	
88	73	
89	59	
1990	44	
91	29	
92	15	
93	5	
94		960
1995		1,440
96		1,440
97		1,440
98		1,440
99		1,440
2000		1,440
01		1,440
02		1,440
03		1,440
04		1,440
2005		1,440
06		1,440
07		1,440
08		1,440
09		1,440
2010		1,440
11		1,440
12		960
TOTAL	6,027	23,520

Source: ODA Project Committee Submission 1975

Note: Income estimates are based on volume from areas planted from 1976 onwards.

Table 2.9 **Projected Timber Yields and Probabilities**

(i)	Estimated yield of Logs m^3/ha	126	144	140	147	154
(ii)	Probability	0.15	0.25	0.4	0.15	0.05
(i) x (ii)		19	33	56	22	8
	Expected Volume Yield			138 m^3/ha		

Source: ODA Projects Committee Submission 1975 and Forestry Division DTM 1/73

Rotation Length and Phasing of Harvesting

In preparing the estimated income in Table 2.8, two different ways of phasing income were examined. One was based on the assumption that the re-stocked area of land would be limited to 48,500 ha. and harvesting would need to be on a sustained yield basis, i.e. an equal area basis over 20 years, and the other involved the assumption that the trees would be felled when they reached 20 years of age, i.e. the areas felled each year would coincide with the areas planted 20 years earlier. The former was considered the more appropriate assumption and is the basis of Table 2.9. In this, it is assumed that approximately 2,400 ha. are felled each year apart from the first and last years, and crop rotation lengths will vary between 20 and 36 years. In retrospect, this is certainly the most realistic assumption of the two, but the projected volume production was left unchanged at 140 m^3/ha (the estimated volume of the crop at age 20), although rotation lengths would extend up to 36 years in some cases. The projected volumes in the project appraisal must therefore be considered to be significantly underestimated. It is however difficult to quantify the extent of this precisely.

Income

It was assumed that the Government would charge a levy or stumpage on the volume of standing timber which would be logged and marketed by private companies who would also be responsible for local processing. The stumpage rate which the Forestry Division expected was $4.24 per m^3 and comprised the residual that would remain after logging companies' operating costs (including profits) have been deducted from the selling price of timber.

In calculating the price of harvested timber on which the stumpage was calculated, no real price increase from those prevailing in 1972 was assumed. At that time, the stumpage rate levied on timber was $1.32 per m^3. In 1975 prices this was equivalent to $1.92 per m^3 which was very close to the actual stumpage of SI $1.85 per m^3 in 1975.

It was also assumed that there would be cost savings for companies when harvesting plantation crops compared with natural forests which would allow the stumpage to be raised by $1.94 per m^3. This would be made up of :-

(i) Saving in road costs through re-opening existing roads which would amount to $0.88 per m^3.

(ii) Extraction costs would be lower because the trees would be

planted closer together and in straight lines and they would therefore be more easy to handle compared with the low density random scatter of trees in the natural forest. Estimated cost savings of approximately 25% were assumed to be equivalent to $1.05 per m^3.

In addition it was assumed that the crops would achieve a higher price on world markets because the trees would be more uniform and of better quality and this would allow the Government to increase the stumpage by an extra $0.44 per m^3 without difficulty.

Financial Appraisal Results

It was estimated on the basis of the cash flow projection in Table 2.8 and the assumptions given above, that the project would provide a financial yield of 5.5%. If harvesting of the crop was not undertaken on a sustained yield basis, but was related to a 20 year rotation and the actual planting years, the financial yield would be 7%.

2.42 Sensitivity Analysis for Financial Appraisal

Possible variations in the principal assumption relating to rotation length, yield and stumpage were also investigated.

Rotation Length

The Forestry Division considered that on the tree growth data available by 1975, rotation lengths of 15 years might be possible and the impact of this on financial yields was investigated.

Yield

The Forestry Adviser at ODA considered that yields of 140 m^3/ha might be over optimistic particularly during the project period because of the rapid expansion of the project which would involve amongst other things, the recruitment and training of more workers and staff. Therefore the impact of obtaining sawlog yields of only 105 m^3/ha were also examined.

Stumpage

It was recognized that this would depend on the future price of timber which was difficult to forecast so far ahead. However since projected stumpage depended to a large extent on achieving cost savings, the impact of reduced logging cost savings of $1.05 per m^3 was examined by assuming future stumpage levels would be only $3.18 per m^3 compared with $4.23 per m^3 in the main analysis.

The results obtained by varying these assumptions are shown in Table 2.10 overleaf.

Table 2.10 Financial Rates of Return (to nearest 0.5%) Resulting from the Sensitivity Analyses

Stumpage Level	Rotation Length & Timber Yield per Hectare			
	15 years		20 years	
	105 m^3/ha	140 m^3/ha	105 m^3/ha	140 m^3/ha
$ 3.18 per m^3	4.5%	6.8%	3.0%	4.5%
$ 4.23 per m^3	6.5%	8.0%	4.5%	5.5%

Source: ODA Projects Committee Submission 1975

Subjectivity probabilities were attached to those outcomes by the Forestry Adviser and DTEU in which it was considered that a 20 year rotation was three times more likely than a 15 year one, and equal weights were attached to the outcomes for the other parameters.

The expected financial rate of return was then calculated to be 4.9% based on the probability distribution shown in Table 2.11

Table 2.11 Probability Distribution Assumed for Calculating the Expected Financial Rate of Return

(i) Financial Rate of Return	3%	4.5%	5.5%	6.5%	8.0%
(ii) Probability of Occurring	0.188	0.438	0.188	0.125	0.063
(i) x (ii)	0.564	1.971	1.034	0.813	0.504

Source: ODA Projects Submission 1975

2.43 Economic Appraisal

The economic appraisal, like the financial appraisal, was undertaken for the whole of the proposed re-stocking programme covering the period 1976 to 1985.

Costs

Apart from the price of unskilled labour, economic costs were assumed to be identical to the financial costs.

Personal emoluments, with supplementation payments included where applicable, were considered to be satisfactory approximations to world prices.

The financial cost of petrol, diesel oil, etc., used by Government is shown net of tax.

The cost of imported equipment included some small customs duties on some items but these were not considered to be large enough to warrant attention.

Careful consideration was given to the selection of the shadow wage rate (SWR). Forestry Division estimates based on local research had indicated a rate of 40 cents per day. Subsequent limited evidence suggested that it might be closer to 50 cents per day, and it was agreed by the Solomon Islands Planning Office and the DTEU that this latter figure should be used. This compared with an actual average daily labour cost of $2.00 on a wage scale which ranged from $1.68 to $4.64.

The estimated costs for the programme are shown in Table 2.12.

Benefits

The stumpage rate used in the financial analysis was calculated as the residual standing value for the trees after subtracting estimated average production costs from estimated product price. It was assumed that so long as the Solomon Islands sawlogs remained competitive at that price in world markets (most was destined for export), the residual of $4.23 per m^3 would be a reasonable measure of the world net price for standing timber. The estimated benefits under the same rotation length and yield assumption of $140 m^3/ha are also shown in Table 2.44.

It was felt that other benefits which could not be included in the analysis would flow from the whole programme of which this project is a part. These are given in Section 2.45.

Economic Rate of Return

The economic rate of return for the project using the cash flow projection in Table 2.44 was 8%.

Table overleaf...

Table 2.12 Projection of the Economic Costs and Benefits of the Project at 1975 Values

YEAR	ESTIMATED ECONOMIC COSTS ($'000)	BENEFITS ($'000)
1976	366	
77	405	
78	410	
79	356	
1980	426	
81	424	
82	409	
83	306	
84	166	
1985	35	
86	28	
87	23	
88	20	
89	16	
1990	12	
91	8	
92	4	
93	1	
94		960
1995		1,440
96		1,440
97		1,440
98		1,440
99		1,440
2000		1,440
01		1,440
02		1,440
03		1,440
04		1,440
2005		1,440
06		1,440
07		1,440
08		1,440
09		1,440
2010		960
TOTAL	3,417	23,520

Source: ODA Projects Committee Submission 1975

Note: Income estimates are based on volume from areas planted from 1976 onwards.

2.44 Sensitivity Analysis for Economic Appraisal

As in the financial appraisal (Section 2.42), the effects of varying the assumptions of stumpage rate, yield and rotation length were investigated. The results are shown in Table 2.13.

Table 2.13 Rates of Return (to nearest 0.5%) Resulting from the Sensitivity Analyses

Stumpage Level	A Rotation Length & Timber Yield per Hectare			
	15 years		20 years	
	105 m^3/ha	140 m^3/ha	105 m^3/ha	140 m^3/ha
\$ 3.18 per m^3	8%	9.0%	5.5%	7%
\$ 4.23 per m^3	9.5%	11.0%	7.0%	8%

Source: ODA Projects Committee Submission 1975

It was also calculated that if a shadow wage rate of \$1.00 per day was adopted, the economic rates of return in the table would be lower by 1.5% in the case of those which are 8% and above, and 1% for the others. This was estimated to be equivalent to increasing costs by 29% and was felt to be evidence that the project was not sensitive to quite large increases in cost.

The same probabilities used in the financial analyses were attached to different outcomes and these are shown in Table 2.14.

Table 2.14 Probability Distribution Assumed for Calculating the Expected Economic Rate of Return

(i)	Economic Rate of Return	5.5%	7%	8%	9%	9½%	11%
(ii)	Probability of Occurring	0.188	0.375	0.025	0.063	0.063	0.063
	(i) x (ii)	1.034	2.625	2.00	0.567	0.599	0.693

Source: ODA Projects Committee Submission 1975

This gave an expected rate of return of 7.52%. It was also calculated that if a shadow wage rate of \$1.00 per day was included in the probability function, then the expected economic rate of return would fall to 7% calculated on the same basis as before.

The DTEU considered that a decision should be made on the basis of the expected rate of return, and felt that the accounting rate of interest for the Solomon Islands would be above 7%.

The project was recommended for approval, and the DTEU accepted the rate of return after bearing in mind the relative poverty of most Solomon Islanders, the unquantified benefits, and the likelihood that future planting programmes would be more productive.

2.45 Other Non-Quantified Benefits

Considerable and important benefits, which were in addition to those included in the analysis of quantified costs and benefits, were felt to be likely to result from the restocking programme. These were:-

1. There would be a potential yield of pulpwood from material not used as saw or peeler logs which was not included in the analysis.

2. As the analysis included stumpage revenue only on the benefit side, there would be additional benefits from harvesting and local processing of the produce. These were likely to be considerable in terms of employment, export earnings and government revenue, additional to stumpage.

3. The project should allow the development of more productive silvicultural systems.

4. Training of personnel for the restocking work is an integral and important part of the project in the early years, and therefore since costs of this training were included in the project costs, the training output would be an additional benefit.

5. The first plantation crop and its harvesting would create conditions enabling more intensive and productive use of the land to be economically feasible, whether for further forest crops or other uses.

6. The programme would encourage the existing timber industry to invest in large scale local processing for timber from the natural forests since they would have some assurance of future local supplies.

7. The programme should attract additional investment in planting new forest crops sources outside the Government lands.

8. There would be a considerable advantage from the provision of employment in rural areas. While a reduced opportunity cost of labour was assumed in the economic analyses by use of shadow wage rate, the location of employment in rural areas was considered to be an additional economic benefit through saving of social costs through unplanned and unproductive urban spread. It was separately felt to be of very considerable social and political importance.

2.5 O D A Project Submission Undertakings

It was considered imperative that progress of the project should be monitored by regular visits by ODA's Forestry Adviser, and in addition approval was given subject to the following:-

(i) that the programme be rephased should the arrival of critical skilled labour and vehicle inputs be delayed beyond the assumed starting date (para 30 project document)

(ii) that the planting and tending operations are in no way skimped in order to achieve greater acreage (paras 17 and 37 project document)

(iii) that the planting rate is curtailed if there is the slightest fear that satisfactory establishment is not being achieved (paras 17 and 37 project document)

(iv) that the area currently being logged be replanted first and only thereafter the backlog (para 36 project document).

Of these, items (ii) (iii) and (iv) were to be monitored by the Forestry Adviser during his regular visits.

3. Evaluation of Project's Objectives and Technical Basis

3.1 Validity of original objectives and strategy. Accepting the decision of SIG to reforest Government land, and not customary land, the objectives considered in detail in para 2.1., and the strategy designed to meet them would appear to be entirely valid for the whole period of the project. In particular, the adoption of an extensive method of working (line planting) was logical, as it is flexible both in meeting targets and in its acceptance of a variety of forest states following logging.

3.2 Validity of the silvicultural basis for the project. It is true that there are very few successful examples of the large-scale application of line planting in the tropics. The principle and rules quoted in para 2.2 are an indication of how difficult it is to meet all the requirements in any particular situation and a majority of tropical countries has sought the option of dense monoculture plantations for their future wood supplies.

In the Solomons however, and in particular on Gizo Island where the first outstandingly successful line plantings were carried out, Dawkins' specifications are met extremely well, i.e.

1. No demand for thinnings
2. Fast initial height growth - 1.5 m a year achieved early on many sites. All the species chosen (except Agathis) are straight, self pruning and natural gap-fillers.
3. The canopy was either felled or poisoned
4. It is virtually impossible to burn the Solomon Islands forests
5. Until the advent of cattle, there were no browsing animals.

Most of the other rules are met. However, in the matter of nursery stock the supply of young wild seedlings was unable to provide enough stock for transplanting to fill the gap in nursery production. It was also often difficult to obtain suitable seedlings to give the desired species mix.

3.21 Establishment technique. The assumption on land preparation (poisoning and line cutting), planting and weeding were sound in the light of previous experience. Although the climber Merremia was known, it was not an all-enveloping pest anywhere and carefully controlled and timely weeding, climber cutting and line opening provided quite adequate control. The project assumed a certain level of logging which did not include the removal of "super smalls", and intensive clearing followed by Merremia invasion had not been noted.

3.22 Validity of species choice. The species chosen all produced utility grade wood with market acceptance though juvenile wood of some species was not really known. A good deal was known about site preferences of the different species, and although Terminalia brassii was probably the only species with marked site

limitations (to wetter sites), the reliance on wildings and difficulties with seed of other species (notably Campnosperma brevipetolata which is the least site-sensitive species) led to inconsistencies in the distribution of species to sites.

The sudden rise of the Merremia climber problem which was not serious on the earlier sites planted, revealed that both the Terminalia species, especially T. calamansanai, are particularly susceptible to climber damage. C. brevipetiolata, as noted above, was in short supply, yet is the most resistant species to Merremia infestation.

4. Analysis of Project Design and Implementation

4.01 Planting Targets

The planting targets during the project period are shown in Table 4.1.below. The total project target for the period 1976-79 was 15790 ha (39000 acres) and the target for 1975 and the preceding years was 6072 ha (15000 acres).

The shortfalls in both targets is undeniable, but the achievements in planting 13143 ha were considerable. There was perhaps undue concern with planting targets and some neglect of weeding and maintenance, especially on Kolombangara. In addition shortfalls in planting in Kolombangara were partly due to unreliable harvesting.

Table 4.1 Planting targets and achievements to 1980, hectares

Year	Planting targets	Revised realistic estimate of Forestry-Adviser (1976)	Actual Planted	Cumulative +/-
Up to 1975	(6072)	-	(5181)	
1976	1620	1215	1718	+ 98
1977	3644	2429	1648	-1898
1978	4858	4040	4054	-2702
1979	5668	4858	3078	-5292
1980	-		2645	-2647*
	15790	12550	13143	

*outside project period

Source: Report PC(76 (13), 1976 plus comments by Forestry Adviser, and SIG records.

The distribution of all areas planted by the end of 1980, was:-

Viru	5929 ha
Kolombangara	6249
Allardyce	2229
Santa Cruz	2211
Gizo	1169
	17787 ha

The reasons for the shortfalls appear to have been largely administrative rather than technical, as detailed in subsequent paragraphs.

The proportions of different species planted in the Project areas from 1974-1980 are given in Table 4.2.

Table 4.2 Percentages of species planted

Species	Years 74	75	76	77	78	79	80
Campoosperma brevipetiolata	59	88	67	40	26	35	33
Terminalia brassii	19	7	17	19	15	11	16
T. calamansanai	22	5	13	7	8	21	17
Eucalyptus deglupta			3	20	26	8	8
Agathis macrophylla				13	24	24	22
Gmelina arborea							3
Swietenia macrophylla					2	1	-
Others					1	1	1

Source: SIG Forest Department Compartment Records

It will be noted that the percentage of C. brevipetiolata has dropped considerably due to a combination of seed problems, shortage of wildings and a move away from Allardyce as a major planting site (where the species was plentiful)

4.02 Reduced Survival

Appendix A contains details of survival by areas and compartments based on the PIP programme. The programme identified the total number of stems, and the number of "O.K." stems, the latter being those subjectively regarded as being of good quality for the final crop. The difference was one of opinion, and non "O.K." trees often recover. The overall figures, however, show lower survival rates than estimated, though the design of the sampling system made it difficult to apply the results to a whole compartment with confidence.

Table 4.3 Survival at the end of 1980 for line plantations

Station	Area ha	Average survival all stems per ha	Average survival OK stems per ha
Gizo	1169	84	51
Allardyce	2229	97	68
Viru	5929	-	105
Santa Cruz	2211	N/A	N/A
Kolombangara	6249	-	105

The reason for this reduced survival are central to this study and they are complex. The main reasons seem to be

(a) Differences in forest structure and logging pattern

(b) Resulting from this, differing levels of weed competition

(c) Variability of frequency and quality of weeding arising from organizational problems of staff, labour and vehicles.

(d) Variability of planting stock quality

Forest structure and logging pattern. Evidence has accumulated that logging intensity, that is the number and size of trees removed and the corresponding damage and canopy disturbance has adversely affected the replanting programme. The damage includes soil compaction, which in turn is affected by soil type and slope. The single major factor in survival is Merremia a climber of quite extraordinary vigour, and a factor that was not foreseen when the project was drawn up. The logging of "supersmall" logs which might appear to be desirable because of its enhanced utilisation, was also not envisaged in the original project. This has led to increased soil damage, and hence to increased Merremia growth, which in turn has reduced survival of the planted trees. This could not have been foreseen in the original submission.

Organisation and productivity of work force. All the areas felled and replanted were carried out on Government land, where there were no local inhabitants. All the workforce therefore had to be transported from other islands and housed.

The importance of quick replanting whilst the logging roads were still in good order has been referred to above, and the large areas clearly stretched the logistics of labour handling beyond efficient limits. New recruits to the work force, often from distant parts of the country, had little experience of forestry work; experienced senior staff were lost from the country after 1976, and there was a lack of supervisory staff for the increased work force. Increased work loads for the senior staff, over the building programme and vehicle procurement and maintenance for instance, led to poorer supervision of the basically poorer work force. The new supervisors trained with New Zealand aid did not become available until late 1978.

Quality of planting stock. Reliance on wildings for the bulk of planting stock meant that, in theory, increased areas of logging made available increased numbers of seedlings for replanting. In practice, natural regeneration is very uneven and in order to achieve targets unsuitable plants were often collected. Planning the planting programme was therefore made difficult. Lack of research and training led to poor nursery practice and some nursery stock was planted either too small, or with poor root systems.

The alternative and better approach to raising nursery stock is raising transplants from seeds. Seed collection was the responsibility of the Research Section (not part of the project), as was research. Since no research component was included in the project, seed problems were not studied immediately the problems became apparent. Terminalia calamansanai, Eucalyptus deglupta, Gmeline arborea presented no problems, but Campnosperma brevipetiolata has proved extremely difficult to raise successfully from seed. T. brassii was difficult to handle, but as the project progressed more success was obtained with the use of very frash seed.

The quality of nursery stock thus suffered both from the sudden expansion of the planting programme, and from the lack of research capability.

4.03 Permanent Inventory Plot Programme

A permanent inventory plot programme was initiated by the Forestry Division in about 1968. The system was designed to provide long term information on tree growth rates and to check on the original growth projections by randomly sampling 4 per cent of the area planted. The Research Section was responsible for setting up the plots and for undertaking the annual measurements.

The increased rate of planting from 1976 onwards placed a considerably increased burden both in time and manpower on the Research Section for which little allowance was made. This meant that the work programme ran behind schedule until a PSAS officer was appointed in 1979

The Management Section had no survey team to inspect restocked areas, and it was the responsibility of the officer in charge of each station to monitor crop performance and to plan the necessary work schedules for beating up (replacing failed trees), and maintenance.

Since the success of the project depended on achieving a final stocking of approximately 111 stems per hectare, or 140 m^3 per hectare, it was extremely important for management to monitor the progress of crop survival and development and in particular to have detailed information on the following:-

- survival after initial beating up.
- adequacy and frequency of maintenance operations.
- maintenance requirements if any in crops older than 3 years (the age when maintenance would no longer be required in the project submission).

It is considered that it would have assisted the successful implementation of the project if a separate inventory team had been set up at the start of the project under the control of the person in charge of the day-to-day management of the project. In this way, provided adequate staff and funds were available to cope with the increasing work programme, management would have been in a position to monitor the survival and development of the crop and to take appropriate remedial operations where survival and maintenance were found to be inadequate. Once maintenance operations were completed and crops were considered to have been successfully established, the permanent inventory plots could have become the responsibility of the Research Officer, but it is felt that this would not be entirely satisfactory since it would have required a division of responsibility, and the setting up and treining of a separate team.

4.04 Interplanting

To improve the poor stocking in certain of the compartments at Viru, the Forestry Division restocked approximately 400 ha in 1980 by interplanting between existing rows. This was carried out by cutting lines between the existing rows so that a final spacing of 5 m between rows would be achieved throughout the compartments. The areas were then replanted.

This spacing will provide a stocking, if survival and maintenance are adequate, which will be considerably in excess of the desired final stocking of 111 stems per hectare. This will therefore mean that the Forestry Division will be required to thin these trees at some future date which will be a net cost since there will be no market for the material. Unless this is carried out in 1983 or 1984, when trees will be small enough to be thinned using a bush knife or axe, these areas will need to be thinned using power saws. This in turn will require the purchase of all the necessary equipment from overseas and the training of men to undertake the operation. It is therefore felt that it would have been more desirable if

the existing lines had been re-opened and the area replanted at the original 10 m x 3 m spacing.

4.05 Size and location of camps. Camps were established as follows:-

Viru

Poitete

Manigisi

Lolobo

The ideal size of station was found to be about 190 men, but only after Poitete Camp, with its sophisticated infrastructure including free electricity, and about 800 men, had been found to be too large for one Range Officer to control.

The question of whether forest operations could be carried out by small groups operating from the sea, camping out and working independently of the road system was examined. It would be difficult to supervise and although the system is apparently very flexible, in practice the logistics of organising parties and support for unexpected events might prove difficult.

4.06 Roads, culverts and bridges. The maintenance of the logging companies' roads was a major factor in deciding the whole phasing of the project. The problems of maintenance were more severe on Kolombangara than at Viru or Gizo, mainly due to the frequent water courses running from the volcanic peak.

Difficulties were experienced over the supply of equipment from PWD, with contractors working in remote areas, and the use of the forestry workforce frequently led to neglect of tending operations.

It is not possible to quantify the effects of these problems in terms of plantation performance. The posting of the Plantation Officer in Honiara certainly made supervision of field stations, especially Kolombangara, more difficult, and each difficulty was cumulative in reducing the effort that could go into plantations.

4.07 Plant, Boats and Vehicles

No major problems were experienced with plant such as generators which were supplied under New Zealand aid, nor with the canoes themselves. A certain amount of trouble was experienced for a time with outboard motors breaking down. The reasons for this are believed to have been design faults in the motors themselves and inadequate care and maintenance. However since they were not essential for the movement of personnel and equipment on a daily basis, this did not materially effect the outcome of the project.

It was recognised from as early as 1972 that the success of the restocking programme depended to a large extent on the provision of an adequate number of well maintained vehicles so that men and materials could be transported between the camps, working areas, and harbours. This was also clearly recognised in the project plan.

Inspite of this, the project suffered continuous difficulties. Table 4.4 shows the number of vehicles projected as being required against the approximate number of vehicles that were present in any one year. It must be stressed however that these figures are only averages and that they can give a very misleading position of the day to day or monthly position of vehicle availability.

Table 4.4 Comparison of Actual and Projected Vehicle Types & Numbers 1976-79

Vehicle		1976			1977			1978			1979		
		Kolo	Viru	St.Cruz	Kolo	Viru	St.Cruz	Kolo	Viru	St. Cruz	Kolo	Viru	St.Cruz
Bedford	Projected	1	2	1	3	2	1	5	2	2	5	2	2
	Actual	1	4	1	1	4	1	1	4	-	1	4	-
Isuzu (Tipper)	Projected	1	1		1	1	-	1	1		1	1	
	Actual	2(2)			2(2)	-	-	2(2)	-	-	4(4)		
Suzuki Jeep	Projected	-	-	-	-	-	-	-	-	-	-	-	-
	Actual	3(3)			3(3)	2	-	3(3)	2	-	5	-	1
Tractor & Trailer	Projected	2	3	-	1	1	-	1	1	-	1	1	-
	Actual	3(2)	1	-	4(2)	1	-	4(2)	2	2	4(2)	1	1
Motor Cycles	Projected	3	3	1	3	3	2	4	3	2	4	3	2
	Acutal	4	5	1	7	5	1	3(3)	4	1	6	4	1
Land Rover	Projected	1	1	-	1	-	-	1	1	-	1	1	-
	Actual	-	-	-	-	-	-	-	-	-	2	2	1
Grader	Projected	1	1	-	1	1	-	1	1	-	1	1	-
	Actual	1	1	-	1	-	-	1	-	-	-	-	-

Figures in brackets indicate the number of vehicles supplied by N.Z. Governmen

NOTE: This table is based upon SIG estimated vehicle needs for the duration of the project and may differ in detail from Table 2.4

If the figures in the table are directly compared it would appear that at Kolombangara the project was forced to use tractors and trailers for transporting men and materials rather than trucks and this was considerably slower and less efficient. At Viru the availability of trucks appears to have been slightly better. A few more motor cycles were available than originally projected, but this appears to have been at the expense of small pick-up trucks. Overall there is no doubt that the project benefited greatly from the vehicles supplied under New Zealand aid although serious delays in the arrival of some of the vehicles beyond dates previously indicated did create a number of difficulties.

The day-to-day problems with vehicles experienced by the project staff were considerable and included:-

a) A very poor standard of vehicles supplied under hire by the Public Works Department. It was felt by some staff that PWD only supplied older vehicles because of the tougher operating conditions in forestry areas.

b) Maintenance difficulties. Because of the poor standard of most vehicles supplied, the vehicles were in constant need of maintenance and repairs. Vehicles were frequently broken down for several days or weeks until a mechanic could be sent from one of the PWD workshops at Gizo or Honiara. Arrangements were subsequently made for the Forestry Division to employ its own mechanics and use its own fuel in exchange for a reduced hire charge, and this overcame a number of difficulties.

c) Shortage of spare parts. This often meant that vehicles were off the road for some time while spare parts were shipped to the various stations. In some cases parts had to be obtained from overseas.

d) There were often long delays in the replacement of worn out vehicles by PWD which was not helped by the need to arrange the necessary shipping facilities between islands.

e) Strenuous operating conditions which meant that the effective life of vehicles was only 3 years compared with the 5 years assumed by PWD.

There is no doubt that difficulties with vehicles seriously affected the implementation of the project. Delays in getting men to their working areas did mean that effective working hours were reduced although task work rates were still employed so that the costs of delays were not always as great as if the men had been employed on a day rate. It is impossible to judge whether the original projections would have been adequate if all the vehicles projected had been supplied and were fully effective throughout the year. In view of the previously known difficulties with vehicles supplied by PWD, it might have been better to have increased vehicle numbers at each station to ensure that an adequate number of vehicles were functioning. The extra cost would have been relatively small in comparison with total project costs. The phasing of working hours and camping out were employed to overcome transport difficulties at some stations, but this only increased the administrative and supervision requirements.

It is apparent that PWD annual budgeting and ordering procedures are inappropriate for implementing a major development project with a phasedand costed programme, and greater consideration should have been given to this, particularly since the British Government also contributed to the cost of supplying vehicles to PWD.

4.08 Training. Before 1980 most of the staff had primary education only, which limited the training opportunities open to them.

For senior staff, most of whom were expatriate, advantage was taken of courses at the CFI as follows:

Research Course	Two officers (in 1965 and 1979)
Management Course	Chief Forest Officer, 1976. Deputy Chief Forest Officer, 1980, proposed but withdrew

No forestry graduate returned during the period but three recruits are currently studying at the University of Lae, Papua New Guinea, and are due to graduate in 1982, 1983 and 1984.

One officer is undergoing Diploma training in Fiji, and due to return in 1983.

For Range Officers, training has traditionally been carried out at the school in Fiji, but twelve Rangers were trained specifically for the project under N.Z. aid, at a specially-established school on Kolombangara. The New Zealand Government apparently offered to train a further twelve persons but the offer was not taken up. As a result, Forest Supervisors or Senior Forest workers had to be employed on Ranger's duties. In any case, the Rangers from the N.Z. programme only entered the service in 1978.

Three officers are at the Fiji School and due to return in 1982.

Training at the Forest Supervisor level. This was carried out at the Honiara Technical Institute and the training unit at Vevia ridge. The general view of the senior officers was that these courses are often irrelevant for the duties required in the forest, and were often pitched at too high a level, and in English rather than Pidgin. The trainees produced were as a result often ill prepared for practical work in the forest. This is the avenue of recruitment, and the Forest Department has little control over the course contents or the people selected. Many of the problems experienced with indiscipline and low output can be attributed to failures at this level.

Training at the clerical and artisan levels. Very little training other than on the job experience was undertaken, and none was specified in the project. Thus, book keeping, administration, accounting, storekeeping, vehicle maintenance and nursery work all suffered, and more senior officers became involved in these tasks.

Training at the forest worker level. No specific worker training programmes were specified in the project. Most of the plantation work can essentially only be done by hand, and the lack of any job analysis or work study is therefore surprising. Virtually all silvicultural work was on a fixed task basis, taking no account of site variation or weed intensity; many teams of workers apparently complete these tasks by 11 a.m. which not only leads to high unit costs, but also leads to unrest in the forest stations.

4.09A Staffing

Table 4.5 shows the original projection of staff required to implement the project, the maximum number of staff positions permitted according to the Establishment Register and the estimated number of staff by grades in post between 1976 and 1980. These estimates exclude the two mechanics (Level 5305) and the electricial (Level 3) since they were not directly involved in the field operations. These posts were not included in the original project estimates, but would have been included in the Establishment Register numbers. The estimates assume that restocking on Vanguna would start in 1979, and on Shortlands in 1978. Based on estimates in Section 2.43, this would mean projected Forest Ranger numbers in 1977 should be 22 and 24 in 1978.

The table shows that the project was implemented up until 1979 with approximately half the number of staff at all levels that were originally projected. The differences were most significant in Levels 3 and 4 where staffing levels were 52%, 37% and 28%

Table 4.5 Estimated, Allowable and Actual Staffing Levels by Grades on the Project Between 1976 & 1980

Post	Level	1976			1977			1978			1979			1980		
		Estimate	Estimate Register	Actual	Est	Est Reg	Actual	Est	Est Reg	Actual	Est	Est Reg	Actual	Est	Est Reg	Actual
Senior Forest Officer	7	1	2	2	2	2	1	2	2	1	N/A	1	2	N/A	3	4
Forest Officer	6	3	2	–	3	2	1	4	4	2	N/A	2	2	N/A	5	3
Assistant Forest Officer	5	4	4	2	7	3	4	7	5	4	N/A	6	5	N/A	6	2
Forest Ranger I	4	19	10	2	24	17	4	29	8	3	N/A	11	3	N/A	22	2
Forest Ranger II	3		13	8		—	8		14	3	N/A	12	14	N/A	8	17

FOOTNOTE: Projections were made assuming that replanting would begin on Vanguna in 1977 and in Shortlands in 1978

of the original projections in 1976, 1977 and 1978 respectively. This was particularly serious since the Forest Rangers were largely responsible for the field supervision of the implementation of the project. Staffing improved at the Forest Ranger level in 1979 which was the final year of the project, with the New Zealand training course finished, but even then only 17 were in post, (although not always fully effective because of holidays and sickness), which must be compared with the 29 originally projected for 1978.

The success of the project must therefore be considered to be even greater than the stocking figures alone show since the results were obtained with less than half the number of staff considered necessary originally. This resulted in considerably increased responsibility and work load for those at post and they certainly deserve considerable credit for what they achieved. It is also significant that most of the Forest Rangers on the project were not able to extend their education beyond primary level.

There is no doubt that greater attention should have been given to planning the staffing for the project, particularly when there was to be such a significant increase in the planting and maintenance programme. With hindsight it should have been obvious that staffing levels would not have improved to any significant extent until the New Zealand-run training course had been completed. It would therefore have been better if greater attention had been given at the start to the projection of staffing levels and the interaction with training courses.

4.09B Labour & Administration

The total number of man days recorded at each of the Forest Stations is shown in Table 4.6 along with the original projections, and the percentage variations. Both sets of figures exclude the labour element spent on constructing and maintaining buildings since this was identified and estimated separately under the category of buildings.

The table shows that, ignoring Vangunu and Shortlands, the total number of man days recorded each year fell below the total number of man days originally projected. At Kolombangara there were shortfalls of 31.8%, 20.2% and 27.2% in 1976, 1977 and 1978 respectively, and it was not until 1979 that the labour force came up to the strength originally projected. At Viru the shortfall was only 9.4% in 1976 but rose to just over 20% in 1977 and 1978, and was reduced to 16.6% in 1979. After a slightly slow build up in the operation at Santa Cruz, total man days were above projected totals in 1978 and 1979.

The application of the recorded man days is also of considerable importance. No separate estimate of the number, or percentage of the total number, of mandays spent on direct and indirect forest activities was shown in the original project document. An analysis of the physical productivity of the direct forest operations is given in Section 4.10.

Indirect forest activities are considered for this purpose to include office work, driving vehicles, building construction and repair, research, road repairs, holidays, sick pay, public holidays, wet time. However an analysis of the situation between 1976 and 1980 was possible using Forestry Division data and the results are shown in Table 4.7.

Table 4.6 Actual Mandays Recorded Annually by Forest Station between 1976 and 1980 Compared with Original Estimates

Forest Station	1976			1977			1978			1979			1980		
	Est. Man Days	Act. Man Days	% Variance	Est. Man Days	Act. Man Days	% Variance	Est. Man Days	Act. Man Days	% Variance	Est. Man Days	Act. Man Days	% Variance	Est. Man Days	Act. Man Days	% Variance
Kolombangara	28650	19542	-31.8	56000	44663	-20.2	81150	59079	-27.2	91100	93076	+ 2.2	-	91890	
Vira	43400	39323	- 9.4	43450	34322	-21.0	43450	34514	-20.5	43450	36927	-16.6	-	39756	
Allardyce	4800	5534	+15.3	3750	-		1250	-		1250	-		-	-	
Santa Cruz	2370	284		10500	9556	- 9.0	16050	17241	+ 7.4	17250	19944	+15.6	-	20026	
Vangunu	-	-		8200	-		14200	-		23250	-		-	-	
Shortlands	-	-		-	-		8200	-		14200	-		-	-	
Totals Excluding Vangunu & Shortlands	79220	64401	-18.7	113700	88541	-22.1	141900	110834	-21.8	153050	149947	- 2.0		151672	

Footnote: Mandays recorded for building construction and maintenance have been excluded to allow comparison with original estimates.

Table 4.7 Percentage of Mandays spent on Indirect Forest Activities including Buildings

Station	1976	1977	1978	1979	1980
Viru	26.4%	29.9%	32.5%	44.7%	45.7%
Kolombangara	48.4%	34.2%	26.2%	28.3%	27.8%
Santa Cruz	-	20.9	24.2%	30.4%	31.8%

This shows that at Viru there has been a significant increase in the percentage of the total mandays spent in indirect activities between 1976 and 1979. For Kolombangara the high figure in 1976 is accounted for by building activities in establishing the camps, but since then there has been a fairly constant percentage. The large size of this operation cannot be the only reason for this since rather similar percentages were obtained at Santa Cruz. Overall there appears to have been a steady upward increase.

Table 4.8 shows a breakdown by operation of the time spent on different indirect activities expressed as a percentage of the total time recorded on all indirect activities. It is apparent from this that annual holidays, sickness, public holidays and wet time account for between 35% and 60% of the total man days recorded as indirect activities. Over the period 1976 to 1979 the percentage appears to be fairly constant for a particular station. At all stations however there appears to be an upward trend in the amount of time spent on "other" activities such as road repairs, and permanent inventory plots and this requires some further investigation. The amount of time spent on office work, driving and buildings after camps have been established appears relatively small and consistent for any station.

Table 4.8 Mandays Recorded by Operation Shown As Percentage of Total Indirect Mandays

Station	Activity	1976	1977	1978	1979
		Percentage			
Viru	Office	6.8	7.9	11.0	6.7
	Drivers	14.1	14.8	14.3	8.8
	Buildings	26.5	10.9	8.3	10.5
	Other	5.8	23.1	29.3	32.9
	Overheads	46.8	43.3	37.1	41.1
Kolombangara	Office	0.4	2.0	5.8	4.5
	Drivers	5.1	10.2	14.2	9.7
	Buildings	66.2	18.6	6.7	9.3
	Other	12.9	28.2	37.4	31.2
	Overheads	15.4	41.0	35.9	45.3
Santa Cruz	Office	-	2.1	4.1	3.1
	Drivers	-	7.0	4.5	7.3
	Buildings	-	67.4	19.7	5.5
	Other	-	1.9	11.5	24.3
	Overheads	-	21.6	60.2	59.8

Footnote: 1. Other - includes permanent inventory plot measurement, road repairs and other miscellaneous items.

2. Overheads - covers annual holidays, public holidays, sickness and wet time.

Administrative back up for the project was fairly minimal as the figures in Table 4.8 indicate. At Headquarters in Honiara there was one person employed in dealing with personnel records, 1 on stores, and 1 almost full time, on wages and accounts. At Kolombangara there were a further 3 people for wages, costings and typing, and from 1978, the same arrangements were adopted at Viru. With labour forces of approximately 150 men at Viru and 300-400 men at Kolombangara, the administrative back-up was relatively restricted. While this is in sharp contrast to many projects where the administrative overheads tend to become excessive, it is felt that better physical and accounting controls might have been obtained if the administrative back-up had been slightly greater.

4.10 Physical Productivity Targets for Operations

Estimates were made of the physical productivity targets for different operations when preparing the project proposals. These were based on an analysis of the average physical productivities actually recorded for different operations between 1968 and 1973. Task work rates were reviewed in October 1975 and these took account of the different physical conditions that might be encountered. A comparison of the two is shown in Table 4.9. These figures may have been revised subsequently, but no information was obtained on this.

Table 4.9 Comparison of Project Estimated Productivities with 1975 Revision by Forestry Division

OPERATION	Project Target mdays/ha	1975 Revision		Productivity Targets in mdays/ha
		Condition	Quantity per m/day	
Control line cutting		Easy	400m	0.1
		Difficult	300m	0.1
Trace Cutting	5.4	Easy	1200m	0.8
		Difficult	1000m	1.0
Poisoning		Very easy	400m	2.5
		Easy	360m of 10m	2.8
		Slightly difficult	300m wide	3.3
		Difficult	250m strip	4.0
Line Opening	7.2	Easy	400m	2.5
		Average	350m	2.9
		Difficult	300m	3.3
Planting (potted nursery stock)	2.5	Block 1	200 plants	1.7
		Block 2	150 plants	2.2
		Block 3 and beyond	100 plants	3.3
Planting (wildings)	2.5	Easy	275 plants	1.2
		Moderate	240 plants	1.4
		Slightly difficult	200 plants	1.7
		Difficult	160 plants	2.1
Maintenance (full)	On a yearly basis only	Easy	1600m	0.6
		Average	1200m	0.8
		Difficult	1000m	1.0
Maintenance (climber)		Easy	1600m	0.6
		Average	1400m	0.7
		Difficult	1200m	0.8

FOOTNOTE: All estimates based on 10m x 3m spacing. (1)

It can be seen from the table that some slight increase in productivity was expected for control line cutting, trace cutting and poisoning, but substantial improvements were anticipated for line opening of the order of 50%. It is difficult to ascertain the reason for this but it is possible that the density of the logged forest was much less than in the period up to 1973 because a wider range of species and trees of smaller diameter ("super smalls") were now being removed by the logging companies.

Using Forestry Division records, the actual productivities for operations up to and including planting were calculated for each forest station between 1977 and 1979. The results, which are shown in Table 4.10 do not include 1976 data because there was insufficient time to analyse the data for that year.

The figures in the table show that the overall productivity was much higher than orighally estimated. In particular, productivity in line opening was much higher and accounted for much of the increase. However if the revised 1975 productivity figures are compared with those actually achieved, (Table 4.10), it can be seen that the two were relatively similar. Of all the operations line opening at

Table 4.10 The Estimated Physical Productivities of Different Forest Operations Compared with Original Targets 1977-79

OPERATION	Target m/day/ha	Physical Productivities measured by m/days/ha.								
		1977			1978			1979		
		Kolombangara	Viru	St Cruz	Kolombangara	Viru	St Cruz	Kolombangara	Viru	St. Cruz
Control Line		0.3	0.3	0.6	0.4	0.8	0.4	0.7	0.7	0.3
Trace Cutting	5.4	1.0	0.9	1.0	1.1	0.9	1.0	1.1	0.8	0.9
Felling		3.3	3.4	5.9	2.5	3.4	4.7	3.2	3.2	3.3
Line Opening	7.2	4.0	3.7	3.0	5.0	3.2	3.2	5.4	3.4	2.8
Planting	2.5	2.2	1.8	2.1	2.2	1.8	1.7	2.1	2.1	1.3
Beating Up	1.0	1.0	1.0	0.5	N/A	N/A	N/A	N/A	1.3	N/A
TOTALS Excluding Beating Up	15.1	10.8	10.1	12.6	11.2	10.1	11.0	12.5	10.2	8.6
% Variance from Target		-28.5	-33.1	-16.1	-25.8	-33.1	-27.2	-17.2	-32.5	-43.0

Kolombangara appears to have had the lowest productivity, even though logging was perhaps the most intensive there.

The productivity of maintenance operations could not be assessed because area information was not recorded with the man days. The compartment numbers were, but it is felt that it would not necessarily be correct to assume that in each instance that the whole compartment was maintained. Individual compartment record sheets are not considered to be a reliable source of data since there was no automatic system for up-dating records.

Based on the areas currently classified as stocked at each Forest Station, (Section 4.1), the maintenance manday requirements were estimated and compared with those actually recorded. In the project proposal it was estimated that plantations would require to be maintained for 4 years and therefore in estimating maintenance requirements for 1976, for example, it has been assumed that this will involve maintaining the areas planted in 1975 and 1974 and the basis of the following man day estimated:-

Year 1	5.4 m days/ha
Year 2	4.2 m days/ha
Year 3	3.8 m days/ha
Year 4	1.2 m days/ha on maintenance/thinning

The analysis for Kolombangara is complicated by the fact that the Cattle Under Trees (CUT) project began shortly after operations started up to 1976, but the estimated number of man days required makes no allowance for the reduced number of man days that resulted from cattle grazing. Therefore the figures are likely to be an overestimate. The results are shown in Table 4.11.

The percentage variance figures show dramatically differing results. At Kolombangara the number of man days spent on maintenance was over 70% higher in 1977, 1979 and 1980 than man days calculated from originally projected requirements even without allowing for any savings from the CUT programme. The reasons for this are not clear, but it may be a reflection of the allocation system for man days, or the fact that the maintenance programme was continually behind schedule, thus increasing the infestation of climbers. For example, it is not clear from the records how work on the CUT project was classified. Therefore the higher figures could be a reflection of the fact that the Forestry Division's contributions were higher than had been estimated. Other items such as research work and the maintenance of the JOAA trial may also be included in the total figure. However it would appear that maintenance requirements have probably been significantly higher than were originally anticipated (Section 4.2). In order to meet these maintenance commitments it would appear that p lanting targets were reduced, quite correctly, so that the existing investment could be safeguarded as far as possible.

Maintenance at Viru appears to have been significantly below target until 1980, and in 1978 this amounted to over 50% below. A similar situation has also existed at Santa Cruz.

Man day figures alone are not in themselves adequate measures of the effectiveness of operations since they give no indication of the quality of the operation. However it would appear that the lower survival than anticipated at Viru and Santa Cruz can probably be explained by the fact that the areas were not adequately maintained. A Kolombangara where different forest conditions may be present, some differences may be accounted for in the actual classification and recording of man day information, or because delayed maintenance led to increased infestations of Merremia.

Table 4.11 A Comparison of Recorded Mandays with Targets Calculated from Maintenance Schedules in the Project Plan 1976-80

	1976			1977			1978			1979			1980		
	Kolo[1]	Viru	St Cruz	Kolo	Viru	St Cruz	Kolo	Viru	St Cruz	Kolo	Viru	St Cruz	Kolo	Viru	Sta. Cruz
Estimated mandays required	2792	10834	-	3754	13656	1620	12765	15634	6476	16799	12941	9134	21023	12252	10279
Mandays recorded	2890	7525	-	6611	7591	277	14489	7320	2131	28617	9889	4197	36187	12598	6664
% Variance from Estimate	+3.5	-30.5	-	+76.1	-44.4	-82.9	+13.5	-53.2	-67.1	+70.1	+23.5	-54.1	+72.1	+2.8	-35.2

FOOTNOTE: 1 Kolombangara figures assume full maintenance of all areas according to original project plan. However 1641 ha. were part of the CUT programme and would have required less maintenance (Section 4.12).

4.11 Accounting, Control and Reporting

The accounting procedures used for the project were in complete accordance with the Solomon Islands Government's standard accounting procedure through the vote book system with the following heads:-

Personnel emoluments

Wages - by Forest Stations

Travelling and Transport - by staff, workers and freight

Hire of plant and vehicles - by stations

Materials and equipment

Fuel and oil

Buildings

Plant maintenance

Miscellaneous

This provides an entirely satisfactory way of controlling annual expenditure, and was all that could have been achieved with the number of staff available.

However the Management Officer would have been able to keep tighter control over costs on a monthly basis, and on individual operations such as the construction of buildings and the field operations if there had been a stronger accounting, control and reporting system, which would have provided him with up-to-date cost information so that he could take the necessary managerial decisions. While there are obvious dangers in developing a large administrative back-up for a project, it is believed that the employment of a qualified accountant on a relatively large project such as this would have been of considerable assistance, both in preparing detailed quarterly or half yearly budgets and in controlling the subsequent expenditure.

4.12 The Cattle-under-trees (CUT) programme

The palatability of Merremia to cattle was well known when the project was drawn up, and the use of cattle to reduce the weed problem in an integrated land use system makes a great deal of sense. Unfortunately, this promising development has been mishandled by the Forest Department, so that much of the area of plantations established on Kolombangara is now at risk through unco-ordinated expansion of cattle raising activities.

By the end of 1982, 1670 ha of plantations had been handed to CUT, plus 780 ha of land for use as pure pasture. The decision of the Ministry of Agriculture and Lands to increase the national herd, and its inability to use land under customary tenure for this development, have led to further demands for forest plantations for grazing.

These demands, plus the involvement of ADAB in the CUT project which essentially sees the forest plantation lands as a ranching area, could not have been foreseen.

A major report by ADAB was due in February 1982, a copy of which was promised for the consultants.1/It was understood however to contain proposals for heavy thinning of the plantations, and financial analyses for various options.

1/ This has now been produced but not sent to the Consultants.

Table 4.12.

ADAB Financial analysis of CUT alternatives.

Treatment	IRR Cattle only	IRR Cattle plus forestry
Control (trees at 10 x 3 m)	1.5%	5%
Trees at 6 x 3 approx.	3%	8%
Trees thinned to give 70% overhead light	5%	7%

Source: telephone conversation P.J. Wood/R. Brownhall of 27.1.82.

Neither the Forestry/ British Aid Division research foresters, nor ODA were consulted about the forestry options.

Cattle damage to planted trees.

Most of the areas enclosed as CUT areas are under Eucalyptus deglupta, and although comprehensive research was proposed before any large scale grazing took place, little was carried out. Evidence so far of cattle damage is therefore restricted both to species and to spacing, and a recent summary for Kolombangara is given in Table 4.13.

Table 4.13 Cattle damage in CUT scheme compartments Kolombangara.

Percentage of trees affected

Cpt No.	1980	1981
5a	20	24
6a	37	30
7a	35	18
8a	29	34
10b	-	23
12a	22	-
12b	45	-
13a	3	-

Source: adapted from report by J. Sandom for visit of Forestry Adviser, August 1981.

E. deglupta grows rapidly and is able to produce callus over the wound quite rapidly, but all trees felled in this condition exhibit heartrot or termite damage which would severely affect their marketability. Tree stocking is down to 20 stems/ha in places.

An environmental problem in the CUT area is increased sheet and gully erosion, with a stocking of 2 beasts/ha.

4.13 Research

Research did not form an integral part of the project, which relied upon the Forest Division's Research Section at Munda on New Georgia Island for research back-up, and also for the supply of tree seed for sowing in nurseries. These are the standard responsibilities of the Section for the whole country.

Several urgent research problems arose during the currency of the project, many of them on the island of Kolombangara, and the Research Division found it difficult to respond to these quickly, partly by reasons of staffing and partly because of the pressure of its existing research programme. They had, of course, produced much information on which the project was based (for instance the work on "Silvics of Species" by Marten and Thomson published in 1980 but available before that time).

The research problems and the action taken to meet them are detailed below. It is clear that outside assistance would have been needed for some of them anyway, but the existence of an "in house" research officer would have helped considerably with the identification of research needs, research planning and financial estimates, and would undoubtedly have speeded these processes up.

Merremia The rapid spread of this weed was not expected at the beginning of the project, and it contributed to many difficulties experienced. The actions taken, following visits by the Forestry Adviser, were a consultancy visit by Mr. P.J. Terry of the Weed Research Organisation in 1981, the development of a new system of forest evaluation before planting, the appointment of a NRSS trainee to test herbicides in 1981, and the appointment of an ODA student to study Merremia ecology and logging damage (also in 1981). These actions were all, of course, after the project ended.

Seed and nursery problems There were difficulties experienced in finding enough wild seedlings of the right species for the line planting programmes. With previous, smaller, planting targets, larger areas of forest could be searched for plants. Action taken was the development of a cooperative research programme with the Royal Botanic Gardens at Kew on seed problems in 1981.

Pests and diseases of plantation trees Some serious insect pests were found on Campnosperma brevipetiolata and Eucalyptus deglupta and an ODA Research Officer (Mr. M. Bigger of COPR) was appointed to work on Kolombangara in 1980.

Cattle under trees The possibilities and potential of using cattle to reduce weed growth - especially Merremia - are very great. However, a great deal of carefully designed research is needed before large areas can be placed under this management system with confidence. Much more information is required on species, stocking of trees, stocking of cattle, differences of soil types and planting of fodder plants. An ODA student was appointed to study these in 1980 but the system had been applied over many hundreds of hectares already by then. The system holds tremendous promise, but lacks experimental data.

4.14 Other Aid Donors

The New Zealand Government made a useful contribution to the forestry project through the provision of vehicles (Section 4.7) and the secondment of two expatriate officers who ran the training programme (Section 4.8), and Poitete Camp on Kolombangara from 1976 to 1978.

The aid was well co-ordinated with, and was conditional on the implementation of the ODA project. Although not a problem between 1976 and 1979 there could be potential difficulties in the future if different aid donors finance the planting and maintenance of separately defined areas since it would increase the accounting difficulties, and more importantly, could lead to staffing conflicts in that the better trained staff or more vehicles might be allocated to one or other project if further aid money was anticipated from one or other the aid donor for example.

The Cattle Under Trees Project (Section 4.12) was run by a manager provided by the New Zealand Government, and finance was provided by the Australian Government through the Australian Development Assistance Bureau (ADAB). This project went ahead with the agreement of all parties, but it is not clear whether the long term implications of the project were adequately considered, and it might have been useful to have had some formal procedure for co-ordinating this project. This may still be worth considering if the results of the ADAB financed review Mission which was in the Solomons at the end of 1981 conclude that the project should be continued. The report of the team should be carefully studied as it will have important implications for forest development on Kolombangara.

4.15 Costs and Cost Changes over the Project

Records of expenditure prior to 1971 were not easy to obtain, but it is estimated that a total of $19,500 was spent on the pilot planting project up to and including 1970. Table 4.14 shows the actual expenditure recorded by the Forestry Division for major items between 1971 and 1980. Annual totals accord closely with the annual statements of Development Aid which show the annual qualifying expenditure. Only in 1975 was there a significant difference of the order of $100,000 which was presumably financed by the SIG. The original allocation of aid money, with the supplementary to cover National Provident Fund contributions and increases in wages to cover housing rental, was estimated to have been exhausted by March, 1981.

The table shows that over the period of the project, approximately 64% of the costs have been on wages and salaries, 14% on vehicles and their fuel and maintenance, 8.5% on materials and equipment, and 8% on buildings, and the remainder on miscellaneous items. In practice buildings have accounted for a slightly higher percentage of total costs since the wages element of repairing and maintaining them was recorded in the wages category in 1973, 1974 and 1975, and this may have occurred in later years as well, but this cannot be checked.

Table 4.15 shows the cost estimates for the period 1976 to 1979, in 1975 prices which was included in the project plan. The original projections were based on the assumption that planting work on Vangunu and Shortlands would commence during the period, but in the event this did not happen for the reasons given in Section 4.1, and therefore the costs have been reduced where possible from those shown in Table 2.7 (Section 2.4).

Table 4.14 A Breakdown of Project Costs by Category in Actual Terms and in Percentages between 1971 and 1980 (B.I. $)

ITEM	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	TOTAL
	Cost in $										
Salaries	15,593 10.7	18,663 14.1	12,099 12.7	11,501 10.3	22,638 10.8	26,905 6.6	34,753 6.1	55,168 8.3	65,135 7.5	91,651 9.2	334,146 8.4
Wages	60,387 41.4	67,532 50.9	63,210 66.8	62,587 55.7	104,615 50.1	284,221 70.0	305,051 53.9	412,387 61.6	490,493 57.6	547,133 54.9	2,315,176 55.4
Travelling & Transport	4,133 2.8	4,870 3.7	3,387 3.6	3,729 3.3	5,677 2.7	10,972 2.7	11,338 2.0	17,818 2.7	16,804 1.9	31,616 3.2	110,136 2.6
Hire of Plant & Vehicles	9,721 6.7	9,804 7.4	5,495 5.8	11,905 10.7	15,111 7.2	20,909 5.1	21,561 3.8	39,539 5.9	76,212 8.8	92,386 9.3	302,803 7.2
Materials & Equipment	7,057 4.8	11,961 9.0	4,650 4.9	12,558 11.2	23,035 11.0	41,869 10.2	50,501 8.9	43,265 6.5	69,097 8.1	75,616 7.5	340,617 8.1
Minor Maintenance	1,882 1.2	169 0.1	177 0.2	864 0.7	6,099 2.9	8,941 2.2	5,448 1.0	NSI	NSI	NSI	23,580
Freight	(1)	(1)	(1)	(1)	4,270 2.0	13,081 3.2	13,110 2.3	7,118 1.1	20,000 2.4	26,020 2.7	85,215 2.0
Fuel	(2)	(2)	(2)	(2)	1,639 0.9	8,660 2.1	25,054 4.4	41,900 6.3	44,922 5.2	71,935 7.2	194,118 4.6
Vehicle Maintenance & Hire	-	716 0.6	241 0.2	-	-	-	-	20,517 3.1	32,049 3.8	20,337 2.0	82,680 2.0
Boats & Motors	2,961 2.0	2,213 1.7	-	1,478 1.3	-	3,212 0.8	NSI	NSI	NSI	NSI	9,864 0.2
Other Equipment	7,410 5.1	-	1,617 1.5	-	-	-	NSI	NSI	NSI	NSI	8,027 0.2
Buildings	36,824 25.3	16,554 12.5	(3) 1,990 2.1	(3) 7,376 6.6	(4) 24,611 11.7	69,081 16.9	74,034 13.2	38,487 4.5	40,732 4.7	31,915 3.2	334,124 8.0
Gratuity	-	-	2,040 2.2	222 0.2	1,[illegible] 0.7	-	-	-	-	-	3,630 0.1
N.P.F.	-	-	-	-	-	632 0.2	24,727 4.4	NI	NI	NI	25,359 0.6
TOTAL % Total	145,[illegible] 100.0	132,522 100.0	94,694 100.0	112,[illegible] 100.0	200,683 100.0	400,571 100.0	566,369 100.0	667,939 100.0	865,032 100.0	997,217 100.0	4,200,035 100.0

FOOTNOTES: (a) NSI is Not Separately Identified and NI is Not Identified
1. Freight included in materials and equipment and buildings
2. From mid 1975 Forestry Division provided fuel for PWD vehicles
3. Materials only. The wages element was included under wages.

In estimating the actual cash requirements for financing the project, certain assumptions were made about likely future rates of inflation. When attempting to check these against recorded rates of inflation it was found that there was little way of doing this. The only index of prices recorded by the Statistical Office was for Retail Prices in Honiara and it is doubtful whether this is necessarily a true measure of overall inflation in the Solomon Islands. However since wages and salaries are the largest single cost component of the project it may not be totally unrepresentative of local costs. The estimated and recorded inflation rates are given in Table 4.16.

Table 4.15 Estimated Costs in 1975 Prices for the Project Excluding those for Vangunu and Shortlands (S.I. $)

	1976	1977	1978	1979	Total
1 Wages (Field Operations)	159,000	227,600	284,200	307,100	977,900
2 Salaries[1]	32,900	47,500	60,200	64,200	204,800
2a OSAS[1]	33,050	30,200	47,100	22,900	133,250
3 Materials & Equipment	43,900	26,400	33,000	35,200	138,500
4 POL Diesel & MM[1]	5,000	10,000	12,700	13,050	40,750
5 HPV (Depreciation)	30,000	38,780	46,340	46,340	161,460
5a Workshop Equipment	10,000				10,000
6 Travelling & Transport[1]	21,700	29,100	35,500	37,000	123,300
7 Buildings (includes Labour)	159,000	79,000	33,000	5,000	276,000
8 Boats and Outboards	3,150	700	2,800	600	7,250
9 Miscellaneous & Contingencies[1]	4,050	6,800	8,250	8,350	27,450
TOTAL	501,750	496,080	563,090	539,740	2,100,660

Footnote: 1. No reductions in these items were possible to allow for the fact that operations at Vangunu and Shortlands did not start.

Table 4.16 A Comparison of Estimated and Actual Inflation Rates

Year	Project Estimates of Inflation	Inflation Measured by Honiara Retail Price Index
1976	9	4.3
1977	8	8.4
1978	8	7.2
1979	8	8.7

If it is assumed that the Honiara Retail Price is an adequate measure of the inflation the project faced, then it would appear that the original estimate were remarkably accurate apart from 1976. In order to compare how costs have moved in relation to original project cost assumptions the original cost estimates as shown in Table 4.15 have been adjusted by the two different sets of inflation rates shown in Table 4.16. This means that the estimates for wages, hire of plant and vehicles, materials and equipment, and buildings have been reduced to allow for the fact that no work took place at Vangunu or Shortlands during the period. No adjustment could be made to salaries or travelling and transport estimates as these were not separately identified in the project document. The results which are given in Table 4.17 show that there are significant variations of actual costs against budgets on a year to year basis, but in total between 1976 and 1979:

a) Expenditure on salaries was more than 25% less than originally projected, but the explanation of this is probably the number of staff on the project was less than projected (Section4.09A).

b) Wages were approximately 17.5% higher than projected over the whole period. It is also possible that the wages element of building costs was recorded under wages rather than buildings, which could explain the higher wage cost and significantly lower building cost.

c) OSAS payments were allowed for in the project submission, but were not recorded as a project cost by the Forestry Division.

d) Travelling and transport costs were approximately 25% lower than estimated but much of this may be accounted for by the fact that Vangunu and Shortlands did not commence operations during the period, but the original cost estimates could not be separately identified.

e) Hire of plant and vehicles was slightly more than 20% below budget. Part of this might be explained by the fact that vehicles were broken down for part of the time and therefore no hire charge was paid. Also the Division became responsible for the maintenance of its own vehicles during the project period, and if this item is included along with petrol, oil and lubricants, costs were approximately 240% above original projections even with Vangunu and Shortlands costs included. If the two categories are combined the cost incurred are only some 24% above estimate during a time when fuel prices have increased considerably faster than the rate of inflation world wide. Vehicles were projected for Vangunu and Shortlands and therefore costs are significantly higher.

f) Building costs were some 40% below these originally projected after allowing for inflation. It is believed that some of the building work was put out to contract and this may have been responsible for holding costs down. It was not possible to investigate the reasons in detail or to compare numbers of buildings against forecast.

Another explanation could be that the wages element of building construction and repair was recorded under wages category, but it was not possible to check on this.

Table 4.17 shows that costs are significantly higher than budget, and the man day figures show actual man days recorded have been below target indicating that the wages cost element has moved up considerably faster than inflation. Table 4.18 shows how actual annual average cost per manday compares with those based on the original projections.

Table 4.17

Comparison of Actual Costs with those Originally Projected[1]
Allowing for Estimated Inflation & Estimated Actual Inflation.

		1976	1977	1978	1979	1980	Actual Total as % Variance from
Salaries[2]	Actual	26,905	34,753	55.168	65.135	181.961	
	Project[3]	35,861	55,917	76,537	88,152	256,467	- 29.1
	Revised[3]	34,315	53,704	72,963	84,581	245,563	- 25.9
Wages	Actual	204,221	305,051	412,207	498,493	1,619,972	
	Project	173,310	267,931	361,325	421,675	1,224,241	+ 13.8
	Revised	165,837	257,327	344,455	404,592	1,172,211	+ 17.5
Travelling & Transport & Freight[2]	Actual	24,053	24,440	24,936	37,612	111,041	
	Project	23,653	34,257	45,134	50,804	253,848	- 27.8
	Revised	22,633	32,912	43,026	48,766	147,337	- 24.6
Hire of Plant & Vehicles	Actual	20,989	21,561	39,539	76,212	158,301	
	Project	32,700	45,652	58,916	63,629	200,897	- 26.9
	Revised	31,290	43,845	56,165	61,051	192,251	- 21.5
Materials & Equipment	Actual	54,022	55,949	43,265	69,897	223,133	
	Project	51,001	31,902	45,515	49,157	177,575	+ 20.4
	Revised	49,073	30,640	43,390	47,765	170,868	+ 23.4
Petrol Oil & Lubricants & Maintenance	Actual	8,668	25,054	62,417	77,771	173,910	
	Project	5,450	11,770	16,142	17,918	51,280	+239.1
	Revised	5,215	11,310	15,392	17,200	49,117	+254.1
Buildings[5]	Actual	69,081	74,834	30,407	40,732	215,054	
	Project	173,310	92,999	41,955	6,865	315,129	- 46.5
	Revised	165,837	89,318	39,997	6,590	301,742	- 40.3
Misc. & Contingencies	Actual	-	-	-	-	-	
	Project	4,050	6,800	8,250	8,350		
	Revised	-	-	-	-		

Footnote:

1. Estimates exclude projected costs for Vangunu and Shortlands unless indicated.

2. Project and Revised estimates include allowance for Vangunu and Shortlands.

3. "Project" estimates show original cost projections adjusted according to inflation assumptions in project document and "Revised" indicates costs adjusted according to the Honiara Retail Price Index.

4. OASAS payments were included in the original estimates but these were not recorded by the Forestry Division as a project cost.

5. Workshop equipment could not be separately identified, but it is believed to have been provided under NZ aid.

A breakdown of total costs is given in Table 4.14.

Table 4.18 Comparison of Actual Average Cost Per Manday with Original Projections

Year	Actual Average Cost per Manday 5.1 $	Projected Average Cost per Manday 5.1 $	% Variance from Projection
1976	3.17	2.70	+ 17.4
1977	3.45	2.36	+ 46.2
1978	3.72	2.54	+ 46.5
1979	3.32	2.75	+ 20.7
1980	3.61	-	

This shows that average costs per manday have increased considerably faster than predicted even taking into account inflation at the levels predicted in Table 4.16. It is however difficult to explain why the actual cost per manday dropped after 1978. Four possibilities are: that greater use was made of casual labour from 1979 onwards; planting on Santa Cruz was undertaken through labour paid by the Allardyce Lumber Company in 1979 and wage rates were less; more younger men were employed; or improved supervision once new Ranges became available from the training course.

4.16 Organisation and Implementing Authority

The organisation and staffing structure for the project, along with the administrative back up has been examined in Sections 4.09A and 4.09B. These arrangements were partly based on the experience gained up to 1974, when the restocking programme was relatively small, and partly on the requirements of the staffing structure of the Forest Division in its capacity as a Government Department.

The possibility of setting up a statutory body was considered at the start of the project (Section 2.34) and although the FAO/UNDP report was not accepted by the Solomon Island Government, there would have been a number of advantages for the administration of the project. In particular, it would have allowed the development of a more flexible staffing structure at Headquarters. For example, it would have been possible to recruit a project accountant and an administration manager which would have allowed the Forest Management Officer or Plantations Officer to spend more time on the technical staffing and training aspects of the project as well as on checking the physical targets such as tree survival percentages, and the productivity of operations.

It is not clear whether an increase in administrative staff at the Forest Stations would have been of assistance or whether this would have been possible within the existing Government structure. There is the possibility that with further administrative back-up, the person in charge of each station could have spent more time on planning and implementing the actual field operations, and that compartment records could have been kept up-to-date, and in some cases in more detail.

A further advantage of a statutory body could have been that it would have been possible for it to attract outside funds more easily to continue the planting programme, and it could also have acted as a contractor for individuals or co-operatives who wished to plant up customary land.

4.17 Effect of ODA Project Submission Undertakings

The project was approved subject to four major provisos listed in section 2.5 above. It appears that some of these were not precisely observed i.e.

The project was not rephased to take acount of late arrival of skilled staff

That planning went ahead despite evidence that weed growth was heavier than expected and that therefore weeding intensity might have to be higher.

5. Project Impact & Achievements

5.1 Stocking and Growth Projections

One of the main criteria for the success of the project must be whether the plantations will be adequately stocked at the end of the rotation. In the project plan "adequate" was considered to be a final stocking of approximately 111 good quality stems evenly distributed over each hectare to provide a final volume of 140 m^3/ha.

The inventory programme was brought up-to-date in 1979 and 1980 so that the stocking and growth projections could be assessed. This work was carried out in accordance with the Forestry Division's publication "Permanent Inventory Plots" as far as was possible.

There were a number of technical difficulties in undertaking this work and as far as can be judged, these were adequately overcome so that the results obtained, based on a 4% sample, are likely to give a reasonably accurate picture of the current stocking and growth of the plantations.

Stocking

In the assessments an estimate was made of the quality of the trees in the lines measured. A tree which was likely to produce a log suitable for sawing at maturity was called "O.K." Two stocking figures were therefore collected for each compartment. One is the average number of surviving stems per hectare, and the other is the average number of O.K. stems per hectare. In arriving at the number of O.K. stems per hectare, it must be recognised that this was a purely subjective assessment, and that trees not classified as O.K. may enter that category by the end of the rotation and vice versa. This is particularly true in compartments which were only recently established.

The results for the different forest stations are given in Appendix A, and the results are summarised in Table 5.1. The average number of surviving stems per hectare were not available for Viru and Kolombangara in detail, and no assessments have been carried out on Santa Cruz so far. The average number of stems per hectare was calculated on the basis of net (not gross) compartment areas. The two

are estimated to differ by, on average, about 10%.

There are significant variations in stocking in the areas planted to date. This is partly as a result of excessive creeper growth and a poor standard of maintenance partly because some planting espacements were wider than 10 x 3 metres 1/ and also for the reasons given in Section 4.02. It is also very important to recognise that the stocking figures given do not provide any indication of how well the trees are distributed throughout the planted areas. Casual observation would suggest that the stocking is often extremely good, close to roads and other main access points, but becomes gradually poorer with increasing distance down the lines.

Table 5.1 indicates that the form of the surviving trees is not always good. In the original proposals allowance was made for this, but with lower survival than anticipated poor form becomes more critical. The reasons for the poor form appear to be largely climbers, strangling the trees, and damage from falling limbs of poisoned trees as well as the inherent genetics of the tree.

In assessing the stocking figures for Allardyce, it must be remembered that the area was in the path of cyclone Ida in 1972, and many trees were damaged.

The figures for Kolombangara includes all compartments whether in the CUT programme or not. It is understood that a number of trees in the CUT areas which cover 1641 ha (or 26.2% of the planted area at 31.12.80) have been damaged by cattle and are also suffering from heart rot. The extent and significance of this for final yield projections is impossible to ascertain at this stage, since a long term policy for the area appears uncertain.

Yield Data

Height and girth increment data collected from the Permanent Inventory Plots, where the trees were large - enough is given in Appendix B by species and Forest Station. This shows that there is quite wide variation between compartments and even within species. This is to be expected particularly since most of the trees are still relatively young and maintenance work has not always been up-to-date, and in some cases, is required for longer than anticipated. It is therefore difficult to make a meaningful assessment of whether an average tree volume of 1.26 m^3 will be achieved by the time the trees are 20 years old. This target implies on average a girth increment of approximately 5 cm per annum, and timber height growth of approximately 1 metre per annum. The available growth information for *Campnosperma brevipetiolata*, *Terminalia calam ansanai*, *Terminalia brassii*, *Eucalyptus deglupta*, and *Agathis macrophylla* taken from Forestry Division *Silvics of Species* Reports, are given in Appendix C.

A complicating factor in determining whether the growth rates will be achieved is the effect of competition between trees where survival has been good and trees are likely to be left at the initial spacing of 10 m x 3 m.

1/ See Appendix A for details.

Table 5.1 Summary of Available Permanent Inventory Plot Stocking Information as at December 1980

FOREST STATION	STEMS STOCKING PER HECTARE	AREA IN HECTARES: ALL STEMS SURVIVING	AREA IN HECTARES: O.K. STEMS ONLY SURVIVING	NET AREA PLANTED (HA)	AVERAGE NUMBER OF O.K. STEMS PER HECTARE
GIZO	over 130	77	0		
	100-130	150	0		
	under 100	887	1114		
	TOTAL	1114	1114	1169	51
				1169 > 1114	
ALLARDYCE	over 130	670	210		
	100-130	372	312		
	under 100	1041	1561	2229	68
	TOTAL	2083	2083		
VIRU	over 130	-	1564		
	100-130	N/A	495		
	under 100	-	2883		
	TOTAL	-	4942	5929	105
KOLOMBANGARA	over 130	-	1260		
	100-130	N/A	533		
	under 100	-	1166		
	TOTAL	-	2959	6249	102
SANTA CRUZ	over 130	-	-		
	100-130	N/A	N/A	211	N/A
	under 100	-	-		
TOTAL			10,902	17787 ha	82

Source: Summarised from SIG Forest Department data reproduced in Appendix A

Notes: No inventory results for Santa Cruz were available at the time of preparing the report. Not all inventories of areas planted by 31/12/1980 at Viru, Kolombangara and Allardyce were available.

Table 5.2 Volume Projections[1] for the Project Based on Current & Theoretical Stocking Levels

Year of Clearfelling Based on 20 Year Rotation	Estimated Volume Based on Current Actual Stocking & Volume per Tree of 1.26 m^3 m^3(2)	Volume Based on Original Projections	% Variance from Original Projections
1986	491	2,100	- 76.6%
1987	9,140	20,580	- 55.6%
1988	13,295	31,920	- 58.3%
1989	81,359	145,180	- 43.9%
1990	99,607	51,240	+ 94.4%
1991	145,199	146,300	- 0.8%
1992	25,410	56,560	- 55.1%
1993	64,013	54,180	+ 18.1%
1994	107,446	122,080	- 12.0%
1995	69,679	89,180	- 21.9%
1996	207,668	245,560	- 15.4%
1997	190,682	156,660	+ 21.7%
1998	704,624	454,020	+ 55.2%
1999	434,118	317,380	+ 36.8%
2000	232,361	691,544	- 66.4%
TOTAL	2,152,731	2,584,424	- 16.7%

Footnote: 1. Volume calculations based on net areas planted since 1966

2. Assumes no thinning operations take place in the future. This table is based on the number of O.K. Stems per ha, except for Santa Cruz where the volume projections are based on 140 m^3/ha, as the % stocking of Agathis macrophylla is unknown.

The available evidence although limited suggests that the growth rate targets are being achieved and therefore it seems reasonable in the light of any firm evidence to the contrary, to assume that the target of 1.26 m^3 per tree will be achieved. Table 5.2 shows the predicted future volume based on the stocking figures in Appendix A, and assuming trees can achieve a volume 1.26 m^3 in 20 years from the time of planting. Also shown are the volumes which should theoretically have been achieved if the original stocking targets of 111 stems/ha had been

achieved. Over the whole period, total volume production on areas planted since 1966 is estimated to be approximately 16.7% lower than anticipated. In calculating stocking levels from areas to be cut from 1997 onwards full stocks, i.e. 111 stems per hectare has been assumed although this may be rather optimistic on the evidence of losses incurred in areas planted earlier.

5.2 Rural development

Roads. The benefits of maintaining the roads built by the logging companies are considerable. In particular, on Kolombangara the facilities of Ringi Cove - airstrip, port, post office, banking, medical etc. - are now available to all who are in reach of the road. The maintenance load has been considerable.

The situation in the main areas at the end of the project period was:

Viru	30 km Roads 6 m wide
Kolombangara	80 km Roads 7 m wide. 90 bridges and culverts
Santa Cruz	20 km roads

A small road system is also maintained at Gizo though its local impact other than on forestry is slight.

Stations shops, clinics etc.

Forest stations have been established successfully on New Georgia, Kolombangara and Santa Cruz.

New Georgia - Viru. Main station at Arara, 9 km from Viru harbour, housing over 170 people, with store, bakery, school and clinic, all run by the project. Subsidiary camp for 30 people at Pichecha 20 km away.

Table 5.3 Buildings at Viru and Kolombangara, 1981

Building type	Floor area ft.2	Location and No. Viru	Poitete	Loloho	Manigisi	Total
Married quarter	1008	-	2	-	-	2
" "	750	-	1	1	1	3
" "	600	3	-	-	-	3
" "	400	4	17	4	1	26
" "	-	2	-	-	-	2
Labour lines	800	5	6	6	2	3
"	-	3	-	-	-	3
Office/workshop	800	2	4	-	-	6
"	400	-	1	2	1	4
School, clinic	-	-	2	-	-	2
Totals		19	33	12	5	69

Source: Project proposal 14309 of 1981

Kolombangara. Main station at Poitete, 45 km from Ringi Cove, housing over 400 people, with electricity, piped water, store, post office, bakery, school and clinic, all run by the project.

Shipping and transport. The effects of road maintenance have been referred to above. It has also made possible the development of public transport, and provided facilities for other Government Departments, notably CUT.

Demands for ferry services by the growing communities on Kolombangara have also led to a regular service being provided economically to Log Pond 3 on the east of the island.

5.3 Staff, labour, skills and training. It must be stated that the opportunities for staff training have never been fully utilised (see also 6.6 below). Nevertheless in the context of staff changes at the onset of independence, attendance at the Research and Planning and Management Courses by various officers has enhanced their effectiveness in the field. The training of 12 rangers through New Zealand aid in association with the project provided a valuable nucleus of staff for enhanced planting work. Some development of worker and supervisory skills has followed from on-the-job experience.

5.4 Financial and Economic Evaluation of the Project

5.41 Financial Evaluation

The Solomon Islands has had a forestry restocking programme since 1966 which has been financed mainly by UK aid. The costs incurred between 1966 and 1971 were relatively small and since this was considered to be a pilot project, these costs have been ignored. As the annual planting targets have not been met since 1976 there are still some 2647 hectares of Government land to be planted. However the area restocked represents some 37% of the Government owned land potentially available, and therefore it is considered that the evaluation of the project can be undertaken without including the costs for restocking the remaining areas. In addition there appears to be some uncertainty about both the rate of future planting and the techniques which should be used.

The Cattle under Trees project involves some 1640 hectares on Kolombangara (Section 4.12), but for the purposes of this evaluation, it is assumed that the area will remain in timber production at least until the end of the rotation, and the trees will recover from any damage that they may have.

Costs

The costs used in the evaluation are those that have been incurred between 1971 and 1980 and which are given in Table 4.14. In undertaking the constant price evaluation 1980 price levels have been used with adjustments for inflation made according to the inflation rates given in Table 5.4.

Table 5.4 Estimated Inflation Rates 1971 to 1980 Based on Honiara Retail Price Index

Year	Estimated Inflation Rates % per annum
1971	4.3
1972	7.0
1973	3.1
1974	18.9
1975	10.1
1976	4.3
1977	8.4
1978	7.2
1979	8.7

Source: 1980 Statistical Year Book

Further expenditure will have to be incurred to maintain the existing plantations if the predicted stocking levels are to be achieved. However this is difficult to predict precisely at this stage. In the 1981-83 submission to ODA by the Solomon Islands Government, some estimates were given for annual maintenance costs up to 1983. It is not clear from these whether the figures allow for inflation or are based on 1981 prices. For the purpose of projecting costs it is assumed that they are in 1981 prices which have been increased by approximately 15% from those applying in 1980. A recent analysis prepared by the Forestry Division indicates, based on certain assumptions which have not been checked, that the best maintenance strategy is to look after re-stocked areas for up to 6 years from time of planting. If this is correct, then estimates for 1984 and 1985 are required. (A further year has been included to complete recurring maintenance). Using data from the project submission, the future maintenance costs in 1980 prices have been prepared for 1981 to 1986 and are shown in Table 5.5.

Table 5.5 Assumed Future Maintenance Costs for Existing Plantations in 1980 Prices (S.I.$)

Year	Estimated Maintenance Costs in 1980 Prices
1981	634,270
1982	507,195
1983	383,435
1984	321,563[1]
1985	217,216[2]
1986	133,439[3]

Footnote:
1. Assumed 1983 non wage expenditure plus 15183 mandays at $5 per day.
2. Assumed 0.75 of 1983 non wage expenditure plus 6596 mandays at $5 per day.
3. Assumes 0.50 of 1983 non wage expenditure plus 2055 mandays at $5 per day.

Estimates of income based on volume projections

There appears to be no case for changing the original assumptions of obtaining 140 m^3 of sawlogs on a 20 year rotation, assuming full stocking. Probabilities were attached to various outcomes in the original report, and there is no evidence currently available to indicate that significantly different probabilities should be attached to the different outcomes. Where permanent inventory plot data are available (Appendices A and B), which provides an assessment of the stocking of OK trees, volume projections have been based on this using a volume per tree of 1.26 m^3 and the net recorded areas. In the areas most recently planted, volume projections have been based on a final stocking of 140 m^3/ha since permanent inventory data were not yet available. The original projections assumed that all areas would be given a thinning/maintenance operation at age 4 to reduce the stems to their final stocking of 111 stems per hectare. Experience to date suggests that mortality reduces the number of stems to approximately this amount without any thinning. Projected future volumes are shown in Table 5.2 (Section 5.1).

Rotation Length and Phasing of Harvesting

In the project submission document it was assumed that the area for restocking on Government land would be 48,500 ha, and that harvesting would be on a sustained yield basis. This meant that almost equal areas would be clearfelled over a 20 year period. However the effect of this was that the age of the trees which would be clearfelled would vary from 20 to 36 years, but no change in the volume projections was made so that 140 m^3/ha was expected when a 36 year old crop was felled, which was the same volume as for a 20 year old crop. This was a particularly conservative assumption which would have significantly depressed the financial and economic results. The options for this evaluation are:-

(1) To assume that trees are clearfelled 20 years after planting.

(2) To assume trees are clearfelled to provide a sustained volume of timber from government owned land, with volumes adjusted to allow for varying rotation ages.

(3) To project future harvesting patterns for each of the Forest Stations where restocking has or is likely to take place.

There are very many variables at this stage in projecting the latter, since they depend on the type, scale and ownership of any timber utilisation operations. It is therefore considered that options 1 or 2 are most likely to provide suitably indicative results. A particularly important factor in practice will be the need to phase the start of harvesting of the restocked forest with the cessation of logging in the natural forest so that the skills and experience of the work force are retained in the industry.

For the evaluation of the investment option (1) has been selected since projection of annual harvesting volumes will be difficult where stocking is variable, volume projections for crops between 20 and 36 years are uncertain, and restocking of logged forest on customary land is possible in the future, such as North New Georgia, so that at the national level future harvesting schedules may have greater flexibility than originally anticipated.

Income

It still appears appropriate to assume that the Government will charge a levy or stumpage on the volume of standing timber and that it will be logged and

marketed by private companies who would be responsible for its marketing. It still remains extremely difficult to forecast the level of the stumpage rate which might be charged in current prices.

Since 1975 the value of royalty and levy on log exports has increased fairly substantially. The levy in August 1980 was raised to 10% on regular logs and 5% on "supersmall" logs and it was proposed that this would be raised to 15% for regular logs and 7½% on "supersmall" logs in January 1982. Royalty, which is the money due to the owner of the timber, was 3% on Government land and 7 to 17½% f.o.b. for the North New Georgia Timber Corporation. The latter was negotiated in 1979/80 and comprised a base value of 12½% on $50 per m^3 f.o.b. with an increase or decrease of 2% on $5 fluctuations in price. Since Levers Pacific Timbers have accepted North New Georgia Timber Corporation Royalty rates, and these are higher than those currently applying on Government owned land it appears reasonable to base an evaluation of the project on them. Information on whether the new levy rates have been introduced is not now available, particularly in view of the rather depressed timber prices of 1981. For the purposes of the evaluation, it has been assumed for evaluating the project in 1980 prices, that the levy would be 10% on regular logs and 5% on "supersmalls" with the royalty based on that in force with the North New Georgia Timber Corporation, i.e. 12½% on $50/m^3$ f.o.b. on a sliding scale.

The average f.o.b. prices received for hardwood logs in the Solomon Islands between 1974 and 1980 are shown in Table 5.6.

Table 5.6 <u>Average F.O.B. Prices for Logs in the Solomon Islands</u>

Year	Actual Average f.o.b. prices $/m³ for log exports	Inflation[2] adjusted prices
1974	18.9	35.5
1975	12.6	19.9
1976	23.5	33.7
1977	30.7	42.3
1978	25.9	32.9
1979	56.7	61.6
1980	57.3	57.3

Footnote: 1. Data for 1974 to 1977 based on prices received by two largest log exporting companies. Figures for 1978 to 1980 are averages for all companies.

2. Based on inflation rates given in Table 5.4.

Since the logs from the restocked areas will be considerably smaller in diameter than the regular logs currently being exported, the prices for "supersmalls" might be considered to be more relevant. Forestry Division data indicates that supersmalls averaged $43/m^3$ in 1980, and $31.3/m^3$ in 1981. The 1980 value is approximately 14% lower than the price received for regular logs in the same year.

If there were no changes in the relative prices of logs, it would appear that based on the situation in 1980, the Government could expect to receive approximately 17½% of $43 per m^3, i.e. $7.5/m^3$. If the new levy rate proposed for 1982 is introduced, this would provide the Government with a stumpage of approximately $8.4 per m^3.

The current price for "supersmalls" is lower than the regular logs because the supplies of regular logs are relatively plentiful. This situation is likely to change in the future as larger logs supplied from natural forests diminish and plantation grown material, which is generally of smaller dimensions, is all that is available. Therefore some increase in price in real terms can be expected. If prices for "supersmalls" came to match those of regular logs, stumpages of $12.6 per m^3 based on 1980 levy and Royalty rates and $15.4 per m^3 on 1982 rates might be expected.

Since some saving in extraction costs should be possible in the restocked areas, because the trees are planted in straight lines rather than randomly scattered, it would appear that a stumpage rate price of about $12 per m^3 in real terms could reasonably be expected. This is equivalent to between 21% and 27% of f.o.b. prices in 1980 depending on whether regular or "supersmall" prices are used. This compares with the originally projected stumpages of between 22% (1974) and 33.6% (1975) of f.o.b. prices when the previous analysis was undertaken.

Financial Yield

Based on the above assumptions and the costs already incurred, the cash flow for the project has been prepared based on 1980 prices, and is given in Table 5.7. Evaluation of the cash flow indicates that the project could provide a financial yield of 7.9% in real terms, assuming the existing crops are maintained until 1986, and no further planting is undertaken. The timber income in 1986 to 1990 is predominantly from the restocked area on Gizo which the model assumes will be cut over a four year period. A more realistic assumption may be to assume that the area is logged and the outturn processed by a local company over say a 10 to 20 year period. It is also significant for the planning of the Sector's development that the majority of the areas will be ready for harvesting from the early 1990s.

Overall the financial yield is almost 1% higher than the yield estimated in the original appraisal in 1975. There are two principal reasons for this:

(a) It has been assumed that the crop will be harvested on a 20 year rotation whereas in the original appraisal rotation lengths were extended up to 36 years without altering the volume estimate which was left at 140 m^3 ha. (see page 22).

(b) The stumpage rate of dollars 12 per m^3 is approximately twice the value in real terms estimated for stumpage in the original submission.

The reason for using this increased level of stumpage have been given in the previous section. However if the stumpage levels are compared with F.O.B. log prices over the same period given in Table 5.6, it is evident that log prices have almost doubled in real terms and therefore no significant change in relative prices between log prices and stumpage have been assumed.

Table 5.8 shows the actual costs incurred up to 1980, and from 1980 onwards costs and stumpage rates have been increased in line with an assumed rate of inflation of 8% per annum (the average rate per annum between 1971 and 1980). Evaluation of this cash flow which is in all other respects based on the same assumptions as the constant price cash flow gives a financial yield of 16.6% per annum. This must be considered to be very satisfactory compared with many other investment opportunities.

5.42 Sensitivity Analysis for Financial Evaluation

The financial implications of using different volume and stumpage price assumptions to those used in preparing Table 5.7, were also examined. However, no attempt was made to alter the harvesting pattern because of the uncertainties surrounding such assumptions.

Table 5.7 **Estimated Cash Flow for Project Based on 1980 Price Levels**

Year	Past & Present Costs $'000	Estimated Revenue $'000
1971	289.3	
72	252.1	
73	168.4	
74	193.8	
75	302.7	
76	538.3	
77	715.4	
78	778.3	
79	941.1	
1980	997.2	
81	634.3	
82	507.2	
83	383.4	
84	321.6	
85	217.2	
86	133.4	5.9
87		109.7
88		159.5
89		976.3
1990		1,195.3
91		1,742.4
92		304.9
93		708.2
94		1,230.4
1995		836.1
96		2,492.0
97		2,288.2
98		8,455.5
99		5,209.4
2000		2,788.3
TOTALS	7,373.7	28,621.1

Footnote: Costs for 1981 to 1986 are projections of the cost of maintaining the existing plantations

Table 5.8 Estimated Cash Flow for Project Based on Actual Past Costs and 8% Per Annum Inflation from 1980

Year	Actual Costs up to 1980 with Subsequent Costs Increased by 8% p.a. £'000	Estimated Revenue £'000
1971	145.3	
72	132.5	
73	94.7	
74	112.4	
75	208.7	
76	408.6	
77	366.4	
78	667.9	
79	863.9	
1980	997.2	
81	883.0	
82	901.6	
83	683.0	
84	637.5	
85	319.1	
86	211.7	9.4
87		128.0
88		295.2
89		1,951.6
1990		2,580.6
91		4,062.6
92		767.8
93		2,089.2
94		3,787.2
95		2,652.2
96		8,537.4
97		8,466.4
98		33,788.3
99		22,482.2
2000		12,996.1
TOTALS	6,928.1	104,654.2

The effects on the project's financial yield of altering volume and timber prices are shown in Table 5.9 below.

Table 5.9 Financial Yield Implications of Alternative Volume & Price Assumptions

Volume Assumption	Financial Yield %	Price Assumption
$105m^3$/ha (-25%)	6.2	Decreased 25%
$120m^3$/ha (-15%)	6.9	Decreased 15%
$140m^3$/ha	7.9	As Projected
$160m^3$/ha (+15%)	8.8	Increased 15%
$175m^3$/ha (+25%)	9.3	Increased 25%

The financial yield of the project does depend on the stumpage which is assumed, but the figures in the Table show that if the stumpage is 25% lower than projected, a financial yield of over 6% in real terms will be achieved. This is approximately 0.8% lower than originally estimated based on harvesting the crop 20 years after planting.

The above analyses did not examine directly the effects of any increases in timber prices in real terms in the future. Currently tropical moist forests are disappearing at a rate of about 11 million ha per annum and therefore over the long term there is likely to be a tightening of supplies relative to demand. This would suggest that some price increases could be expected although the extent and timing of these increases is hard to forecast.

There is no doubt that developments in Japan, which is by far the largest market in the region, and in Indonesia in particular will have a considerable influence. If the Solomon Islands Government is prepared to allow the majority of the country's production to be exported in log form in the future, then there is the prospect of significant real price increases, as other log producers in the region are currently requiring greater proportions of their log production to be processed locally, e.g., Indonesia. However if the Government insists that the majority of the production from restocked areas is processed in the Solomon Islands, and then exported as sawn timber, then the prospects of real timber price increases are unlikely to be as good, although they may still increase in real terms.

A study in the UK (CAS Report 1980) 1/ suggests that world roundwood prices may be some 30% higher in real terms in the year 2000 compared with 1980. This is equivalent to an annual increase of 1.5% per annum over the same period. The effect of this assumption and of increases of 3.0% per annum real price increase have been investigated and the results are as follows:-

1/ Centre for Agricultural Strategy, University of Reading "A Strategy for the UK Forest Industry" 1980.

Real Price Increases for Timber from 1980	Financial Yield in Real Terms
1.5% per annum	9.3%
3.0% per annum	10.7%

Since an important assumption underlying the success of the project is that the timber from the project will be price competitive, since it is of utility quality, it is important not to place too much reliance on obtaining significant real price increases in the future.

If significant real price increases for timber are obtained, then the scheduling of the harvesting operations will need to be carefully evaluated in conjunction with projected tree growth rates.

5.43 Economic Evaluation

The economic evaluation was undertaken for the same period as the financial evaluation, i.e. 1977 to 2000.

Costs

The cost of imported equipment does include some customs duties, but these were not considered to be large enough to warrant attention.

Petrol, oil and lubricants carry a 10% duty and where these costs could be identified, a reduction has been made. It was assumed that 30% of travelling and transport costs were made up of petrol, oil and lubricant costs.

All other costs apart from the price of unskilled labour were assumed to be identical to financial costs.

There have been no detailed studies recently undertaken of what the appropriate shadow wage rate for the Solomon Islands is. Recent studies have generally assumed it is approximately 50% of provincial Government wage rates for unskilled labour. It is not possible to identify what proportion of the total wages is for unskilled labour, and therefore it has been assumed that it is approximately three quarters of total wage costs. A 50% reduction has therefore been made on 75% of the wages element of project costs. Table 5.10 shows the estimated economic costs of the project up to 1980 with projections to 1986.

Benefits

The stumpage price is the estimated residual standing value of the trees after subtracting estimated average production costs and profits from the estimated f.o.b. price of timber. The estimated stumpage value of $12 per m^3 can therefore be considered to be a reasonable measure of world prices.

A rotation length of 20 years has been assumed for the reason indicated in the financial evaluation.

A number of other benefits were identified at the time of appraising the project, (Section 2.45), and these still appear relevant.

Economic Rate of Return

Using the cash flow based on constant 1980 prices given in Table 5.10, the economic rate of return has been calculated to be 9.0% in real terms assuming no further planting takes place, but the plantations established up to 1980

(to page 80)

Table 5.10 Economic Costs and Benefits of the Project in 1980 Prices

Year	Past and Projected Costs in 1980 Prices $'000	Estimated Benefits $'000
1971	264.1	
72	219.6	
73	135.8	
74	165.2	
75	265.4	
76	471.2	
77	614.6	
78	640.6	
79	793.7	
1980	776.4	
81	506.5	
82	409.7	
83	314.8	
84	241.2	
85	162.4	
86	100.0	5.0
87		109.7
88		159.5
89		976.3
1990		1,195.3
91		1,742.4
92		304.9
93		768.2
94		1,289.4
95		830.1
96		2,492.0
97		2,286.2
98		6,455.5
99		5,209.4
2000		2,788.3
TOTAL	6,081.7	28,621.1

Footnote: 1 Costs for 1981 to 1986 are projections of the costs of maintaining the existing plantations.

2 Estimated financial costs for 1984 to 1986 have been reduced by 25% to determine economic costs. This was the relationship between economic and financial costs between 1981 and 1983.

Table 5.11. Economic Costs and Benefits of the Projects Based on Estimated Actual Past Economic Costs and 8% per Annum Inflation from 1980

Year	Actual Costs Up to 1980 With Subsequent Costs Increased by 8% pa $'000	Estimated Benefits $'000
1971	122.1	
72	105.9	
73	70.0	
74	87.9	
75	167.8	
76	328.2	
77	446.4	
78	504.4	
79	669.9	
1980	776.4	
81	547.0	
82	477.9	
83	396.6	
84	328.1	
85	239.4	
86	158.7	9.4
87		188.0
88		293.2
89		1,951.6
1990		2,580.6
91		4,062.6
92		767.8
93		2,089.2
94		3,787.2
95		2,652.2
96		8,337.4
97		8,466.4
98		33,788.3
99		22,482.2
2000		12,996.1
TOTAL	5,426.6	104,654.2

Footnote: 1 Costs for 1981 to 1986 are projections of the costs of maintaining the existing plantations.

2. Estimated financial costs for 1984 to 1986 have been reduced by 25% to determine economic costs prior to adjusting for inflation

Table 5.12 Economic Rates of Return Obtained Under Alternative Volume and Price Assumptions

Volume Assumptions	Economic Rate of Return	Price Assumptions
$105m^3/ha$ (-25%)	7.3	Decreased 25%
$120m^3/ha$ (-15%)	8.0	Decreased 15%
$140m^3/ha$	9.0	As Projected
$160m^3/ha$ (+15%)	9.9	Increased 15%
$175m^3/ha$ (+25%)	10.4	Increased 25%

The figures in the table show that even if the stumpage price assumed is 25 per cent lower than predicted, the economic rate of return should still be in excess of 7%.

If real timber price increases of 1.5% and 3.0% per annum were obtained, the economic rates of return would be as follows:-

Real Price Increases for Timber from 1980	Economic Rate of Return
1.5% per annum	10.4%
3.0% per annum	11.8%

continue to be maintained for 6 years. In the project submission the economic rate of return was 8.0%.

The project was also evaluated using the actual book costs up to 1980 adjusted as described in Section 5.43 along with future costs and stumpages increased in line with an estimated inflation rate of 8% per annum, (Table 5.11). The result was that the project showed an economic rate of return of 18.1%. This must be considered to be a very satisfactory rate of return.

5.44 Sensitivity Analysis for Economic Evaluation

Similar price and volume assumption to those investigated in the financial evaluation were investigated, and the results are shown in Table 5.12.

6. Lessons from the project

6.1 Planting targets

Over ambitious planting targets often lead to neglect of maintenance and lowering of morale of staff. Formal reviews of targets should be undertaken when shortfalls are apparent, including monitoring of survival. Recommendation: A small monitoring team within the Forest Department should be set up and given training, especially for evaluating survival.

6.2 Research

Research lagged behind management, and this was exacerbated by the departure of long-serving expatriate officers at about the time of the project's commencement. As noted below, extra research loads could have been dealt with most efficiently by one or two VSO's with back-up services from the CFI, Royal Botanic Gardens etc. Again, the lack of critical reporting to ODA, and perhaps a lack of development urgency allowed the situation to continue, trying to write up past results before tackling the new challenges. This is not to criticize the mass of silvicultural information made available by the Research Division (see Appendix D for a list of publications), but to indicate that a management research element is needed in every project, and that there are international organisations who can assist.

Particular aspects requiring attention in any project are:-

Nursery practice
Seed procurement and handling
Spacing and survival
Wood quality

Recommendation: a research component should be included in each afforestation project, unless clearly unnecessary.

6.3 Technical expertise and training

Shortages of staff in the early stages of a project are frequent and this one was no exception. Administrative delays occurred in appointing expatriates and no specific training programme was detailed in the project proposals.

The main deficiencies in training were in the supply of Rangers to the project, and in clerical, supervising and artisan grades.

For the Ranger cadre, the training course run under New Zealand could hardly have been begun earlier, but with this knowledge the planting programme should perhaps

have been expanded more slowly, notwithstanding the need for rapid planting following logging.

For the supervisory grades, the importance of the project would have warranted setting up specific forestry courses at the Honiara Technical College.

For the other grades, more use could have been made of short in-service courses. This includes more senior officers, especially if they were given assistance in setting up short courses themselves. Such courses could have been run by teams from the Commonwealth Forestry Institute, for instance, supplemented by serving officers from neighbouring countries. Courses would ideally be for 1-3 weeks in length, perhaps interspersed with periods of work experience.

Suitable subjects would have been:

Accounting

Store keeping

Work study/job analysis

Book-keeping/record keeping

Research methods

Nursery methodology

Volunteers are intended to be used in developing countries to fill staffing gaps and to train local personnel. The situation in the Solomons from 1976 onwards was ideal for them, with the departure of experienced expatriates and the absence of local officers on overseas training. Some local officers might have been released for further training by this means.

The fields in which VSO's could have been particularly useful are:

Research, both field and office

Station design and construction

Workshops: Setting up, managing and training.

Recommendations: (1) The recruitment of expatriate and local staff should be given the highest priority

(2) Suitably qualified volunteers should be used as flexible short term assistants.

(3) Short in-service training courses should be used wherever a lack of skills is detected e.g. particularly in supervision and work study.

(4) Training and recruitment may have to precede project implementation however urgent to the work programme

6.4 Physical resources

(a) General

Difficulties with vehicles undoubtedly influenced the effectiveness of the project.

The PWD system should work, but it does not, and clearly the economic basis for hire charges and supply of vehicles from a pool is unsound. On the other hand the project was clearly intended to be a time-slice of ongoing forestry activity, and it therefore was correct in trying to make the existing structure workable. To this end the setting up of Forestry Division workshops on site and the consequent reduction of the hire charge was a necessary step.

(b) Choice of vehicles

The choice of vehicles was left almost entirely either to PWD who use cheap and reliable 2-wheel drive Bedford trucks, or to the New Zealand Government, or to the local staff who buy what happens to be in the market. None of these produced the correct truck for the job, although the small 4-wheel drive personnel carriers and motor cycles were satisfactory. For most of the time the trucks were used for transporting labour on "main" and logging roads with some light load carrying in addition. For the purpose the military Bedford 4 x 4 5 tonner would have had the advantage of easier spares (via PWD) and six fewer tyres than the Toyota trucks actually used.

(c) Spare parts and delivery

Spare parts, whether the responsibility of PWD or the Forestry Divison, are a continual problem, and there would seem to be no alternative to setting up a proper stores organisation, with a trained storekeeper. Most of the Toyota spares had to be flown in from Japan, (at project expense) as the local agents were usually out of stock. The movement of vehicles for repair or replacement between islands presented problems for PWD.

In general, the PWD system found itself overstretched in servicing an intensive development project at several centres away from the capital.

The purchase and supply of spares for nursery pumps, outboards, generators etc. was generally easier owing to possibilities for local purchase and portability of items.

Recommendations: (1) At the outset separate project vehicles should be provided for if PWD "pool" services are inadequate

(2) Vehicles often arrive after long delays and organisational procedures may need streamlining.

(3) Specifications of equipment must take account of especially harsh conditions as well as availability of spares.

(4) Servicing is vitally important, and if government servicing arrangements are inadequate either project targets should be lowered, or separate facilities set up.

6.5 Cattle under trees. This represented a major unplanned change in the project. The enormous potential of cattle with trees is undoubted. The current unsatisfactory situation is a result of some weakness in the Forestry Division, and some secretiveness in MAL. Poor reporting to ODA of the actual situation was the responsibility of the Chief Forest Officer, and it appears that reports from the field staff were not passed on to ODA. Currently 1670 ha of plantations and over 700 ha of plantable land is under a form of management that cannot meet the objectives for forest production laid down in the project and for which British funds were supplied.

Cattle under single management control is, however, a most valuable element in the optimum system for control of Merremia.

Recommendation: There should have been insistence on a properly conducted pilot-scale trial of all the variables outlined in para 4.13 above before large areas of investment in plantations were put at risk. Even so, several hundred hectares, a research officer and very close co-operation would have been required.

6.6 Physical and financial reporting

When approving the project, the Projects Committee insisted as condition of approval that the progress of the project should be monitored by regular visits by ODA's Forestry Adviser. These have taken place at intervals of about a year. However it is considered that an adviser could not or should not have been expected to analyse all the past physical and financial data to assess the progress of the project in the course of a visit, as well as considering all the aspects of the project such as staffing, training, research and other tech matters during his visits.

It is considered that the Solomon Islands Government should have been a submit 6 monthly progress reports on the project to ODA. This could have information on:-

- Expenditure since 1976 showing budgeted and actual expenditure.
- Planting rates showing areas planted against targets.
- Physical productivity of operations.
- Schedule of maintenance operations undertaken by compartment against foracasted requirements.
- Stocking rates achieved in plantations already established at, say, 2, 4 and 6 years planting.
- Vehicle availability.
- Other factors which might materially affect the outcome of the project.

It might be felt that the provision of such information would have resulted in an additional burden on the Forestry Division at a time when it was already heavily stretched in undertaking the restocking project. While it would appear that this might have been the case, it is believed that this type of information ought to have been readily available to those concerned with managing the project.

If such reports had been submitted to ODA on a six monthly basis in an agreed format, it would have not only allowed the Forestry Adviser to keep a check on progress and allow him to discuss immediately any difficulties that developed with the project, but it would have also ensured that those concerned with the management of the project collected the necessary information.

The submission of regular reports to other aid agencies financing projects appears to present no problems, e.g. Australian aid.

Recommendation : Reports should be submitted to ODA on a 6-monthly basis.

6.7 General comments on the project and its benefits

The project may be considered to have been cost effective in spite of the difficulties experienced in its implementation, bearing in mind its estimated financial rate of return of 8% (Economic Rate of Return of 9%) in real terms assuming no further planting takes place and that existing plantations are maintained.

APPENDIX A

INVENTORY DATA

SHOWING AVERAGE STOCKING PER HA.

AND NET AREAS BY COMPARTMENTS AND FOREST STATION

AS AT 31/12/80

Source (1) SIG Forest Dept. : Special Report for visit of Forestry Adviser 1981

(2) SIG Forest Dept. : Internal Reports on Permanent Inventory Plot assessments.

Note: Occasional discrepancies between gross and net areas appear because of diverse sources of data, but in most cases gross areas are recorded as larger than net.

FOREST STATION: GIZO

PLANT. YEAR	COMPT. NO.	GROSS AREA(HA)	NET AREA(HA)	TOTAL AREA PLANTED IN YEAR(HA) NET	AV.NO. OF SURVIVING STEMS/HA	AV.NO.OF OK STEMS /HA	COMMENTS
1966	2	9.2	15	15	69	26	Gross Area< Net Are
1967	3	34	27	27	128.	66	
1968	5	49	69		98	28	Gross Area <Net Are
	9a	40	38	107	.		No inventory data
1969	7a	120	76		104.	66	
	b	13	77		193	67	Gross Area< Net Are
	8a	17	118		9	4	" " " "
	b	27	26		38	19	
	9a	40	38		73	70	
	b	16	16		98	93	
	c	63	61		77	50	
	10a	40	38		74	63	
	b	90	87		78	61	
	11a	21	20		91	77	
	12a	44	42		112.	90	
	b	[illegible]	17				No inventory data
	c	40	19		[illegible]	40	
	13a	90	92		77	72	
	14a	30	18	741	72	49	
1970	8a	46	5		106.	67	
	b	93	80		77	39	
	8c	49	47		51	33	
	14b	146	134	270	72	49	
TOTAL			1,164	1,164			
Mean No. per Ha.					84	51	

Note: 6 Compartments were planted at 13.4 x 3.6 metres = 207 stems/ha
All others were planted at 20.1 x 2.2 metres = 226 stems/ha

FOREST STATION: ALLARDYCE

PLANT. YEAR	COMPT. NO.	GROSS AREA(HA)	NET AREA(HA)	TOTAL AREA PLANTED IN YEAR(HA)	AV.NO. OF SURVIVING STEMS/HA	AV.NO.OF OK STEMS /HA	COMMENTS
				NET			
1967	1a	13	12		52	42	
	2a	33	31		46	40	
	3a	49	44		47	39	
	4a	48	33	120	84	61	
1968	2b	22	20		45	30	
	3b	12	11		40	22	
	c	58	53		44	26	
	4b	41	4		63	53	
	c	33	33	121	74	63	
1969	1b	12	11		86	53	
	c	44	40		74	64	
	2c	28	25		25	18	
	4d	30	27		73	64	
	5b	32	30		80	20	
	6a	?	98				No Inventory Data
	7a	47	40		40	27	
	8a	?	25	296			No Inventory Data
1970	2d	?	23				No Inventory Data
	6b	107	45		59	44	
	7b	21	19	87	98	63	
1971	7c	107	98		126	69	
	8b	242	221		76	36	
	9a	212	193		93	58	
	10a	161	147	659	104	69	
1972	5b	163	149	149	61	31	
1973	11a	48	44		290	198	Gross Area < Net Area
	b		24		290	198	" " " "
	12a	95	87		127	84	
	13a	156	142	297	199	156	
1974	14	160	146		143	108	
	15	182	166		139	107	
	16	162	148	460	138	94	
1975	17	44	40	40	102	75	
	TOTAL		2,229	2,229			
Mean No. Per Ha					97	65	

Note Compartment 13 was planted at 10 x 3 metres
All others were wider, down to 174 trees/ha

FOREST STATION: VIRU

PLANT. YEAR	COMPT. NO.	GROSS AREA(HA)	NET AREA(HA)	TOTAL AREA PLANTED IN YEAR(HA) NET	AV.NO. OF SURVIVING STEMS/HA	AV.NO.OF OK STEMS /HA	COMMENTS
1971	3	100	86			107	
	4a	147	24			43	
	5a		51				No Inventory Data
	6a	149	36			89	
	7a	188	189	386		73	
1972	8a	67	50			113	
	9a	242	205	255		62	
1973	8b	33	27			101	
	11a	78	8			86	
	b	16	15			30	
	12a	45	40	90		97	
1974	10a	25	20			45	
	b	63	53			51	
	c	72	63			120	
	12b	30	0			77	
	14a		182				No Inventory Data
	16b	13	7			130	
	d	84	70	412		50	
1975	19a	232	91			56	
	20a	106	65			93	
	21a	104	94			160	
	22a	232	205			50	
	23a	40	40			105	
	25a		122	632			No Inventory Data
1976	15a	135	122			46	
	17a	82	73			292	
	19b	30	27			70	
	22b	37	30			90	
	23a	40	36			105	Replanting of
	24a	135	30			76	
	b	165	170			13	
	26a	60	51			63	
	27	70	62			154	
	28a	60	77			145	
	29a	93	82			223	

FOREST STATION: Vira (cont'd)

PLANT. YEAR	COMPT. NO.	GROSS AREA(HA)	NET AREA(HA)	TOTAL AREA PLANTED IN YEAR(HA) NET	AV.NO. OF SURVIVING STEMS/HA	AV.NO.OF OK STEMS /HA	COMMENTS
1976	30	234	211			90	
(cont'd	31	88	77			76	
	32	87	41			124	
	33	150	135	1237		8	
1977	14b	35	27			5	
	15b	117	53			133	
	d	84	52			158	
	16a		134				No Inventory Data
	c		215				" " "
	d	76	36			14	
	18a	84	12			4	
	19a	232	91			56	Replanting of 19a F75
	34	176	64			103	
	35	103	95			160	
	36	63	20			00	
	37	69	22	826		161	
1978	4c	67	63			203	
	d	123	111			77	
	e		98				No Inventory Data
	f	19	14			153	
	28b		33				No Inventory Data
	c	39	37			120	
	38	63	50			83	
	39	82	74			160	
	40	53	48			126	
	50a	93	84			181	
	b	52	43			96	
	51	51	44			160	
	52	133	120			157	
	53	173	158			146	
	54	220	164			188	
	56	67	60	1203		182	
1979	4b		100				No Inventory Data
	55	130	117			163	
	57	39	43			241	
	58	295	147			60	
	59		52	459			No Inventory Data

FOREST STATION: Viru cont'd

PLANT. YEAR	COMPT. NO.	GROSS AREA(HA)	NET AREA(HA)	TOTAL AREA PLANTED IN YEAR(HA)	AV.NO. OF SURVIVING STEMS/HA	AV.NO.OF OK STEMS /HA	COMMENTS
1980	5a		152			89	No Inventory Data
	6a	149	107			86	
	11a	78	73			86	
	13a	111	92	424		48	
TOTAL			424	424			
Mean No per Ha.						105	

Note: two of the earliest plantings were wider than 10 x 3 metres.

a1

FOREST STATION: SANTA CRUZ

PLANT. YEAR	COMPT. NO.	GROSS AREA(HA)	NET AREA(HA)	TOTAL AREA PLANTED IN YEAR(HA)	AV.NO. OF SURVIVING STEMS/HA	AV.NO.OF OK STEMS /HA	COMMENTS
1976	1		80				
	2		102	182			
1977	3a		160				
	b		49				
	4		118	327			
1978	5		108				
	6		109				
	7		134				
	8a/b		342				
	10		106	799			
1979	9		130				
	11	120	120				
	12a		227				
	b		314				
	13		112	903			
	TOTAL		2211	2211			

footnote: No information is available on the stocking of Agathis macrophylla and therefore the volume projections have been based on 140m³/ha.

FOREST STATION: KOLOMBANGARA

PLANT. YEAR	COMPT. NO.	GROSS AREA(HA)	NET AREA(HA)	TOTAL AREA PLANTED IN YEAR(HA)	AV.NO. OF SURVIVING STEMS/HA	AV.NO.OF OK STEMS /HA	COMMENTS
1976	3	276	276			44	
	4		241	517			No Inventory Data
1977	5a*	52	52			120	
	6a*	36	32			163	
	7a*	70	69			173	
	8a*	134	140	293		45	Gross Area < Net Ar
1978	8b/c	461	328			140	
	9b	128	278			138	Gross Area < Net Ar
	12a*	123	123			115	
	b*	156	140			160	
	c*	72	72			151	
	13a*		147				No Inventory Data
	16a	132	135			110	Gross Area < Net Ar
	b	141	141			90	
	17a	155	182			47	Gross Area < Net Ar
	b	833	47			51	
	c		77				No Inventory Data
	18a	111	118			134	Gross Area < Net Ar
	b		212	2000			No Inventory Data
1979	9b/c	173	163			96	
	6b/c	226	223			101	
	7b/c	234	223			133	
	10b*		106				No Inventory Data
	13b*		167				" " "
	15a		61				" " "
	16c		104				" " "
	d		76				" " "
	19a		120				" " "
	b		120				" " "
	c		93				" " "
	21b/c		102				" " "
	22b		51				" " "
	c		37				" " "
	23b		82	1604			" " "

FOREST STATION: KOLOMBANGARA (cont'd)

PLANT. YEAR	COMPT. NO.	GROSS AREA (HA)	NET AREA (HA)	TOTAL AREA PLANTED IN YEAR (HA)	AV. NO. OF SURVIVING STEMS/HA	AV. NO. OF OS STEMS /HA	COMMENTS
1980	1	135	142			86	Gross Area Net Ar
	2a	84	75			23	
	b		70				No Inventory Data
	14a*		104				" " "
	b*		92				" " "
	c*		42				" " "
	23a*		123				" " "
	c		32				" " "
	d		77				" " "
	e*		82				" " "
	24a*		87				" " "
	b*		63				" " "
	c		19				" " "
	25a		121				" " "
	26		101				" " "
	27		120				" " "
	40a		81				" " "
	b		55				" " "
	41a		94				" " "
	b		45	1631			" " "
TOTAL			6249	6249			
Area Number per Ha.						102	

* Compartments in Cattle Under Trees project.

A P P E N D I X B

PERMANENT INVENTORY PLOT DATA

Source: SIC files, 1982

Kolombangara

E. deglupta

Comp.	Age	Area Ha	No of OK Stems/ha	Av ht m	MAI m	Av. Girth cm	MAI cm
2A	3y 7m	84	9			52	14.0
5A	2y 3m	52	22	5.4	2.4		
5B	2y 5m	88	4	6.1	2.5		
5C	2y 6m	85	12	6.2	2.5		
6A	2y	36	90	3.4	1.7		
6B	2y 6m	63	3	5.2	2.00		
6C	2y 1m	165	1	6.7	3.2		
7A	1y10m	69.6	149	3.4	1.8		
7B	2y 6m	100	11	5.8	2.3		
8A	2y 3m	134	35	9.5	4.2	35.9	159
8B	1y 5m	225	49	3.8	2.6		
8C	1y 3m	241	11	3.5	2.8		
9B	2y	128	13	4.8	2.4		
12A	1y 1m	123	102	3.7	3.4		
12B	9m	156	159	3.2	4.3		
12C	7m	72	149	2.1	3.2		
16A	1y 3m	132	74	3.6	2.8		
16B	1y	142	78	2.8	2.8		
17A	1y 3m	155	31	3.4	2.7		
17B	1y 8m	835	38	4.2	2.5		

Kolombangara - TERCAL

Terminalia calamansanai

Comp.	Age	Comp. Area Ha	No of OK stems/ha	Av ht m	MAI m	Av. Girth m	MAI cm
1	4y	135	1			22.5	5.6
2A	3y 7m	84	10			25.5	7.1
3A	3y 1m	126	19	6.7	2.1		
3B	3y 1m	150	5	6.1	1.9		
5A	2y 3m	52	42	1.8	0.8		
5B	2y 5m	88	61	0.5	0.2		
5C	2y 6m	85	85	0.86	0.34		
6A	2y	36	65	1.1	0.5		
6B	2y 6m	63	75	0.6	0.2		
6C	2y 1m	165	95	0.5	0.2		
7B	y 6m	100	55	1.1	0.4		
7C	2y	138	81	0.57	0.2		
8A	2y 3m	134	7	6.3	2.8		
8B	1y 5m	225	50	0.6	0.4		
9B	2y 0m	128	42	0.56	0.2		
12A	1y 1m	125	2	8.25	7.6		
16A	1y 3m	132	20	0.8	0.64		
16B	1y 4m	141	7	0.9	0.9		
17A	1y 3m	155	5	1.7	1.4		
17B	1y 8m	835	1	3.9	2.3		
18A	1y 6m	111.5	59	1.6	1.1		
7A	1y10m	69	2	2.7	1.5		

97

Kolombangara - CAMB

Campnosperma brevipetiolata

Comp.	Age	Area Ha	No of OK Stems/ha	Av Ht. m	MAI m	Av. Girth cm	MAI cm
2A	3y 7m	84	4	5.4	1.7	27.3	7.4
3A	3y 1m	126	18	5.4	1.7		
3B	3y 1m	150	3	4.6	1.5		
5A	2y 3m	52	14	4.9	2.1		
5B	2y 5m	88	4	3.1	1.2		
5C	2y 6m	86	6	4.2	1.7		
6B	2y 6m	63	9	1.2	0.4		
6C	2y 1m	165	11	3.1	1.4		
7A	1y10m	69	24	3.0	1.7		
7B	2y 6m	100	45	1.4	0.5		
7C	2y	138	19	1.4	0.7		
8A	2y 3m	134	3	5	2.2		
8B	1y 5m	225	14	1.4	1.0		
8C	1y 3m	241	53	1.0	0.8		
9B	2y	128	85	0.5	0.2		
12A	1y 1m	125	11	2.7	2.5		
12B	9m	156	1	1.9	2.5		
12C	7m	72	2	1.6	2.7		
16A	1y 3m	132	1	1.6	1.3		
16B	1y 0	141	5	1.8	1.8		
17A	1y 3m	155	5	1.7	1.4		
17B	1y 8m	835	7	1.6	1.1		
18A	1y 6m	111	23	1.6	1.0		

Kolombangara - TERB

Terminalia brassii

Comp.	Age	Area Ha	OK stems per ha.	Av Ht. m	MAI m	Av. Girth cm	MAI cm
3A	3y 1m	126	10	7.9	2.5		
3B	3y 1m	150	19	7.5	2.4		
5A	2y 3m	52	42	4.7	2.1		
5B	2y 5m	88	15	3.6	1.4		
5C	2y 6m	85	8	4.2	1.6		
6A	2y	36	8	3.5	1.7		
6B	2y 6m	63	6	0.6	0.27		
6C	2y 1m	165	1	3.8	1.8		
7B	2y 6m	100	37	1.0	0.3		
7C	2y	138	17	0.5	0.2		
8C	1y 5m	225	17	1.6	1.1		
16A	1y 3m	132	15	1.4	1.1		
17A	1y 3m	155	6	2.8	2.2		
17B	1y 8m	835	5	2.9	1.7		
18A	1y 6m	111	52	2.5	1.6		

Kolombangara - Other Species - SWIM

Swietenia macrophylla

Comp.	Age	Area	No of OK stems	Av. Ht.	MAI	Av. Girth	MAI
8C	1y 3m	241	86	1.0	0.8		
			GMEA				
1y	4y	135	35			58	16
2	3y 7m	83	14			62	18

99

Viru - CAMB

Campnosperma brevipetiolata

Comp.	Age	Area Ha	No of OK Stems	Av. ht m	MAI m	Av. Girth cm	MAI cm
4A		147	21			60	
4C		67	193			17	
4D	1y 7m	123	50	2.5	2.5		
4F	9m	15	153	0.5	0.6		
8A		67	4			60	
10B		63	51			46	
14B	1y 9m	35	5	1.5	0.8		
15A		135	1(?)	3.9	1.9		
15B		117	113	3.7			
15E	1y 1m	23	35	1.5	1.5		
16D	2y	76	14	1.9	0.9		
17A	2y10m	82	202	4.6	1.6		
18E	5y 5m	84	4			26	4.7
19A	4y 1m	232	56			30	7.5
19B	3y10m	30	79			26	6.9
20A	4y	106	93	6.7	1.6	31	7.9
21A	3y 5m	104	126			23	6.6
22A	4y 4m	232	50			30	6.9
22B	3y 8m	37	96			26	7.1
23A	3y 9m	98	105			25	6.6
23B	2y	62	93	3.3	1.6		
23C	1y 8m	28	128	0.9	0.5		
24A	3y 1m	135	76			19	6.1
24B	3y 1m	165	13			27.3	8.9
26A	3y	65.5	63			18.1	6.0
27	3y 4m	75.5	158			20	6.2
28A	3y 3m	85.5	145			71.8	6.7
28C	1y	39	68	0.9	0.9		
29A	4y 5m	93	223			21.4	4.7
30	3y 2m	234	90			32	10.1
31	3y	88	76			18	6.2
32	2y10m	87	124	3.8	1.3		
34	2y 8m	176	103	4.8	1.8		
35	2y 8m	103	160	4.0	1.5		
36	2y	63	49	1.2	0.6		
37	2y 6m	69	13	2.7	1.1		
38	1y 8m	63	47	2.1	1.3		
39	1y 5m	82	71	1.7	1.2		
40	3y	53	103	1.1	0.3		
50A	1y	93	130	1.3	1.3		
50B	1y	52	48	0.9	0.9		
51	1y 5m	51	108	0.8	0.5		
52	1y 4m	133	112	1.3	1.0		
53	1y 3m	175	48	1.1	0.9		
54	8m	220	175	0.4			
55	6m	130	163	0.2			
56	11m	67	119	1.1			
57	4m	39	228	0.9			
58	4m	163	76	0.5			

Viru - TERCAL

Terminalia calamansanai

Comp.	Age	Area Ha	No of OK Stems per ha	Av ht m	MAI m	Av Girth cm	MAI cm
1			133			43	
2			69			40	
3		100	107			128	
4A		147	22			46	
6A	6y 7m	149	89			59	8.9
7A	7y 4m	188	73			55	7.6
8A		67	109			56	
8B		33	101			47	
9A	7y 3m	242	68	5	0.7		
10A	6y 1m	25	45			41	6.7
10C		72	129			36	
11A	6y 2m	78	86			41	6.8
11B		16	39			50	
12A	6y 8m	45	97			49	7.4
12B		30	77			38	
10E		63	60			41	
13A	4y 5m	111	48			33	7.5
14B	1y 9m	35	186	3.06	1.7		
19A	4y 1m	232	56			22	5.5
21	3y 5m	104	34			16	4.9
38	1y 8m	63	5	1.7	1.0		
39	1y10m	82	5	1.5	0.8		
50B	1y 0m	52	45	0.5	0.5		
51	1y 5m	51	37	0.5			
52	1y 4m	133	2	2.0	1.5		
53	1y 3m	175	46	0.5			
54	8m	220	13	0.3			
56	11m	67	17	0.5			
57	4m	39	13	0.6			
58	4m	56	56	0.4			

Viru - TERB

Terminalia brassii

Comp.	Age	Area	No of OK Stems	Av. Ht. m	MAI m	Av. Girth cm	MAI cm
4C	1y 3m	67	10	1.3	1.2		
4D	1y 7m	123	27	3.8	2.4		
10E		63	3			30	
15A	2y	153	11	2.9	1.4		
15B		117	9	3.6			
15D		84	68	3.1			
15E	1y 1m	23	139	3.6	3.3		
16E	2y	76	32	2.4	1.2		
18D	5y 5m	84	59			49	8.9
18B	1y 7m	13	139	2.9	1.8		
23C	1y 8m	28	73	1.3	0.8		
24B	3y 1m	165	58			19	6.2
28C	1y	39	52	1.2	1.2		
33	3y 2m	150	7			14	5.6
36	2y	63	33	4.1	2.1		
37	2y 6m	69	76	3.1	1.2		
38	1y 8m	63	18	1.6	1.0		
39	1y 5m	82	66	2.3	1.6		
40	3y	53	16	4.7	1.5		
50A	1y	93	3	1.5	1.5		
50B	1y	52	3	1.3	1.3		
51	1y 5m	51	35	1.8	1.2		
52	1y 4m	133	43	0.6			
53	1y 3m	175	48	1.0			
56	11m	67	46	1.2			

Viru - Other Species

Comp	Age	Area Ha	No of Stem per hec.	Av. Ht. m	MAI m	Av.Girth cm	MAI cm
			E DEG				
15A	2 yrs	135	36	6.5	3.2		
15B		117	11	4.6			
15D		84	90	4.9			
33	2yrs 6m	150	1	0.8			
36	2 yrs	63	17	5.0	2.5		
37	2yrs 6m	69	72	4.5	1.8		
38	1y 8m	63	13	4.1	2.6		
39	1y 5m	82	18	2.3	1.5		
40	3 yrs	53	7	5	1.6		
50A	1y	93	48	2.2	2.2		
			SWIM				
53	1y 3m		7	1.4	1		
			TEAK				
58	4m	163	27	0.2			
			CEDO				
13A	4yrs 5m	111	1			38	8.6
			GMEA				
24B	3yrs 1m	165	3			48	15.5
27	3yrs 4m		13			35	10.5

103

ALLARDYCE

Summary of Results for Compartments Planted at 22 x 2.6 m

Compt	Gross Area Ha	Species	Age	Spacing (m)	Stocking st/ha		Girth (cm)		MAI	HEIGHT (m)		MAI	AV. BASAL AREA (m^2/ha)
					ALL	O.K.Only	ALL	O.K. Only	O.K.	ALL	O.K.only	O.K	O.K. ONLY
1A	13	CAMB	12y 6m	22x2.6	52	42	87.5	92.9	7.4	18.6	19.1	1.54	3.06
3A	49	TERB CAMB	12y 6m	22x2.6	47	39	67.1	67.9	5.4	17.5	17.9	1.43	1.30
2A	33	CAMB ENDM	12y 5m	22x2.6	46	40	110.0	109.0	8.7	22.5	22.8	1.8	3.21
4A	48	CAMB TERB	12y 4m	22x2.6	84	61	70.9	72.5	5.9	16.7	17.9	1.45	2.13
4B	41	CAMB ENDM GMEA	12y 0m	22x2.6	65	53	83.0	83.0	7.4	20.0	20.0	1.69	2.90
2B	22	CAMB	11y 8m	22x2.6	45	30	108.3	112.0	9.6	21.8	23.2	1.98	2.99
4C	36	CAMB TERB	11y 6m	22x2.6	74	63	77.0	80.5	7.0	16.6	17.6	1.53	2.89
3B	12	CAMB	11y 4m	22x2.6	40	22	94.4	96.2	8.4	22.8	24.0	2.09	1.62
1B	12	CAMB	11y 2m	22x2.6	88	55	43.4	45.6	4.1	12.8	13.1	1.18	0.91
4D	30	CAMB	11y 0m	22x2.6	75	64	85.3	83.7	7.6	21.0	21.0	1.91	3.24
3C	58	CAMB TERB	10y 10m	22x2.6	44	26	79.4	84.0	7.7	16.6	18.3	1.68	1.46
1C	44	CAMB	10y 9m	22x2.6	74	64	74.5	75.6	7.0	16.4	16.3	1.51	2.73
5A	52	CAMB	10y 8m	22x2.6	80	29	59.8	71.9	6.7	15.1	16.4	1.53	1.19
2C	28	CAMB	10y 7m	22x2.6	25	18	49.5	50.3	4.7	13.1	13.5	1.27	0.35
7A	47	CAMB	10y 5m	22x2.6	40	27	59.8	60.3	5.8	14.7	16.1	1.55	0.77
6B	107	CAMB	10y 3m	22x2.6	59	44	70.2	72.8	7.1	17.0	17.6	1.72	1.94
TOTAL Area	612												

104

ALLARDYCE

Summary of Results for Compartments Planted at 14.5 x 4m, 12 x 3m, 10 x 3m, 5 x 3m

Compt	Gross Area (ha)	Species	Age	Spacing (m)	Stocking st/ha			Girth (cm)		Height (m)			AV. BASAL AREA (m^2/Ha) OK only
					ALL	O.K. only	ALL	O.K. only	MAI OK	ALL	O.K. only	MAI OK	
7B	21	CAMB	10y 2m	14.5x4	98	63	69.1	74.6	7.2	13.7	14.0	1.35	3.05
7C	107	CAMB	9y 8m	14.5x4	126	69	64.3	6.59	6.8	13.2	14.1	1.45	2.38
1D	44	CAMB	8y10m	14.5x4	102	75	70.4	74.8	8.4	18.9	19.0	2.1	3.34
8B	242	CAMB	8y 7m	14.5x4	76	36	47.0	50.1	5.8	12.4	14.2	1.65	2.07
9A	212	CAMB	8y 6m	14.5x4	95	58	56.6	58.8	6.9	14.3	15.2	1.79	1.60
10A	161	CAMB	8y 5m	14.5x4	104	69	61.8	62.4	7.4	15.3	15.8	1.86	2.01
5B	163	CAMB	7y10m	14.5x4	61	31	56.2	61.6	7.8	14.8	16.1	2.04	0.89
11A+B	48	CAMB	7y 3m	5x3	290	198	55.9	60.2	8.3	13.1	13.7	1.87	5.70
13A	156	CAMB	6y 5m	10x3	199	156	45.9	47.7	7.4	12.1	12.7	1.98	2.61
12A	95	CAMB	6y 3m	12x3	127	84	46.5	47.7	7.6	11.2	11.8	1.9	1.52
16	162	CAMB	6y 1m	12x3	138	99	44.0	46.3	7.2	13.0	13.2	1.87	1.53
14	160	CAMB	5y10m	12x3	143	108	39.8	41.2	6.9	10.4	11.2	1.9	1.46
15	182	CAMB	5y 6m	12x3	135	107	36.5	36.9	6.7	10.0	10.3	1.87	1.16
TOTAL Area	1753												

SUMMARY OF RESULTS FOR GIZO COMPARTMENTS PLANTED WITH TERMINALIA CALAMANSANI - 1980

CPT	Total Area Ha.	Line Area ha	Species	Age	All Stems			O.K. Stems					Average Basal area per ha m^2/Ha.
					Stems per/ha	Mean Girth cm	Mean Ht.	Stems p/ha	Mean Girth cm	MAI Girth cm	Mean Ht.m	MAI Ht. m	
21*	7.2	0.86	Tercal	13 yrs	93	70.9	13.7	33	92.3	7.1	17.1	1.3	2.23
3B	28.2	1.40	Tercal	12y 4m	43	52.5	52.5	20	65.0	5.3	10.6	0.8	0.67
5D	11.7	0.58	Tercal	12y 8m	112	51.4	12.5	48	66.3	5.2	13.5	1.1	1.67
6B	93	2.66	Tercal	9y 6m	77	32.0	8.8	35	39.6	4.2	12.1	1.3	0.44
7A	129	2.07	Tercal	10y 6m	104	52.7	14.7	66	61.2	5.8	16.1	1.5	1.97
8A	17	0.67	Tercal	10y 2m	9	37.5	12.1	4	59.1	5.8	12.1	1.2	0.11
8B	27	1.38	Tercal	9y10m	38	55.6	13.6	19	56.4	6.4	14.0	1.4	0.48
9B	16	0.63	Tercal	11y12m	98	35.9	7.4	55	45.1	4.0	11.5	1.0	0.89
10A	40	1.32	Tercal	10y 8m	74	53.7	11.6	63	55.1	5.2	11.7	1.1	1.52
11A	21.4	6.92	Tercal	10y10m	91	57.6	12.11	77	58.3	5.4	12.2	1.1	2.08
12C*	46	1.17	Tercal	10y 4m	67	66.7	14.6	40	78.5	7.6	16.7	1.6	1.96
13A	96	0.74	Tercal	10y 2m	77	57.0	11.4	52	63.6	6.2	12.0	1.2	1.67
14A&B+	178	5.02	Tercal	9y 4m	72	46.8	12.2	45	53.5	5.7	13.3	1.4	1.02
15A	144.6	4.58	Tercal	9y 0m	93	41.9	9.2	57	50.8	5.6	10.3	1.1	1.17
Total	1855.1	30.10											

* Thinned

\+ Clearfelled

• Distance between lines 13.4m and between trees 3.6 m
All other compartments, 20.1m between lines and an average of 2.2m between trees.

18

SUMMARY OF RESULTS FOR GIZO COMPARTMENTS PLANTED WITH CAMPHOSPERMA BREVIPETIOLATA - 1980

CPT	Total Area Ha	Line Area Ha	Species	Age	All Stems			O.K. Stems					Average Basal area per ha m^2/ha
					Stems per/ha	Mean Girth cm	Mean Ht	Stems p/ha	Mean Girth cm	MAI Girth cm	Mean Ht.m	MAI Girth	
2E*	2	0.61	Camb	12y10m	45	69.3	16.7	19	69.2	5.4	16.7	1.3m	0.72
.6A	48	0.71	Camb	9y 7m	106	82.0	16.5	67	87.2	9.1	20.8	2.2	4.05
.7B	12.9	0.24	Camb	9y 4m	193	77.5	14.2	67	88.6	9.5	20.4	2.2	4.18
9A*	40	0.68	Camb	11y 3m	73	90.2	12.6	70	89.8	8.0	12.6	1.1	4.49
9C*	63	2.91	Camb	11y 0m	77	91.4	16.8	59	94.6	8.6	16.9	1.5	4.28
10B	90	5.57	Camb	10y 9m	78	75	14.9	61.9	80.9	7.5	15.4	1.4	3.18
12A*	44	0.66	Camb	10y 6m	112	87.4	17.5	90	89	8.5	17.5	1.7	5.67
Total	299.9	10.72											

* Thinned

• Distance between 13.4m and between trees 3.6 m

All other compartments, 20.1 m between lines and an average of 2.2 m between trees.

107

SUMMARY OF RESULTS FOR GIZO COMPARTMENTS PLANTING - OTHER SPECIES

CPT	Total Area HA	LINE Area HA	Species	Age	ALL STEMS			O.K. TREES					Average Basal Area Per Ha
					Stems per ha	Mean Gth cm	Mean Ht	Stems per ha	Mean Girth cm	MAI Girth	Mean Ht	MAI Height m	
3B		0.96	TERB	12y 4m	97	50.2	12.5	49	59.3	4.8	13.9	1.13	.3
3A	11	0.35	TERB	12y 6m	14	76.6	7.5	8	75	6.0			.35
3A		2.75	MADE		57	54.2	12.6	30.0	53.7		13.2		
3A		0.75	MADE		44	56.2	14.0	5	79.2	20.8			
5A	10	0.96	MADE	11y 4m	54	38.4	11.2	2	48.2	4.2	17.0	1.5	0.0
5A		2.03	CEDO	9y10m	58	50.8	8.5	27	50		8.5		
8C	49	3.00	CEDO	9y10m	51	53.7	12.2	35	80.1	8.1	16	1.6	1.78
5C	27	0.67	SWIM	11y10m	71	30.4	8.7	8	37.5	3.1			0.09
Total	97	11.47											

. Distance between lines 13.34m and between trees 3.6 m

11 other compartments 20.1 m between lines and an average of 2.2 m between trees.

APPENDIX C

GROWTH DATA FOR THE PRINCIPAL PLANTATION SPECIES

Source: Forestry Division "Silvics of Species" Research Reports

(Note: the graphs included here are for completeness only - the original publication is not well printed and if required for further publication would need to be re-drawn)

AGATHIS MACROPHYLLA

Growth Rates

Height growth of trees in full light with intensive weeding should reach 2 metres in 2-2.5 years, 3 metres in 3-5 years, and 6 metres in 5-6 years. Where trees have high light shade and are weeded the trees that get away should reach 2 metres in 7 years, while those trees that do not get away grow more and more slowly. Once these trees are 2 metres they will reach 5 metres in another 1-5 years. Trees with more shade grow extremely slowly in the early stages.

The girth increments of regenerated crops and undersized trees left after logging are quoted from:-

(a) Trees in full overhead light and well maintained grow to 75 cm. diameter in 45-50 years, with a fairly even diameter increment of 1.8 to 2.0 cm per year.

(b) Trees in logged forest with no maintenance grow to 75 cm girth in 80-90 years, with a fairly even increment of 0.8 to 1.2 cm per year.

(c) Trees over 300 metres a.s.l. in logged forest with no maintenance grow to 75 cm girth in 150 years with variable diameter increment not more than 1 cm per year between 30 and 45 cms girth, and much slower above and below these girths especially if no exposed sites.

The latest measurements on the Mount Austen Plot are:-

Age	18 years
Girth	91.cm
CAI (1974-80-5 yrs) Girth	1.9 cm
Height	21 metres
CAI (1974-80-5 yrs) height	0.8 metres
Log Volume	.473 cubic metres

Yields

The Permanent Inventory Plots at Santa Cruz are too young to give useful data on potential yields. A 45 to 55 year rotation is envisaged at Santa Cruz which should yield 60-80 stems per hectare averaging about 2.0 cubic metres per stem.

Utilization

The timber has orange brown heartwood which dries to straw colour. Sapwood is slightly lighter in colour. The timber is soft and light and usually straight grained with an attractive lustrous finish. Basic density is .400 to .450. The timber is very stable and easily worked. It is used for veneer, light construction furniture, weather boards ship decking and planking.

Timber cut from 17 year old trees on Mount Austen was rather knotted but suitable for light construction, weather boards, and furniture.

CAMPNOSPERMA BREVIPETIOLATA

Growth Rates

In dense rain forest on west Kolombangara Campnosperma trees in the upper canopy grow about 1.9 cm in girth per year. In the more disturbed and probably rather younger forest on the northern part of the island girth growth at 3.8 cm per year was much faster.

Some growth figures from plantation grown trees are given in the attached Table II based on the latest measurements taken in 1979/80. These are summarised in Table I below, taken from Figure 1:-

Table I — Growth Trends

Age	Height (m)			Girth (cm)		
	Low	Average	High	Low	Average	High
5	9	12	15	40	50	70
10	14	17	20	70	90	110
15	17	21	25	100	120	140
20 est	19	24	30	120	140	160

There appears to be little difference between growth rates closed planted and line- planted, though close-planted trees tend to have rather longer log length, and line-planted trees grow rather faster in girth.

Yields

Stocking data from Permanent Inventory Plots at Gizo, and Viru is very variable in compartments up to about 12 years old. The number of good (O.K.) trees per hectare seldom exceeds 150 when crops are 3-4 years old.

A series of local volume tables have been computed from optical measurements on standing trees growing on a range of sites. These are given in Table III and shown in Figure 2. There is now enough data to compute a family of volume curves segregated by log length classes. Girth/Volume relationships are summarised below:-

Girth	Volume (Cubic metres)		
	Low	Average	High
100cm	.40 -	.55	0.70
150cm	.80 -	1.10	1.40

In Figure 2 lines (9) and 10 represent older trees that regenerated naturally after World War II, that have a wider spread of Girth. The line planting technique aims to produce a crop of 80-100 logs per hectare averaging about

140-150 cm. girth in 20 years. Yield estimates based on this would be around 80 — 140 m^3/hectare.

Accurate yield prediction would need more data from plantations around 15 years old from which to build up stand tables of good (OK) trees based on girth or diameter, which will not be available for about 5 years. When these data are available they are likely to confirm the yield indicated in the previous paragraph.

Utilisation

The mature timber is soft pale pink in colour, with no marked difference between sapwood and heartwood. The wood is odorless lacks annual rings, is straight-grained to slightly interlocked, and has sawdust that can cause skin irritation.

The mature wood is used for structural grade plywood, and light general purposes such as siding, packing cases, blackboards etc.

Plantation grown timber is rather lighter and softer than mature timber as the following shows:-

Mature trees	Solomons	density	.325
	P.N.G.		.332
	Solomons 30 yr old		.263
Plantation	Solomons 8 yr old		.283

Test of plantation grown material had reasonable yields of acceptacle paper. Much more work needs to be done to identify end uses for the light and rather weak plantation grown material.

TABLE II **Campnosperma brevipetiolata - Growth Data**

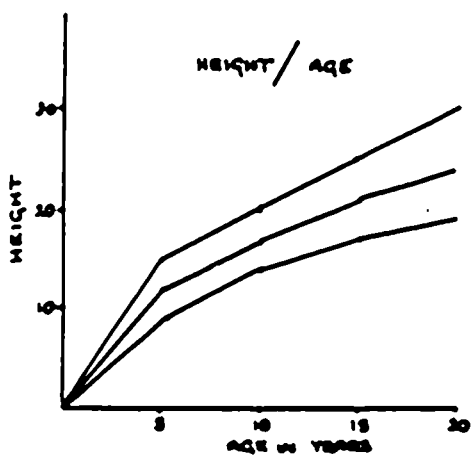
X-No	Locality	Land System	Age Yrs	Ht m.	CAI Ht m/yr	Diam cm	CAI Diam cm/yr	Vol m^3	Remarks
176	Baga (CP)	Alokan	15.4	24	1.0	38	1.6	.838	6 stems
172	Baga (BQ)	Monoi	15.4	23	0.6	40	2.0	.904	6 stems
185	Gizo	Suva	15.1	21	0.6	34	1.6	.624	7 stems
268	Baga (CP)	Alokan	14.4	21	0.6	34	1.2	.661	04ha 25 stems
391	Mt. Austen	Lagakiki	14.5	18	0.6	32	2.1	-	
474	Gizo	Maringe	12.4	19		39	-	.625	LP 7 stems
475	Gizo	Suva	12.4	19	-	38	-	.763	LP 10 stems
476	Viru	Viru	12.0	18	-	36	-	.570	LP 9 stems
332	Gizo	Maringe	12.1	16	-	33	-	.487	LP 11 stems
334	Viru	Viru	16.6	19	-	37	-	.620	LP 17 stems
338	Viru	Viru	11.5	19	-	38	-	.493	LP 30 stems
280	Allardyce	Allardyce	9.3	17	-	28	-		
165	Vanikolo	Peau	8.1	15	-	21	-		
S/506	Allardyce	Allardyce	6.2	8.7		16	-		LP
333	Allardyce	Allardyce	5.8	10.7		17			LP
S/507	Viru	Viru	5.0	10.3		12			LP
477	Allardyce	Allardyce	4.9	10.2		14			LP

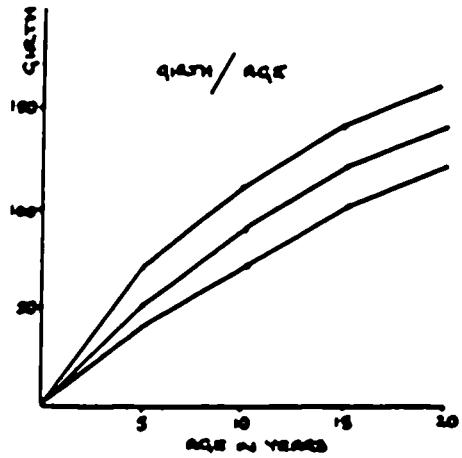
TABLE III

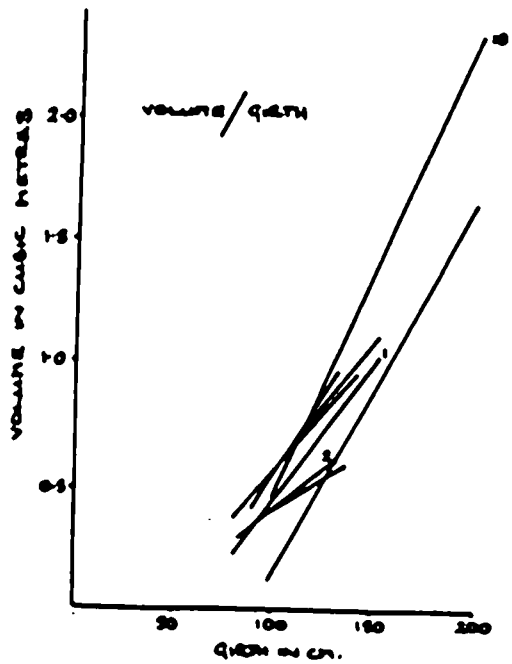
Campnosperma Local Log Volume Tables

Girth Class cm	80	90	100	110	120	130	140	150	160	170	180			
						——Cubic metres——								
1) Gizo L/SST's	.252	.359	.466	.573	.680	.787	.894	1.001						27 stems
2) Gizo Cpt 7a	.274	.339	.405	.470	.535	.600								22 stems up 9m
3) 7a		.419	.557	.695	.833	.971	.971							18 stems over 9.0m
4) Baga Close planted		.475	.571	.666	.761	.856	.951							25 stems
5) Gizo/Baga ST'S	.374	.480	.586	.692	.798	.904	1.010	1.116						
6) Viru. L.P.		.342	.396	.450	.504	.557	.611							36 stems up to 9m
7) Viru. L.P.		.432	.517	.603	.688	.774	.859							23 stem over 9m
8) 95-10.5	.208	.324	.440	.556	.672	.788								
9) Moro			.110	.266	.422	.578	.734	.890	1.046	1.202	1.358	1.514	1.67	
10) Munda			.470	.656	.842	1.028	1.214	1.400	1.586	1.772	1.958	2.144	2.330	

CAMPNOSPERMA BRAUNETIOLATA







EUCALYPTUS DEGLUPTA

Growth Rates

The data available on older final crop trees is given in Table II which was taken from the latest measurements taken in 1979/80. These summarised in Table I below taken from figure I.

Table I — Growth Trends

Age (Years)	Height (Metres)			Girth (Centimetres)		
	Low	Average	High	Low	Average	High
5	15	20	25	30	60	110
10	20	25	33	80	110	150
15	22	30	36	110	150	170
20	24	32	36	130	160	190

Some recent line planted areas that suffered attack by Ambleypelta grew for the first 5 years or so at the low rate, but where they have survived can be expected to accelerate for the next 10 years as shown in X-339 at Viru.

Yields

The only Permanent Inventory Plot data is of very young trees for Kolombangara, and shows wide variability in stocking but reasonable growth rates. In a few years better data will be available from Cattle Under Tree areas.

A series of local volume tables have been made from optical measurements of height and diameter and given in Table III and Figure 2. These may be summarised.

Girth	Volume		
	Low	Average	High
100 cms	.40	.50	.60
150 cms	.80	1.00	1.40
200 cms	n.a.	n.a.	2.40

Log lengths vary a great deal but the effect of long logs on volume is shown in lines (4) and (5) show in Figure 2. The line planting technique aims to produce a crop of 80 to 100 logs after about 160 cm girth in 20 years. Yield estimates would have to be reduced because the stocking of good trees would be lowered because Ambleypelta and other damage has left higher numbers of malformed trees. Yield of 100 to 150 good logs should be possible since the

remaining trees would be rather larger than average.

Utilization

The reputation of the species is based partly on the uses to which mature logs and lumber from Kerevat can be put, and partly on the proven pulping qualities of plantation grown material. These do in fact conflict as is shown in the following table.

Mature Timber	Papua New Guinea basic density	.6
Plantation Timber	Solomons (13 yrs Mt. Austen)	.382
	Solomons (8 yrs Gizo)	.4

The Gizo tree was growing more slowly than the Mount Austen tree which may account for the difference. Data from other countries indicates a basic density of about .400 at 15 years.

If a density of around .400 is realistic for timber from plantations of 15 to 20 years, it means that the wood will be quite promising structurally. Recently furniture was made from timber from 19 year old trees on Mount Austen and Rove which indicates that the timber is useful for framing and furniture. Poorly formed logs can be used as pulpwood.

Table II Eucalyptus deglupta - Growth Data

K-No	Locality	Land System	Age Yrs	Ht m	CAI Ht m/yr	Diam cm	D.I cm/yr	Vol m^3	Remarks
K-73	Mt. Austen	Lengakiki							Burnt 1978
K-434	Rove	Lengakiki	21	37	1.3	47	1.8	483	Partly burnt 3 stems
K-187	Gizo	Suva	1.52	22	-	43	0.6	823	6 stems
K-209	Baga CP	Alokan	15.2	33	1.0	48	1.6	760	10 stems
S/584	Ringi	Ringi Cove	7	22		22			L.P.
S/59	Viru	Viru	6.5	21		31		511	LP 4 stems
S/598	Ringi	Ringi Cove	5.5	29		18	-		LP
S/648	Ringi	Ringi Cove	5.0	21		24			LP 70 stems
S/59	Allardyce	Allardyce	4.8	20		18			LP 52 stems
S/596	Ringi	Ringi Cove	4.5	9.9		11			LP High

TABLE III

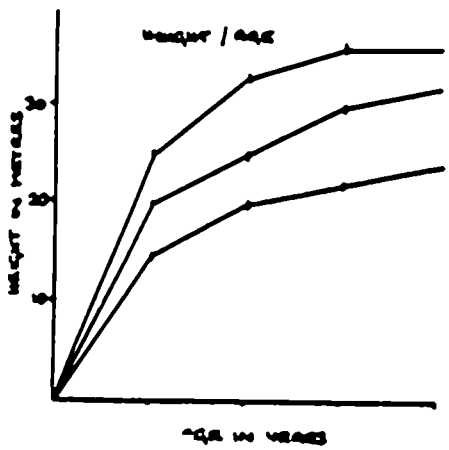
EUCALYPTUS DECLUPTA

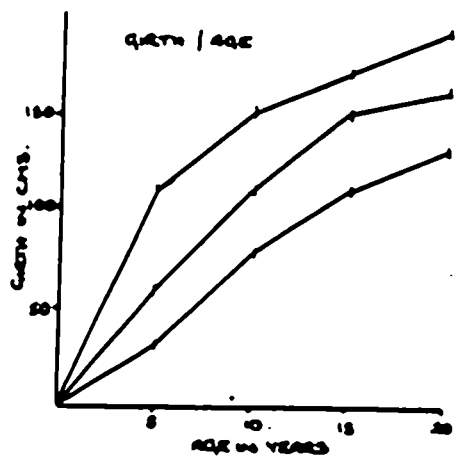
LOG VOLUME TABLES - CUBIC METRES

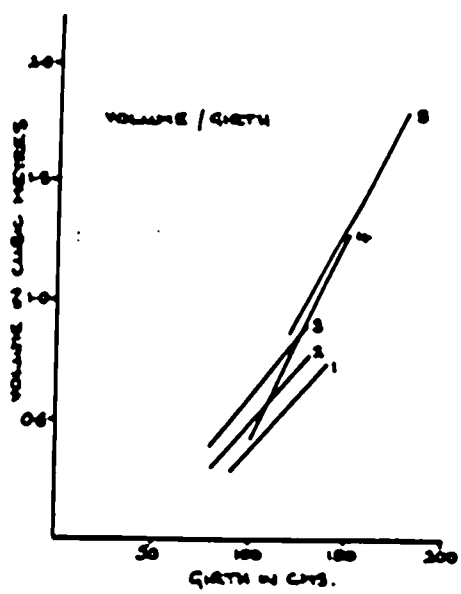
Girth Class - Cms

	80	90	100	110	120	130	140	150	160	170	180	190	200	
						—— Cubic metres ——								
(1) Viru 5-9 metre logs		.292	.382	.472	.563	.653	.743							6-12 years
(2) " 0-12 metres	.302	.395	.488	.581	.674	.766								
(3) " 3-16 metres	.399	.500	.601	.702	.803	.904								
(4) Trial plots 10-15 years			.440	.612	.784	.956	1.128	1.300						
(5) Trial plots 15-20 years					.866	1.064	1.262	1.460	1.658	1.856	2.054	2.252	2.450	

EUCALYPTUS DEGLUPTA







TERMINALIA BRASSII

Growth Rates

Very little data is available on the growth rates of mature trees in the normal swamp or alluvial habitat.

Trees that naturally regenerated after the war on devastated areas give the following growth data:

Table I

Locality	Age (approx.)	No Stems	Height metres	Girth (overbark) cms	Stem Volume (overbark) m^3	P.A.I. (Girth) cms
Munda	28	13	29	170	1.8	1.5(4 yrs)
Sege	28	20	35	169	2.1	3.2(4 yrs)
Noro	29	20	32	193	2.1	3.0(5 yrs)

The trees at Munda were on a hard uplifted coral site which is fairly dry, and growth has slowed down considerably. The trees have now been felled. The trees at Noro are on fairly loose soil, and appear to be growing extremely well. The plot was thinned in 1978.

Some figures from plantation grown trees are given in Table II overleaf taken from the latest arrangements in 1979/80. These are summarised in Table III below, taken from Figure I:-

Table III

Growth Trends

Age	Height (metres)			Girth Centimetres)		
	Low	Average	High	Low	Average	High
5 yrs	8	15	21	40	60	90
10	17	22	27	70	90	140
15	21	26	30	100	120	170
20	22	27	32	120	150	190

With the better site selection indicated in para 23, there is no reason why the low trends cannot be avoided.

Yields

There is very little stocking data from Permanent Inventory Plots and that mainly from crops under 5 years old. Part of Cpt 14a at Viru shows good average development on their clay soils of the Alokan Land Systems.

A series of local volume tables have been computed from optical height and diameter measurements on standing trees growing on a range of sites. These are given in Table III and shown in Figure II. The volume tables for Viru are segregated into log length classes and give a reasonable indication of Girth/Volume relationships to be expected with this species:-

Girth (cm)	Volumes (Cubic metres)		
	Low	Average	High
100 cm	.40	.6	1.00
150 cm	1.00	1.5	2.40
200 cm	-	-	3.75

In Figure 2 lines 6 and 7 represent are for older vigorous natural regrowth, but line (1) from Mbava compares very favourably. With T. brassii log lengths tend to be long in well grown trees. The line planting technique aims to produce 80 to 100 logs per hectare about 150 cm in girth in 20 years. Yield estimates based on this would be around 120 - 150m^3 per hectare.

Accurate yield prediction will need more data from plantations around 15 years old from which to build up stand tables of 9000 (OK) trees based on girth or diameter. These will not be available for about 10 years.

Table II Terminalia brassii - Growth Data

No	Locality	Land System	Age Yrs	Ht m	CAI Ht m/yr	Diam cm	CAI Diam cm/yr	Vol m^3	Remarks
86	Mt. Austen	Langakiki	16.6	20	-	48	2.4	1.271	2 stems burnt
394	Mt. Austen	Langakiki	15.7	29	0.8	52	2.6	1.612	8 stems
179	Baga (CP)	Alokan	15.2	29	0.4	54	1.2	2.406	8 stems
293	Gizo	Suva	14.8	22	0.4	32	2.2	-	
333	Gizo	Maringe	12.1	22		29		1.029	LP 4 stems
334	Viru	Viru	11.6	20		29		.550	LP 11 stems
338	Viru	Viru	11.4	21		30		.626	LP 22 stems
206	Mounga	Ringi Cove	6.7	17		22		.266	
333	Allardyce	Allardyce	5.8	13.2		18		-	LP

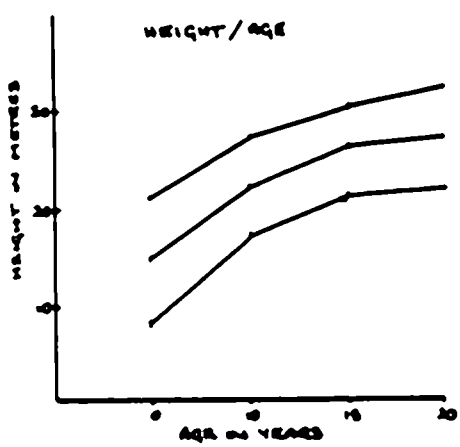
Table 3

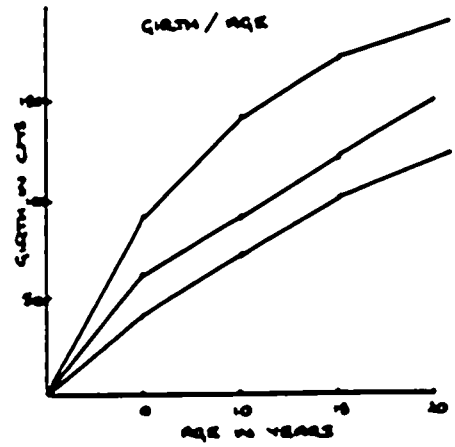
Terminalia brassii - Local Log Volume Tables

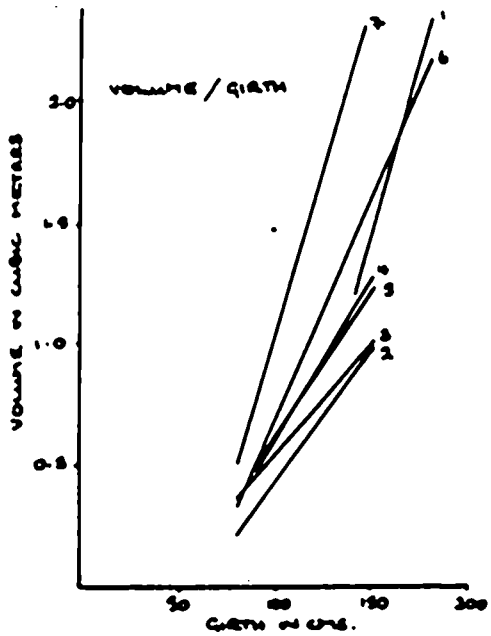
Girth

	80	90	100	110	120	130	140	150	160	170	180	190
1) STa Baga, Mt. Austen							1.204	1.491	1.778	2.065	2.352	2.639
2) Viru Logs 7-9 m	.208	.318	.428	.538	.648	.758	.868	.978				
3) Viru Logs 10-12 m	.353	.450	.549	.647	.745	.844	.942	1.046				
4) Viru Logs 13-19 m		.472	.606	.740	.874	1.008	1.142	1.276				
5) S.Tis Age 9-11	.362	.486	.610	.743	.858	.982	1.106	1.230				
6) Seghe	.324	.492	.828	.996	1.164	1.332	1.500	1.668	1.836	2.004	2.172	2.340
7) Noro	.502	.781	1.060	1.339	1.618	1.897	2.176	2.455	2.734	3.013	3.292	3.571

TERMINALIA BRASSII







TERMINALIA CALAMANSANAI

Growth Rates

Girth growth rates of older natural trees on Kolombangara were about 1.0 cm per year.

Very little data is available on planted trees over 12 years old.

Some figures from plantation grown trees are given in the attached Table II taken from the latest measurements in 1979/80. These are summarised in Table I below, taken from Figure I:-

Table I Growth Trends

Age	Height (m)			Girth (cm)		
	Low	Average	High	Low	Average	High
5 yrs	7.5	10	16	30	50	75
10	12	16	21	60	80	110
15 est.	15	20	25	70	110	140
20 est.	20	25	30	90	140	160

Graph I clearly shows that when the species is planted in the wrong conditions as in X-S/507 Viru, where the initial canopy was far too dense it does not grow well.

Yields

Stocking data from Permanent Inventory Plots at Gizo and Viru is very variable, often reflecting poor techniques used in early years. Younger crops are improving, as site selection is becoming more accurate. The number of good (O.K.) trees per hectare still seldom exceeds 150 when crops are 3-4 years old. An example of a good crop is in Cpt 2 i. at Gizo which is unfortunately with 20 m between lines.

A series of local volume tables have been computed from optional height and diameter measurements on standing trees growing on a range of sites. These are given in Table III and shown in Figure 2. There is now enough data to compute a family of volume curves segregated by log length classes. Girth/Volume relationships are summarised below:-

Girth (cm)	Volume (Cubic metres)		
	Low	Average	High
100 cm	.35	.50	.65
150 cm	.50	1.00	1.50

With the exception of (4) on Figure 2 for very short logs, log lengths with T. calamansanai tend to be longer than those of Campnosperma. The line planting technique aims to produce a crop of 80-100 logs per hectare about 140-150 cm girth in 20 years. Yield estimates based on this would be around 100-140 m^3/hectare.

Accurate yield prediction will need more data from plantations around 15 years old from which to build up stored tables of good (O.K) trees based on girth or diameter. These will not be available for about 5 years.

Utilisation

The mature timber is pale yellow, rather soft, with a subdued figure, and no colour contrast between sapwood and heartwood.

The mature wood is used for light framing, cladding and decking, mouldings and shelving. It is similar to West African Afara, Terminalia superba and could prove to be a useful substitute for this on the European market.

Plantation grown timber is rather lighter and softer than mature as the following shows:-

Mature trees :	Solomons basic density	.469
	Papua New Guinea	.375
	Solomons (30 yrs old)	.458
Plantation	Solomons (5.5 yrs old)	.276

There are indications from the above figures that by 30 years T. calamansanai in the Solomons is approaching maximum density.

Only pulping tests have been done on plantation grown wood and the results for older material are considered to be satisfactory. A few 7 year old trees were cut down recently and yielded quite solid sawn timber which planted quite well. All T. calamansanai timber must be protected against insects and rot by dip diffusion or pressure treatment which only gives "fair" results.

Table II **Terminalia calamansanai - Growth Data**

No	Locality	Land System	Age Yrs	Ht m	CAI m/y	Diam cm	CAI m/yr	Vol m^3	Remarks
467	Gizo	Suva	12.9	24	1.4	37	1.8	.739	
Cpt 2.i	Gizo	Suva	12.9	20		34		.898	LP
396	Mr. Austen	Lengakiki	12.8	21	1.4	38	2.8	.763	
474	Gizo	Maringe	12.4	20		32		.613	LP 10 stems
475	Gizo	Suva	12.4	18		39		.629	LP 10 stems
476	Viru	Viru	12.0	19		29		.440	LP 9 stems
S/506	Allardyce	Allardyce	6.2	11		14		-	

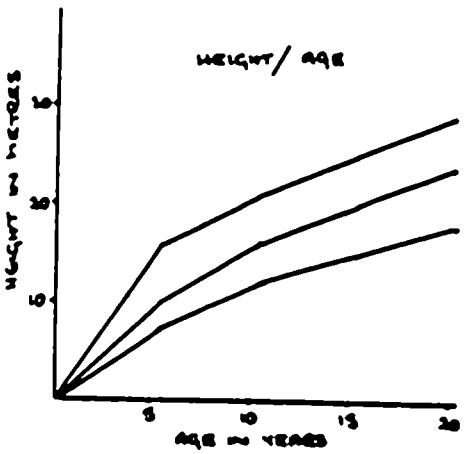
Table III

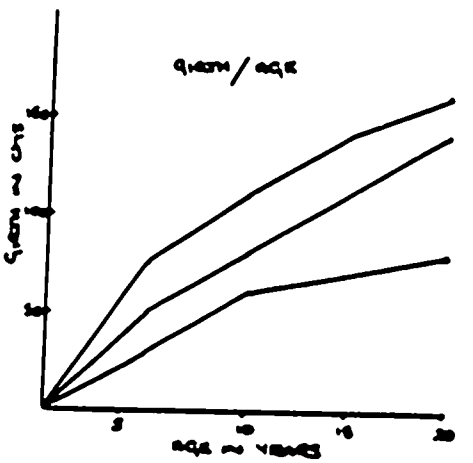
Terminalia calamansanai - Log Volume Tables

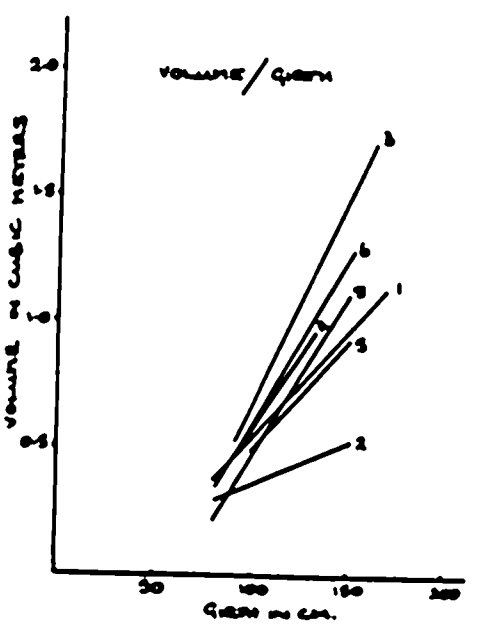
Girth Class cm

	80	90	100	110	120	130	140	150	160	170	
1) Gizo 32/SST	.365	.454	.543	.631	.720	.808	.897	.986	1.614	1.163	20 stems
2) Gizo Cpt 2.i up to 12 m	.219	.347	.475	.603	.731	.859	.951	1.115			16 stems
3) Gizo Cpt 2.i over 12 m		.528	.694	.866	1.038	1.210	1.382	1.554	1.726		
4) Viru LP 5-8 m	.293	.326	.359	.391	.424	.457	.490	.523			20 stems
5) Viru LP 9-12 m	.270	.365	.459	,554	.649	.743	.838	.932			23 stems
6) Viru LP 13-17 m		.472	.606	.740	.874	1.008	1.142	1.276			20 stems
7) 9 years	.350	.470	.590	.710	.830	.950					

TERMINALIA CALAMANSANAI







APPENDIX D

A LIST OF FORESTRY DIVISION TECHNICAL NOTES 1958-1974

A LIST OF FORESTRY DIVISION TECHNICAL NOTES 1958-1974

1/58:	Common S.I. timbers and prospects of commercial working.
(1)2/58:	Kauri forest management in relation to licence renewal.
3/58:	Extracts from "Forest Industries - Sierra Leone" article - prefal, - shingles.
(1)4/58:	Timber Exports - Malaya North Bonco Sarawak.
5/58	Experimental tree planting plots.
6/58:	No Mans Land
(1)1/59:	Forestry in the Solomons since 1949 - with emphasis on timber development prospects.
(1)1/60:	Timber Development Prospects BSIP - re FAO/ECAFE study.
1/61:	Forestry and Land Tenure.
1/62:	The Forest Estate.
1/63	Check list of Some Common Sol. Is. Trees.
2/63:	Abbreviations of plant names
3/63:	Timber Calophyllum spp
4/63:	Dillenia in the Solomon Islands
5/63:	Timber Development Prospects in the Solomons
6/63:	General Volume Table
7/63:	Land for Forestry
8/63:	A kauri forest on Vanikoro: T.C. Whitmore
9/63:	A Botanist's notes on the Vanikoro kauri forests: T.C. Whitmore
10/63:	Regeneration of kauri at Vanikoro: J. Leggate.
1/64:	Forest key to calophyllum
2/64:	A Guide to the Sapotaceae
(1)3/64:	Albizia in the Solomons
4/64:	Celtis in the Solomons
(1)5/64:	Elaeocarpaceae, The oil fruits; in the Solomons
(1)6/64:	Easily Recognised Families of Trees
7/64	Check List (Handbook Form)
8/64:	Notes on Botanical Collecting trip to Uairaha River

(1)9/64: A Provisional Key to the Common species of Terminalia

10/64: A Forest Key to the Common Big Trees of Lowland Forests.

11/64: Notes on the Japanese timber market in 1964.

1/65: A list of Vanikoro weed species (mainly trees) by Mbalua (st. Cr Santa Cruz) duties names.

2/65: Report on CFO's Malaysia tour (via TPNG and Aust) July/August, 1965.

3/65: Local volume Tables for Pometia pinnata growing on Zaga Island.

(1)1/66: A Summary of the performance of various species in departmental trial plots.

2/66: Local volume tables for Campnosperma brevipetiolata growing at Allardyce Harbour, Isabel Island.

(1)3/66: A preliminary investigation into the timber produced by Eucalyptus deglupta planted in the Solomons

4/66: Note on floristic analyses and site typing in the Solomons.

(1)5/66: A defect study on Dillenia salomonensis on Vangunu Island.

6/66: Preliminary Results of a Timber Survey on Vangunu Island.

1/67: Results of a Timber Survey in the Viru/Kalena Area

2/67: A Study of Lumber Recovery from the round log at the Tenaru & Mounga Sawmills.

3/67: Explanation of Govt. Forestry policy

4/67: Amenity planting and storm hazard

5/67: Resistance of certain tree species ... to cyclone damage.

(1)6/67: Raising Pinus caribaea seedlings

7/67: Dip diffusion (boron diffusion) preservative treatment of timber for the Solomon Islands.

8/67: Local volume tables for Calophyllum kajewskii growing on Banga Island.

9/67: Data on certain BSIF timber species

(1)10/67: Mech. properties (green) of Canarium salomonensis and 4 other timber spp.

1/68: Pulping potential of 5 common BSI timber species.

2/68: Trials of BSIF spp for Phywood Manufacture

3/68: Strength grouping of 13 common BSI timber spp.

4/68: Resistance of certain tree species ... to cyclone damage.

(1)5/68: The "Tumeric" test for boron (dip) diffusion treated timber.

(1)6/68: Mechanical properties (green) and strengths grouping of 5 BSI timber species.

7/68: Local volume tables for Terminalia brassii and Dillenia salomonens at Allardyce Harbour, Isabel Island.

8/68: Portable mill Lumber Recovery study

9/68: Log Recovery Study (Allardyce Harbour)

(1)1/69: Mechanical Properties (green) of a further 14 Solomon Islands timber species.

1/70: World Timber Trends related to the Solomons

2/70: Functions and organisation of Forestry Department in developing economics.

3/70: Nursery and Establishment Techniques used in New Guinea (T.P.N.G.) for Klinkii pine (Araucaria hunsteinii).

4/70: Observations on the Regeneration techniques used in the lowland rain Forest and Monsoon Forest in the Territory Papua New Guinea.

5/70: Local Volume Tables for Terminalia brassii, Canpnosperma brevipetiolata, Calophyllum kajewskii, Pometia pinnata and Dillenia salomonensis at Viru Harbour, New Georgia Island and Canpnosperma brevipetiolata and Calophyllum kajewskii at Ringi Cove, Kolobangara Island.

(1)6/70: Log Recovery Study - Ringi Cove

7/70: Log Recovery Study - Viru Harbour

1/70: A Summary of the performance of various species in Departmental trial plots.

2/72: Wood remaining after Logging - Kolobangara and Viru/Kalena.

(1)1/73: Timber Planting Programme 1974 to 1985 (Projection and Appraisal).

(1)1/74: Timber Planting Programme Projection 1974 to 1985 and Log Production cost estimates.

APPENDIX E

ITINERARY

ITINERARY

11/1/82	PJW	Left London, Flight BA11
13/1/82	PJW	Arrived Sydney in transit. Over night Sydney.
14/1/82	PJW	Left 0630, arrived 1430 Honiara. Met by Mr Enele Kwanairara Ag CFO & Mr A. Orr, PFO. Discussions with them, Mr T. Nolan Logging & Timber Control. Then to British High Commission, discussions with Mr D. Kerly & Mr G. Slater, High Commissioner. Night Honiara.
15/1/82	GRW	Left London.
16/1/82	PJW	Left 0600 for Munda, met by TCO's Mr G. Chaplin & Mr J. Sandom. Discussions & examination of experimental files and data in Research Office. Night Munda.
17/1/82 (SUN)	PJW	At Munda all day in Research Office. GRW night Brisbane.
18/1/82		Left 0800 for Viru by canoe. Examined line plants areas dating from 1971, workshops, boats and current logging areas. Returned 1830. GRW arrived Honiara and discussions at Forest Division. Night Munda.
19/1/82	PJW	Left Munda 0930 by canoe for Manigisi, Kolombangara. Visited trials dating from 1974, nursery, then to Poitete Station.
	GRW	Left Honiara, arrived Poitete. Night Poitete.
20/1/82		All day Lelobo Range on North Kolombangara. Visited Cattle under trees areas plantations. Discussions with entomologist Mr M. Bigger. Night Poitete.
21/1/82		Left Poitete 0900 for Manigisi & Ringi Cove Inspected trials plantations and logging areas. Met Levers Pacific Timbers Staff. Canoe to Munda in evening. Night Munda.
22/1/82	PJW	Left Munda flight IE 884 to Honiara with Messrs Chaplin & Sandom. Meeting in afternoon with Messrs Orr & Kwanairara. Night Honiara.
	GRW	To Viru to inspect plantations for 1 day. Night Munda.
23/1/82	PJW	In Honiara. Writing notes in morning, in afternoon to Forest Office for photocopying, obtaining maps etc.
	GRW	Returned to Honiara. Night Honiara.

13

24/1/82 (SUN)	PJW & GRW	Left 0545 by air charter to Santa Cruz group. Arrived 0900 Accompanied by Messrs Chaplin, Sandom & Watt. Toured ODA & EDP plantations. Left 1515 returned Honiara by 1930. Night Honiara.
25/1/82		Discussions in morning with Mr Kerle & Mr Kwanairara in British High Commission, and visited Ministry of Finance, Ministry of Transport, Communications & General Utilities, Planning Office, Cattle Under Trees Officials.
	PJW	Flight IE 515 to Brisbane. Arrived Sydney 2130. Night Sydney.
	GRW	at Forestry Department Night Honiara.
		Note: no flights available till 1 February.
26/1/82	PJW	In Sydney. Contacted ADAB officials responsible for Australian aid programme to CUT programme. Full discussion on telephone - no flight available to Canberra that day. No British Airways Flight to London that day. Night Sydney.
	GRW	At Forestry Division collecting data from project records Night Honiara.
27/1/82	PJW	In Sydney until 1330. Flight BA 12 to London.
	GRW	Collection of data from Forestry Division files Night Honiara.
28/1/82		Collection of data by GRW from Forestry Division files Night Honiara.
29/1/82		Collection of data from Forestry Division files by GRW Night Honiara.
30/1/82	GRW	Analysis of data collected Night Honiara.
31/1/82	GRW	Delayed flight Night Honiara.
1/2/82	GRW	Departed Honiara for Australia Night Sydney.
2/2/82	GRW	Depart Sydney for London. Delay of 12 hours in Singapore due to mechanical failure on plant (Flight BA 14)
3/3/82	GRW	Arrive Heathrow, overnight at Hotel at B.A. expense.
4/2/82	GRW	Arrive Edinburgh.

LIST OF PERSONS MET

Mr Enele Kwanairara	Ag CFO
Mr A. Orr	OSAS FFO
Mr G. Slater	British High Commissioner, Honiara
Mr D. Kerly	First Secretary, BHC Honiara
Rt. Hon. P. Salaka	Minister for Natural Resources
Mr R. Russell	Ag Permanent Secretary
Mr E. Doliano	SFO, Timber Control
Mr T. Noland	ODA TCO, Timber Control
Mr P. Beenders	Secretary, N. New Georgia Timber Control
Mr J. Mulholland	Commonwealth Development Corporation
Mr G.E. Chaplin	ODA TCO, Forest Research
Mr J. Sandom	ODA TCO, Plantations
Mr R. Maoriasi	FO, Timber Control
Mr T. Tahisan	RO, Viru
Mr R. Hiti	RO, Manigisi
Mr T. Apai	RO, Poitete
Mr S. Pitokolo	RO i/c Kolombangara
Mr P. Neil	ODA Student
Mr S. Cager	ODA Student
Mr M. Bigger	ODA TCO Entomologist
Mr R. Bradford	Manager, C.U.T. (N.Z. Aid)
Mr J. Keise	FO, Research, Kolombangara
Mr D. McNeil) Mr D. Gilbert)	Lever Pacific Timbers, Ringi Cove
Mr I. Tanen	RO, Santa Cruz
Mr K. Sanders	Field Research Officer, Ministry Home Affairs & National Development
Mr J. Martin	Senior Planning Officer
Mr W. Wilson	Senior Mechanical Engineer, Ministry of Transport Communication & General Utilities
Mr J. Cornish	Under Secretary, Ministry of Finance
Mr I. Knight	Ag Principal Veterinary Officer, Honiara
Mr E. Mason	Permanent Secretary, Ministry of Agriculture and Lands

Telephone Meeting

Mr R. Brownbell	Economist, ADAB, Canberra, Australia.

137

APPENDIX F

TERMS OF REFERENCE FOR THE CONSULTANTS

TERMS OF REFERENCE FOR THE CONSULTANTS

I am directed by the Secretary of State for Foreign and Commonwealth Affairs to offer you appointment as an Evaluator of British Aid to assist Forestry Development in the Solomon Islands. The appointment will consist of an assignment in the Solomon Islands and thereafter the preparation of your report thereon. The assignment will be for a period of 2 to 3 weeks from the date of your emplaning by the direct route for the Solomon Islands until the date of your arrival back in the United Kingdom by the direct route, or until such other date as may be decided by this Administration or by the local British Representative on behalf of this Administration.

During your assignment you will evaluate the Overseas Development Administration's (ODA) funded financial assistance and technical cooperation for the exploitation and development of forestry in the Solomon Islands during the period 1965-1980.

Your appointment will consist of a study and report on the history of this programme of aid together with a detailed evaluation of:

(a) the administration of the aid in terms of the efficiency of project selection design and execution;

(b) the impact or expected impact of the programme of aid, including where appropriate selected projects within this programme, and a comparison of this with the objectives and expectations of the aid at the outset (where possible this should include comparison as between ex-ante and ex-post or current estimated rates of return);

(c) the relative extent to which any failure to achieve the targets set in the project can be ascribed to

(i) insufficient technical information at the outset;

(ii) insufficient technical expertise in the execution of the project;

(iii) lack of physical resources eg equipment, vehicles etc;

(iv) organisational failures in applying available resources;

(v) other major factors (to be specified).

(d) in the light of (c) what preventive or remedial action might have been taken, for example in the fields of research or training, to improve project performance;

(e) whether, given the technical decisions and capabilities, the programme was cost-effectively designed and executed.

Further, in the light of (a) - (d) and any other relevant factors, you will make such recommendations regarding aid administration and the design of this type of project or programme which you feel would improve cost effectiveness, developmental impact, or commercial benefit to Britain. In undertaking the evaluation you will take into account documentation in ODA, relevant reports, and comments from interested or involved parties including officials of the ODA and the recipient Government.

During the initial phase of the evaluation you will liaise closely with the Evaluation Unit to agree the methodological approach to be adopted and the structure of the written report required which should be in accordance with that suggested in the ODA publication "Guidelines for the Preparation of Evaluation Studies".

APPENDIX C

CONSULTANTS' PERSONAL HISTORIES

TITLE	SURNAME	FORENAMES	
	Watt	Guy R.	
DATE OF BIRTH	3.10.45	NATIONALITY	British

QUALIFICATIONS AND PROFESSIONAL SOCIETIES	B.Sc. (Forestry) Aberdeen, 1969. B. Litt (Forest Economics) Oxford, 1971 C. Dip. Accounting & Finance, 1978, Association of Certified Accountants Certificate in Industrial Engineering.Central Institute of Technology, Wellington, NZ, 1977 Member of Institute of Chartered Foresters U.K. Member New Zealand Institute of Foresters Member of Commonwealth Forestry Association.
CURRENT POSITION	Forestry Economist for Economic Forestry Group since 1979
APPOINTMENTS AND EXPERIENCE	1972-1974 Solomon Islands Forestry Dept. Experience in tropical forest research, Management, and economics and planning 1975-1978 Scientist with New Zealand Forest Service at the Forest Research Institute Rotorua, New Zealand. Member of the Economics of Silviculture Group which involved work on forest valuation, evaluation of silvicultural regimes, tropical forestry research literature reviews and land use studies. There were also a number of short term secondments to the New Zealand Ministry of Foreign Affairs involving visists to Fiji, Samoa, and Solomon Islands to advise on silvicultural research and aid. 1979 - Present Forest Economist with responsibility within the group for all financial and economic research, appraisals and evaluations associated with investment in forestry in the U.K. and in the U.S.A. Consultant to a number of leading U.K. Pension Funds and Life Assurance Companies. Regular visists to U.S.A. Consultancy appointments have also been undertaken for FAO Overseas Development Administration, UNDP, and the Asian Development Bank in the South Pacific, Malaysia and Brazil in forest economics and planning.

SIGNED ..... DATE 27th August, 1982.

COMMONWEALTH FORESTRY INSTITUTE

STAFF PERSONAL HISTORY

TITLE:	SURNAME	FORENAMES	
	WOOD	PETER J.	
DATE OF BIRTH:	23.3.32.	NATIONALITY:	BRITISH

QUALIFICATIONS AND PROFESSIONAL SOCIETIES:

B.A. (Botany) Oxford, 1954.
M.A. (Forestry) Oxford, 1960.
Fellow of the Institute of Foresters of Great Britain; Fellow of the Instit of Wood Science; Hon. Treasurer, Commonwealth Forestry Association.
Co-Chairman, IUFRO Working Party 2.02-8, Tropical Species Provenances.
Member Intermediate Technology Development Group, Forestry Panel.

POSITIONS HELD AT CFI:

Senior Research Officer from 1969. Head of Unit of Tropical Silviculture since 1977.

APPOINTMENTS AND EXPERIENCE:

1957-69 Tanzania Forest Department. Experience of tropical rain forest management; pine, cypress, Eucalyptus, teak and other hardwood plantations; Silvicultural research in wet and dry zones; timber concessions; agro-forestry; forestry training, timber utilisation research and development o production lines for furniture and wooden housing.
1969-present Visited East and West Africa, Sudan and Central Africa; India, Nepal and Sri Lanka; Australasia and Pacific; South and Central America.
Senior Research Officer at CFI concerned with evaluation of species; silvicultural research; organisation of training courses, especially in planning and management; gene conservation.

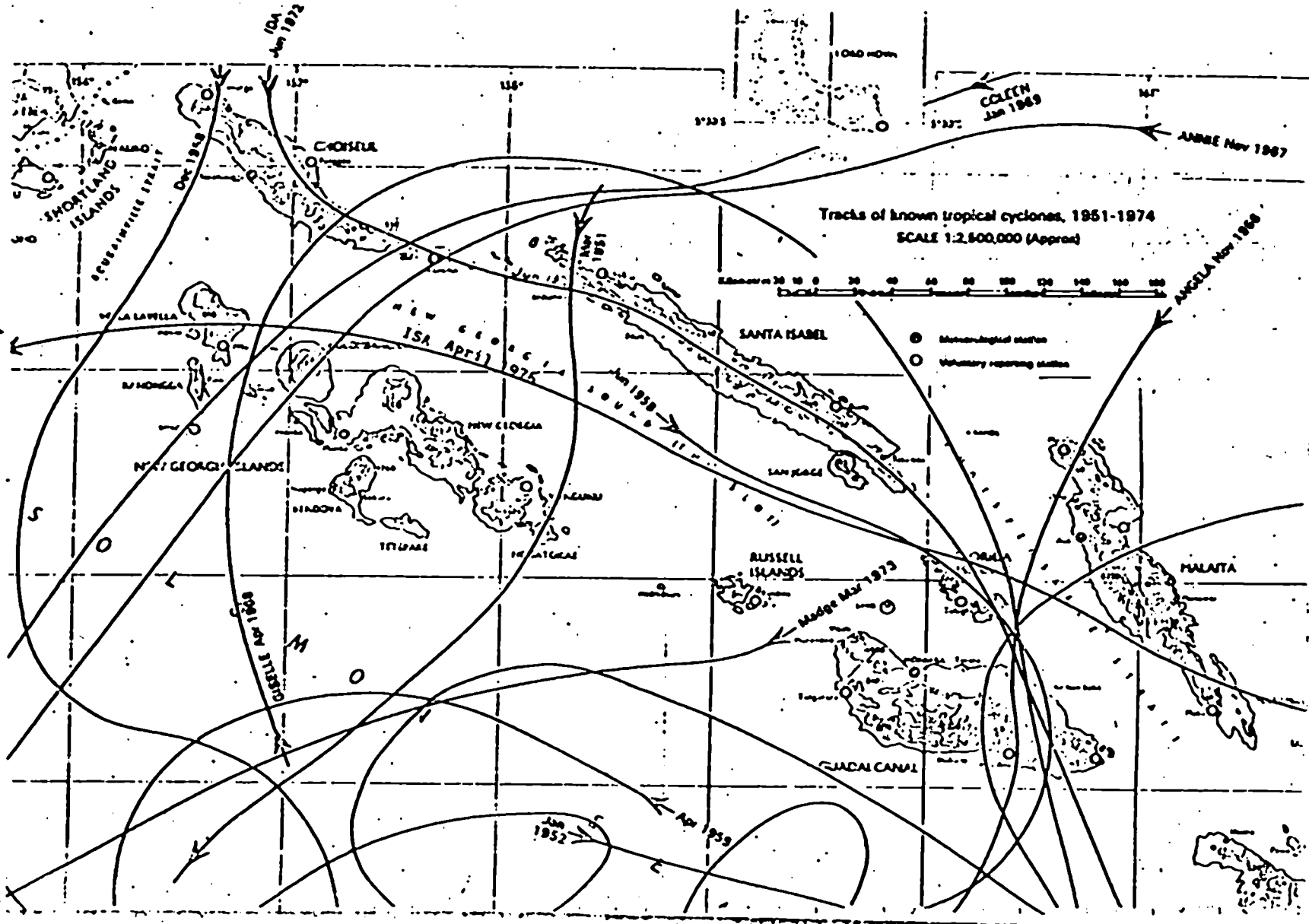
Consultant to FAO, Overseas Development Administration (UK) World Bank, Minister Agriculture Ltd., Clouston Cobham and Partners in arid zone forestry, social and community forestry, forest plantations, forestry training.

LANGUAGES:	READ				WRITE				SPEAK			
	EX	GOOD	FAIR	SLIGHT	EX	GOOD	FAIR	SLIGHT	EX	GOOD	FAIR	SL
ENGLISH	✓				✓				✓			
FRENCH		✓				✓				✓		
SWAHILI		✓					✓			✓		
SPANISH		✓						✓			✓	

SIGNATURE:	STAFF MEMBER:		DATE:	6.10.5

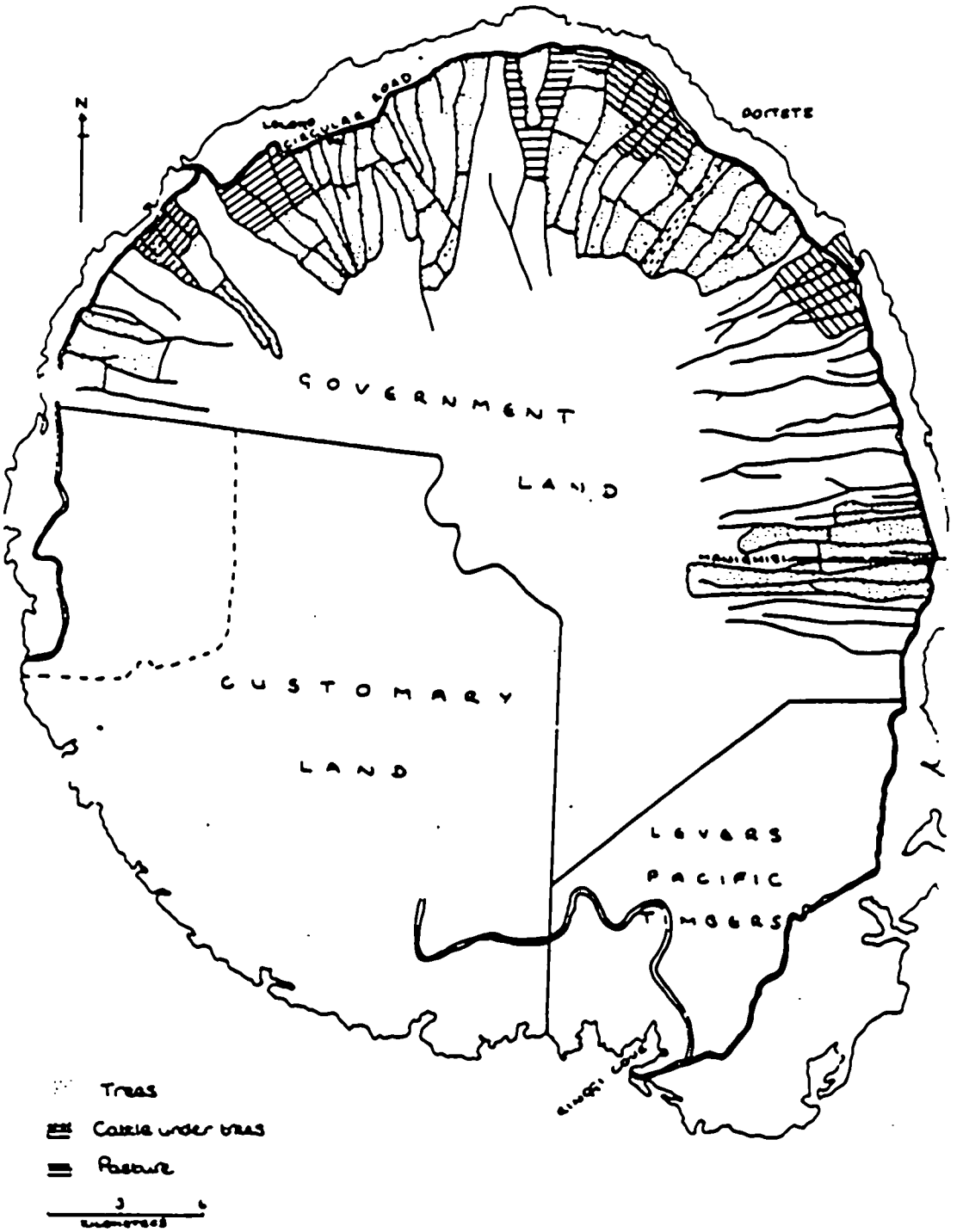
148

CENTRAL AND PROVINCIAL GOVERNMENT ADMINISTRATION
Central Government Headquarters
Provincial Headquarters
Provincial Sub-Stations
Police Stations
Customs Posts
Electricity Supply Stations
MALAITA
SANTA ISABEL
GUADALCANAL
CHOISEUL
NEW GEORGIA
VELLA LAVELLA
RENNELL
BELLONA
FLORIDA IS.
SANTA CRUZ
VANUATU
MAP 1
General Location Map
of the Solomon Islands.
Planted areas.

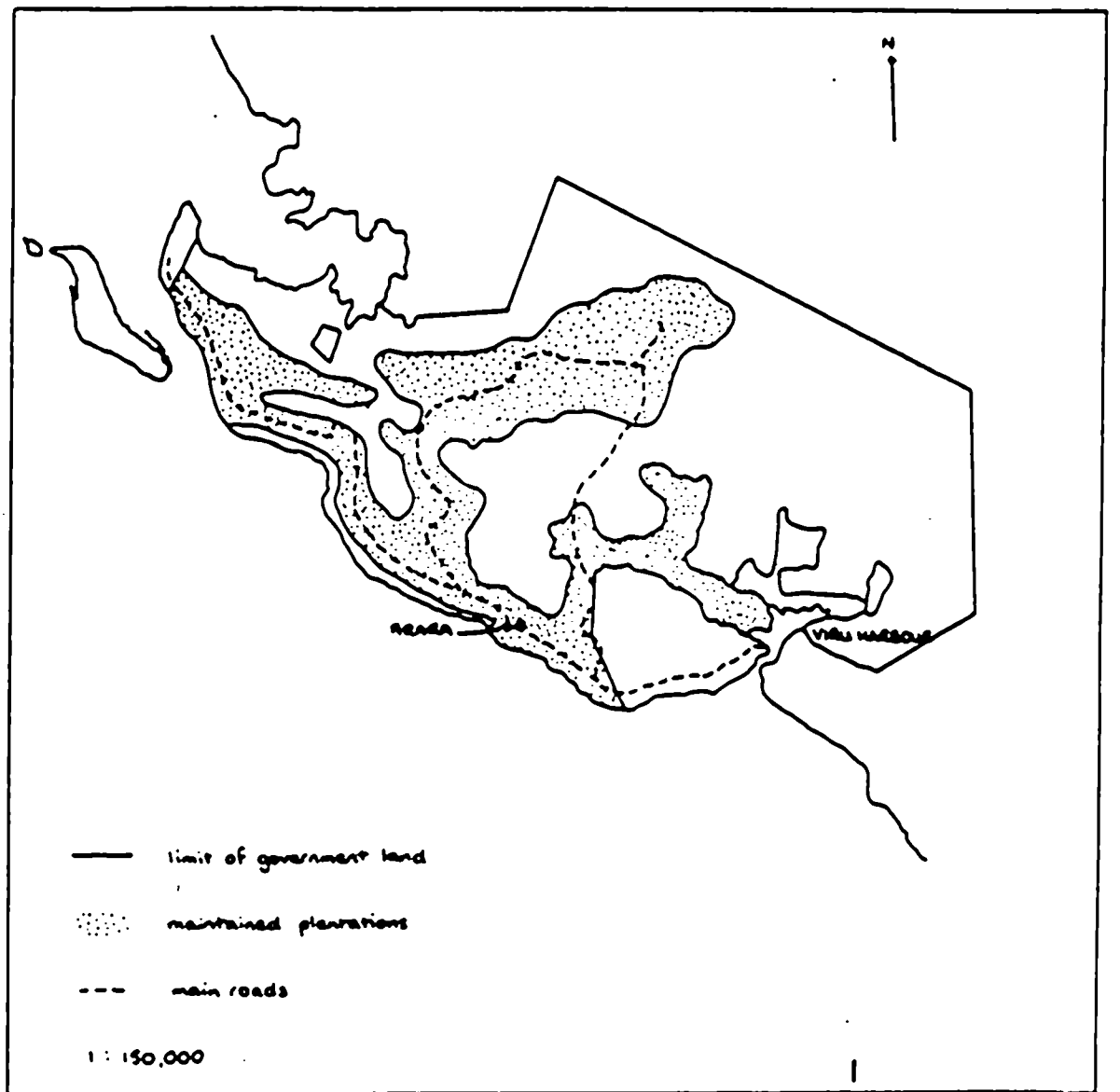
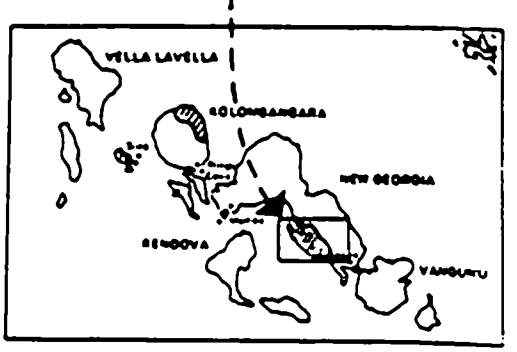


Map 2 General location map, showing paths of cyclones.

Map 3 KOLOMBANGARA SHOWING PLANTATIONS AND CUT AREAS, AND GOVERNMENT LAND 1980



Map 4 VIRU - SHOWING PLANTATION AREAS AND GOVERNMENT LAND, 1980



Location Map