SOUTH EAST JOHORE PROJECT.

WORKING PAPERS.

DISCUSSION PAPER ON FORESTRY AND TIMBER UTILISATION IN JOHOR STATE AND IMPLICATIONS FOR FORESTRY POLICY.

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I apologise for the length of this report, but that is partly a result of the report form adopted. There is however a content list and a brief summary. I would be grateful to receive any criticisms, further information or advice which you may have.

C.B. Edwards

CBE/BN/12/1/70

Check on Class III Land Cap. Class. criteria

Discussion Paper on Forestry and Timber Utilisation in Johor State and the implications for forestry policy

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This paper is, as will no doubt become painfully obvious, a paper for discussion - doubtless much of the information in it will be subject to considerable error. One of the main objects of the paper is to bring forward corrections or further information which will put the existing conclusions on a firmer base or enable further conclusions to be drawn or recommendations made.

| If so, been written too early.

A number of studies are underway in West Malaysia which should fill many of the gaps. The main studies are:-

(1) A study of Forest Industries in Malaysia - under UNDP - the field work is due to be completed by 1971 but the final report is not due to be produced until 1973.

(2) A UNDP study of the feasibility in West Malaysia of developing plantations of quick-growing exotic softwood species for pulpwood. This is also a 5-year programme and is due to be completed by 1972/73 (see also Part 3 of this Paper).

(3) A study of the marketing prospects for forest products produced in South East Asia. FAO is also the executing agency for this study which is being carried out by Toloumni of U.S.A. and which should be completed by June 1970. (See also Part 1 (iv) of this paper).

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This paper consists of three parts preceded by a very brief summary paper containing the main conclusions and recommendations.

The layout is as follows:

Part 1 - Agriculture versus Forestry - the Economics.

1.1 Introduction to forestry in West Malaysia and especially Johor State.

1.2 The priorities in the Land Capability Classification.

1.3 An economic comparison of land use in agriculture with land use under regenerated forest. - the EPU Bukit Sedanan Study.

1.4 An economic comparison of land under agriculture and land under forest - for Class III Land.

Part 2 - Wood-based industries in W. Malaysia

2.1 Introduction.

2.2 The logging and sawmilling industries.

2.3 The plywood and other wood-based panel industries.

2.4 The pulp and paper industries.

Part 3 - Some implications

3.1 The implications of Parts 1 and for timber flows in the southern states of West Malaysia - 1970-1990.

3.2 Forestry policy in Johor State - conclusions and recommendations.

All references are listed at the end of the paper.

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A Brief Summary.

The total area of forest land in West Malaysia in 1967 was approximately 20 million acres or a little over 60% of the total land area. (section 1.1).

Sections 1.1 and 1.2 show that with a strict application of the LCC to forestry policy in W.Malaysia, about 6.6 million acres which are presently under forest would be alienated to agricultural use. This would leave something like 14 million acres under forest in W.Malaysia (about 44% of the total land area), and about 10 million acres of this would be productive forest. The area 'in dispute' between the 'pre-foresters' and the 'pre-agriculturalists' consists of about 4 million acres - this is the area of forest which has Class III soils.

The application of the LCC to Johor State would mean that 1½ million acres of forest would be cleared for agricultural use, and about ½ million acres of this would be 'productive' forest. Of the 1½ million acres, about 800,000 acres is on the 'disputed' Class III land. If the land allocation in the LCC were implemented, almost the whole of the productive lowland forest in Central Johor would be cleared for agricultural use, leaving most of the remaining forest of this type in Johor in an area bordering on Pahang and Negri Sembilan.

The case for or against agriculture on Class III land was discussed in Parts 1.3 and 1.4. No firm conclusions could be reached because of lack of information. Land may be designated as Class III for reasons of

(i) drainage
or (ii) soil texture and fertility
or (iii) slope.

Investigations into the returns likely to be obtained from agricultural and livestock activities on various type of land are continuing. It is however likely that for land designated as Class III because of slope, the returns from rubber would be considerably higher than the returns from regenerated forest.

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These comparisons are based on an assumption of a 30 tons-per-acre yield at the end of a rotation cycle of 40 years and a price of $235 per ton for timber and an assumed yield from rubber of 1,650 lbs per acre (d.r.c.) in the 6th year of tapping. If anything these assumptions are 'kind' to timber and it is unlikely that improvements in timber-utilisation would lead to incomes from timber being much higher than this.

Part 2 discusses the problems of, and prospects for improvements in timber utilisation in W.Malaysia. Although the world demand for wood materials is expected to continue to expand for decades to come, the main expansion of demand is expected to be for reconstituted woods. Yet forestry management in W. Malaysia is geared primarily to the production of sawlogs. In addition the principal wood-using industry in W.Malaysia in 1968 was still sawmilling. In 1968 log exports and log input into sawmills accounted for over 90% of log outturn from W.Malaysia. There was a relatively small output of plywood and virtually no output of particle board, fibreboard, and pulp and paper products. Yet this is where the future lies. And, more importantly, except for plywood, the wood raw material requirements of the rest of the products are not as exacting as those of sawnwood. The reconstituted products do not demand high quality sound logs of large dimensions and the fundamental and essential requirement common to all the products is low density. The fast growing LHWs are therefore acceptable.

The analysis of timber utilisation in Parts 2 and 3 suggests a number of changes in, or reviews of forestry policy which seem worthy of serious consideration. These are (briefly);

(i) a critical appraisal of the 'List of Approved Species' should be made - in recent years the HHW have been exploited to a very limited extent;

(ii) further research into the suitability of various regeneration practices to the hill forests needs to be carried out since an increasing proportions of the timber supply will come from hill forests;

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(iii) various ways of encouraging the development of the reconstituted wood industries in W.Malaysia need to be investigated. These are:

- (a) a survey of the sizes of the current concession areas should be carried out to see whether, as some sawmillers claim, this is a limiting factor to the further development of reconstituted wood industries;

- (b) further analysis is needed to see whether higher export duties or royalties on logs or higher land premia would act as an incentive to further processing and utilisation. It may be that the high profits (more than 20% p.a. on capital employed) earned in the logging, sawmilling and plywood-milling industries act as a disincentive to efforts to look for more profitable uses for the slabs, edgings, etc., especially if the markets for reconstituted products are uncertain; | does it sound excessive.!

- (c) the uncertainty about the markets for, and profitability of manufacturing the various types of reconstituted wood products could possibly be reduced by the establishment of a Timber Utilisation Promotion Board which would carry out research into these problems - this Board could be financed by a cess on the production of sawn timber or could be an enlarged version of the Timber Utilisation Section of the Forest Department;

- (d) the possibility of more direct action to promote the development of the reconstituted wood industries by the establishment of a Government Timber Corporation manufacturing timber products should be investigated;

(iv) a review should be made of the licensing of sawmills and plywood mills since it is likely that the cost of collecting the licenses (the annual fee is $5 per sawmill)

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exceeds the revenue and, more importantly, it is possible that the fee structure could be changed in such a way that the development of reconstituted wood industries is encouraged. (The licensing should of course be integrated with the Forestry Working Plans of Johor and neighbouring States and with the licensing of sawmills and plywood mills in neighbouring States).

- (v) more research should be carried out to determine the optimum rotation period for the faster-growing LHW's and the effects of the development of the reconstituted wood industries on this optimum cycle.

But even after the research in (v) has been carried out, it is likely that the most economic use of Class III land will be for agricultural activities. If, however, the implications of the LCC are carried through - that is if all Class III land presently under forest is transferred to agricultural use - what are the prospects for the timber-using industries in Johor?

This problem is examined in Part 3.2. It is likely that, over the next 20-30 years, there will be an adequate supply of timber to enable the present industry (sawmilling and plywood milling) in Johor to expand at something like an average rate of 4-5% p.a. (At present both Johor and Pahang States are net exporters of logs on a large scale). | ?

In the longer term (that is beyond 1990-2000), there would almost certainly need to be some contraction in the timber-using industries in Johor unless there continued to be substantial imports from Pahang State. By 2000, following the clearance for agriculture of 1½ million acres of forest (about 50,000 acres p.a.), Johor would be left with ½ million acres of 'productive' forest and about ½ million acres of 'protective' forest. The sustainable yield from this could be as much as 375,000 tons p.a., and in addition there might still be substantial flows of logs from Pahang after 1990-2000. But what is certain

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is that the benefits from co-ordination between the Southern States in timber industry licensing, and in the preparation of Forestry Working Plans, will grow rather than diminish with time.

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Part 1 - Agriculture versus Forestry - the Economics

1.1 Introduction to forestry in West Malaysia and especially Johor State

The 'natural' type of forest in West Malaysia is evergreen tropical rain forest. The most important family of trees in West Malaysia is the Dipterocarpacae, and virtually all indigenous trees in West Malaysia are hardwoods. The canopy is usually 100-150 feet high and girths are up to 12-15 feet.

For silvicultural purposes, the Dipterocarp forests in Malaysia are divided into Hill and Lowland forests. Hill forests occur on the inland ranges between the approximate altitudinal limits of 1000 and 2500 feet. There is no sharp difference in vegetation at the 1000 feet contour and hill forests have a tendency to be found at lower limits (down to 500 feet above sea level) on exposed ridges. (ref. 16)

The total area of forest land in West Malaysia in 1967 was approximately 20 million acres or a little over 60% of the total land area. Of this 20 million, about 8.6 million acres were under forest reserves; 1.6 million were under wildlife and other reserves; and the rest, that is about 9.8 million acres, were under State Land Forest. (ref: 1)

Of the 20 million acres under forest, 7.8 million were in Pahang State while Johor had about 1.7 million acres under forest. The other States bordering Johor are of course Malacca and Negri Sembilan and these had 0.04 million acres and 0.8 million acres respectively under forest.

Of the 8.6 million acres of forest reserve in West Malaysia, about 5.5 million acres are productive. This 5.5 million acres represents about 17% of the land area of West Malaysia. Johor State has approximately 1.1 million acres of forest reserve, 1.0 million of which are estimated to be productive.

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Currently roughly half of the log production in Johor State is from Forest Reserves where exploitation is under strict control, and half from State Land Forests where exploitation is uncontrolled to the extent that supervision is minimal. The Forest Reserves are usually subjected to silvicultural treatment, whereas generally no natural or artificial regeneration is applied to the State Land Forests. Requests for the gazettement of Forest Reserves usually originate from the District Forestry Officers (Johor State is split into 4 Forestry Districts - North, South, East and West). These requests are then forwarded by the State Forestry Officer to the State Natural Resources Committee. The N.R. Committee, which is chaired by the Mentri Besar, usually receivesa report from the A.D.O. of the Administrative District concerned, setting out any objections to the Gazettement, and it will hear comments from other interested parties - the Agricultural Department, for example. Guidance is now sought from the Land Capability Classification, but no formal economic comparison of the uses of the land is, it seems, made.

According to the latest published (1966) Report of the Forest Department (p.4, ref.5), the Interim National Forest Policy formulated in 1961 by the Working Party appointed by the Cabinet has still not been implemented. The recommendations were under study by the Government. According to the EPU, however, the Interim Forest Policy has now been accepted, following the completion of the Land Capability Classification for West Malaysia.

Figures showing log production and the utilisation of logs in West Malaysia for the 10 years to 1968 are given in Table 1. The average annual growth rate in log production over the past 10 years has been 11.7%, and the average annual growth rate in processing (sawmilling, plus plywood mills but excluding others) has been 10.6%. The apparent export of logs has risen at about 14-15% per annum i.e. somewhat faster than the production of logs. During the 10 years from 1959-1968, about 5% of the logs exported went

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FOREST PRODUCTION DATA FOR 1959-1968 IN W. MALAYSIA

TABLE 1 (ALL FIGURES IN '000 TONS UNLESS OTHERWISE INDICATED - 1 TON = 50 CU. FT.)

YEAR	LOG PRODUCTION	SAWMILL LOG INTAKE	PLYMILL LOG INTAKE	LOG EXPORTS	DIFFERENCE BETWEEN COL.1 AND 2+3+4	SAWMILL PRODUCTION		EXPORTS OF SAWN TIMBER		PLYMILL PRODUCTION	
						VOLUME	CONVERSION % (COL.6/COL.2)	VOLUME	AS A % OF COL.6	* M SQ.FT.	AS A % OF INPUT (COL.3)
	1	2	3	4	5	6	7	8	9	10	11
1959	1,177	889	2	245	41	544	61	144	26	4	64
1960	1,589	1,220	3	275	91	727	60	217	30	5	57
1961	1,563	1,181	4	282	96	710	60	177	25	6	55
1962	1,632	1,236	8	305	83	755	61	202	27	11	48
1963	1,905	1,380	12	417	96	830	60	251	30	16	45
1964	2,105	1,506	23	495	83	935	62	324	35	27	39
1965	2,278	1,520	47	574	137	946	66	335	36	60	42
1966	2,691	1,631	80	777	203	1,004	62	345	34	117	49
1967	2,966	1,829	102	816	219	1,219	66	412	34	123	40
1968	3,587	2,272	191	959	165	1,418	62	596	42	225	39

* PLYWOOD OF 5MM. (1/5") THICKNESS - COL.10 x 1/5" x 1" x 1/50 THEREFORE REPRESENTS PLYMILL OUTPUT IN TONS - MORE PRECISE FIGURES WERE USED THAN THOSE SHOWN TO CALCULATE COL. 11

SOURCES: REF. 2 FOR COLS. 1, 2, 3, 4, 5, 6 AND 10.
REF. 1 FOR COL. 8

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what has happened to all this timber -

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to countries other than Singapore. From 1966-1968, just under 9% of the logs exported went to countries other than Singapore. The export of logs to overseas destinations is controlled through a system of export licenses (in addition to an export tax of 10% ad valorem), whilst export to Singapore remains open. As more industries become established in Southern Pahang and Johor, the volume of logs available for Singapore will presumably drop. (see Part 3.1) Exports of sawlogs and sawntimber from West Malaysia in 1968 totalled about $700 million compared to an export value in 1964 of about $300 million. The export of timber in 1964 and 1968 represented 9% and 17% respectively of total exports from West Malaysia (in value).

In 1966, 21% of the log production came from Johor forests and 43% from Pahang. Of the 2.7 million tons produced in 1966, 0.2 million tons came from Negri Sembilan and only about 4,000 (sic) tons from Malacca. Log outturn by States in 1957 and 1966 is shown in Table 2.

The principal types of sawn timber exported are shown in table 3.

The main species exported are therefore Keruing and the Merantis. These 2 main types represented 73% and 71% of the sawn timber exports from W. Malaysia and Singapore respectively for the period covered.

No data has yet been obtained on log production by species or on log exports by species. Most of the timber used in plymills is of the LHW group, but sawn timber exports from W. Malaysia (including those to Singapore) only represent about 30%-40% of sawn timber production. The rest is used domestically - no information has yet been obtained on the species used domestically.

Information in Wong (p.11 ref.3) and the Jengka Triangle Report (p.93 ref.4) from sample enumerations of commercial species, do however, suggest that the LHW group represents between 48% and 56% of the commercial stand. This is not significantly different from the sawn timber export proportion.

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TABLE 2 LOG OUTTURN BY STATES - W. MALAYSIA 1957 AND 1966

(ALL FIGURES IN '000 TONS)

STATE	1957			1966			
	FROM STATE LAND	FROM FOR. RES.	TOTAL	FROM STATE LAND	FROM FOR. RES.	TOTAL	% OF PROD^{N} IN W. MALAYSIA
JOHOR	192	133	325	358	215	573	21
KEDAH	29	57	86	27	125	152	6
KELANTAN	24	21	45	87	49	136	5
MALACCA	1	8	9	-	4	4	-
N. SEMBILAN	56	52	108	113	93	206	8
PAHANG	243	12	255	968	196	1,164	43
PENANG	-	-	-	-	-	-	-
PERAK	32	150	182	75	178	253	9
PERLIS	2	1	3	1	-	1	-
SELANGOR	34	45	79	42	45	87	3
TRENGGANU	41	13	54	99	16	115	4
TOTAL	654	492	1,146	1,770	921	2,691	100*

* DOES NOT SUM DUE TO ROUNDING

SOURCE REF. 1 (TABLE 21)

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TABLE 3 EXPORTS OF SAWN TIMBER FROM W.MALAYSIA AND SINGAPORE FOR THE 9 MONTHS FROM OCT. 1968 - JUNE 1969

Species	W. Malaysia (1)		Singapore	
(weight in lbs per cu.ft. at 15% moisture content)	'000 Tons	%	'000 Tons	%
HHW (50-70)	10	2	2	1
MHW (45-55)				
- Keruing	132	29	31	13
- Kempas	26	6	9	4
- Others	34	7	5	2
- Total	192	42	45	19
LHW (25-45)				
- D.R.Meranti	93	21	88	36
- L.R.Meranti	72	16	21	9
- Red Meranti	31	7	32	13
- Others	52	11	16	6
- Total	248	55	157	64
Others	3	1	38	16
Total	453	100	242	100

(1) Just over a quarter of the exports from W. Malaysia went to Singapore.

1.2.) Priorities in the Land Capability Classification (LCC)

On the basis of soil and forestry productivity classes, West Malaysia was, in 1967/68, divided into the following capability classes;

Class 1 : Mining - priority over all other land uses

Class 11 : Agriculture - high potential with a wide range of crops (includes Classes 1 and 11 of soil suitability).

Class 111: Agriculture - moderate potential with a restricted range of crops.

Class 1V : Productive Forest

and, Class V : Protective Forest.

Agriculture was given priority over forest for all land having soils of Classes 1, 11 or 111. Land may be classified as soil Class 111, for one of a number of reasons, namely

(i) drainage status;

(ii) soil conditions such as depth, texture and fertility;

or (iii) slope (of between 12° and 20°).

Class I is mining & has priority above agric. check on Class III criteria //

Forest areas were divided into 5 classes as follows;

Class 1 : 25 tons of commercial timber per acre (Included as commercial species are those in classes A to C of the Forest Department's Linear Sampling (LS) list of species. For the list of those species see the Manual of Malayan Silviculture for Inland Forests - Vol 1 M.F.R. No. 23 - ref.6)

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Class II : 15-25 tons per acre.

Class III: 10-15 tons per acre.

Class IV : Regenerated Forest
R & T

Class V : less than 10 tons per acre.

Charles Carrier to comment!

Timber quality & stand depends to a large extend on soil quality.

Following some investigations, however, members of the UNDP forest industries project team have expressed doubts as to whether there are any significant differences in productivity between some of the classes. (They have also expressed some doubts on whether all of the (Capability) Class III land should have been 'allocated' to agriculture. - for a further discussion of this, see below).

Needs further explanation.

Table 4 shows the area under forest in West Malaysia in 1969 and the area that would be under forest following a strict application of the Land Capability Classification to the forest area. The table shows that the area that would be transferred from forest to agriculture is 6.6 million acres, leaving a total of 14.3 million acres under forest. This 14.3 million acres represents about 44% of the total land area in West Malaysia. Table 5 shows the forest land in each state of West Malaysia, on the various soil classes. The main area "under dispute", that is, the Class III land (Class III soil suitability) covers an area of about 4 million acres. This represents 60% of the forest area 'threatened' by agriculture. About 1.6 million acres of this is currently Forest Reserve.

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TABLE 4 DISTRIBUTION OF FOREST AREA BY STATES IN W. MALAYSIA - CURRENT (1969) AND 'PROPOSED' BY THE L.C.C.

STATE	¥ TOTAL LAND AREA	¥ FOREST AREA	¥ FOREST LAND SUITED FOR AGRICULTURE (1)	¥ POTENTIAL FUTURE FOREST AREA
JOHOR	4,691	2,471	1,330	1,141
KEDAH	2,342	986	148	838
KELANTAN	3,680	2,751	545	2,206
MALACCA	410	79	33	46
N. SEMBILAN	1,642	860	315	545
PAHANG	8,879	7,481	3,220	4,261
PERAK	5,107	3,137	397	2,740
PENANG	255	38	2	36
PERLIS	198	69	46	23
SELANGOR	2,027	887	119	768
TRENGGANU	3,127	2,149	413	1,736
TOTAL	32,448	20,908	6,568	14,340

¥ ALL FIGURES IN '000 ACRES

(1) ACCORDING TO THE L.C.C.

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TABLE 5 - DISTRIBUTION OF FOREST BY STATE AND SOIL CLASS
W. MALAYSIA, 1969 - '000 ACRES

According to which system.

STATE	FOREST ON SOIL CLASS 1	FOREST ON SOIL CLASS 2	FOREST ON SOIL CLASS 3	FOREST ON SOIL CLASSES 1/2/3	TOTAL FOREST AREA
JOHOR	156	462	712	1,330	2,471
KEDAH	22	20	106	148	986
KELANTAN	20	59	466	545	2,751
MALACCA	11	16	6	33	79
N. SEMBILAN	9	46	260	315	860
PAHANG	607	775	1,808	3,220	7,481
PENANG	1	1	-	2	38
PERAK	184	36	177	397	3,137
PERLIS	-	6	40	46	69
SELANGOR	30	43	46	119	887
TRENGGANU	63	69	281	413	2,149
TOTAL	1,103	1,533	3,932	6,568	20,908

SOURCE : FROM TABLE 18, REF. 1.

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Table 6 shows figures taken directly from the LCC Report for the State of Johor. These differ slightly from those produced by Dr. Baker in ref.1. and reproduced in Table 5. This is partly because Baker's figures apply to 1969 and partly because Baker's figures include areas proposed as Forest Reserves but not yet gazetted. But the conclusions are of the same order of magnitude. They show that about 1.1 million acres of forest would be alienated to agriculture although it should be noted that almost exactly half of this wouldconsist of forest productivity classes 4 and 5. Following the implementation of the LCC the 'productive' forest land in Johor would amount to about half a million acres.

At the date of the LCC in 1967/68, Forest Reserves occupied 1.04 million acres or 22% of the total land area of the State of Johor. (The 1968 Forest Department Report for the State of Johor stated that the 'Inland Forest Reserve occupied about 1.16 million acres of which about 1.01 million acres was said to be productive.) The Working Plan for the Johor Forest Reserves (due to expire in 1970) allows for the exploitation of 14,451 acres p.a. This area is on the whole managed by long term agreements stretching over 10-20 years. At present (1969) there are about 45 agreements extant. The Forest Reserves are managed on a sustained yield basis over a rotation cycle of 70 years (70 x 14,451 = 1.01 million acres). In 1968 expenditure on the regeneration treatment of 13,756 acres was $0.16 million or an average of about $11.5 per acre. (see ref.5)

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TABLE 6 - THE LAND CAPABILITY CLASSIFICATION - JOHOR STATE - 1967/8 ('000 ACRES)

	MINING	AGRICULTURAL	FORESTRY RESERVES	STATE & OTHER LAND	TOTAL AREA
ALIENATED	36	2,028	1,039	1,590	4,693
OF WHICH					
- SOILS 1/2	11	711	283	489	1,494
- SOIL 3	14	781	273	511	1,579
- SOILS 4/5	11	536	483	590	1,620
ADDITIONAL (REDUCTION IN) CAPABILITY	26	1,535	(556)	(1,005)	-
OF WHICH:- SOILS 1/2	8	764	(283)	(489)	-
- SOIL 3	13	771	(273)	(511)	-
- SOILS 4/5	5	-	-	(5)	-
- 'FINAL LAND ALLOCATION	62	3,563	483	585	4,693

FOREST PRODUCTIVITY	IN 1967/68	'ALLOCATED'	REDUCTION
- CLASSES 1/2/3	1,145	542	(603)
- " 4/5	1,484	526	(958)
- TOTAL	2,629	1,068(1)	(1,561)

(1) of which - F. RESERVE 483
- STATE LAND 585

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For State Land, on the other hand, there is no regeneration. This is in line with the Forest Department's policy. In 1968, the log outturn from Johor was about 413,000 tons of which 196,000 tons came from State Land. Most of the State Land has been logged or is under timber extraction licenses. In 1968 51,800 acres were logged by 49 licensees.

The implications of the LCC for the State of Johor can be summarised as follows;

L.C.Class 1 - Mining - conflict with agriculture and priority over it on 0.2 million acres. (see Table 6)

L.C.Class 11 - Agriculture - high potential - soil classes 1 and 11 - conflict with, and priority over existing forest of 0.8 million acres.

L.C.Class 111 - Agriculture - moderate potential - soil class 111 - conflict with, d priority over existing forest of again about 0.8 million acres.

L.C.Class IV - Productive Forest - total remaining amounts to about ½ million acres after 'losses' to agriculture of about 0.6 million acres.

L.C.Class V - Protective Forest - Total remaining amounts to about 0.5 million acres and not 1.06 million acres as stated in the L.C.C. Report for Johor State. (The difference represents land already under, or alienated for agriculture but not 'suitable' because the land consists of soil classes 4 or 5.)

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Thus the Forest Reserves would be cut by 556,000 acres and the State Land Forests would be cut by a little over 1 million acres. The 'productive forests' would be cut by 603,000 acres and the 'non-productive' by 958,000 acres. Most of the Forest in the S.E. Johor project area below the "steep land contour" (around 300') would be alienated to agriculture.

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There is not such a thing

The primary purpose of this preliminary paper is to compare in some detail the advantages of developing land of soil class lll with agriculture or livestock with the advantages of keeping the same land under "permanent" forest (i.e. as regenerated forest reserve). Once this is done, the next step is to study the implications of the conclusions for land use in Johor State, for the timber using industries of Johor and finally for forestry policy in Johor State and to a lesser extent in West Malaysia. This is in accordance with the L.C.C. which stated that "It should be clearly understood that in producing the L.C.C. certain basic assumptions had to be made. At present not enough basic information is availab le to introduce a priority to any one resource development. In areas of conflict further studies should be undertaken to evaluate the alternative uses of the land" (ref.7). The L.C.C. does go on to say, however, that the priorities are probably about right, and that 'It is of the utmost importance that the Forest Department is well informed of future agricultural development schemes to ensure that all commercial timber has been cut and if development takes place within the boundaries of a forest reserve, no silvicultural methods are used to regenerate the timber. In order to minimize conflicts of this nature, it is recommended that the State Government focus

Do you mean soil class III ?

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its attention in the first place on state land before de-gazetting forest reserve for land development ".

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1.3 An economic comparison of land use in agriculture with land use under regenerated forest. - the E.P.U. Bukit Sedanan Study.

"The Interim National Forestry Policy formulated in 1961 by the Working Party appointed by the Cabinet was still not implemented. The recommendations were under study by the Government. The reservation of a permanent forest estate is related to other land uses, such as agriculture, mining, etc., and by 1966 the future land-use pattern of the country was still being worked out ". (F.D. Report - 1966 - see ref. 5)

The F.D. report then went on to say that 'The .... land capability classes indicate that lands possessing high mining and agricultural potential should be developed for such purposes and other lands not required for such purposes may be best suited for forestry purposes. If such plans are implemented most of the lowland forests will be clearfelled for agricultural and mining purposes and such liquidation of forest resources may endanger the future supply of timber requirements of the nation". (ref.5)

Dr. Baker writing in September 1969 stated that "For the present, the forest industry is dependent primarily upon an uncertain supply of timber which . is in turn dependent on institutional and political factors rather than the sustained productive capacity of the forest. This situation combined with the associated heavy waste of wood material serves to retard opportunities for capital investment in the establishment of integrated wood industries and the improvement in operational efficiency of existing mills". (ref.1). In addition to this plea for a co-ordinated forest/agricultural policy, the paper goes on to say "The intangible (social)

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values of the forest should not be overlooked" and further recommends that "new Federal and State agricultural schemes be confined to land areas already alienated for agriculture, but not yet in use" and that "all of the unalienated forest soil class 4 and 5 lands (including the encompassed pockets of soil classes 1 and 2) plus the forests on class 3 soils within the existing and proposed Forest Reserves be established and recognized as the 'permanent forest estate' of West Malaysia and designated as national forest " (ref.1)

Depends on size

Some 'Defenders of the Forest' project the future timber consumption of West Malaysia, compare this with the likely outturn on a sustained yield basis and then (usually) by comparison suggest that more land should be gazetted as forest reserve. Dr. Baker in ref.1 follows this line. Baker points out that the L.C.C. puts the minimum. forest area as 14.3 million acres or 44% of the total land area of West Malaysia. He then admits that 'projecting both timber flows and timber requirements at this time is difficult because of the tenuous data about the forests, particularly the Hill Dipterocarps" but then assumes an average outturn of about 15 tons per acre and does the following calculation;

- Present (1969) per capita consumption of wood in W.Malaysia -0.24 tons per year.
- 1990 " " " " " " " -0.34 " " "
- Population in the year 1990 (based on a 3% p.a.growth rate) = 16.1 million
- Domestic wood consumption in 1990 therefore equals 5.5 million tons.

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On the basis of a sustained yield and using a crop cycle of 70 years, one-seventieth of 14.3 million acres or 0.2 million acres would be cutover annually. Applying an average outturn of 15 tons per acre to this gives an annual output of something like 3 million tons. The argument then ends with the conclusion that therefore (?) more than 14 million acres needs to be gazetted as forest reserve.

Other common arguments of the 'Defenders of the Forest' are:-

- (i) forest cover is necessary to prevent soil erosion;
- (ii) if too much forest is chopped down there will be irreversible (and unfavourable ?) changes to the micro-climate;
- (iii) the price of timber is rising, whereas the prices of rubber and of oil palm are likely to fall - therefore timber provides a greater profit and/or better insurance;

and (iv) the t imber industry provides valuable employment opportunities.

It was in an attempt to express in the same t erms these arguments and the counter-arguments of those who wan t t o see more land alienated for agriculture, that th e Economic Planning Unit carried out a study of the B ukit Sedanan Forest Reserve in Mal acca in 1969. This study followed a similar study by the Task Force on Agriculture and Forestry of the Malacca Dev. Planning Committee on that portion of the Bukit Sengg eh Forest Reserve which was known to have an agricultural development potential.

In order t o compare the use of the land under forestry and agriculture, the study used the criterion of the provision of the maximum benefits to the State and Nation.

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(In so far as they can be quantified. Even if some of the benefits cannot be quantified, it may still be useful to do a cost-benefit analysis, since this may reveal how great the non-quantifiable benefits would have to be to alter the conclusions.) Such benefits could, the EPU study said, be measured

- (i) by the net returns expected from each possible use of the land

and (ii) by the amount of employment which each land use provides.

All expenditures and returns under the 2 systems of land use were converted to present values to give a common basis for the comparison of net benefits - Sawn timber and rubber production up to the year 2000 were discounted to 'present' i.e. 1969 values, using a discount rate of 10% p.a. (For details see Appendices 1 and 2 to this paper).

The Bukit Sedanan Forest Reserve totals about 8,000 acres, of which 7,500 acres are productive forest. About 10% is covered by primary forest and the remaining area contains regenerated forest of various ages. The Reserve is class II land according to the LCC (i.e. Soil classes 1 and 2) and is therefore "highly suitable for a wide range of crops". The use of the area as a Forest Reserve is compared with its use as an FLDA Rubber Scheme (The area was thought to be too small to be developed as an oil palm scheme). The net present value (NPV) of the land under forest was calculated as $4.6 million, whereas the NPV of the land under rubber was $11.3 million. The 'surplus' of rubber over timber is therefore about $6.7 million, using an interest or discount rate of 10% p.a. Using a discount rate of 15% p.a. and the EPU's cost and revenue figure, the NPV of rubber is $6.5 million compared with a NPV from timber of $3.0 million, a surplus to rubber of $3.5 million (See Table 7).

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TABLE 7 BUKIT SEDANAN FOREST RESERVE - THE COMPARISON AT A 15% P.A. DISCOUNT RATE.

YEAR	AS A FOREST RESERVE: NET PROFIT (OR LOSS) ($000)	15% DISCOUNT FACTOR	PRESENT VALUE ($ M)	AS A RUBBER SCHEME: NET PROFIT OR (LOSS) YEAR BY YEAR ($000)	15% DISCOUNT FACTOR	PRESENT VALUE ($ M)
1970	628	.87	.54	1970 8234		7.20
71	628	.76	.48	71 (2221)		(1.68)
72	628	.66	.41	72 (841)		(0.59)
73	303	.57	.17	73 (1045)		(0.60)
74	192	.50	.10	74 (1199)		(0.60)
75	444	.43	.19	75 (1002)		(0.43)
76	444	.38	.17	76 (1002)		(0.38)
77	463	.33	.15	77 903		.30
78	388	.28	.11	78 1300		.36
79	212	.25	.05	79 1851		.46
80	221	.21	.05	80 2141		.45
81	221	.19	.04	81 2251		.43
82	221	.16	.04	1982-86 2426	.63	1.53
83	231	.14	.03	1987-89 2154	.21	.45
84	94	.12	.01	1990 2106	.05	.10
85	40	.11		1991 1955	.05	.10
86	40	.09		1992 1904	.04	.08
87	40	.08	.02	1993 1856	.03	.06
88	40	.07		1994 1807	.03	.05
89	40	.06		1995 1669	.03	.05
90 - 94	761	.20	.15	1996 1692	.02	.04
95 - 97	1562	.07	.15	1997 1597	.02	.03
98	1350	.02	.03	1998 1357	.02	.03
99	761	.02	.02	1999 1269	.02	.02
2000	12,000	.01	.12	2000 1181	.01	.01
TOTAL (NET PRESENT VALUE - $M)			3.03			6.47

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The other main assumptions of the EPU report are as follows:

(a) Timber (i) - felling on the basis of an annual acreage of 200 acres.

(ii) - an average yield (from both intermediate felling and final felling) of about 55 tons per acre cut. (i.e. 55 tons per acre of productive forest)

(iii) - all logs converted into sawn timber at a 65% conversion factor.

(iv) - all sawn timber sold at a price of $195 per ton in 1970 rising to $235 per ton in the year 2,000.

(v) - Forestry management costs of $5 per acre.

(vi) - Logging costs of $24 per ton of logs cut.

(vii) - Sawmilling costs of $28.6 per ton of logs cut or $44 per ton of sawn timber produced.

(b) Rubber (i) - a once and for all yield of timber on initial clearance of 19 tons per acre.

(ii) - survey costs of $16.5 per acre or $165 per holding.

(iii) - a cost of $337 per acre for felling, land preparation and cover crop

(iv) - a cost of $207 per acre for planting, weeding, and manuring.

(v) - maintenance costs of an average of about $45 per acre (1)

(vi) - managerial charges of about $75 per acre planted p.a.

(vii) - tapping costs of about $250 per ton of rubber p.a. (1)

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(1) Labour costs (unskilled) were reduced by 15% from FLDA estimates "to reflect the abundant supplies of this form of labour in Malaysia."

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(viii)- site capital costs of $1,067 per acre (the capital costs of providing water supplies, housing, health, education and religious facilities on the FLDA scheme are excluded on the assumption that these would be supplied elsewhere if not through the FLDA Development)

(ix)- Latex and scrap yields of 940 lbs per acre in first year of tapping (6th year after planting) rising to 1650 from the 6th year of tapping (11th year after planting) consisting of 82.4% of latex and 17.6% scrap.

(x) - Rubber prices of 50 ¢ per pound (f.o.b. RSS 1) in 1977 declining to 45 ¢ per lb in 2000. Scrap price of 8 ¢ per lb less.

(xi)- No production from settlers' own plots or from intercropping.

The EPU study concluded that in addition to the greater profit generated by the rubber scheme, it would provide 967 jobs, compared to 41 provided by the land if retained as a forest reserve. It then recommended that the Forest Reserve be degazetted, and developed under agriculture.

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1.4 An economic comparison of land under agriculture and land under forest - for Class III land.

The EPU study assumed (if the Bukit Sedanan Reserve continued to be a forest reserve) that the timber would be felled at the rate of about 200 acres per annum. This section however assumes that there would be an initial felling of the whole area and that the yield from this initial felling would be somewhat similar to the yield obtained from felling and clearing the timber for agricultural development. The yield from initial felling as a Forest Reserve would probably be somewhat lower than the yield obtained from agricultural clearance, but the object of this paper is to get an idea of the orders of magnitude involved and of the factors which are particularly important. Hence the simplification.

With this assumption of the same return from initial felling, the return from rubber ignoring the revenue from the initial clearing is 10% p.a. compared to a return from forest regeneration of about 6% p.a. (The return from forest regeneration is based on a 70 year cycle and a yield per acre at the en d of the 70 years of 55 tons, together with the other assumptions contained in the EPU study).

In order to very quickly get an idea of the factors to which the returns are particularly sensitive, the Present Values of each of the major cost and revenue items were calculated for the forest and rubber alternatives. These are shown in Tables 8 and 9. Both tables ignore the yield from the initial selling of timber.

For timber, the most important variable (if it can economically be varied) is the rotation period. If this could be shortened and more or less the same yields be obtained the effect would be dramatic. The discount factors for interest rates of 5%, 10% and 15% p.a. in the 30th, 40th, 50th, 60th and 70th years are:

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Discount Factors for - Interest rates (%p.a.) of:-

Year	5	10	15
30	0.2314	0.0573	0.0151
40	0.1420	0.0221	0.0037
50	0.0872	0.0085	*
60	0.0535	0.0033	*
70	0.0329	0.0013	*

* Negligible at 4 decimal places.

Thus at a 10% p.a. interest rate, the revenue yield in the 40th year could be as little as 6% of the yield in the 70th year and yet felling in that 40th year would be worthwhile. Similarly (and again using an interest rate of 10% p.a.) the yield in the 60th year could be 40% of the yield in the 70th, the yield in the 50th could be 15% of the yield in the 70th... and the earlier felling would be worthwhile. Again using an interest rate of 10% p.a., provided that the revenue from felling 10 years earlier is at least 40% (or more precisely 38.55%) of the revenue from felling 10 years later, then the earlier felling is preferable. At higher interest rates, the minimum 'desirable' yield falls even further - that is the earlier felling becomes, with the same yields, more and more desirable at higher interest rates. Since an interest rate of 10% p.a. is, in the Malaysian context, if anything an understatement of the alternative rate of return (at least in the public sector), the use of a '40% - 10 years earlier' rule seems reasonable. The sections below therefore examine the growth pattern and yields from lowland Dipterocarp forest in more detail. Later sections also make a somewhat less detailed analysis of timber prices and logging and sawmilling costs.

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TABLE 8 : ECONOMIC RETURN FROM THE REGENERATION OF FOREST

(1) ASSUMPTIONS :- (a) 70 year cycle

(b) Yield in 70th Year of 55 tons of commercial logs per acre.

(c) Prices and costs as for the year 2,000 in E.P.U. report.

(d) Initial felling yield ignored - assumed to be the same as from Clearance for Agriculture

(e) Regeneration management costs of $5 Per acre per annum.

	TONS PER ACRE	$ PER TON OF SAWN TIMBER	$ 000 PER ACRE	DISCOUNT FACTOR (AT 10% P.A.)	PRESENT VALUE (AT 10% P.A.)
					$
OUTTURN REVENUE	35.75(1)	235(2)	8.40	0.0013(3)	11
COSTS - LOGGING -		37	(1.32)	0.0013(3)	(2)
- SAWMILLING -		44	(1.70)	0.0013(3)	(2)
- REGENERATION MANAGEMENT ($5 PER ACRE) -				9.987(4)	(50)
NET PRESENT VALUE ($)					(43)

(1) ASSUMES A LOG YIELD OF 55 TONS PER ACRE AND A CONVERSION FACTOR INTO SAWN TIMBER OF 0.65

(2) BASED ON A COST PER TON OF LOGS OF $24

(3) THE FACTOR IN THE 70TH YEAR AT 10% PER ANNUM

(4) THE CUMULATIVE FACTOR OVER 70 YEARS AT 10% P.A.

INFORMATION TAKEN FROM TABLE 4 OF THE E.P.U. STUDY REPRODUCED IN APPENDIX 1 TO THIS PAPER.

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TABLE 9 THE ECONOMIC RETURN FROM RUBBER

		PRESENT VALUE PER ACRE PLANTED (AT 10% P.A.)[1] ($000)
REVENUE FROM LATEX AND SCRAP.[2]	-	2.7
COSTS:-		
CAPITAL - SURVEYING, LAND PREPARATION, PLANTING, WEEDING AND SITE WORKS ..	-	(0.6)
'OPERATING' OR 'CONTINUOUS' - MAINTENANCE, MANAGERIAL AND TAPPING/COLLECTION	-	(1.8)
NET PRESENT VALUE	-	0.3

(1) FROM E.P.U. STUDY - SEE APPENDIX 2 TO THIS PAPER.

(2) FOR ASSUMPTIONS SEE PART 1.3 OF THIS PAPER.

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For rubber, the EPU study assumed a yield of 940 lbs. of rubber (d.r.c.) per acre in the first year of tapping rising to 1650 lbs in the sixth year of tapping and then falling from the 14th year to a yield in the 24th year of tapping of 1176 lbs of rubber. The first year of tapping was the 6th year after planting and the 7th year after clearing. But the Bukit Sedanan Forest Reserve consists of class 1 and 11 soils whereas this paper's main objective is to compare the returns from forest regeneration and agriculture on class 111 soils. Unfortunately little is at present known about the likely returns from various types of agricultural or livestock use of Class 111 land. As stated in Part 1 (i) of this paper, soils can be classified as class 111 for one of a number of reasons. If the reason is poor drainage, rubber is likely to give a very poor yield. If the reason is because the slope of the land is between 12° and 20°, then rubber is likely to give a fairly good yield. Current average yields in West Malaysia of rubber are below 1,000 lbs. per acre per annum (d.r.c.), but the highest yielding estate gives an average yield of 1,600 - 1,700 lbs. with individual fields (up to 50-100 acres in size) giving up to 3,000 lbs per acre per annum. (see ref.8). New plantings with the new RRIM 600 and 700 series clones are, however, confidently expected to yield 2,000 - 2,500 lbs. per acre per annum (ref.8). Dr. Guha of the RRI is doing some investigations into the likely yields of rubber from various types of soils and more information may be available in the near future. To give an idea of the importance of the yield to the likely return, a reduction in the average yield in the 6th year of tapping from EPU estimates of something like 25% to an average of 1,200 lbs per acre per annum would change the Net Present Value from a 'profit' of about $300 per acre to a'loss' of about the same amount. Similarly an increase in the average yield (again with the same costs and rubber price) to something like 2,000 lbs per acre per annum would raise the 'profit' to a present value of about $800 per acre.

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The EPU study assumed a rubber price of 50 ¢ per lb (f.o.b. RSS 1) in 1977 declining to 45 ¢ per lb in the year 2000. This is if anything likely to be a little on the pessimistic side. Ref.9 stated, after an examination of various forecasts and the supply and demand factors involved, "....., it would appear more realistic to assume a continued slow downward trend in natural rubber prices as suggested by the Jengka forecast or Bevan and Goering's 1968 forecast. - that is, declining from around 60 ¢ per lb in 1970 to 45 - 50 ¢ per lb by the end of the century." (p.5, ref.9)

Information is currently being collected on the likely value of settlers' own production for rubber schemes of 10 acres per settler.

Clearly then little is known about the relative returns from forest regeneration and agriculture or livestock on Class III land. The sensitive factors do however seem to be :

(a) the yields of rubber on class III land (and the returns from other agricultural/livestock activities on Class III land) - further information will be available on these aspects in the near future.

(b) the yield and optimum rotation cycle of regenerated forest, and to a lesser extent the prices of and costs of obtaining the timber.

An analysis of (b) follows.

Optimum rotation period and yield.

There are two aspects to this problem;

(i) The development of reconstituted wood industries to utilise the species which are currently not exploited (see Part 2) and to make better use of the (presently) 'commercial' species.

and (ii) the better utilisation of the 'commercial' species - by,

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(a) a shorter rotation period;

(b) the reduction of defects;

and (c) the reduction in conversion waste (see (i) above).

The present average yield figures (see Table 10) do not provide very much guidance for this paper since they do not distinguish between virgin and regenerated stands, and do not give any indication of the ages of the trees cut.

A Research Paper by Wong Yew Kwan discussed the yields from 3 one-acre plots of virgin forest in S.W. Pahang. This research was carried out in 1952 (see ref. 3) and involved measuring all trees with girths equal to or greater than 9 inches at breast height (4' 6" from the ground). All parts of the tree were measured down to 9" girth over bark (g.o.b.). The total underbark volume per acre was found to range from well over 7,000 to 10,000 cu.ft. (from 140 tons to 200 tons). The summary of the report stated that "This indicates a high potential volume for utilisation other than lumber and plywood manufacture which at the present moment remove only about 1,000 cu.ft. (20 tons) from the forest". But the results of Wong's paper provide little guidance to this paper since he was investigating virgin, not regenerated, forest.

irrelevant

At present almost all the regeneration work of the Forest Department is in the Forest Reserves (rather than the State Land forests) and almost all of it consists of Natural (as opposed to Artificial) Regeneration. The Natural Regeneration system used is the Malayan Uniform System. The Malayan Uniform system consists basically of the poison-girdling with sodium arsenite of the uneconomic balance of the canopy of commercial-sized trees after the removal of that part of the upper canopy which consists of the economic crop. At the same time all the smaller trees and saplings down to a minimum g.o.b. of 6" - 18" are poison-girdled other than those of economic species of sound form. (P.6, ref.5). The upper canopy removal is followed after 4 to 5 years by a systematic linear sampling of the stocking of young regenerated

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TABLE 10 RECORDED OUTTURN FROM FOREST RESERVES 1957-1966 - W.MALAYSIA

STATE	AREA LICENSED (000 ACRES)	LOG VOLUME (000 TONS)	TONS PER ACRE
JOHOR	97	1,682	17
PAHANG	142	870	6
PERAK	83	1,646	20
SELANGOR	71	531	7
KEDAH	61	802	13
OTHERS	118	1,433	12
TOTAL/AVERAGE FOR W.MALAYSIA	572	6,964	12

SOURCE: REF. 2.

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sapling of economic species. This is to discover whether the area has successfully regenerated. Thinning operations are carried out at later stages - at, for example, 20 and 55 years. At the 70th year, acc rding to the Manual of Malayan Silviculture for Inland Forests (see ref. 6) "the crop is not expected to exceed 20 commercial trees per acre and the yield at the end of the conversion rotation is estimated to average about 40 tons of logs per acre". The Manual goes on to state "The present management policy is one of definitely favouring the quicker growing lighter timbers; and the rotation of 70 years is based on the estimated time taken for the crop trees of economic Medium Hardwood and Light Hardwood species to attain a mean girth of 6 ft. at breast height or abowe buttresses (b.h./a.b.)" (ref.6)

Elsewhere the Manual states that - "the optimum number of stems per acre or espacement at any particular age in regenerated forest, with its multi-storeyed structure, very mixed specific composition, and variation in tree girth, is difficult to determine, but the postulated final crop density of Meranti Tembaga (Shorea Leprosula) is given by Noakes (ref 10) as 26 stems per acre with a mean girth of 6' at 48 yearsof age and 18 stems per acre with a mean girth of 7½' at 60 years." The same source gave some growth figures for a regenerated lowland forest very rich in Shorea species of the Red Meranti timber group and principally Shorea Leprosula. The sample plots were in Perak, Malacca and Negri Sembilan, and since the Red Meranti group is one of the fastest-growing groups, the data was further analysed for this paper. Table 11 summarises, for each plot, the growth rate by age groups. The growth rate shown is the average growth rate in cu.ft. per annum within each age group within each plot. It can be seen that from year 30 onwards, the annual growth rate is in every case below 10%. Presumably however the value per cu.ft. is rising as the average girth rises; this is because with a larger tree, the wastage as a proportion of the volume of the tree presumably drops. At the time of writing this paper no information is available on the relationship between the size of the tree (as for example measured by girth) and the average value per cu.ft. of the tree. In order to provide

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TABLE. 11 - THE AVERAGE MEAN ANNUAL INCREMENT IN CU. FT. AS A PERCENTAGE OF THE CU. FT. IN THE PLOT AT THE BEGINNING OF THE YEAR. - THAT IS, THE AVERAGE GROWTH RATE IN CU. FT. PER PLOT BY PER AGE GROUPS - SOURCE TABLE 4, REF. 6.

AGE GROUP (IN YEARS)	SAMPLE PLOT NO.																				AVE. GIRTH OF (1) TREES IN LAST YEAR
	PERAK			MALACCA												NEGERI SEMBILAN					
	$40_{(1)}$	$40_{(2)}$	$40_{(3)}$	2	$9_{(1)}$	$9_{(2)}$	$9_{(3)}$	$11_{(1)}$	$11_{(2)}$	$11_{(3)}$	$11_{(4)}$	$11_{(5)}$	$21_{(1)}$	$21_{(2)}$	$21_{(3)}$	$12_{(1)}$	$12_{(2)}$	$12_{(3)}$	$12_{(4)}$	$12_{(5)}$	
12-23								18	17	17	18	17									31
13-21													24	23	27						35
17-20	39	41	37																		28
20-30	12	10	11																		35
21-25													8	7	7						38
21-31					4	5	3														41
22-32				14																	38
23-27/23-23								13	13	7	6	9				10	9	9	8	5	34
25-29													5	5	3						43
28-32																3	5	9	7	4	38
30-35	4	8	8																		41
31-36/32-38				6	3	5	9														46
35-40	2	4	3																		46
36-41					5	3	3														50
38-44				3																	48
40-45	2	4	2																		48
41-46					2	1	2														54
44-48				3																	52

(1) OF ALL TREES OF MORE THAN 24" g.ab/bh o.b.

some guidance - on the growth in value of the tree, should this information become available, Table 11 shows in the far right-hand column the average girth of the trees at various ages. It is evident that the average girth in year 20 is about 2' 6", in the 30th year about 3' 2", at 40 about 3' 10", and at the age of 50 about 4' 6".

Once data on the relationship between the size of a Meranti tree and its value become available it may be possible to work out the optimum rotation cycles for a number of different interest rates. But, and this hardly needs to be emphasised, the information contained in Table 11 may not be at all representative since it is based on a small number of small plots. In addition to the small size of the sample, a number of other criticisms of the data can be made. These are:

(i) The data relate to Malacca, Perak and Negri Sembilan and there is some evidence (by no means conclusive) to suggest that the volume per tree in Johor may be slightly greater than the average volume in the other 3 States. This is presumably because the clear bole height is greater for a given tree girth (see Table 14 ref.11).

(ii) The calculated volume (on which the table 11 in this paper is based) is an approximation for all trees having a minimum girth of 24" or over at breast height. It is based upon the volume table by 3" girth classes for Shorea spp. in the Malayan Forest Manual, 1953, Chapter XIV, App.C., and a graphed projection of the curve for the classes below 36" girth. It is approximately true volume under bark, and includes the stump and all timber in the bole to the first branch and any merchantable volume above the first branch. It is based on the single variable of girth with no sub-classification made for height and no allowance for defect. It is not possible to assess the error likely to result from using single-entry tables (i.e. making no allowance for height variations), the volume is however likely to be overstated, since present trade practices do not seem to use log No. 1 (a trimming log of the order of up to 5' long), invariably stop well short of the theoretical upper limit of the clear bole, and do not generally use any of the timber above the first branch. (ref. 11)

Why bother.!!

?? nonsense

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The likely proportion of wastage through defects is difficult to assess. The Johor Forest Department works on the basis of a defect allowance of 21% of the commercial volume when calculating the theoretical royalty (see Part 3 of this paper). It is not clear what defect factor was used in the Jengka Report. Wong's paper seems to suggest that the proportion of defective log volume to timber volume remains fairly constant at between 5% and 10% for trees of up to 7' girth. Thereafter the defect % rises until the percentage defect factor for trees of more than 9' girth is 47% - but it should be emphasised that Wong's sample was a very small one. (see Table 12).

Thus on the basis of the information available at the moment it is impossible to calculate an optimum rotation cycle for regenerated forests. The Manual (ref.6) suggested that the largest 25 trees per acre or crop trees of Shorea (Leprosula and S.Parvifolia can expect to reach economic saw-log size between 50 and 55 years. The sparse data in this paper would seem to support this and the optimum rotation period could be as short as 40 to 45 years. At this sort of age the commercial volume per acre is not likely to be very much short of 30 tons per acre. (This assumes the best of the existing exploitation and control practices).

But this sort of rotation period assumes a high density of Meranti and this assumption should be borne in mind when calculating the average price for the crop. The timber price is therefore discussed in more detail below.

Timber Prices.

The EPU study assumed an average selling price for all the timber of $195 per ton in 1970 rising to $235 in the year 2000. The price rise could be about right but the price level seems to be on the high side.

If the whole of the timber were to be exported in the form of sawn timber (Table 1 in this paper shows that only about 32% of log production was exported in 1968 in the form of sawn timber and plywood equivalent), an assumed price of $195 per ton

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TABLE 12 DEFECT FACTORS FOR 3 ONE - ACRE PLOTS IN S.W. PAHANG

GIRTH SIZE CLASS	DEFECT %(1) PLOT 1	PLOT 2	PLOT 3	TIMBER(2) VOLUME (CU. FT.)	VOL. OF(2) DEFECTIVE LOGS (CU. FT.)	% OF(2) 5 TO 4
(inches)	(1)	(2)	(3)	(4)	(5)	(6)
24 - 36	6	4	3	1463	58	4
36 - 48	6	4	10	2200	168	8
48 - 60	2	7	4	2896	132	5
60 - 72	6	15	13	1962	240	12
72 - 84	-	-	8	2475	125	5
84 - 96	5	-	43	1331	233	17
96 - 108	32	-	42	2165	465	21
108 AND ABOVE	58	25	54	5235	2484	47
TOTAL/AVERAGE	22	10	25	19727	3905	20

(1) % OF VOLUME OF DEFECTIVE LOGS TO THE TIMBER VOLUME. TIMBER VOLUME, UNDERBARK, IS THE VOLUME THROUGH TO 24" G.O.B. OR TO FIRST PERMANENT BRANCH (TOP OF CLEAR BOLE) WHICHEVER IS ARRIVED AT FIRST. IT INCLUDES ALL (COMMERCIAL AND 'NON COMMERCIAL') SPECIES.

(2) FOR ALL PLOTS.

SOURCE: REF.3

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could be about right. (see Table 13 for the average export prices of sawn timber exported from W.Malaysia and Singapore between 1962 and 1966). On the other hand if part of the timber were sold locally, the aver ge price would almost certainly be lower. (Table 14 shows the average prices of average grade sawn timber sold for local use ex-mill in Selangor from 1941 - 1966).

For this particular analysis we are interested in the prices of the faster growing species such as Meranti. For the first 8 months of 1969, the average export price of the Red Merantis was about $210 per ton (see ref.12). If the average local price is assumed to be around $140 per ton, then the weighted average price (weighted by the present proportion of sawn timber exports to domestic consumption) would be between $170 and $190 per ton. Even this is likely to be too high rather than too low - the Jengka Report assumed an average export price (f.o.b.) of $162 and an average local price ex-mill of $117. These were estimates for all species combined, but Meranti prices are fairly similar to the average for all commercial species. In 1967, the average value per ton of output from Johor sawmills was given in the Manufacturing Survey as $110. (ref.13).

However if a price of, say, $175 is assumed, at what sort of rate will it rise or fall? The EPU assumed that it would rise at the rate of about 0.5% p.a. from 1970 to the year 2000. This is probably as good a guess as any. Tables 13 and 14 show that prices did in general rise slightly between 1963 and 1966 and this slight rise has, I think continued into 1969. (This will be checked). A study is now underway in S.E.Asia, sponsored by F.A.O., which will include price forecasts of forest products including tropical hardwoods. This study is due to be completed by June 1970. (see Introduction).

F.A.O. publications (refs. 14 and 15) forecast that the estimated world consumption of sawn wood will rise from 1960/62 to 1975 at a rate of between 1 and 2% p.a. The same publications forecast much faster rises in the consumption (in both S.E.Asia and the rest of the world) of wood-based sheet materials - plywood, and (with an especially fast growth

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TABLE 13 SAWN TIMBER EXPORT PRICES - FROM W. MALAYSIA AND SINGAPORE BETWEEN 1962 AND 1966.

	AVE. F.O.B. PRICE ($ PER TON)			VOLUME EXPORTED (000 TONS)		
YEAR	W. MALAYSIA	SINGAPORE	W. MALAYSIA AND SINGAPORE	GRADED	TOTAL	% GRADED TO TOTAL
1962	164	150	158	236	303	78
63	173	160	168	290	372	78
64	200	174	188	378	461	82
65	194	170	184	428	530	81
66	194	194	194	456	559	82

SOURCE - FOREST DEPARTMENT REPORTS W. MALAYSIA - 1963 - 1966

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TABLE 14 AVE. PRICES OF AVERAGE GRADE SAWN TIMBER FOR LOCAL USE EX-MILL IN SELANGOR IN $ PER TON OF 50 CU. FT.

	HHW		MHW		LHW	
	CHENGAL	OTHERS	KAPUR	OTHERS	MERANTI	OTHERS
1941	60	50	48	35	200	180
1952	500	400	290	200	200	180
1960	320	220	195	125	155	125
1963	265	215	200	125	135	100
1964	265	210	200	125	140	105
1965	245	215	185	130	140	120
1966	258	215	185	150	140	125

SOURCE : FOREST DEPARTMENT ANNUAL REPORTS : W. MALAYSIA 1963 - 1966.

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rate) particle board - and pulpwood. Thus the price prospects for sawn timber as opposed to reconstituted materials are not particularly bright - in this paper an average price of around $175 is assumed for 1970 rising at an average of about $1.5 per ton p.a. to a price of $220 per ton in the year 2000. This price rise is based not so much on an expected rise in the price of sawn timber, but more on the expectation of further processing in W.Malaysia of the lower grades of timber. The prospects for the further processing of timber in W.Malaysia are considered in more detail in Part 2 of this Paper.

No further information has been obtained on logging and sawmilling costs beyond that contained in the EPU study, which was extracted from the Jengka Report. The report estimated that the variable costs of logging in the Jengka Triangle would be between $18 and $20 per ton of logs, and that the capital costs would be about $15.9 million for about 169,000 acres over about 10 years. If this capital cost is depreciated at an interest rate of 10% p.a. over a period of 10 years, the annual cost is about $2.6 million, and the cost per acre per annum is about $150. On the basis of an average yield per acre of something like 30-40 tons, this represents a cost per ton of about $4-5.

If then it is assumed

(i) that the optimum rotation period for regenerated forest is 40 years;

(ii) that the yield of commercial timber at the end of the 40 year period is about 30 tons per acre;

(iii) that this 30 tons is logged at a cost of $24 per ton of logs and then sawn into lumber at a conversion rate of 65% and a cost of $44 per ton of sawn timber;

(iv) that the sawn timber is sold at an average price in the 40th year of about $235 per ton;

(v) that the forest regeneration costs average about $5 per acre per annum;

- the net present value of regenerated forest at a discount rate of 10% p.a.

is as follows:

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	Tons per acre	$per ton of sawn timber	$000 per acre	Discount factor (at 10% p.a.)	Present Value (at 10% p.a.)
Outturn Revenue -	20(1)	235	4.70	0.0221(2)	104
Costs - Logging -		37 (3)	(0.74)	0.0221	(16)
- Sawmilling -		44	(0.88)	0.0221	(19)
- Regeneration Management - ($5 per acre)				9.779 (4)	(49)
- Net Present Value ($ Per Acre) -					20

(1) Based on 30 tons per acre at 65% Conversion Factor. - Rounded to 20 tons.

(2) The Discount Factor in the 40th year.

(3) Based on a cost per ton of logs of $24.

(4) The Cumulative Factor over 40 years at 10% p.a.

The 'profit' at an interest rate of 10% p.a. is, on these assumptions, $20 per acre. This does of course exclude the initial felling which, as was stated earlier, is assumed to be equally profitable to both the agriculture and forest regeneration alternatives.

As was stated earlier too little is known about the returns from agricultural and livestock activities(1) on Class III land but it is likely that the returns from rubber planted on land designated as Class III land because of slope will be higher than

Surely, figures are available of crop grown on Class III Land!

(1) The potential for livestock activities is now being investigated by members of the S.E. Johore Project team. Preliminary indications are, however, that the returns will be fairly high relative to those from regenerated forest (and possibly oil palm and rubber) and, more importantly a livestock industry could be developed on land designated as Class III on the basis of drainage, depth nutrient status and texture but not slope.

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the return from forest regenerated on the same land. This advantage is emphasised by the greater employment that the use of the land as a rubber plantation provides. The 'profit' and employment advantages are not reduced to any significant extent by costs associated with erosion or possible changes in the micro-climate. The soil erosion problems associated with 12 - 20° slopes are insignificant and the research done on the relationship between precipitation and the clearance of vegetative cover would seem to indicate that clearance has little or no effect on the micro-climate. (1).

Provided management standards are high

But has effect water catchment efficiency; higher run-off.

But before any firmer conclusions can be arrived at, much more information is needed on the points noted in the above sections. One particular problem that will have to be considered in more detail is the interest rate to be used to discount costs and benefits. The net present value of regenerated forest is in particular very sensitive to the rate of interest used.

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(1) For example, Penman in Chapter 1 of 'Vegetation and Hydrology' published by the Commonwealth Agricultural Bureaux in 1963, concludes - "The implication to be carried forward is that though vegetation may affect the disposal of precipitation, it cannot affect the amount of precipitation to be disposed."

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Part 2. Wood-based Industries in West Malaysia

2.1 Introduction.

The purpose of this Part of the paper is

- (i) to try to discover how wood utilisation can be improved in existing industries and (ii) to assess the prospects in W. Malaysia and especially Johor for the further development of industries based on wood, and to try to discover, where these industries do not exist, why they do not exist.

Most of the discussion concerns tropical hardwoods, but there is some discussion of the use of mangrove forest, old rubber trees and exotic softwood species, particularly in section. 2.4

At present the main wood-using industries in W.Malaysia are the sawmilling and plywood/veneer producing industries. The degree of wastage incurred during exploitation is high relative to utilizable volume. An analysis of extraction data and stand tables suggest that of the volume actually felled within the forest approximately one-third remains unextracted - that is the top end of the bole below 4' g.o.b. and down to 18" g.o.b. and damaged but utilizable trees which are left in the forest. The Forest Department Annual Reports indicate that an average something like 12-15 tons of logs are extracted from each acre. Since this represents something like two-thirds of the utilizable volume felled, the actual felled and utilizable volume is approximately 18-23 tons per acre. In addition the unfelled but utilizable volume of species anticipated to be of commercial value is probably about 10 tons per acre. Therefore the utilizable volume is at least 28 tons per acre. In Forest Reserves which have been regenerated, the species which are presently non-commercial would represent a smaller proportion of the total volume, but the 'wastage' resulting from the non-use of the top end of the bole would still result. Furthermore the conversion factor for the sawmilling industry is something like two-thirds of the input and the conversion factor for the plywood industry is about 40%. And so even if the 'wastage' resulting from the non-use of

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non-commercial species is eliminated through regeneration, the wastage remaining is still likely to represent around 60% of the volume felled. There is therefore considerable potential for raising the effective yield from the species presently listed as 'commercial'.

The industries using logs or the primary by-products of other wood-using industries are covered by the following Malaysian Industrial Classification codes;

351 - Sawmills, Planning Mills and other wood mills,

and 371 - Manufacture of pulp, paper and paperboard.

In 1967 the gross output of all industries covered by the Department of Statistics Survey (ref.13) - estimated to cover more than 70% of all industries in W.Malaysia - was $2,303 million, and the net output was about $644 million. The gross output of the (Code 351) wood using industries was $165 million, the net output being about $59 million. The output of the pulp, paper and paperboard industries (Code 371) was not covered in the survey, but was almost certainly less than 5% of the output of the Code 351 industries. The output of the 'primary wood-based' industries was therefore something like 4 - 5% of total manufacturing output (as defined above). These wood-based industries provided direct employment for about 14,000 people in 1967, about 15% of total employment in Manufacturing industries, but only about 0.5% of all people in W.Malaysia between 20 and 55 years of age, in 1967 (ref.18)- that is less than 1% of the working population.

In 1967, about 13% of the gross output of the sawmilling industry (code 3511) came from Johor, and about half of the gross output of the plywood/veneer and particle board milling industry. Therefore of the output of the primary wood-based industries (excluding paper and pulp manufacture) in W.Malaysia in 1967, about 17-18% came from Johor.

Apart from the sawmilling, plywood (and particle board) and pulp - and paper-producing industries, there are also a small number of other industries using wood. These are match and pencil factories, 2 wood wool slab 'factories' (discussed in section 2.4.

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below) and a number of small establishments processing sawn timber such as planing mills, window and door mills, and joinery works (Manufacturing code 3513) and wooden boxes and crates (3531). But these, apart from the wood wool plants, are not the concern of this paper.

The exports and imports of 'primary wood products' for 1966 and 1967 are shown in Table 15. The table shows that the volume of 'wood imports' in 1966 and 1967 was around 120-130,000 tons. Since the majority of these imports consisted of pulp and paper products which use something like 1 ton of fibre to produce 1 ton of paper the maximum immediate potential for further utilisation of wood in the reconstituted wood industries is somewhere around 100,000 tons. The average value per ton of output would then of course be much higher than the average value per ton of output from the existing wood-based industries in W.Malaysia.

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TABLE 15 IMPORTS AND EXPORTS OF "PRIMARY WOOD PRODUCTS" - W. MALAYSIA - 1966/1967

M.T.C.[1] CODE(S)	DESCRIPTION	IMPORTS				EXPORTS			
		1966		1967		1966		1967	
		(000 TONS)	($M)	(000 TONS)	($M)	(000 TONS)	($M)	(000 TONS)	($M)
241/100-200	FUELWOOD/ CHARCOAL	23	1	9	-	30	1	78	1
242/200-300	SAWLOGS/ VENEERLOGS	-	-	-	-	777	43	816	59
242/400-900 - 243/100	POLES/POSTS/ RAILWAY SLEEPERS	2	-	3	-	17	1	15	1
243/211-315	SAWNLUMBER OVER 0.2"	3	1	3	1	344	56	409	70
251	PULP AND WASTE PAPER	21	4	26	4	-	-	-	-
631/100-219	PLYWOOD/ VENEER	1[2]	1	2[2]	2	17[2]	7	25[2]	12
631/400	PARTICLE BOARD	-	-	-	-	-	-	-	-
641/100	NEWSPRINT	14	7	15	7	-	-	-	-
641/200	PRINTING PAPER	13	11	18	14	-	-	-	-
641/300	KRAFT PAPER (BOARD)	14	7	17	9	-	-	-	-
641/500	WRAPTING PAPER (BOARD)	10	7	14	9	-	-	-	-
641/601-603	HARDBOARD	3[3]	1	2[3]	1	-	-	-	-
641/604-605	SOFTBOARD	4[4]	1	3	1	-	-	-	-
641-900	PAPER/PAPER BOARD	7	7	10	9	-	-	-	-
642	BOXES, BAGS AND OTHER PAPER ARTICLES	9[5]	15	9[5]	14	1[5]	2[6]		3[6]
TOTAL -		124	63	131	71	1,186	110	1,345	146
AVE.VALUE ($PER TON)[7]		510		540		90		110	

(1) MALAYSIAN TRADE CLASSIFICATION - BASED ON THE S.I.T.C.
(2) CONVERTED FROM SQ.FT./5 MM.THICK AT 3,000 SQ.FT. = 1 TON OF 50 CU.FT.
(3) CONVERTED FROM SQ.FT.OF VARYING THICKNESSES AT AN AVE. OF 5,000 SQ.FT/TON
(4) CONVERTED FROM SQ.FT.OF VARYING THICKNESSES AT AN AVE. OF 2,200 SQ.FT/TON
(5) ESTIMATED
(6) MOSTLY RE-EXPORTS TO E. MALAYSIA AND SINGAPORE
(7) ROUNDED TO NEAREST $10 PER TON.

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2.2 The logging and sawmilling 'industries'.

(a) Output.

About 27% of log production was in 1968 exported; the majority of the rest was consumed by the sawmilling industry. This industry is characterised by a large number of small production units, a substantial number of which lack adequate professional or management skills.

As of August, 1969 the sawmilling sector in W.Malaysia comprised 442 registered sawmills. At that time new licenses had been approved by the various State Governments for an additional 108 units of unspecified capacity and location. At the present time the status of the sawmilling sector is illustrated by the fact that 374 sawmills have an annual log intake of less than 5,500 tons per mill. The 14 largest sawmills have an average annual log intake of 14,000 tons per mill, with the largest single sawmill having an annual log intake of 20,000 tons. The overall average log intake per sawmill per year stands at approximately 4,000 tons.

1966 statistics suggest that there are only 132 breakdown saws in sawmills in W.Malaysia (ref.5) - 63 of these were circular. Therefore about two-thirds of the sawmills use resaws to break down the logs. In Singapore by contrast there were (in 1962) 43 sawmills with 58 breakdown saws (36 of which have log carriages) and 139 resaws. The average output per resaw per day in Singapore was over 5 tons compared with an average output per resaw per day in W.Malaysia of about 3 tons. The sawmills in Johor are, however, larger and "better - equipped" than the average sawmill in W.Malaysia. In 1966, (ref.5) there were 43 sawmills in Johor, 35 of which had breakdown saws and the average annual log input of which was 6,500 tons (compared to the W.Malaysian average of 4,000 tons in the same year).

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No information has yet been obtained on the economic advantages of using kilns for drying the timber; the best quality timber is still obtained by air-drying timber but the use of a kiln does of course reduce the average capital invested, since at any one time there will be less timber in stock. A kiln is not an expensive item of machinery, the most common type in W.Malaysia having an installed cost of about $200,000 - the cost of a small steam boiler is an additional $10,000.

There are various types of wood preservation in practice. Probably the most common form of preservation is that of painting, the purpose of which is to prevent access of the weather, but this type of preservation does not usually afford any protection against dry rot, insect, bacterial or fungal attack. The best means of preserving timber against these attacks is by impregnating it with various salt solutions and anti-fungal agents. The two most common processes in use in W.Malaysia are the "Tanalith" and "Celcure" processes. In 1966 there were about 40 plants in W.Malaysia using either of these processes - about 70,000 tons were treated in that year. Again however little information is available on the economic returns from these processes. But one particular advantage of these preservation practices is that they may enable timbers to be sold that would otherwise be non-commercial.

(b) Processes, costs and profits.

No information has yet been obtained from particular companies in W.Malaysia on the profits earned from logging and sawmilling. Tables 16 and 17 (gathered from the Jengka Triangle Report and other "synthetic sources") do however give some sort of picture of the profits from logging and sawmilling in W.Malaysia and Johor State.

The average return from an investment in a logging operation is difficult to estimate but seems to be at least 15% p.a. and is probably as high as 20-25%. The average annual return from sawmilling is equally difficult to estimate. The log is

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TABLE 16 THE APPROXIMATE RETURNS FROM LOGGING IN W.MALAYSIA AND JOHOR

LOGGING

	$15.9 m W. Malaysia	Johor
CAPITAL INVESTMENT (1)		
ANNUAL SURPLUS		
- SALE PRICE OF LOG AT MILL (2) ($PER TON)	46	46
- LOGGING COSTS ($PER TON) (3)	(19)	(19)
- AVERAGE ROYALTY/PREMIUM FOR W.MALAYSIA AND JOHOR. (4) -	(11)	(13)
- SURPLUS ($PER TON) -	16	14
- '000 TONS PER ANNUM (5)	203	287
- SURPLUS ($M. PER ANNUM)	3.25	4.02
ANNUAL RATE OF DISCOUNTED RETURN (% p.a.)		
- ON A 10 YEAR ASSET LIFE -	15%	22%
- ON A 15 YEAR ASSET LIFE	19%	25%

PRESENT VALUES OVER 10 YEARS AT 10% P.A.	$M
CAPITAL INVESTMENT	16
ANNUAL SURPLUS	20 - 25
NET PRESENT VALUE	4 - 9

(1) FROM JENGKA REPORT - COVERING 169,000 ACRES OVER 10 YEARS.

(2) BASED ON AVERAGE EXPORT VALUE OF $ 64 PER TON IN 1966/67 (SEE TABLE 15) LESS AN EXPORT TAX OF 10% LESS TRANSPORT COSTS TO PORT OF $10-$15 PER TON. A SALE PRICE AT THE SAWMILL OF $46 PER TON OF LOGS IS CONSISTENT WITH TABLE 17.

(3) BASED ON JENGKA REPORT.

(4) THE AVERAGE INCOME OF THE FOREST DEPARTMENT IN 1964-1966 PER TON OF LOG OUTTURN WAS $10; THE AVERAGE INCOME OF THE FOREST DEPT. IN JOHOR STATE FOR 1967 /68 WAS $12 PER TON. THE ROYALTIES CHARGED BY JOHOR ARE CURRENTLY $10 PER TON FOR LHW AND $15PER TON FOR MHW, AND THE HIGHEST PREMIUM IN JOHOR STATE IS GENERALLY NO MORE THAN $5 PER TON. (SEE MY INTERVIEW WITH S.F.O. ON 16 NOV.) - THE 'GUIDANCE PREMIUM' USED BY THE JOHOR STATE OFFICE OF THE FOREST DEPT. IS 3/16ths OF THE ROYALTY. THUS AVERAGE ROYALTY/PREMIUM FIGURES OF $11 PER TON FOR W.MALAYSIA AND $13 PER TON FOR JOHOR STATE SEEM IF ANYTHING ON THE HIGH SIDE.

(5) ON THE BASIS OF 10,900 ACRES P.A. AT AN AVERAGE OF 12 TONS PER ACRE FOR W. MALAYSIA AND 17 TONS PER ACRE FOR JOHOR STATE - SEE PART (1) of this paper

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TABLE 17 THE APPROXIMATE RETURN FROM A SAWMILL IN W. MALAYSIA AND JOHOR

SAWMILLING	$ PER TON	$M(2)
INITIAL CAPITAL INVESTMENT(1)	50-125, say 80	0.52
ANNUAL SURPLUS		
- SELLING PRICE OF SAWN TIMBER(3)	130-135	0.85-0.88
- PURCHASE PRICE OF LOGS(4)	(70-75)	(0.46-0.49)
- OPERATING COSTS (EXC DEPRECIATION)(5)	(33-35)	(0.22-0.23)
- RANGE OF ANNUAL SURPLUS	20-32	0.13-0.20
- APPROXIMATE ANNUAL RETURN (% P.A.) OVER 10 YEARS -		21-37

PRESENT VALUE AT 10% P.A. OVER 10 YEARS	$M
- CAPITAL INVESTMENT	0.5
- ANNUAL SURPLUS	0.8 - 1.2
- NET PRESENT VALUE	0.3 - 0.7

(1) SEE TEXT

(2) BASED ON AN ANNUAL THROUGHPUT OF 6,500 TONS - SEE TEXT.

(3) BASED ON AN AVERAGE SELLING PRICE (INC. BY-PRODUCTS) IN REF. 13 FOR 1966/1967 OF BETWEEN $130-$135 PER TON.

(4) BASED ON AN AVERAGE PURCHASE/COST PRICE IN REF. 13 OF BETWEEN $45 AND $50 PER TON OF LOGS OR $70-$75 PER TON OF SAWN TIMBER.

(5) BASED ON '66/'67 COSTS AS GIVEN IN REF. 13.

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generally broken down into flitches (rough-sawn shapes of the final product) by a resaw, or in better equipped mills by a breakdown saw. The cost of machinery and buildings for a 3-4 bench mill is probably between $50,000 and $100,000. The average output of a mill o f this size in W.Malaysia is about 3,000 tons p.a. (compared with an average output from a similar Singapore mill of about 5,000 tons p.a.) and the investment cost per ton of output is therefore about $17-$33 per ton. Figures produced by the F.A.O. estimate an investment cost of $75 per ton of raw material including working capital. (see ref.17). The working capital needs of a sawmill plant (or at least the average sawmill in W. Malaysia) are considerable. This is mostly because of the prevalent use of air-drying (as opposed to kiln-drying)techniques , but also because of the relative scarcity of logs between approximately end-November and end-January (in these months about two-thirds of the average monthly supply) which means an investment in a stock of logs as well as of sawn timber. Something like 2-3 months of stocks are commonly kept, and since the value of an annual throughput of 3,000 tons is $300,000 or more, the investment in stocks could be as much as $100,000 or $30 to $40 per ton of output. The investment costs would seem therefore to be somewhere between $50 and $125 per ton of annual output. The operating costs are obtained from the 1967 Manufacturing Survey and average between $33 and $35 per ton which, when the cost of capital consumption is added, (an initial capital cost of, say, $80 per ton recovered at 10% p.a. represents an annual cost per ton of $80 x 0.163 = $13), agree fairly closely with the Jengka estimates of $44 per ton for all costs (capital and operating).

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Table 17 suggests that the profits earned from sawmilling activities in W. Malaysia are very high indeed (around 30% p.a.) and Table 16 suggests that the profits from logging activities, though somewhat lower, are still lucrative.(1) It is however difficult to say what implications, if any, these returns have for the further utilisation of timber in W. Malaysia. The lack of research and/or investment in W. Malaysia in reconstituted wood industries by logging and sawmilling companies could be due to one or more of a large number of factors:

- (i) the high profits earned in activities requiring little capital investment (logging and sawmilling) and in which considerable experience has been acquired, therefore reducing the pressure on the logging and sawmilling companies to cut down on 'waste' (that is to look for more profitable ways of using slabs, edgings and sawdust);
- (ii) the small or at least uncertain markets in W. Malaysia for reconstituted wood products (see Parts 2.3 and 2.4 of this paper);
- (iii) the high (relative to logging and sawmilling) capital investment required to manufacture plywood ($110 per ton o f throughput p.a.), fibreboard ($150 per ton), particle board ($150 per ton) and particularly pulp and paper ($600 per ton) - all figures in brackets are from ref.17;

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(1) These figures are lower than the returns which one timber company (North Borneo Timber Berhad) earned in the year ending May, 1969. This is the only company for which information was available at the time of writing this paper. In the year ending May 1969 the company earned a return (gross profit before depreciation to total capital employed) of over 50%. This higher return in Sabah is however probably to be expected - tonnage per acre is higher than in W.Malaysia and royalty/export duty per ton seems to be lower (the annual report of the company for 1969 suggests that the average export duty/royalty in 1968/69 paid by the company was about $8 per ton.)

Reference ?

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- (iv) the (possibly) lower profits to be earned on the processing and production of reconstituted wood. Even if the profits would not in retrospect turn out to be lower than those obtainable from existing activities, they are certainly in the existing state of knowledge more uncertain;
- (v) the uncertain supply of timber from logging concessions (because "the concessions are too small". - the complaint of the two sawmilling companies so far interviewed) which means that the source of supply for more capital intensive industries may be uncertain.

Some ways in which the further utulization of wood might therefore be encouraged in the timber-utilization industries are:

- (i) By raising royalties on logs - this might;

(a) raise log prices (raise/lower the value of log exports) and lower sawmilling profits. The lowering of sawmilling profits might in turn be an incentive to the further utilisation of 'waste' or might simply lead to a reduction in investment in the sawmilling industry.

or, (b) lower logging profits - this might encourage more integration with the sawmilling industry, might encourage the more intensive exploitation of existing species (or with a differential royalty, of lesser-known species) or might simply reduce investment in logging activities;

- (ii) by raising the land premia. - this would have the effect of increasing the cost per acre exploited by a fixed amount. The higher premia could be combined with a lower royalty to make the fixed element even greater. This would probably be a more effective method of increasing utilisation than that of raising royalties. But it might need to be combined with a fairly tight control on logging in order to prevent too many small commercial trees being extracted;

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- (iii) by raising the export duty on logs or even by banning the export of logs of particular species. The raising of export duty might;

(a) raise the prices of logs but keep the volume of log exports the same. This would mean more income to the Malaysian Government and more foreign exchange income to the country;

or, (b) reduce the volume of logs exported. Singapore might obtain more of its supplies from East Malaysia or (more probably) Indonesia. If the export volume of logs were reduced, the sawmilling industry in W.Malaysia might be expanded or the volume of logs extracted might be reduced. This depends on whether the logs exported are exportable by W.Malaysia in the form of sawn timber, or whether Singapore (possibly by the use of kiln-drying or preservation techniques) markets a wider range of species or makes better use of the existing commercial species.

A differential export duty (higher for commercial species) could of course be introduced in order to encourage the further utilisation in W.Malaysia of commercial species but this would probably be unduly complicated to administer;

- (iv) by letting out larger concessions, if the complaints of the sawmillers interviewed are justified. These larger concessions could be combined with penalties for bad exploitation and/or the possibility of cancellation. The larger concessions, if combined with higher premia and/or royalties and/or export duties on logs, might guarantee a regular supply of logs but at the same time put some pressure on the sawmillers (and the loggers) to make better use of the timber in the forest;
- (v) by setting up a Timber Utilisation Promotion Board financed by a cess on the production of logs and timber (similar to the way in which the Malaysian Timber Export Industry Board is at present financed by a small cess of 80¢ per ton of logs or sawn timber exported).

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Alternatively the functions and powers of the Timber Utilisation Section (Forest Products) of the Forest Department and Forest Research Institute could be expanded and strengthened, and (if necessary) financed by a cess. The establishment of a new or strengthened Utilisation Section should again be accompanied by one or more of the measures discussed in (i), (ii), (iii) and (iv);

- (vi) by the establishment of a Government Timber Corporation which would more directly participate in the industry, in a similar way to the way in which MARA is participating in the exploitation of the forest in the Jengka Triangle. That is, it would probably be necessary to bring in timber 'experts' from overseas to set up and initially manage the various industries established. Cantrans (according to the information received) is not in fact managing industries on behalf of the Government but acting as an advisor to individual companies set up under the auspices of MARA

More information is needed before the effects of any detailed recommendations can be predicted and any suggestions or information which might help would be welcome.

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2.3 The plywood and other wood-based panel industries.

(i) Plywood and veneer.

The most rapidly expanding sector of the timber industry in W.Malaysia in the past 5 years has been the plywood, veneer and particle board sector (Manufacturing code 3512). Output in W.Malaysia was 6.4 million sq.ft (of 5 m.m. thickness) in 1961 and 224.7 m.sq.ft. in 1968. By August 1968, 16 mills were registered as operational in W.Malaysia with a further 22 licences approved (of unspecified capacity and location).

However Table 1 in this paper shows that, despite this rapid expansion, less than 6% of log output in 1968 was fed into plywood and veneer mills. The majority of this input was converted into plywood. In 1966 about half of the plywood and veneer output came from Johor State. All the mills in Johor State are (or, at least, were in 1966) in Kluang. Plymill log intake in W.Malaysia in 1967 was 102,000 tons (see Table 1) and net exports in the same year were approximately 23,000 tons (see Table 15 of this paper). The conversion rate for the plymills was 40% in 1967, but the conversion rate seems to have varied considerably from one year to another (see Table 1).

However assuming a conversion rate of 40%, the output of the plymills in 1967 was about 40,000 tons and consumption in W.Malaysia was therefore about 17,000 tons. (This compares with an apparent consumption in 1966 of about 23,000 tons - but the statistics are not very reliable. Apparent consumption in 1966 and 1967, in millions of sq.ft. was 70 and 54 respectively).

Little is known by the writer (at the time of writing this report) about the prospects for the prices of plywood and veneer. World consumption of wood-based panel materials seems to have grown very rapidly over the past 15 years. In aggregate, world consumption rose from 12.5 million m^3 in 1951 to 30.2 million m^3 in 1961 an average

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annual growth rate of 9.3%. During the first half of the 60's consumption grew even faster at an average rate of 10.5% p.a. to reach 45.2 million m^3 in 1965. The appearance of particle board (a new product) accounted for an important part of this rapid growth in panel use in the post-war period. But growth in use of the other panel products was also substantial. Between 1951 and 1961 consumption of plywood increased by 147% and fibreboard by 110%. Since 1961, uses of these two products has grown by a further 42% and 34% respectively. World price prospects for plywood are therefore probably bright.

The average price of plywood per thousand sq.ft. of 5 m.m. thickness in 1967 was about $150 ex-factory (see ref.13). This represents a price per ton of output of about $450 ex-factory or of about $460 per ton F.O.B. (the average export price in 1966/67). On the basis of these prices and the average costs given in the 1967 Manufacturing Survey, the annual return on capital invested in a plymill, in W.Malaysia is somewhere around 23% p.a. (see Table 18). (The Jengka figures would given an even higher return - over 35% p.a. - but they were based on an average annual output of 100 m.sq.ft., whereas the annual average output per mill in W.Malaysia in 1966/67 was only about 8 m.sq.ft). However it needs to be emphasised that the above analysis is based on very approximate estimates especially for the capital investment. (If the initial capital investment were, say, double the Jengka estimate per ton of output, the average annual return would still be about 18% p.a.)

It does not appear to be the common practice to steam logs prior to peeling in W.Malaysia; it is possible that the main reason for this is that the logs are peeled while they are still in a 'green' condition but it is likely that the more widespread use of steaming would enable a wider range of species (especially the harder woods) to be peeled. At present the species peeled are almost exclusively in the LHW group.

The conversion rate at present seems to be about 1,200 sq.ft. (of 5 m.m.thickness) per ton of log input - implying a conversion rate of about 40%. Frequently a large

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TABLE 18 COSTS AND PROFITS IN THE PLYMILLING INDUSTRY OF W. MALAYSIA

	$ PER '000 SQ. FT. (AT 5 MM.)
INITIAL CAPITAL INVESTMENT(1) :-	100
SELLING PRICE EX MILL(2) :-	180
	$ PER TON OF TIMBER INPUT
OPERATING COSTS(3)	
- TIMBER	74
- OTHER PURCHASED SUPPLIES	60
- WAGES	36
- TOTAL	170
	$ PER '000 SQ.FT.(4)
OPERATING COSTS -	142
ANNUAL SURPLUS	38
ANNUAL RETURN (% P.A.)	
- BASED ON A 10 YEAR ASSET LIFE -	23
- BASED ON A 15 YEAR ASSET LIFE -	25

(1) JENGKA ESTIMATED A CAPITAL COST (INC. WORKING CAPITAL) OF ABOUT $84 PER '000 SQ.FT. OF OUTPUT FOR A PLANT WITH AN ANNUAL OUTPUT OF 100 M. SQ.FT. (5 MM. THICKNESS) PER ANNUM. F.A.O. FIGURES SUGGEST A FIGURE OF $105 PER CU. TON OF INPUT OR BASED ON A 1,200 SQ.FT. CONVERSION RATE, OF AGAIN, ABOUT $84 PER '000 SQ.FT. OF OUTPUT. A CAPITAL COST OF $100 PER '000 SQ.FT. OF OUTPUT HAS BEEN ASSUMED FOR THE PURPOSES OF THIS PAPER.

(2) THE PRICE INCLUDES 'BY PRODUCT' SALES (SEE REF. 13, TABLE 19.3)

(3) SEE REF. 13 (AVERAGE FOR 1966 AND 1967).

(4) AT A CONVERSION RATE OF 1,200 SQ.FT. PER CU. TON OF INPUT - THE CONVERSION RATE IMPLIED BY THE MANUFACTURING SURVEY WAS 1,200 SQ.FT. FOR 1966/1967.

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part of the 'waste' will be used as fuel for steam and power needed in the plant for hot presses, dryers, etc. It is however likely that a more profitable use could be made of the residue by using at least some of it in the manufacture of particle board, fibreboard, or some other reconstituted wood.

(ii) Other wood-based panels.

The particle board and plywood industries are often integrated because the particle board can be made from the 'waste' of the plywood mill and they both serve the same consuming sectors (construction and furniture). The imports of particle board into W.Malaysia in 1966/67 were however negligible; probably for the above reason, namely that particle board serves the same market as the domestically - produced plywood. The production of particle board in W.Malaysia is also negligible - there is one small plant in Johor at Tampoi but its production in 1966 amounted to less than 1,000 cu. tons. A larger plant based on padi stalks, coconut husks and waste wood with an annual production capacity of about 7,000 tons of particle board is however planned for Province Wellesley (see ref.19). The advantage of particle board replacing plywood for some uses in W.Malaysia is that it would 'deepen' the use of wood - that is there would be a better use of the 'waste' resulting from sawmills and plywood mills. The investment costs per ton of output for a particle board mill are somewhat higher than the investment costs of a plywood mill - something like $150 per ton of raw material input for a particle board mill compared with an investment cost of $105 per ton of input for a plywood mill. Further investigations of the potential for particle board mills in W.Malaysia are being made.

Similarly the manufacture of hardboard or softboard may make a more profitable use of the 'waste' resulting from the manufacture of sawn timber or plywood. The imports of these materials (hardboard and softboard) into W.Malaysia were, in 1966/67, running at about 5-7000 tons p.a. or about 15-25 m.sq.ft. p.a. Further investigations of the potential for a plant manufacturing hard and/or softboard in Johor are being made. It seems that the investment requirements of a fibreboard (hardboard/softboard) plant

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are similar to those of a particle board plant, and work by Peel in 1960 suggested that a fibreboard plant in Selangor (producing mainly hardboard and based on rubberwood and Meranti waste) might be feasible. (see ref.20).

Another type of wood-based panel which is being manufactured in Johor is a mineral panel in which a mineral binding material is used to bind wood shavings or shreddings together in sheet form. Again however little information is currently available on this process although it is known that the plant at Tampoi in Johor produced less than 2,500 cu. tons of products in 1966.

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2.4. The pulp and paper industries in W.Malaysia.

(i) Consumption and production

The estimated consumption of paper and paper products in W.Malaysia from 1960 to 1968 is shown below:

'000 tons

	1960	1963	1966	1968*
Writing and book paper	7.0	10.5	14.3	15.0
Wrapping and bag paper	2.6	12.6	12.4	11.5
Paper board	3.5	6.9	14.9	14.8
Newsprint	5.7	11.1	14.1	14.7
Total	18.8	41.1	55.7	56.0

* For the 9 months from Jan.-Sept. 1968 only.

Source: ref.21.

Ref.15 estimated that the world consumption of newsprint, of printing and writing paper, and of industrial paper and paperboard would rise by about 5%, 6% and 6% p.a. respectively between 1961 and 1975. Consumption in W.Malaysia is however expected to grow much more rapidly than this from 1968 to 1975 - almost certainly by more than 17% p.a. (Between 1960 and 1967 the annual growth in consumption was about 20%).

At present there is a small output of wrapping paper in Penang (by North Malaya Paper Mills) but a far larger plant is planned for Ipoh by a new company called Kretas Perak Berhad. This is a joint venture between Nagoya Pulp and Marubeni-Iida of Japan and Gula Perak. The planned production is of 30,000 tons of pulp and paper p.a. based mainly on the bagasse obtained from Gula Perak. A feasibility study was apparently done on the plant in October 1969 (this has not yet been obtained).

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(ii) Processes and raw materials.

Paper can be made from any cellulosic raw material ranging from lalang to pine trees and agricultural residues such as rice straw and bagasse (ref. 21). Raw materials are generally classified as short-fibred or long-fibred as fibre length imposes definite limitations on the grade of paper that can be made. In general long-fibred raw materials have been preferred in the past because of their superior tearing strength. Thus long-fibred pulp is an essential component of all grades of paper and paper products which are subjected to stress in usage. However long-fibred pulp is not indispensable for products for which tearing strength is not an important requirement. Such products include writing and printing papers, and certain industrial papers and boards. These types of paper probably represent something like half the present consumption in W.Malaysia, but this part of the consumption is probably growing faster than the 'long-fibred part.' Usually broad leaved or hardwood species yield short-fibred pulp and coniferous species or softwoods produce long-fibred pulp.

Cellulosic materials indigenously available in W.Malaysia include the following short-fibred ones:

- (i) Tropical hardwoods - heavy and medium hardwoods are generally unsuitable. Some light hardwoods can however be used in the production of high grades of writing and printing paper and of low grades of wrapping paper.

- (ii) Rubberwood - this has the advantage that it is concentrated in particular areas to which there is generally good access and that it is a uniform raw material. Currently Daishowa of Japan are chipping and exporting about 20,000 tons of rubberwood (70%) and mangrove woods (30%) per month from Port Swettenham for (mainly*) paper manufacture in Japan. Some waste is taken from the sawmills but

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* it seems that the mangrove species are used in the manufacture of rayon.

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there are two problems associated with this;

(a) the variation in fibre length between species;
and(b) the variation in the quality of woods from the sawmills.

In addition some tropical hardwoods are difficult to chip because of their hardness (e.g. keranji, kempas, derom and chengal). The yield of rubberwood per acre is about 25 tons - thus the Daishowa plant is using the 'output' of about 7,000 acres of rubber a year. A similar wood-chipping plant is to be established in the near future in Johor Baharu. (see ref.22).

- (iii) Secondary (e.g. macaranga) and mangrove species - secondary species are thought to be suitable for making groundwood or light - coloured semi-chemical pulp but the 43,000 acres of mangrove forest reserves in Johor State are likely either to be continued to be used for producing charcoal or for export as wood chips.

- (iv) Rice - problems of collection, transport and storage arise in the use of this material and it is probably more profitable to plough the rice straw as mulch back into the soil.

- (v) Bagasse - currently being used in Perak, but a successful Johor State sugar industry is unlikely.

There are no indigenous supplies of long-fibred species and it was in order to investigate the potential for developing plantations of exotic softwood species that the FAO-sponsored study mentioned on page 1 of this paper was started in 1967. The FAO project is putting emphasis on research rather than development and is developing a pilot plantation at Lenggeng near Sembilan in Negri Sembilan.

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(iii) Prospects.

If it is assumed that the consumption of pulp and paper in W.Malaysia of the short-fibred type in 1967/68 was about 30,000 - 40,000 tons and that the Kretas plant goes ahead as planned with its capacity of 30,000 tons of output a year, there seems little scope for another substantial pulp and paper plant in W.Malaysia in the near future unless such a plant could produce pulp and paper for export to, say, Singapore whose total consumption of paper and paper products was about 51,000 and more than 90,000 tons in 1967 and 1968 respectively.

There does however seem a good prospect for the chipping of rubberwood and mangrove species for export in chip form to Japan.

Further, more detailed, investigations, into the potential for pulp and paper industries in W.Malaysia, and particularly Johor State, will be made.

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Part 3 - Some Implications

3.1 The implications of Parts 1 and 2 for timber flows in the southern States of W.Malaysia.

Parts 1.1 and 1.2 showed that with a strict application of the LCC to forestry policy in W.Malaysia, about 6.6 m.acres which are presently under forest would be alienated to agricultural use. This would leave something like 14 million acres under forest in W. Malaysia (about 44% of the total land area), and about 10 million acres of this would be productive forest. The area 'in dispute' between the 'pro-foresters' and the 'pro-agriculturalists' consists of about 4 million acres -- this is the area of forest which has Class III soils.

The application of the LCC to Johor State would mean that 1½ million acres of forest would be cleared for agricultural use, and about ½ million acres of this would be 'productive' forest. Of the 1½ million acres, about 800,000 acres is on the 'disputed' Class III land. If the land allocation in the LCC were implemented, almost the whole of the productive lowland forest in Central Johor would be cleared for agricultural use, leaving most of the remaining forest of this type in Johor in an area bordering on Pahang and Negri Sembilan.

The case for or against agriculture on Class III land was discussed in Parts 1.3 and 1.4. No firm conclusions could be reached because of lack of information. Land may be designated as Class III for reasons of

(i) drainage
or (ii) soil texture and fertility
or(iii) slope.

Investigations into the returns likely to be obtained from agricultural and livestock activities on various type of land are continuing. It is however likely that for land designated as Class III because of slope, the returns from rubber would be considerably higher than the returns from regenerated forest.

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If it is assumed - that the optimum rotation period for regenerated LHW forest is about 40 years; and that the commercial yield of timber at the end of the 40 year period is 30 tons per acre; and assuming the present logging and sawmilling costs but an average selling price of $235 per ton of output, the return from regenerated forest is about 10% p.a.(1) (Forest management costs of $5 per acre per annum are assumed.) This compares with a return from rubber of over 14% p.a.(2) (The main assumption was of a rubber yield of 1650 lbs. of rubber - d.r.c. - in the sixth year of tapping).

Before any firmer conclusions can however be reached, much more information is needed on - the rate of interest to use for discounting future costs and income, - the optimum rotation period for timber and the likely yield of timber at the end of the optimum period, - likely rubber yields on Class III land , - and the likely yields from other crops (or livestock activities) on Class III land.

The assumptions of a 30 ton-per-acre yield at the end of a rotation cycle of 40 years and a price of $235 per ton are, however, thought to be fairly optimistic and it is unlikely that improvements in timber utilisation would lead to incomes from timber bring much higher than this.

The prospects for using;

(a) the existing species more intensively

and (b) other presently non-commercial species,

were considered in Part 2 of this paper. In the long term the main problem is that of using the existing species more intensively, since natural regeneration will, to a large extent, weed out the non-commercial species.

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(1) Ignoring the returns from initial felling.

(2) This ignores the returns from the initial clearing of timber.

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The timber using industries in W.Malaysia are at present confined to logging, sawmilling, and plymilling.

In 1968, about 27% of the total log outturn was exported in log form and the conversion of this into sawn timber or plywood is one obvious way of intensifying utilisation.

A greater use of preservation techniques in the sawmilling industry might widen the species used, but the main scope for improvement in the sawmilling industry lies in better sawing techniques and especially in the better use of the slabs, edgings and sawdust.

Similarly in the plymilling industry, there is some scope for widening the species used by a more widespread use of steaming but again the main potential for further utilisation lies in the development of processes using the 'waste' material.

There is probably considerable scope for the manufacture of particle board in W.Malaysia even though the board would be meeting the same or similar needs as the plywood presently marketed. The most attractive feature of the particle board industry is its ability to absorb large quantities of inferior quality timber, especially when the board is manufactured by the three-layered process in which the inferior timber forms the core. Practically all species are acceptable as long as the density is low. The species normally used lie within the basic density limits of 25-43 lb/cu.ft. Thus only the LHW's could be used in W.Malaysia for producing particle board. This is of no great importance, however in the context of this paper, since the faster-growing species are in the LHW group, and the ability of the particle board industry to use LHW 'waste' is its most valuable characteristic.

Ten years ago experiments were conducted to assess the suitability of local raw materials for fibreboard (see ref.23), but little has been done since. But those experiments indicated that "insulating boards of typical strength and densities can be made from rubberwood and from Red Meranti" (ref. 23).

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Similarly light hardwoods (as well as secondary growth species, rubberwood and bagasse) can be used in the production of lower grades of wrapping and high grades of writing and printing papers. That is, some of the lighter woods may be suitable for producing short-fibred pulp and paper.

More information will be obtained on the potential in W.Malaysia for using the LHWs in reconstituted wood industries and on the advantages and disadvantages of the various ways in which this further utilisation might be encouraged.

With the existing data however the assumption of a 30 tons-per-acre yield at the end of a 40 year rotation period valued at an average of $235 per ton seems if anything to favour the regenerated forest alternative.

But what are the prospects for the timber industries in W.Malaysia, if the implications of the LCC are carried through - that is, if all Class III land presently under forest is transferred to agricultural use?

The question can best be answered by considering it over 2 periods - over the short term (that is over the next 20 years) - and over the longer term (that is from 1990 onwards).

In the short term there is likely to be an adequate supply of timber to enable the present industry (sawmilling and plymilling) to expand at something like an average rate of about 4 or 5% p.a. At present Johor and Pahang States are net exporters of logs on a considerable scale. The timber flows from and between states for 1966 are shown in Table 19. This table shows that in 1966 Johor and Pahang together exported more than 650,000 tons of logs to Singapore and (to a much smaller extent) Japan. In 1968, Johor exported more than 200,000 tons of logs to Singapore (ref.24), and this represented more than one-third of Johor's outturn of logs in that year.

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TABLE 19 TIMBER FLOWS IN W.MALAYSIA - 1966 (000 TONS)

	LOG OUTTURN	MOVEMENTS BETWEEN STATES		TOTAL LOG USE	LOG EXPORTS	SAWMILL & PLYMILL INPUT	LOG USE	BALANCE UNACCOUNTED FOR:-
		TO/FROM PAHANG	TO/FROM OTHER STATES					
JOHOR	573	52	11	636	297	312	609	27
PAHANG	1,164	(399)	-	765	369	298	667	98
NEGRI SEMBILAN	206	-	(24)	182	34	118	152	30
MALACCA	4	18	17	39	-	39	39	-
SELANGOR	87	322	5	414	-	390	390	24
KELANTAN	136	-	-	136	50	76	126	10
TRENGGANU	115	(13)	(12)	90	23	61	84	6
PERAK	253	20	(18)	255	4	236	240	15
PERLIS	1	-	2	3	-	3	3	-
PENANG	-		50	50	-	53	53	(3)
KEDAH	152	-	(31)	121	-	125	125	(4)
TOTALS	2,891	-	-	2,691	777	1,711	2,488	203

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Total exports of logs to Singapore from W.Malaysia in the same year were about 689,000 tons. Thus the plan to develop a belt of sawmmills along the southern border of Pahang State would not in the short term harm the sawmilling industry of Johor State though it might slow down its expansion. (The plan might of course considerably affect the supplies of timber to Selangor and, to an even greater extent, Singapore.)

The present average yield of timber in Johor State from each acre of forest reserve exploited is between 15 and 20 tons. With the implementation of the LCC, a forest area of about 1½ million acres would be cleared. If this were cleared at the rate of about 50-100,000 acres p.a. over the next 20 years, and an average yield of about 10 tons per acre were obtained (making some allowance for the non-productive forest included in the 1½ million acres), the log outturn from the State would be between 500,000 and 1 million tons p.a. This would be sufficient to maintain the present flow of logs to Johor's sawmills and to permit an average expansion in the output of the sawmilling and plymilling industries of between 2% and 3% from the present (1968) level. If logs were, in addition, imported from Pahang State the possible sustained expansion of the industries would be even higher. If the utilisation of timber were improved, the expansion rate could be even faster.

In the longer term (that is beyond 1990), there would almost certainly need to be some contraction in the timber-using industries in Johor unless there were substantial imports from Pahang State. (The Pahang Tenggara region of over 1.25 million acres would ... at that time probably still be in the process of development, and unless there were a belt of sawmills along the border between Pahang and Johor, log exports to or through Johor would be forthcoming). By 1990, following the clearance for agriculture of 1½ million acres of forest, Johor would be left with ½ million acres of 'productive' forest and about ½ million acres of 'protective' forest. The sustainable yield that could be obtained from this is difficult to guess. The forested areas of Johor State, including both state land and forest reserves, can be divided into 2 categories;

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(a) forests below the 'steep land boundary' (300' - 500' contour)
and, (b) forests above the steep land boundary.

The northern part of the State, adjacent to the Pahang and Negri Sembilan borders, is covered with forest reaching as far south as the Segamat - Kluang - Mersing road. The greater part of this area, especially the most northern part, has a steep topography. Other forest above the steep land boundary can be found in the hilly parts of the Districts of Kota Tinggi and the small hill ranges in the Mersing District. Forests below the steep land boundary are found on the fringes of these areas.

It is difficult to say how much of the forest above the steep land boundary would be exploitable. Information on the regeneration of Hill forests is less complete than data on the regeneration of lowland forests. The Malayan Uniform System is only accepted as a successful regeneration system for lowland light hardwood forests particularly for those rich in Red Merantis. "The system (M.U.S.) has not proved satisfactory in the hills largely because of lack of seedlings in the virgin stand (due to long periods between seed years and inhospitable conditions for the establishment of seedlings), very concentrated fellings on ridges where the stand is dense, and almost no opening where the stand is poorer on lower hill slopes, lack of control over exploitation damage, and the comparatively slow rate of growth in the early stages of the more valuable species." (ref.25)

A further problem in hill forests may arise from erosion associated with the development of access roads. "In very steep sideling ground the cutting of a road results in spoil covering the slopes below for many chains, and the complete destruction of seedling regeneration where it does so." (ref.25). Furthermore "it can be assumed that on slopes above 45^{0}, seedlings cannot generally establish themselves", and "our studies show that in the altitude range of 500 to 1,500 feet about 15% of the land area is steeper than 45^{0}, and though studies in the upper Dipterocarp forest are yet to be completed there is clearly a general increase in steepness with altitude and we can expect the percentage

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of land over 45° to increase to about 20% above the 2,000 ft. contour." (ref.25). Finally silvicultural management costs are likely to be considerably higher in the Hill areas than in the lowland forests.

Further research is going on and it is not yet possible to guess at the sustainable yield that the forest remaining after the allocation of Class III land to agriculture could provide. If the remaining ½ million acres of 'productive' forest could be successfully regenerated and exploited over a 40 year rotation period to give a yield of 30 tons per acre the annual outturn of logs from Johor State would be something like 375,000 tons p.a. In addition to this however there would probably be substantial exports of logs from Pahang to Johor resulting from land clearance in Pahang State after 1990. What does seem important is that when the Working Plans come up for review in 1975 (for most States, but in 1970 for Johor) they should be redrawn on an integrated basis - that is, the Working Plans of individual States should attempt to take the plans of other States into account. This and other recommendations are set out below in Part 3.2.

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3.2 Forestry policy in Johor State - some tentative conditions and recommendations.

The world demand for wood materials has increased very rapidly over recent decades and this trend is expected to continue for decades to come. It does, however, need to be emphasised that the main expansion in demand will continue to be for reconstituted woods. It has been estimated that by 1975 "more than half of all the industrial wood consumed in Europe will be in the form of wood pulp products and wood-based panel products" and that by the end of the century the greater part of wood products consumed will be in these forms. (ref.26). A similar trend in the demand for reconstituted products is also evident in the developing countries.

Forestry management in W.Malaysia is geared primarily to the production of sawlogs. In addition the principal wood-using industry in W.Malaysia in 1968 was still sawmilling. In 1968 log exports and log input into sawmills accounted for over 90% of log outturn from W.Malaysia. There was a relatively small output of plywood and virtually no output of particle board, fibreboard, and pulp and paper products. Yet this is where the future lies. And, more importantly, "except for plywood, the wood raw material requirements of the rest of the products are not as exacting as those of sawnwood. The reconstituted products do not demand high quality sound logs of large dimensions. The fundamental and essential requirement common to all the products is low density. For economic reasons, the supply of raw material must be adequate and assured to sustain a mill and should preferably be located within minimum transport distances. Ideally it should be in compact blocks and grown in a manner which will facilitate exploitation at minimum costs. On the basis of these requirements the general management objective should therefore be the production of the greatest amount of wood per unit area within the shortest possible time and at the lowest possible costs. Bearing in mind the low density specification, all fast growing light hardwoods, including those not currently in the 'List of Approved Species' (ref.6) will be acceptable as long as they are capable of reaching economic utilisable size". (ref.21)

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The above suggests a large number of developments in forestry policy which are worth considering. These are:

- (i) a critical re-appraisal of the 'list of Approved Species' is needed. In recent years the demand for HHW has declined (in 1966 they represented less than 8% of round wood removal and less than 1% of the sawn timber exported), and there seems little point in retaining them as approved species, since they are generally unsuitable for use in the reconstituted wood industries. Conversely there are probably some species which are not on the List, but which could profitably be used;

- (ii) the current trend towards favouring the development (in natural and enrichment forest regeneration) of the faster growing light hardwoods should be continued;

- (iii) a survey of the sizes of current concession areas should be carried out to see whether, as some sawmillers claim, this is a limiting factor to the further development of reconstituted wood industries. 'Small' concession areas may mean that the source of timber supply for the more capital-intensive reconstituted wood industries is uncertain; larger areas may also tend to reduce the risk involved in timber exploitation since a paper by Vincent (ref.27) in 1961 suggested that the proportion of timber volume represented by defects varied "widely within and between known strata".

- (iv) further research into the suitability of various regeneration practices to the hill forests needs to be carried out. The MUS is accepted as a successful regeneration system for lowland light hardwood forests but it is not likely to be successful for the Hill forests which are likely to represent an increasingly important source of supply for the timber industries of W.Malaysia;

- (v) various ways of encouraging the development of the reconstituted wood industries in W.Malaysia need to be investigated. These were set out in Part 2.2 of this paper, but can be briefly summarised as :

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(a) the raising of royalties on logs. (The profits earned in the logging, sawmilling and plywood milling industries are generally high - 20-25% p.a. in logging, about 30% p.a. from sawmilling, and around 23% p.a. in plywood milling - and it is possible that the high returns in these (relatively low-risk) industries discourage the development of more profitable methods of extracting and utilising those parts of the tree which are not used in the form of sawn timber or plywood).

(b) the raising of land premia for timber extraction (at present these represent much less than half of the income from royalties in Johor State. By raising the premia, the fixed cost of exploitation would rise and there would probably be more pressure on the timber companies to more intensively exploit the forest -that is to look for better ways of utilising the parts of the tree which are presently thrown away or used for fuel)

(c) the raising of the export duty on logs (see section 2.2 for a discussion of this)

(d) the granting of larger concessions (see above)

(e) the setting up of a Timber Utilisation Promotion Board (see section 2.2)

(f) the setting up of a Government Timber Corporation (see section 2.2)

The advantages and disadvantages of each of these proposals are being considered in more detail, but it seems likely that on grounds of income redistribution (from timber companies to the State Government) alone, there is a strong case for raising timber royalties and/or premia. In 1967, Johor State revenue from its forests was $6.1 million or about 13% of total State revenue (including Federal Grants and Allocations). If, therefore, the timber royalty on LHW were raised from its present $10 per ton to, say, $20 per ton (reducing the average profit on combined logging and sawmilling operations to around 15% p.a. on the capital invested, * the total State revenue would be increased by about $5 million p.a. (based on the 1967 figures) or by about 10%.

* See Table 20

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TABLE 20 PROFITS OF LOGGING/SAWMILLING COMBINED - JOHOR STATE - EFFECT OF DOUBLING THE ROYALTY

	$ per ton of timber
CAPITAL INVESTMENT - Logging[1]	85
- Sawmilling[2]	80
- Total	165
SELLING PRICE OF TIMBER	130 - 135
Operating Costs :	
- Logging (exc. royalties and premia)	29[3]
- Sawmilling	33 - 35
- Royalties/premia (at present level)	20[3]
- Royalties (additional 100%)	20[3]
Range of annual surplus ($ per ton)	26 - 33
Annual rate of return :-	
- with a 10 year asset life	10% - 15%
- with a 15 year asset life	13% - 18%

(1) $\frac{\$15.9 \text{ m.}}{16{,}900 \text{ acres} \times 17 \text{ tons per acre}}$ = $55 per ton of logs or $85 per ton of sawn timber (see Table 16).

(2) See Table 17.

(3) On the basis of a conversion rate of logs into sawn timber of 65%

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- (vi) finally the licensing of sawmills and plywood mills should either be abolished (the cost of collecting the $5 annual fee per sawmill and plywood probably far exceeds the revenue), or, if continued, the fee structure and level should be changed so as to encourage the further processing of 'waste' material. The licensing of sawmills and plywood mills should, if continued in Johor, be more closely integrated with the long-term Working Plans of Johor and neighbouring States and with the planned development of the saw-and plywood - milling industries in neighbouring States (and in particular Pahang).

CBE/ZA/BN/3/1/70.

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APPENDIX I

ESTIMATED RECEIPTS AND EXPENDITURES IN THE OPERATION OF THE BUKIT SEDANAN FOREST RESERVE

(7,951 acres of which 7,469 are productive forest; 000's at M$)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Operating Costs																										
Forestry Department managerial charges @ $5/acre	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Logging costs @ $24/ton[2]	216	216	216	107	72	144	144	144	123	72	72	72	72	72	36	-	-	-	-	-	192	192	192	192	192	384
Sawmill costs @ $28.60/ton of logs	257	257	257	127	86	172	172	172	146	86	86	86	86	86	42	-	-	-	-	-	229	229	229	229	229	458
Total cost	513	513	513	274	198	350	356	356	309	198	198	198	198	198	118	40	40	40	40	40	461	461	461	461	461	882
Production & Revenue																										
Log production (tons)	9,000	9000	9,000	4,440	3000	6000	6000	6000	5105	3000	3000	3000	3000	3000	1,485	-	-	-	-	-	8000	8000	8000	8000	8000	16,000
Sawn timber production (tons) @ 65% recovery	5850	5850	5850	2886	1950	3900	3900	3900	3318	1950	1950	1950	1950	1950	965	-	-	-	-	-	5200	5200	5200	5200	5200	10400
Sawn timber price/ton (f.o.b. export unit value)	195	195	195	200	200	205	205	210	210	210	215	215	215	220	220	225	225	225	225	235	235	235	235	235	235	235
Gross value, sawn timber	1141	1141	1141	577	380	800	800	819	697	410	419	419	419	429	212	-	-	-	-	-	1222	1222	1222	1222	1222	2444
Discount factor @ 10%	.909	.826	.751	.683	.621	.564	.513	.467	.424	.386	3350	.319	.290	263	.239	218	198	.180	.164	.149	.135	.123	112	.102	.092	.084
Present value of benefits	3123																									
Present value of costs	3510																									
Discounted net benefits	4613																									

[1] Based upon recent expenditures of the Malacca Forestry Department. Includes wages and salaries pl
with the regeneration program.

[2] Includes felling, skidding, loading, hauling, unloading and footing, road construction and mainten

ESTIMATED RECEIPTS AND EXPENDITURES IN THE DEVELOPMENT AND OPERATION OF THE BUKIT SEDANAN FOREST RESERVE AS AN FLDA RUBBE
(7,351 acres Less 700 acres steep Land which will remain as forest, Less 751 acres waste and roads Less 350 acres village area equals 6,150 acres main crop) (000's M$)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Development and Operating Costs																								
Survey fees[1]	104																							
Felling, Land preparation and cover crop[2]	2073																							
Planting, weeding, manuring[3]		1273																						
Maintenance[4]			676	803	738	641	510	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228
Managerial charges[5]	215	215	215	215	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461
Tapping and collection[6]								787	985	1031	1031	1076	945	945	945	945	945	1117	1117	1117	1097	1097	1058	1038
Village roads @ $835/acre		292																						
Site development @ $170/acre		60																						
FLDA buildings, plant & equipment@ $62/acre		381																						
Logging costs	3436																							
Sawmilling costs	4095																							
Total costs	9920	2221	891	1045	1199	1002	1002	1476	1674	1720	1727	1765	1634	1634	1634	1634	1634	1806	1806	1806	1786	1768	1747	1727
Production and Revenue																								
Production (lbs.d.r.c./acre)																								
Latex			800	1000	1200	1300	1350	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1375	1350	1325	1300	1275	
Scrap			141	176	212	230	238	247	247	247	247	247	247	247	247	247	247	247	243	240	234	230	225	
Total production (tons d.r.c.)																								
Latex			2197	2745	3295	3569	3706	3844	3844	2844	3844	3844	3844	3844	3844	3844	3844	3844	3775	3706	3638	3569	3501	
Scrap			387	483	582	631	653	678	678	678	678	678	678	678	678	678	678	678	667	659	643	631	618	
Total			2584	3229	3877	4200	4360	4521	4521	4521	4521	4521	4521	4521	4521	4521	4521	4521	4443	4365	4280	4200	4119	
Assumed price(f.o.b.)																								
Latex(RSS 1, SMR5-L)			50	50	50	50	50	49	49	49	49	49	48	48	48	48	48	47	47	47				
Scrap			42	42	42	42	42	41	41	41	41	41	40	40	40	40	40	39	39	39				
Weighted price/lb.of total production[7]			48.6	48.6	48.6	48.6	48.6	47.6	47.6	47.6	47.6	47.6	46.6	46.6	46.6	46.6	46.6	45.6	45.6	45.6	45			
Price/ton to produce[8]	7531		921	921	921	921	921	878	878	898	898	898	876	876	876	876	876	853	853	853	85			
Gross value,sawn timber[9]	18154																							
Gross value,rubber in 1977-2000			2379	2974	3511	3868	4016	4060	4060	4060	4060	4060	3960	3960	3960	3960	3892	3723	3651	3583	35			
Discount factor @ 10%	909	.826	.751	.683	.621	.564	.513	.467	.464	.386	.350	.319	290	.263	.239	.218	198	180	.164	.149	.135	123	112	.102
Present value of benefits	33053																							
Present value of costs	21754																							
Discounted net benefits	11300																							

[1]At $165 for each of the 615 holdings. This includes $20 for boundary stones on the houselot and main crop area plus $145 for survey fees.

[2]At $337 per acre. Includes felling,burning,pruning, stacking, reburning, lining, holing, terracing, jeep track construction, establishmen

[3]At $207 per acre. Includes planting materials, planting seeds at stake, green-budding, pruning, bridge/culvert construction.

[4]At $110, $135, $120, $88 and $83 in years 3-7 (1972-76), respectively, $37 through 1995 and $18 thereafter. The labor component of FLDA c shaded by 15 percent.

[5]At $35 per acre in years 1-4, when some of these services are provided by contractors, rising to $75 during the mature period.

[6]Based upon estate costs p/ton of rubber collected which range from about $250p/ton to $360,depending upon yield. Estate costs have been sh

[7]Latex is assumed to make up 82.4% of total production, scrap 17.6%.

[8]Weighted f.o.b. price Less 1 ¢ research cess and 6.5 cts.for transport to factory, processing and distribution costs.

[9]Commercial timber in this area is estimated to total 143,175 tons of logs in 1970 or 93,100 tons of sawn timber at a 65% recovery rate.

SOURCE - TABLE 5 - BUKIT SEDANAN STUDY.

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