

COMMISSION DES COMMUNAUTES EUROPEENNES  
Direction Générale XI Environnement, Sécurité Nucléaire et Protection Civile  
BRUXELLES (Belgique)

**ETUDE DES MODALITES D'EXPLOITATION  
DU BOIS EN LIAISON  
AVEC UNE GESTION DURABLE DES FORETS TROPICALES HUMIDES**

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**SECOND RAPPORT INTERMEDIAIRE**

**Volume 4**

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**Etude de Cas : INDONESIE**

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CIRAD-Forêt (ex CTFT)  
Département Forestier du CIRAD  
Centre de Coopération Internationale en Recherche  
Agronomique pour le Développement  
45 bis, avenue de la Belle Gabrielle  
94736 NOGENT-SUR-MARNE Cedex (France)

Novembre 1992

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Document préparé par : **BURGESS P.F.**  
**COSSALTER C.**  
**LAURENT D.**

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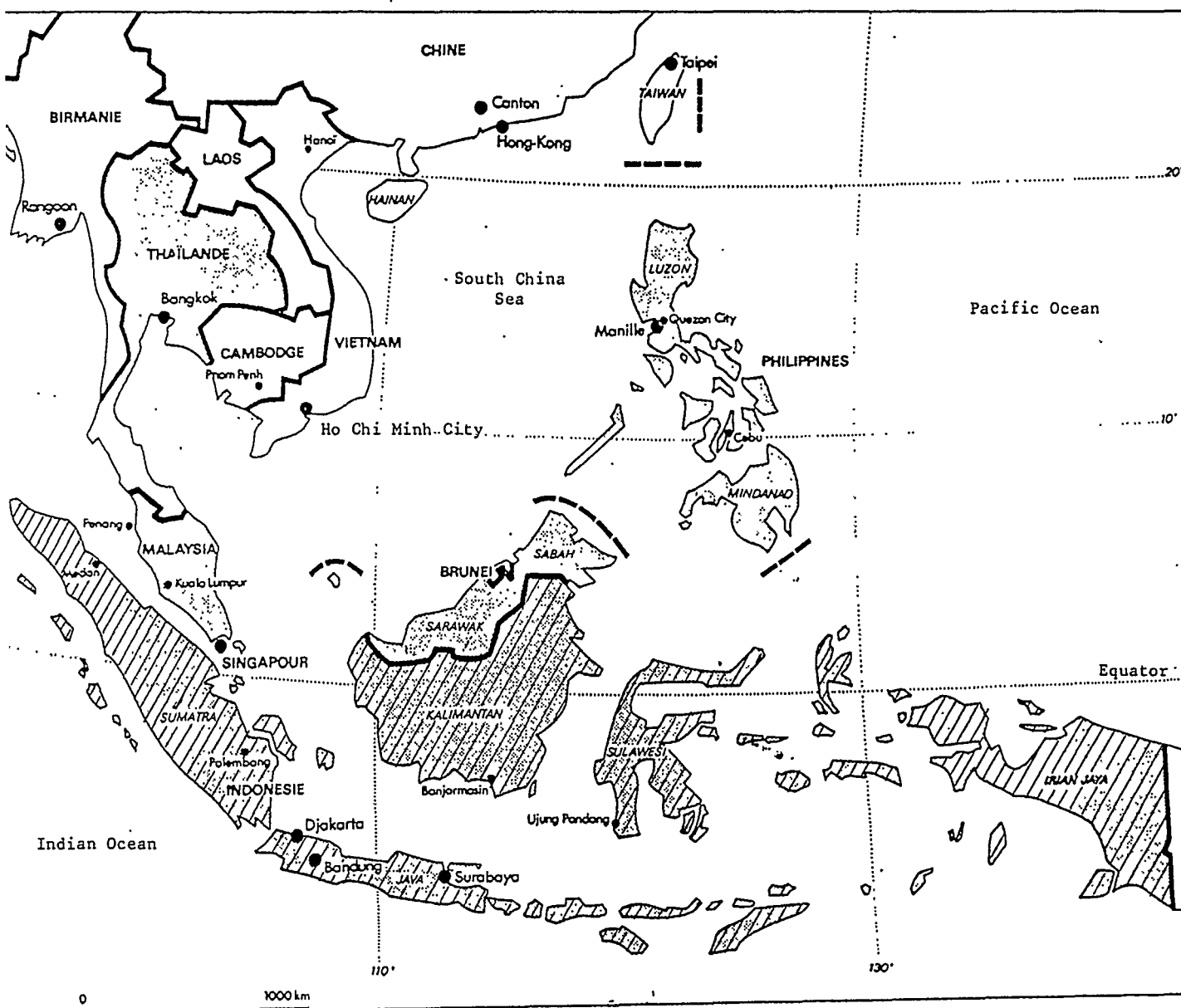
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# SOUTHEAST ASIA



Indonesia



Southeast Asian Nation



City of more than 1 million inhabitants

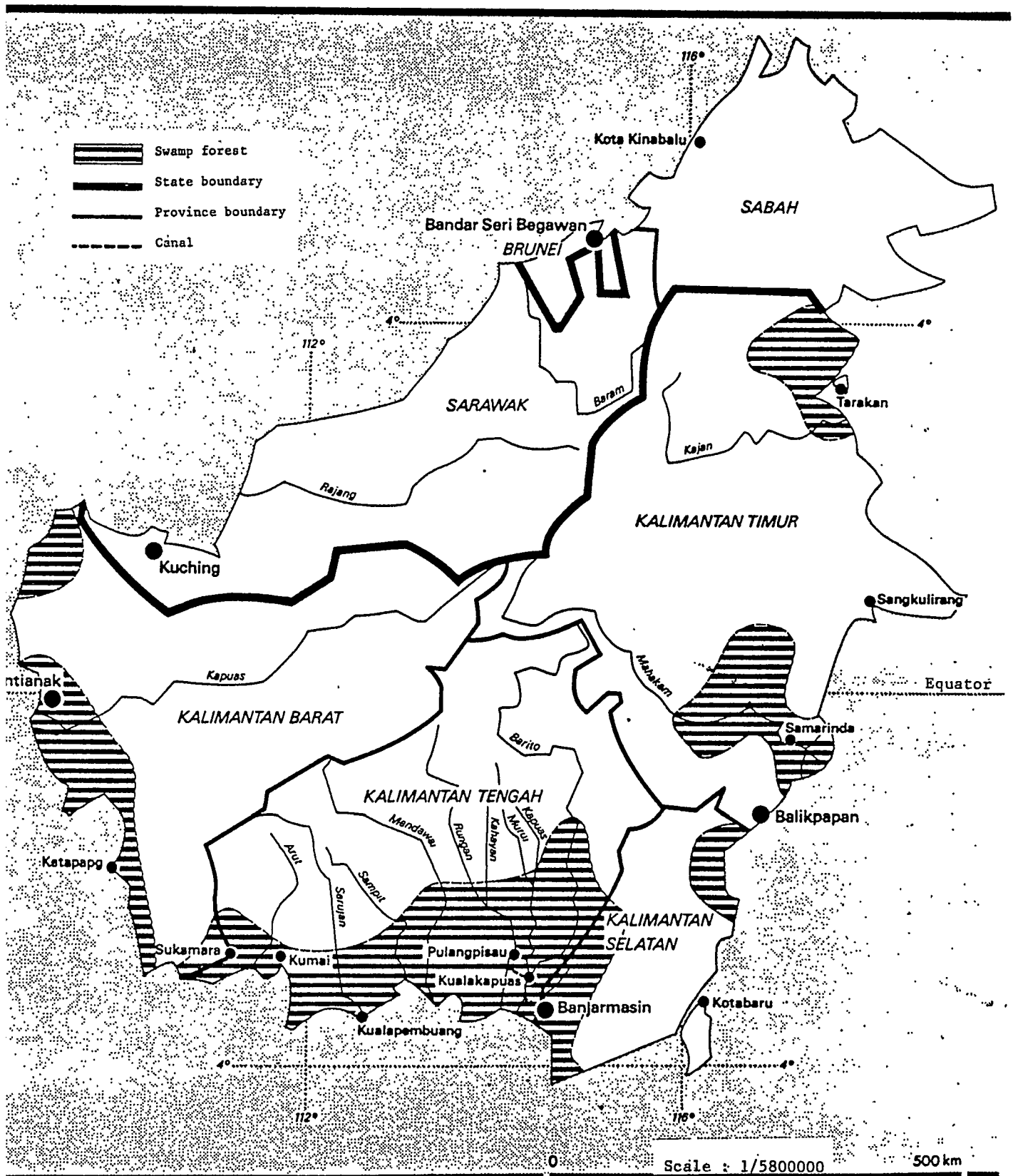


City of more than 250 000 inhabitants

(Source : 57, Page 31)



# CLOSE SHOT ON KALIMANTAN



## **1 - ECONOMIC IMPORTANCE OF THE WOOD SECTOR AND THE TIMBER INDUSTRY IN THE NATIONAL ECONOMY**

### **11 - General figures regarding the wood sector in Indonesia**

We give in this section the basic general information available regarding the wood sector in Indonesia, from after the most up to date FAO Data bases (unless otherwise quoted) so as to provide a general overview of the sector.

#### **111 - Overview of the wood sector for the 1980 - 1990 period**

We remind here after the evolution of the production and foreign exchanges of the two main categories of forest products for Indonesia, namely "fuelwood and charcoal", "industrial wood" and the contribution of "saw-logs and veneer logs" to this latter. We also indicate in the same table the production, foreign exchanges and domestic consumption of the main categories of primary processed forest products, namely "sawn-wood and sleepers", "wood based panels" and the contribution of "plywood" to this latter.

Up to now, no significant imports of such products have been recorded at the level of accuracy indicated in the table. (only a few thousands cu.m. of plywood were imported annually at the beginning of the 80's decade).

**Table 1 : overview of the production and foreign exchanges of forest products in Indonesia from 1980 to 1990**  
**(in millions m3)**

Product/year		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Fuelwood and charcoal	Production	115.5	117.9	120.4	122.9	125.5	128.0	130.6	133.2	135.8	138.4	141.0
	exports	3.6	3.9	2.5	1.9	1.6	2.6	2.8	3.1	3.1	4.0	17.0
	consumption	111.9	114	117.9	121	123.9	125.4	127.8	130.1	132.7	134.4	124.0
Industrial wood	Production	30.9	26.5	25.5	28.7	30.1	26.6	30.6	28.7	29.8	31.5	30.5
	exports	16.3	7.0	3.5	3.5	2.1	0.5	0.5	0.8	0.9	0.8	1.0
Sawlogs and veneer logs	production	28.1	23.7	22.8	25.8	27.3	23.8	27.8	25.8	26.9	28.5	27.5
	exports	15.2	6.5	3.2	3.1	1.8	0.5	-	-	-	-	0.2
	consumption	12.9	17.2	19.6	22.7	25.5	23.3	27.8	25.8	26.9	28.5	27.3
sawn-wood and sleepers	Production	4.8	5.3	6.8	6.3	6.6	7.1	7.5	9.9	10.3	10.5	9.1
	exports	1.2	1.2	1.2	1.8	2.2	2.2	2.7	2.3	3.1	2.8	0.6
	consumption	3.6	4.1	5.6	4.5	4.4	4.9	4.8	7.6	7.2	7.7	8.5
Wood based panels	Production	1.0	1.6	2.5	3.3	3.9	4.9	6.1	6.7	8.1	9.1	9.6
	exports	0.2	0.8	1.2	2.2	3.3	4.1	4.8	5.8	6.5	8.2	8.6
	consumption	0.8	0.8	1.3	1.1	0.6	0.7	1.3	0.9	1.6	0.9	1.0
Plywood	Production	1.0	1.6	2.5	3.1	3.6	4.6	5.8	6.4	7.7	8.8	9.3
	exports	0.2	0.8	1.2	2.1	3.0	4.0	4.6	5.6	6.4	8.0	8.4
	consumption	0.8	0.8	1.3	1.1	0.6	0.6	1.2	0.8	1.3	0.8	0.9

(source : 54)

### 112 - Production of forest products in Indonesia

The table below summarizes the evolution of the production of forest products in Indonesia since 1970 and several projected productions expected for year 2000.

It shows a sharp increase in industrial roundwood production, rising from 12.7 millions m3 in 1970 to 30.5 millions m3 in 1990.

It also shows a tremendous increase in the processing industry, with a wood based panels production being multiplied by 1227 and a sawn-timber production rising by 438 % over the last two decades.

It finally shows that another increase is expected in woodpulp and sawn-timber productions, while the plywood industry is expected to slightly slow down its output by the end of the century.

Table 2 : Production of forest products in Indonesia

PRODUCT GROUP	1970	1980	1990	2000 (Projection)
(1000 CUM)				
CHARCOAL	84.00	105.00	128.00	
FUELWOOD + CHARCOAL	92037.00	115508.03	141007.00	
INDUSTRIAL ROUNDWOOD	12666.00	30921.50	30525.50	
ROUNDWOOD	104703.00	146430.00	171532.00	
SAWN-WOOD + SLEEPERS	1701.00	4814.50	9145.00	10499.20
WOOD-BASED PANELS	7.84	1011.53	9616.53	8176.16
FIBERBOARD	0.84	0.53	0.53	
(1000 MT)				
WOODPULP	0.50	46.00	108.00	231.99
WASTE PAPER	2.00	110.00	187.00	
NEWSPRINT	3.00	0.00	157.00	44.15
PRINTING/WRITING PAPER	6.00	121.00	504.00	415.68
OTHER PAPER + PAPERBOARD	10.00	110.00	777.00	448.17
PAPER AND PAPERBOARD	19.00	231.00	1438.00	907.99

### 113 - The importance of forest products in the foreign trade :

#### 113.1 - Imports of forest products in Indonesia

The table below indicates the evolution of the Indonesian imports of forest products over the last two decades.

It shows a large deficit in paper and wood pulp products due to a very sharp increase in the consumption of those products on the domestic market.

As regard to the other wood products (sawn-timber, plywood...), Indonesia is one of the major world exporting countries.

#### 113.2 - Exports of forest products

Indonesia is, with Malaysia, among the few top leading exporting countries for primary tropical forest products in the world.

We summarize in the following table the evolution of the exports of forest products from Indonesia over the past two decades.

It shows that the voluntary policies to nearly stop log and to decrease sharply sawn-timber exports from Indonesia have been successful.

It also shows that the plywood exports still expanded by 47 % over a three year period between 1987 and 1990 at a very high level (8.6 millions m<sup>3</sup> of plywood being exported that year).

Table 3 : Exports and imports of forest products : Indonesia

PRODUCT GROUP	1970	1980	1987	1990
(1000 CUM)	EXPORTS			
CHARCOAL	24.50	42.90	37.00	73.00
FUELWOOD + CHARCOAL	147.00	257.50	222.00	438.00
INDUSTRIAL ROUNDWOOD	7850.00	16314.00	811.70	973.30
ROUNDWOOD	7997.00	16571.00	1033.70	1411.30
SAWN-WOOD + SLEEPERS	44.10	1213.80	2336.60	636.40
WOOD-BASED PANELS	0.00	245.00	5840.40	8591.20
(1000 MT)				
WOODPULP	0.00	0.00	0.00	130.00
NEWSPRINT	0.00	0.00	17.30	0.60
PRINTING/WRITING PAPER	0.00	7.00	72.90	81.00
OTHER PAPER + PAPERBOARD	0.00	0.00	79.20	84.60
PAPER AND PAPERBOARD	0.00	7.00	169.40	166.20
(1000 CUM)	IMPORTS			
SAWN-WOOD + SLEEPERS	0.20	0.10	0.00	0.00
WOOD-BASED PANELS	2.10	2.20	0.00	0.00
(1000 MT)				
WOODPULP	0.00	117.80	256.00	296.10
WASTE PAPER	9.00	11.70	226.00	463.30
NEWSPRINT	40.60	66.00	1.40	13.80
PRINTING/WRITING PAPER	44.00	34.70	13.70	19.10
OTHER PAPER + PAPERBOARD	32.00	111.70	104.50	80.50
PAPER AND PAPERBOARD	116.60	212.40	119.60	113.40

#### 114 - Consumption of Forest products in Indonesia

We give in the table below the national figures for the consumption of forest products in Indonesia, its evolution over the last two decades and a projection of what these consumptions are likely to be in year 2000.

Roundwood production is likely to rise another 17 % during the next decade and reach about 200 millions m<sup>3</sup>/year by the end of the century while industrial roundwood is expected to reach around 43 millions m<sup>3</sup> annually, i.e. an increase of over 44 % during the decade 1990 - 2000.

Paper, Paperboard and Sawn-Wood levels of consumption are expected to stay roughly at a standstill, while wood based panel consumption is projected to double and reach 2.1 millions m<sup>3</sup> per year.

Table 4 : Consumption of Forest products in Indonesia

PRODUCT GROUP	1970	1980	1990	2000 (Projection)
(1000 CUM)				
CHARCOAL	84.00	105.00	128.00	
FUELWOOD + CHARCOAL	92037.01	115508.00	141007.00	155672.00
INDUSTRIAL ROUNDWOOD	4816.00	14607.80	29552.19	42614.97
ROUNDWOOD	96706.01	129858.00	170121.00	198287.00
SAWN-WOOD + SLEEPERS	1657.10	3600.80	8508.60	7698.11
WOOD-BASED PANELS	9.94	768.73	1025.53	2099.95
FIBERBOARD	0.84	0.53	0.53	
(1000 MT)				
WOODPULP	0.50	163.80	274.10	549.48
WASTE PAPER	2.00	110.00	187.00	354.72
NEWSPRINT	43.60	66.00	170.20	208.00
PRINTING/WRITING PAPER	50.00	148.70	442.10	450.99
OTHER PAPER + PAPERBOARD	42.00	221.70	772.90	620.56
PAPER AND PAPERBOARD	135.60	436.40	1385.20	1279.55

# 115 - Production capacity of pulp and paper products in Indonesia

We summarize in the following table the production capacity of pulp and paper products in Indonesia and its evolution over the last two decades.

Table 5 : Production Capacity of pulp and paper products of Indonesia

PRODUCT GROUP	1970	1980	1989	1990
(1000 MT)				
TOTAL WOODPULP, PAPER GRADES	2	8	417	612
MECHANICAL	2	0	10	10
TERMOMECHANICAL	0	0	0	0
SEMI-CHEMICAL	0	0	48	108
CHEMICAL	0	8	359	494
OTHER FIBRE PULP	17	65	477	477
DISSOLVING PULP	0	0	0	0
TOTAL PAPER AND PAPERBOARD	22	182	1384	1494
NEWSPRINT	5	0	180	180
PRINTING AND WRITING		141	490	590
OTHER PAPER AND PAPERBOARD	17	41	714	724



116 - Current prices of forest products in Indonesia (1990)

We indicate in the following table a summary of the main levels of prices for the major forest products marketed in and from Indonesia in 1990.

Table 6 : Prices of Forest products in 1990 : Indonesia

PRODUCT GROUP (UNIT)	NATIONAL PRICE		REGIONAL PRICE	
	IMPORT PRICE	EXPORT PRICE	IMPORT PRICE	EXPORT PRICE
(DOLLAR/CUM)				
FUELWOOD			58.59	90.00
CHARCOAL		233.38	91.70	185.46
SAWLOGS + VENEER LOG		28.55	111.03	
PULPWOOD + PARTICLES		23.31	61.15	
SAWN-WOOD		225.74	207.60	
PLYWOOD		323.13	301.55	
PARTICLE BOARD		132.10	195.10	
FIBERBOARD			427.08	
(DOLLAR/MT)				
MECHANICAL PULP	411.62	465.52	508.99	146.08
CHEMICAL PULP	585.93	550.44	574.23	565.75
WASTE PAPER	195.98		150.82	
NEWSPRINT	756.67	776.67	530.36	
PRINTING/WRITING PAPER	930.73	852.40	1008.60	
OTHER PAPER +PAPERBOARD	1560.30	541.06	940.04	

## 12 - The timber industry in the National economy

### 121 - Wood production classified by utilisation class, species group, and processing destination

We provide in the paragraph "overview of the wood sector for the period 1980-1990" a table showing the production and exports of fuelwood and charcoal, industrial wood, saw-logs and veneer logs, sawn-wood and sleepers, wood based panels, and finally plywood.

It shows that most of the harvest in the forested areas is destined for fuelwood and charcoal making : about 140 millions m3 are harvested annually in that purpose. A growing share of this harvest is being exported.

Industrial wood harvest has been relatively stable during this decade, at a high level (around 30 millions m3 per year), but which represent only 20-21 % of the woodfuels collection.

#### 121.1 - Log exports

Indonesia replaced the Philippines as Japan's largest log supplier in 1971, and these exports peaked at nearly 19.5 million m3 in 1978. Log export restrictions, aimed at developing processing industries within Indonesia, were imposed gradually from 1978 ; log exports to Japan were halved between 1980 and 1981, and again in 1982, followed by a total ban in 1985, so that by 1986 Indonesia had ceased to export hardwood logs.

#### The rate of decline of the hardwood log exports.

The rate of decline of the log export market was very sharp indeed as the following figures show :

Table 7 : Rate of decline of the log exports

1977	18.9 million m3
1978	19.5 "
1979	18.2 "
1980	15.2 "
1981	6.5 "
1982	3.2 "
1983	3.1 "
1984	1.8 "
1985	0.5 "
1986	nil "
1987	" "
1988	" "
1989	" "
1990	0.2 "

(source, 40, 50, 54)

### 121.2 - Sawn-timber production and exports.

We provide in the paragraph "overview of the wood sector for the period 1980 - 1990" a table showing production and exports of sawn-wood and sleepers.

It indicates that after a regular increase from 1980 to 1987 (respectively from 5 to 10 millions m<sup>3</sup> of product) the production has been stabilized at this level and even tends to slightly slow down.

Sawn-wood exports steadily increased from 1.2 million m<sup>3</sup> in 1980 up to 3.1 millions in 1988 but have recently been reduced to about 0.6 million m<sup>3</sup> (in 1990) due to heavy export duties on low-graded sawn-timbers.

From another source, production, export and domestic consumption of sawn-timber (only), in millions m<sup>3</sup> has been as follows :

Table 8 : Production, exports and domestic consumption of sawn-timber (in millions m<sup>3</sup>)

Year	Production	Export	Domestic Consumption
1984	6.3	2.3	4.0
1985	8.1	2.1	6.0
1986	8.6	2.4	6.2
1987	9.3	2.8	6.5
1988	9.8	3.5	6.3
1989	10.6	3.5	7.1

(Source, 2)

With effect from November 1989 a new tax was imposed on the export of sawn-timber, with the aim of encouraging value-added processing of sawn-wood.

The effect of the new tax will be to reduce substantially exports of rough and partly processed sawn-wood ; however it will also result in unpopular species, such as Bangkirai (*Shorea laevis*, a heavy hardwood) being left unfelled in logging operations.

In 1985, when log exports had virtually ceased, the distribution of sawn-timber exports by species was as follows :

Table 9 : Distribution of sawn-timber exports by main species groups (1985)

Specie group	Volume (million m3)	%
Meranti	0.800	36.9
Ramin	0.470	21.7
Agathis	0.015	0.7
Teak	0.037	1.7
Pulai	0.022	1.0
Keruing and Kapur	0.149	6.9
Other	0.673	31.1
Total	2.166	100.0

(Source 8)

### 121.3 - Wood Based panels :

We provide in paragraph "overview of the wood sector for the period 1980-1990" the available statistics on wood panel production, exports and domestic consumption in millions of m3. Most of these are of course plywood panels.

It shows a tremendous increase in production and exports over this decade, having been respectively multiplied by 9.6 and 43, while the domestic consumption has been irregular with important changes from one year to another and seemed recently stabilized at around 1 million m3 annually.

From another source, wood based panel production, exports and domestic consumption was as shown below.

Table 10 : Wood based panel production, exports and domestic consumption  
(in millions of m3)

Year	Production	Export	Domestic Consumption
1978	0.424	0.083	0.341
1979	0.624	0.126	0.498
1980	n/a	n/a	n/a
1981	1.532	0.774	0.778
1982	2.140	1.250	0.890
1983	2.943	2.000	0.943
1984	3.820	3.010	0.810
1985	4.983	3.783	1.200
1986	5.000	4.000	1.000
1987	7.210	5.951	1.259
1988	8.200	6.900	1.300

(Source, 2)

#### 121.4 Production of fuelwood and charcoal

This again is summarized in the table in paragraph "overview of the wood sector". The annual production per capita is estimated by FAO at about 0.761 m3 of fuelwood and 0.0007 metric ton of charcoal.

About 140 millions m3 are needed annually in this purpose.

Only incomplete data are officially available, and these are in units which cannot be directly related to the roundwood volume required to produce them ; nevertheless they indicate the scale of production and the trend.

Table 11 : Firewood and charcoal

	1981	1982	1983(*)	1984(*)	1985
Charcoal, tons	3.657	6.070	17.572	17.752	43.038
Firewood, sm (+)	346.711	411.127	666.882	666.882	254.933

(Source, 8)

(\*) These data are the means for the two fiscal years.

(+) The unit sm is not understood, but it may be a stacked cubic meter.

Undue reliance should not be placed on the data in this table.

Much, probably most, firewood and charcoal production in Indonesia is by village people and goes unrecorded. The above data probably represent the production from mangrove forest to supply large towns for domestic and small trader use.

#### 121.5 - Pulp and paper production

The Indonesian pulp and paper industry dates back to the 1920's when the first mill was built by a Dutch company. From 1930-1975 the industry developed abreast of the general industrial development of the country, but from the mid-1970's there was a dynamic expansion as the following table shows :

Table 12 : The pulp and paper industry profile

Year	Number of Mills	Production (tonnes)	
		Paper	Pulp
1960	2	7,100	5,000
1965	3	9,600	14,000
1970	5	18,400	14,000
1975	9	51,000	32,000
1980	29	228,800	80,000
1987	36	826,000	n/a
1988	n/a	935,900	(191,600)
1989	38	(1,172,000)	n/a

() estimate

In 1987 Indonesia achieved self-sufficiency in paper and became a net exporter.

Out of the 38 pulp and paper mills only one is a pure market pulp mill - PT Indorayon Utama in North Sumatra. Fifteen are entirely or to some extent integrated with their own pulp production.

Most mills (32) are in Java, 5 in Sumatra and 1 in Sulawesi ; three paper mills ceased production during the last few years, including the only one in Kalimantan.

There are plans for a further 35 mills, but in the present depressed state of the world pulp market it is likely that construction will be deferred for some years and it is most unlikely that all will be built in the foreseeable future.

Sumatra accounts for 56 % of the total pulp production of the country.

Mills are, by World standards, small, but by South-East Asian standards well above the average.

Imported paper is heavily taxed, but pulp and waste paper are imported duty-free ; about 50 % of the fibre is imported, notably *Pinus radiata* pulp from New Zealand.

Many of the mills use second-hand equipment, bought very cheaply as overseas pulp mills cut out their log supplies ; nearly half the mills have very poor production performance, but over 40 % have very good capacity utilisation. The sulphate (Kraft) process is dominant, but NSSC (semi-chemical) processes are also applied for pulping bagasse. In some mills the recovery of black liquor is very low ; in some there is no chemical recovery at all. Very recently stringent standards on effluent have been formulated by the Ministry of the Environment.

Only some 40 % of the paper-making fibre composition is from wood pulp and nearly half of this is imported ; the domestically produced wood pulp, 196.300 tons per annum, corresponds to a wood consumption of about one million m<sup>3</sup> per annum.

New pulp mills in Sumatra are expected to achieve a net balance of exports over imports in 1990-92. Bagasse from sugar mills in Java, together with straw (rice ?) produce pulp which is integrated with paper production by the Java mills ; there is scope for a few new mills using bagasse in Central and East Java and in South Sumatra.

Bleached hardwood pulp made from mixed tropical hardwoods is the main domestic pulp grade and pulp mills operate on this material as the rain forest is cleared for planting, e.g. with *Eucalypts* and *Acacia mangium* to provide furnish for the mills on short rotations in the long term.

One mill, that of PT Indorayon Utama uses *Pinus merkusii* from old, mostly pre-war, plantations which are being replaced by *Eucalyptus* spp ; this mill also uses pulpwood from montane forests, largely *Lithocarpus* spp and some *Podocarpus*, cut from the forest to be replanted with *Eucalyptus*. (Source, largely 2).

## 122 - Socio-economic significance of wood production and forest management.

Forests make a major contribution to the social and economic welfare of Indonesia and are also of regional and global importance.

Their functions as a regulator of intense rainfall, permitting the gradual percolation of water and nutrients into the ground, reducing runoff and controlling erosion, as a regulator of extremes of climate, as a habitat for important species of plants and animals, and the preservation of genetic diversity, as a sink for carbon dioxide, and as a source of food and recreation for mankind, all cannot be readily quantified and valued, but are nevertheless extremely real and important.

The contribution of forests to the direct economy of Indonesia, through the harvesting, manufacturing and marketing of forest products, and the regeneration and management of the forest to yield their products at a sustained level in perpetuity, can however be quantified, and it is these values which are further considered here.

Forest products are Indonesia's most important non-oil export and they provided about US\$ 2.5 billion in foreign exchange in 1987, compared with total exports estimated at US\$ 17.5 million.

Indonesia is thought to have nearly 60 % of all tropical forest in Asia and perhaps 90 % of the remaining virgin stands ; her forests are among the richest in the world in terms of commercial production and East Kalimantan has possibly the most homogenous and valuable Dipterocarp forests on earth.

The forests also provide poles and timber for domestic construction, fuel wood and charcoal, and minor forest products such as rattan, resin, turpentine, latex and bamboo make an important contribution to the economy.

It has been suggested that drugs originating from the genetic storehouse of the World's tropical forests are worth US\$ 20 billion annually in the US alone and of the 63 genera from which they are produced 90 % are from the rain forests (Source, 5).

Finally, forests, and the exploitation and manufacture of their products, make a very important contribution to employment in Indonesia.

Significant development in the forest industry was initiated in 1965, and at that time unrestricted log exports were permitted since capital, experience, skilled management and labour and markets to sustain a large manufacturing industry were lacking and had to be built up gradually.

By 1978 log export restrictions were gradually imposed, culminating in a total ban from 1985 by which time progress in the installation and operation of milling industries, chiefly for plywood manufacture, had been made ; after the ban on log exports milling facilities expanded substantially and rapidly. Meranti was the major species group in demand for plywood, and this has led to the creaming of forests for these species, an imbalance which is only now being slowly redressed.



Since all logs are now processed in Indonesia it is convenient to regard the logging and forest products manufacturing industries as a whole when examining the importance of the forest in the Indonesian economy ; the following table indicates the contribution which forest products made to the export trade of Indonesia in the year 1988, in millions of US\$ :

Table 13 : Contribution of forest products to total exports from Indonesia (1988)

Commodity Group	Value (millions US\$)	Value of Export % in forestry	Value of Export % in economy	(*) No.of Employees (1986/1987)
Timber products :				
Plywood panel	2154.6	68.9		106,087
Sawn wood	579.8	18.6		80,391
Pulp and paper	150.2	4.8		29,189
Furniture (not rattan)	9.8	0.3		67,430
Fuelwood & charcoal	3.1	0.1		n/a
Logs, pulpwood residues	2.9	0.1		n/a
Matches	n/a	n/a		7,800
Total timber products	2900.4	92.8		
Non-timber products				
Rattan and rattan furniture	204.4	6.5		23,239
Other non-timber products	20.1	0.6		1,852
Total non-timber products	224.5	7.2		
Total forest products	3124.9	100.0	16.3	
Total non-oil exports	11536.9		60.0	
Total exports	19218.5		100.0	

- (\*) The data on employment are not satisfactory. Figures for medium and large establishments are for 1987 and those for small establishments 1986. Those for the pulp and paper industry include cardboard and also manufacture from non-forest produce such as bagasse, several of the classification headings are obscure, and it is not clear whether the first three major headings under timber products include log production employees in the forest. It is also likely, in the case of small village industries, such as wood carving and furniture making, that many employees do not work full-time.

(Source, 2)

The Forestry Department (in Source 8) gives the number of employees in forest concessions in 1985 as 130,420 but again it is not clear if these include mill employees ; probably not, if the mills are in towns as many of the larger ones are.

The same publication also gives the total employee strength of the Forestry Department as 31,937 plus 15,512 honorary appointments. Unfortunately staff are defined merely by grade number (I - IV) and it is not clear what these are ; the status and responsibilities of the honorary officials are also not clear.

Despite the uncertainties listed above, it appears that the forest and forest products industry produced exports valued at about US\$ 3, 125,000 in 1988, and that up to about 478,000 people gained employment, some of it perhaps part-time, from the forest and its products.

In the major plywood, sawmill, and pulp/paper operations some 160,000 people are employed, possible plus a further 130,000 in logging operations and 32,000 in the Forestry Department.

In addition to the exported forest products domestic sales are far from insignificant. In the major industries of sawmilling and wood based panel manufacture the extent of the domestic market was as follows in 1990 (million m<sup>3</sup>) :

Table 14 : 1990 domestic sales of sawn-timber and wood based panels (in millions m<sup>3</sup>)

Product	Export	Domestic consumption	Total
Sawn timber	0.6	8.5	1
Wood based panels	8.6	1.0	9.6

The forest industries, including those further downstream, such as furniture, accounted in 1986 for 11 % of total manufacturing GDP and 2 % of the country's total GDP. They show a rapid development.

## 2 - THE FORESTS AND THEIR EXTENT

### 21 - Changes in area during the decade 1980-1990 : types of forest affected.

Consistent data are hard to come by, especially those coinciding with the start and end of the decade. An indication is given, however, by the following figures (in thousands of hectares) :

Table 15 : Evolution of extent of forested lands in Indonesia (1000 ha)

Province	Total land area	Forested land (all legal categories but excluding plantations)				
		1981 (a)	1982 (b)	1984 (c)	1987 (d)	1990 (e)
Sumatra	46,949	22,200	23,300	30,209	20,754	
Java	13,219			3,013	999	
Kalimantan	54,825	54,825	35,400	44,968	37,379	
Sulawesi	19,661			13,284	10,068	
Bali/NT	7,318			5,674	2,338	
Maluku	8,573			5,533	6,143	
Irian Jaya	41,066	38,000	35,000	40,592	34,371	
E.Timor	1,461			700	?	
Other		18,000	18,000			
Total	193,072	113,600	115,900	143,973	112,052	106,400

The data for 1981-2 are based on different interpretations of air photographs and other sources, mostly dating from 1981 and 1982. Those for 1984 are merely a summary of legally defined forests and have not been validated by either air or ground survey. The origin of the 1987 figures is not given. The World Bank (1990, p.2) using FAO and other data suggests that the best estimate for the rate of deforestation is 900,000 hectares/year, and if this rate is applied to the RePProT data for 1982, the 1990 area of forest will be of the order of 106,400,000 hectares. Until the National forest inventory, now being planned and commenced by FAO and the Indonesian Forestry Department, is completed no better estimate can be made.

Sources :  
 (a) FAO (in World Bank 1990 p.2)  
 (b) RePProT (in World Bank 1990 p.2)  
 (c) Forestry 1985/86. Ministry of Forestry, Jakarta  
 (d) Thang, HC 1991,p.39  
 (e) Estimate based on deforestation rate of 900,000 hectares/year.

## 22 - The reasons for change

The World Bank (1990, p.3) estimates the sources of deforestation to be approximately as follows :

Table 16 : Sources of deforestation (ha/year)

Small-holder conversion	500,000
Development projects	250,000
Logging	80,000
Fire	70,000
<b>TOTAL</b>	<b>900,000</b>

The small-holder conversion figure includes expansion of shifting cultivation from existing regrowth into high forest (much of which will have been logged, since shifting cultivators tend to enter high forest along logging roads).

The loss due to development projects assumes that tree crop and transmigration programmes will continue at the same rate as in Repelita III, 1979-84, though it is understood that transmigration has not proved universally successful and there may be some deliberate scaling-down of this programme.

Loss due to logging is assessed at some 10 % of the annual area logged in a recent study by the consultants Atlanta/INPROMA (presumably this includes unregenerated forest as well as roads, landings, log dumps, mill sites and eroded land). In our view this estimate may well be high since shifting cultivation associated with logging has already been included under small-holder conversion, and also because poorly regenerated forest is not lost to the total forest area ; it merely will take longer to produce a second cut.

The figure for loss by fire excludes the Kalimantan fire of 1983 (approximately 3.6 million hectares). In this connection it must be remembered that that fire included much peat swamp in the Mahakam valley originally covered by poor *Alstonia* forest and that much of the area classified as burnt was in reality only damaged by drought ; some of the *Dipterocarp* trees which appeared dead in 1983 in fact recovered. In our view the figure for current fire loss may well also be high ; evergreen tropical lowland rain forest will only burn under exceptional conditions (such as in 1983 in Kalimantan) and current forest fires in, for example, South Sumatra (which caused closure of airports due to smoke in the late 1980's and early 1990's) were associated with agricultural and forest plantation activity, not with high forest. There is relatively little seasonal forest (where the fire risk is much higher than in evergreen rain forest) in Indonesia, this being confined largely to the Lesser Sunda Islands, the extreme South of Sulawesi, and a few locations in Maluku.

On balance, we would be inclined to accept the World Bank estimate of 900,000 hectares/year loss of forest as reasonable ; even if the estimates of loss by logging and fire are high, the opportunities for loss by shifting cultivation are bound to increase as more and more forests are opened up by logging roads.

### 23 - The status of the forests

Indonesia has no system of Forest Reservation for production forests, though National Parks and other Reserves are gazetted as conservation areas under the protected area system. Production forests are allocated at provincial level by a consensus between Government Departments with interests in land use ; this cannot be said to make them inviolate. Under this system and the protected area system, forested land has been allocated as follows (1984 data):

Table 17 : Allocation of forested land, 000s ha

Province	Total Land Area	FORESTED LAND							Non-Forested Land
		Protection Forest	Parks & Reserves	Production Forest		Total Permanent Forest	Conversion Forest	Total Forested	
				Limited	Other				
Sumatra	46,949	7,094	3,683	7,579	6,821	25,177	5,032	30,209	16,742
Java	13,219	554	445		2,014	3,013		3,013	10,206
Kalimantan	54,825	6,825	4,101	11,415	14,235	36,675	8,293	44,968	9,857
Sulawesi	19,661	3,867	1,406	3,926	2,092	11,291	1,993	13,284	6,377
Bali & NT	7,318	1,243	299	628	506	2,676	2,998	5,674	1,644
Maluku	8,573	1,550	441	2,076	1,030	5,097	436	5,533	3,040
Irian Jaya	41,066	8,649	8,312	4,732	7,124	28,817	11,775	40,592	475
East Timor	1,461	435	39	171	45	690	10	700	761
Total	193,072	30,316	18,726	30,527	33,867	113,436	30,537	143,973	49,102
% of total land	100.0	15.7	9.7	15.8	17.5	58.8	15.8	74.6	25.4

Apparent inconsistencies due to rounding

### **3 - FOREST POLICY, FOREST LEGISLATION AND CONTROL OF FOREST EXPLOITATION**

#### **31 - Forest and land use policy**

There is no single clearly stated forest policy declaration for Indonesia, nor is there a coherent land use policy.

The Basic Forestry Law (5/1967) however stipulates that the forests should be managed in accordance with the principles of multiple-use and sustained production.

Decrees by the Directorate-General of Forestry and of Forest Utilisation require the forests to be managed either by a form of Selection system or by clear cutting and natural regeneration and planting, or in the case of mangroves, by a Seed Tree System.

At least three institutions have strong vested interests in land use planning, but there appears to be no over-riding authority.

The Basic Forestry Law (No. 5/1967) is the primary source of authority and guidance for all forest administration and regulation ; it consists of eight chapters covering forest definition, planning, administration, management, conservation and security.

The Law delegates authority over forests to the Minister of Forestry, and amongst many other provisions authorises the granting of HPHs (Forest Concession Agreements) which are defined as : "A right to exploit the forest in a designated forest area through cutting of timber, regenerating and caring for the forest, and processing and marketing forest products in accordance with a forest exploitation work plan, in line with existing regulations and on the basis of conservation and sustainable production".

#### **32 -Implementation of forest policy, interaction with land policy, status of forest inventory**

The principles of conservative forest management on a sustained yield basis are incorporated in the Basic Forestry Law.

Decrees by the Directorate-General of Forestry and Forest Utilisation require the forests to be managed either by a form of the Selection System, or by clear cutting and natural regeneration and planting.

These principles are implemented under the terms of the Concession Agreements and by the TPTI (Indonesian Selection, Felling and Planting System) instructions.

In practice, however, the tremendous expansion of the forest exploitation industry in the 1970's and 1980's prevented the Forestry Department from exercising adequate control over the industry and many of the rules for regulating the cutting and regeneration of the forest could not be adequately enforced.

There are now over 500 concessions, with an average size of about 104,000 hectares, some 800,000 hectares of forest being logged over annually ; the control of these operations is a formidable task. In 1990 it was decided by the Ministry of Forestry to impose a stricter control over concession working and several operations were closed where reaches of the regulations were particularly flagrant. There is still much progress to be made before logging operations can be considered to be sustainable and in particular this must involve an objective examination of the TPTI system and the short felling cycle which has come to be associated with it.

Forestry Department procedures also require examination ; according to the World Bank nearly 50 % of all forestry staff manage forestry resources in Java while officers in the outer islands are almost entirely dependant on the concessionnaire for information and access to concessions.

The lack of Government infrastructure in remote forest areas is demonstrated by the terms of the concession agreements. These require Concessionnaires inter alia to construct roads linking up with the Government road system, survey and demarcate their concessions, produce aerial survey and maps, carry out forest inventory, build and maintain staff schools and hospitals, protect the concession forests from encroachment and many other matters which, to some extent at least, ought to be executed by the Government.

Many, perhaps most, Concessionnaires have interpreted the imposition of these obligations upon them as an indication that government is not prepared to interfere significantly in the operation of concessions and the result has been, in some cases at least, that exploitation continues largely uncontrolled.

There is no coherent land policy in Indonesia and outside Java and the major settled areas, land titles are not surveyed and demarcated. Until a firm land policy is imposed, supported by adequate survey and settlement of titles, and by an adequate agricultural extension service, shifting cultivation will continue to be the main form of agricultural activity in lands bordering the permanent forests. While this situation exists, and the permanent forests remain largely unsurveyed, constant encroachment will occur.

Forest Inventory in Indonesia is largely carried out by the Concessionnaires, who produce sample inventories for the preparation of five-year Working Plans and 100 % enumeration of coupes prior to felling. No post-felling inventories are normally carried out. A National Forest Inventory is currently under planning by FAO and the Indonesian Forestry Department. This is the first inventory of its kind and it will take several years to complete.

Continuous Forest Inventory plots in forests under exploitation and regeneration are an essential tool of forest management if the yield is to be regulated on a truly sustainable basis. Such plots are not prescribed in the regulations for the TPTI system and it is urgently necessary that they should be.

### **33 - Recent trends and developments in Policy, influence of local and international pressure**

Given that in general the theoretical basis on which the Indonesian forests are managed is possibly adequate, (though see Section 4.3) and that the major weakness is in the implementation of the regulations, the most important trend is that of tightening-up on the regulation of Concessions initiated by the new Minister for Forestry in 1989/90.

Recently some concessions have been cancelled outright and about 100 operations suspended for serious infringement of logging regulations. A further 260 concessionnaires were fined a total of US\$ 8.3 million for less serious violations (Source 1, p.103).

The influence of international conservation organisations is becoming increasingly felt in all the forest operating countries of South-East Asia and culminated in the Rio Conference on biodiversity in mid 1992. The Prime Minister of Malaysia, however, took an uncompromising stand at the Conference, rejecting Western intervention in forest management matters and Indonesia, as a fellow member of ASEAN, will doubtless follow the same line. Indonesia has a strong internal conservation movement, centred largely on the scientific institutions at Bogor, but until recently little heed was paid to it by the concessionnaires or the Forestry Department.

It now seems clear that, supported by the FAO and other organisations such as ITTO, environmental issues will become increasingly important in the management of concession operations, though pressure may well be directed more towards the preservation of biodiversity and protection of the environment than to strict yield regulation on a sustained basis.

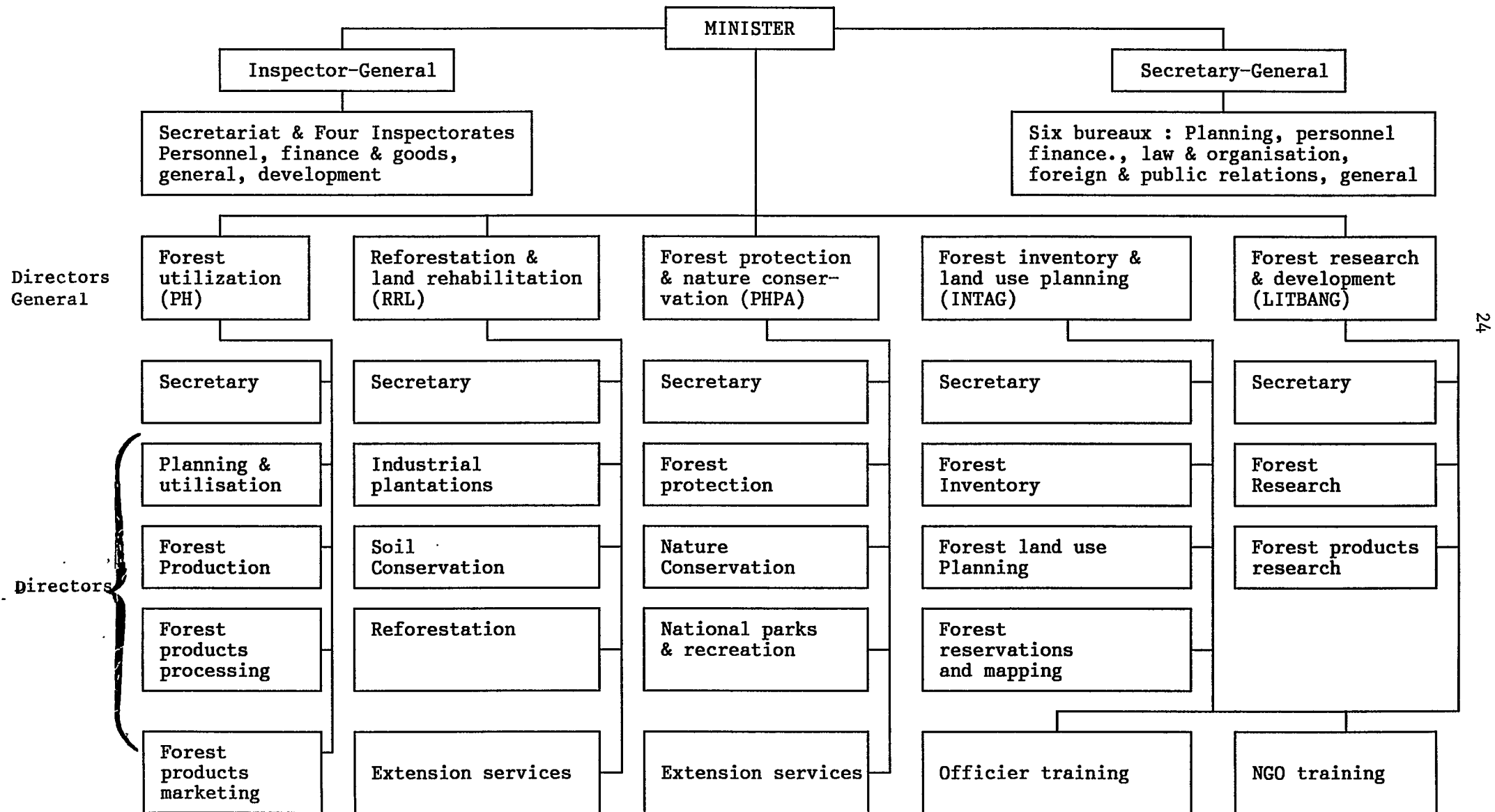
### **34 - The forest management organisation of the Forestry Department**

The Forestry Department, with headquarters at Manggala Wanabakti in Jakarta, has a complex structure headed by the Minister of Forestry, who is not normally a professional forester.

The basic structure of the Headquarters organisation is shown on the following chart:



Table 18 : Organisation Chart of the Ministry of forestry headquarters



In addition, four State enterprises (Inhutani I to IV) which operate forests and mills, function under the general control of the Minister as does Perum Perhutani which manages the forests of Java.

This is a formidable bureaucratic machine, but the major part of it which is directly concerned with forest management is that controlled by the Director-General of Forest Utilisation.

The Directors-General of Forest Protection and Forest Inventory have presumably some control over forest protection and inventory in concessions, but their major functions appear to be control over protection forests and of the National Forest Inventory.

The role of the General Forest Inspectorate in FDHQ is not clear from documents available here. It is perhaps significant that there is no Director with defined responsibility for yield control and natural regeneration of concessions. It is also significant that the officer in charge of concession working is styled Director-General of Forest Utilisation and not Director-General of Forest Management ; this is perhaps a relic of the days when the Department was directing its efforts to the initiation of large-scale forest exploitation rather than the present stage when management and control of exploitation have become more important.

The Ministry and Headquarters organisation operates in the Provinces through the Regional Forestry Office or KANWIL, which co-ordinates the activities of the various Technical Implementation Units of the Ministry at provincial level.

Territorial control over forest land, and collection of forest revenue are not under the control of the Minister ; these are the functions of the Provincial Forestry Service or DINAS KEHUTANAN, which reports to the Governor of the province.

The respective responsibilities of the KANWIL and DINAS appear to be clearly defined and they normally function from separate offices with entirely separate staff and equipment ; the system is however difficult for a stranger to understand, and one would think that there must be duplication at provincial level of administration arrangements, travel expenses and possibly work. There is no uniformed field staff as there is, for example, in Malaysia.

According to Source 8, there were, in 1986, 3,093 officers employed by the MOF at Headquarters in Jakarta, including directorates and agencies with nationwide responsibilities such as the Directorate and Agencies of Forest Utilisation, Reforestation, Forest Protection and Nature conservation, Forest Inventory and Planning, and Forest Research. There were also, in 1986, 28,946 officers employed at provincial level in Regional Forest Offices, the Provincial Forestry Service, National Parks, Forest Inventory and Mapping, and Forest Research. Excluding State Enterprises (Perhutani and Inhutani) this amounts to 32,039 officers, 9.6 % of these being in Jakarta Headquarters, and 90.4 % in the provinces. This does not quite agree with the statement in paragraph 1.23 of the World Bank Country Study 1990 (Source 5) where nearly 50 % of all forestry staff were found to be managing forest resources in Java ; even if the State Enterprise, Perum Perhutani, which operates the Teak plantations in Java, is included the percentage of staff managing Javan forests is 38 %.

The percentages of Professional, Technical and Vocational forestry staff operating at MOF Jakarta, in the provincial forestry administration, in State Enterprises and in concessions and private enterprises is as follows :

Table 19 : Distribution of the staff operation for the Forestry Administration  
(in per cent per level of education)

	Professional	Technical	Vocational
MOF Jakarta	24	5	1
Provincial Forestry	49	35	10
State Enterprises	11	14	5
Concessions and Private Enterprises	16	46	84
Total %	100	100	100

Although there is a very large staff of foresters of all grades employed at provincial level (28,946 in 1986, 29,820 in 1989) and these are supplemented by officers of MOF HQ operating out of Jakarta, it cannot be denied that their efforts are not yet reflected in adequate control of logging operations in natural forest.

There are approximately 500 concessions in operation, so about 60 foresters of all grades should be available to monitor and control the activities of each concession.

This level of staffing should be more than adequate and the fact that it appears not to be suggests that the procedures of the regional and provincial Forestry Offices require improvement. In particular officers are generally stationed in towns and not in the concessions camps, they almost always have to rely on concessionnaires for transport and as a result they are dependent on the concessionnaires for information and data. Staff, including professional officers, should be required to submit diaries at least once per month to their immediate superiors, not only so that their time and activities are monitored, but so that each officer is made aware of the findings of his subordinates without the necessity for the sending of numerous reports and memoranda.

Above all, it is essential that forest officers are enabled to live and operate independently of the concessionnaires, and this applies to housing, power and water supplies, schooling, medical facilities, transport, and supply of domestic provisions. Each concession camp should have a simple rest house for touring forest officers (and other Government staff) monitored and financed by Government.

### 35 - Concessions Agreements - (HPH) licences

In 1985 there were 521 Concession Agreements in force, covering 53,374,750 hectares, an average of just over 102,000 hectares per agreement. Details by Province are as follows :

Table 20 : Distribution of concessions in Indonesia

	in 1985			in 1988		
Province	Number of concessions	Total Area (1000 ha)	AAC Maximum (1000 m3)	Number of concessions	Total Area (1000 ha)	AAC Maximum (1000 m3)
Sumatra	161	14,333	17,596	167	14,682	16,074
Kalimantan	291	30,536	41,730	299	33,215	39,685
Sulawesi	34	3,514	4,460	36	3,713	3,957
Nusa Tenggara	1	20	92	1	25	87
Maluku	22	2,260	4,164	22	2,459	3,296
Irian Jaya	12	2,812	6,747	12	2,812	2,342
Total	521	53,376	74,789	537	56,906	65,441

Note : AAC = Annual Allowable Cut

• The outturn of logs, sawn timber and plywood for Indonesia in 1985/6 totalled 28,828,938 m3 when reduced to the volume of logs producing it (sawn x 2, plywood x 2.08) which is less than half the AAC ; even at the peak of production in 1980 outturn expressed as round logs amounted to 30,744,970 m3, again less than half the AAC. (Source of basic data, 8).

The terms of the Concession Agreements vary slightly, and almost all are written in Bahasa Indonesia. The following example, however, is in English and is representative of the majority of agreements :

#### **I - Definition of terms**

#### **II - Grant of Agreement**

#### **III - General statement of rights and obligations of the Concession holder with regard to utilisation of forest products and implementation of production, including the establishment of manufacturing plants and creation of work opportunities.**

#### **IV - Provisions concerning basic principles relating to forestry matters**

- Tree species which shall not be cut or felled.
- Use of trees for Company's operations.
- Good timbering and ecological practice.
- Fire prevention.
- Damage to Government and third party's property.
- Encroachment by unauthorised parties.
- Forest utilisation work plan : description of procedures for annual working plans.
- Employment of forestry experts by Company (forest planning, management, timber cruising, grading and scaling require qualified personnel approved by Forest Department).
- Department's right to review production targets.
- Relation of forest industry to commercial species.

#### **V - Forest area**

- Size and location of work area : this excludes protected forest 500m above sea level and slopes >25 % (14°), wild life reserves, national parks, private lands, etc.
- Term of HPH : 20 years extendable (according to industrial progress).
- Marking of boundaries of work area within 3 years after FA to limit the production forest; check by FD.
- Right to fell, transport, process and market timber (according to Indonesian law).
- Aerial photography is required within 2 years after issue on working area at scale 1 : 20,000.
- Mapping company must provide vegetation and contour maps at 1:20,000 scale within 3 years after issue.
- Prohibition against subcontracting (except if approved by FD).
- Procedures and conditions for selective cutting and logging including girdling of unmerchantable species, thinning and stand improvement.
- Precautions in felling and skidding : especially to limit damage to young trees.
- Provision for a "working circle" for smaller concessions, grouping of work areas to assure steady production.
- Limitation, requirements and identification of the proportion of the timber stand to be cut: minimum diameter to be felled.

#### **VI - Company's obligation to establish a fully integrated forest industry**

- General obligation to establish a fully integrated forest industry.
- Modern logging operations to be established and forest management to be planned and executed.
- Establishment of log processing and wood processing plants.
- Economic feasibility studies concerning processing industries (within 9 months).
- Terms of reference of economic feasibility studies.
- Unfeasibility of establishing particular plants.

## VII - Operational Plan

Scope of work :

- First five years : logging : maximum and minimum annual cuts for species percentages, detailed figures are in annual working plans ; log processing : minimum capacity of mill.
- Second five years : logging : possible increase of minimum AC.
- Third five years : log processing.
- Group of species to be produced and percentage.

Schedule of investment :

- logging
- processing plants
- obligation of processing 60 % after 7 years of operation

Department's revision of levels and quantities for each form of operation.

Company working jointly with third parties possible.

Construction of road network.

- (a) main road minimum intensity 3 m/ha.
- (b) connections with public roads.
- (c) construction standards.

Right of access for other companies (possible).

## VIII - License fee and royalties (cf Government of Indonesia (GoI) regulation 22/1967)

- License fee based on work area GoI (paid once).
- Royalties are applicable also on trees felled and not extracted and on merchantable trees left standing.

## IX - Scope of Investment

- Company's obligation to provide cash and import equipment and machinery.
- Investment which shall qualify as satisfying Company's investment obligations (only new equipment).
- Determination of technical specifications and prices of equipment and machinery (by FD).

**X - Employment and training of Indonesian personnel**

- Employment of Indonesian personnel (priority to Indonesians).
- Recruiting and training programmes.
- Other personnel (cf. Presidential decree no. 28/1974).
- Equal treatment with preference for Indonesians for employment and training.
- Employment of personnel cleared by Government team.

**XI - Health, safety and compensation provisions**

- Health and safety measures.
- Law applicable to accidents involving Company's employees.

**XII - Rights of indigenous community in the work area**

- Rights of Indonesian community : no limitation of customary rights.
- Co-operation between Government and company concerning indigenous community.

**XIII - Community development**

- Community development : worship places, electricity, low cost housing.
- Medical facilities : hospital (<1 year after issue).
- Educational facilities.
- Dredging of rivers and resettlement.

**XIV - Promoting national welfare**

- |                                      |                 |
|--------------------------------------|-----------------|
| - Use of national flag facilities    | } Preference    |
| - Encouragement of domestic products | } to Indonesian |
| - Contractors and importers          | } facilities    |
| - Sales of products                  | }               |

**XV - Flora, fauna and objects of historical and scientific value.**

- Measures for protection of fauna and flora
- Measures for protection of scientific and historical objects.

**XVI - Provisions concerning relations between concessionnaire and agreement**

- Relations
- Effect of termination on agreement

## **XVII - Provision concerning shareholding and capital contribution**

## **XVIII - Arbitration**

## **XIX - Alterations in the size of the work area**

- General provisions : reductions, merging, exchanges.
- Procedures : reductions, merging, exchanges.

## **XX - Default provisions**

- Events of default.
- Material breaches : no implementation > 180 days of issuance.
- Notice of default.

## **XXI - Temporary suspension or surrender for cause**

- Temporary suspension (< 2 months)
- Surrender for cause.

## **XXII - Consequences of default or surrender for cause**

- Obligations after default or surrender
- Liability of Company after default
- Disposition of property following expiration or termination

## **XXIII - Performance bond**

- Deposit of performance bond
- Department recourse to performance bond

## **XXIV - Force majeure**

- General
- Notice

## **XXV - Records and audit**

## **XXVI - Supervision**



## XXVII - General provisions

- No rights granted except as specifically provided.
- Government's right to examine. Amount of consideration.
- Notices.
- Non-assignability.
- Indonesian to be governing text.
- Governing law.
- Rights and remedies cumulative.
- Reports.

The procedure for the issue of Concession Agreements was, until late 1988, governed by SK No. 141/1981 of the Director-General of forestry, but in 1988/9 three new directives were issued establishing a common procedure for application and renewal and setting out specific criteria and requirements for renewal.

There are thirteen steps involved between the preparation of the application and approval by the Minister but no copy of these directives is available in the UK, nor in France. In Source 1a p. 158 the procedure is reviewed and considered to be satisfactory but it is there suggested that in addition applicants should provide (i) information on their present and past involvement in logging and wood processing, (ii) a non-refundable application fee to discourage all but serious applications, and that (iii) quantitative criteria should be laid down for each stage of approval to ensure consistent decisions, (iv) deadlines should be provided for all stages, (v) a preliminary environmental impact study should be made, followed by a full one on approval of the Concession.

It has generally been accepted that no new Concessions will be issued, except in Irian Jaya. By 1987 the area under Concession Agreement was about 57.9 million hectares. Of this 43.3 million ha. (75 %) were production forest (the balance being unproductive due to environmental restraints, poor stocking, etc.) but only 36.8 million ha. were permanent production forest, the rest being conversion forest for alienation or plantations. It is estimated that at the end of 1989 some 24.18 million ha. of operational production forest remained unlogged, some 8.85 million ha. having been logged. (Source 1a, p.61)

All concessions are now held by Indonesian nationals or by Indonesian companies.

36 - Factors which have influenced the location and status of forest areas and their opening to exploitation.

361 - Wealth of the forest.

Only part of Indonesia has a uniformly wet climate which will support evergreen tropical rain forest ; most of Java, the lesser Sunda Islands, the two Southern limbs of Sulawesi and parts of Maluku have a marked dry season and do not naturally support such forest. The character of the forest also changes as Wallace's Line is crossed, dividing the Asian and Australasian floras faunas, running between Borneo and Sulawesi and between Java and the Lesser Sunda Islands. Dipterocarps predominate in the emergent trees to the West of the Line, while to the East of it other families predominate and dipterocarp species are far fewer ; this does not mean that the forests to the East are necessarily less valuable, in some cases, notably P. Obi in Maluku, only two or three species of dipterocarp occur but they are so common that the forest is almost pure dipterocarp and thus very valuable.

In general, Dipterocarp forests run out at an altitude of about 1200 m (say 4000 ft) and are there replaced by oak-laurel forests which are far less valuable.

Apart from the plant geographical factors mentioned above the influence of man has removed evergreen rain forest from a large part of Sumatra South of Palembang, from a strip along the coast of Eastern Borneo (Kalimantan) ; the South-East corner of Kalimantan, in the Banjarmasin area, is also seasonally dry and cleared forest lands have become a fire climax dominated by Imperata grass. Extensive areas of land in West Kalimantan, notably in the flood plain of the Kapuas river, have also long been cleared for cultivation. In the highlands of Kalimantan there is a relatively high population which lives in equilibrium with the forest by shifting cultivation ; many of these people have been confined to the highlands because of the severity of malaria in the lowlands.

The most valuable production forests, West of Wallace's Line, and excluding lands with a marked dry season, thus lie between on the one hand the cleared lands of the coasts, and main river flood plains, and on the other the dipterocarp altitudinal limit of about 1200 m or the areas of extensive highland shifting cultivation.

East of Wallace's Line the coniferous forests of Araucaria, and in Maluku Agathis, extend the commercial forests into the montane zone, while below them a few dipterocarp species, notably Shorea assamica, Shorea selanica and Anisoptera spp., and also Pometia pinnata and Dracontomelum provide the bulk of the commercial timber stand.

### 362 - Water access.

The pattern of exploitation which developed in the forests existing in the 1960's and early 1970's, when the majority of concessions were issued, depended almost entirely on water access.

At that time the log export market dominated exploitation planning, and the first requirement was a secure anchorage for the log ships and a reasonably well protected route for log rafts to load them. Many rivers in Kalimantan, Sumatra and other islands have bars at their estuaries which are either unstable or too expensive for logging companies to dredge. For this reason sheltered bays frequently became the most suitable sites for log loading and camps developed on the adjacent mainland with direct road, or in earlier days rail, access to the forest. The number of such favoured sites is limited and they have, to a considerable extent, dictated the pattern of exploitation.

The development of flexible rafts with logs arranged in a herring-bone pattern along a central steel cable later allowed sea-towing of rafts over considerable distances and reduced the reliance on a limited number of sheltered shipping points.

Where deep river estuaries exist and ships can enter, as for example on the Mahakam river in East Kalimantan, sawmilling and plymilling towns developed with many operators rafting logs down the same river from camps located right up to the rafting limit and with a direct road access from the camps to the forest.

Ideally exploitation should have then developed in depth with each drainage being logged to its headwaters before the other drainages were opened so that accessible and remote forests were logged together systematically.

In practice this has not always happened, the selection of coupes being left largely in the hands of concessionaires rather than being pre-planned by the forestry department.

#### 4 - PRINCIPLES UNDER WHICH THE FORESTS ARE MANAGED

##### 41 - Forest Inventories

###### 411 - National Forest Inventory.

There is no National Forest Inventory in Indonesia but one is now being planned and executed by the Forestry Department with assistance from F.A.O..

This will take several years to complete.

A major difficulty will be the identification of tree species by the field teams ; there is no foresters' tree identification manual in Indonesia.

As the world shortage of tropical hardwoods develops it becomes more and more important to identify a wide range of timber species at all stages of their growth ; it is not enough to classify trees for example as red meranti and record all unknown trees as "other species".

Check-lists of species reaching timber size have recently been completed by Whitmore et al working from the Forest Research Institute at Bogor for each province of Indonesia (though that for West Irian remains to be printed). Though these contain keys to the Dipterocarps and line drawings, they contain no species descriptions. The taxonomy of the Dipterocarps has now been investigated and a definitive account published by Flora Malesiana, but the species descriptions are highly technical and designed for use by botanists rather than by foresters.

It is necessary for a foresters' tree manual to be prepared as a matter of urgency and it is understood that this is now being undertaken by a research team with technical assistance from the Overseas Development Administration in London. The importance of this work to the development of sustained-yield management in the forests of Indonesia can hardly be over-emphasised.

###### 412 - Management Inventories

Guidelines which set standards for management inventories have been produced (in Indonesian) by the Forestry Department ; Technical Guidelines no. 366/IV - Expo-1984.

Inventory and survey are carried out in a number of steps of increasing intensity and are usually preceded, in large companies, by an air survey to locate main extraction routes, productive and non-productive forest, and encroachment by shifting cultivation.

###### 412.1 - Orientation and forest survey

A grid of main orientation lines is cut, originating at a readily identifiable geographical point, and this forms the basis for the one kilometer-square blocks which will be cruised later.

At the same time an orientation survey on 20 m wide sampling strips is carried out, all harvestable trees of 50 cm dbh and up being recorded ; the centre lines of the 20 m wide strips are 80 m apart, giving a 25 % survey.

The annual coupe boundaries and those of the one kilometer-square blocks are demarcated with cut lines 1 m wide.

#### 412.2 - Timber cruising

This is a 100 % inventory of all the harvestable trees in every 1 km square block ; it is normally carried out 1 to 2 years before exploitation. Each block is divided into 20 sub-blocks, each 50 m wide and 1000 m long, and 5 ha. in area. The cruise is carried out from a centre line along the major axis of each sub-block, the book being closed at each 100 m of line length. All harvestable trees 50 cm dbh and up are marked on a 1:2000 map recorded by number, species, dbh, estimated marketable bole, and tree volume. Rivers, creeks and other factors such as occurrence of road metal are also recorded and each tree is marked with a tag giving the tree block number. A crew of 9-12 people can cruise two 1 km square blocks per month. Stand and stock tables in 10 cm diameter classes are prepared, a copy being sent to the Forestry Department.

#### 412.3 - Inventory of (putative) residual stand

This covers trees 20 to 49 cm dbh and is carried out at the same time as the timber cruise but covers only 5 % of the trees, i.e. 1 sub-block (5 ha. 50 m x 1000 m) per block. Trees enumerated are confined to marketable species (i.e. those included in the timber cruise) and they are recorded by 10 cm diameter classes. There is no provision for the quality of the stem and the crown classification to be recorded, nor for the trees to be marked.

Reports and maps are again provided to the Central Planning Division of the Forestry Department in Jakarta each year.

Note : The procedures outlined in paras 412.1 to 412.3 are those followed by one of the major Concessionnaires, P.T. Kayu Lapis, and are representative of the best practice in the industry.

#### 412.4 - Post-logging inventory

This is prescribed in Chapter V of the Pedoman Tebang Pilih Indonesia (1980) and should follow after exploitation is complete, sampling both young regeneration and also "pohon inti" (literally nucleus trees, i.e. the pole sized trees, 20 to 50 cm dbh which form the basis of the young regenerated stand). The sample of "pohon inti" must not be less than 20% and a scale for damage assessment is given. The survey is to be carried out by the Concessionnaire and the results sent to the Forestry Department. In practice these surveys are never, or almost never, carried out.

#### 412.5 - Continuous Forest Inventory

A procedure of this kind, where small sample plots are enumerated in the forest before exploitation starts, are felled over in exactly the same way as the rest of the coupe, re-enumerated after felling and at fixed intervals thereafter, should form the basis for monitoring stand development ; without them no sound prediction can be made of the increment of the stand and thus of the Annual Allowable Cut in the second and subsequent felling cycles. There are no prescriptions for CFI plots in the Forestry Department management rules and they are not used by Concessionnaires.

## 42 - Objects of Management

The Basic Forestry Law (No. 5/1967) stipulates that the management of forests shall be in accordance with the principles of multiple use and sustained yield. The silviculture systems in use are designed for :

- Efficient utilization of the productivity of the site ;
- Conservation of the genetic resources ;
- Maintenance of environmental stability and quality.
- Sustainable utilization of forest (wood and non-wood) products ;
- Retention of a viable residual stand after logging. (source 1a. p.36)

We have not been able to find a more comprehensive statement of the objects of management.

## 43 - Silvicultural systems, rotations, and felling cycles, post harvest treatments, studies of forest productivity

### 431 - Silviculture Systems

Three silvicultural systems have been devised for the management and regeneration of the tropical rain forests of Indonesia ; their use is prescribed in a decree issued by the Director-General of Forestry. No 35/1972, amended by a decree issued by the Director-General of Forest Utilization August, 22nd, 1989.

The three systems are :

- (i) The Indonesian Selective Felling System (TPI) amended to become the Indonesian Selective Cutting & Planting System (TPTI) in August 1989.
- (ii) The Clear Cutting with Natural Regeneration System (THPA)
- (iii) The Clear Cutting with Replanting System (THPB).

Of these only the first (TPTI) is in practice applied to Concession working in rain forest.

The THPA approximates to the Malayan Uniform System with a rotation of 70 years; we know of no instance where it has been applied in Concession working in recent years.

The THPB is a system for the conversion of poorly stocked forest (less than 25 m<sup>3</sup>/ha of commercially recoverable wood) to industrial forest plantations (HTI).

### 432 - The Indonesian Selective Felling system (TPI)

The system is described in 'Pedoman Tebang Pilih Indonesia' No. A/56/1980 issued by the Directorate-General of Forestry (An English translation of the essential part of this is in Appendix 1) and the Director-General's Guidelines for the TPTI system in Appendix 4 of Armitage & Kuswanda (3a) :

#### 432.1 Conditions for application of the System.

The system is for use in mixed Dipterocarp forests with a normal stem diameter frequency. This must include sufficient natural regeneration to ensure future forest development and at least 25 sound vigorous trees of commercial species per ha., 20 - 49 cm dbh. It may only be used in high rainfall areas (over 1000 mm/year) and where soil is not sensitive to erosion.

#### 432.2 Cutting limits and felling cycle.

A minimum diameter cutting limit of 50 cm over bark (or 60 cm in limited production forest), felling cycle 35 years, rotation assumed to be 70 years.

#### 432.3 Increment predicted on nucleus trees (the putative residuals) 1.0 cm diameter/year.

#### 432.4 Sequence of operations. (note : F = year when felling occurs)

F - 1 to 2 years = Pre-felling inventory, marking of trees to be cut and of nucleus trees for retention. Road and landing construction.

F = Selection felling of unmarked trees above the minimum cutting limit.

F+0 = Undergrowth and climber cutting. Enrichment planting if necessary. Post felling inventory of residuals.

F+5 years = Tending and release of regeneration.

#### 432.5 Operation of the system.

Trees for felling are marked by the Concessionnaire (see Section 4.1 above) using a zinc numbered tag and two paint crosses one above the felling cut and one below it, the direction of felling to be marked with a paint arrow and the tree number to be repeated on the stump. This marking is done 1 - 2 years before felling as part of the 100 % coupe enumeration.

Skid trails are laid out, marked and surveyed ; felling direction to take into account of the skidding direction. Trees for retention ("pohon inti") are selected, a minimum of 25/ha. of commercial species, sound, of good form and with vigorous crowns. These must be well distributed and within the size range 20 cm to 49 cm (or 59 cm in limited production forest) dbh. (Note : in Armitage & Kuswanda pages 193 and 195 the lower limits given as 35 cm, but table 3 page 22 of Pedoman Tebang Pilih gives 20 cm. and this is repeated in the TPPI prescriptions.)

The selected trees for retention are to be numbered with yellow paint, entered in a register, mapped and marked with a ring of yellow paint about 20 cm above the buttresses so that they are visible from all directions.

Exploitation proceeds, with the minimum of damage, trees being felled according to the marking for direction felling so as to avoid damage to nucleus trees, and to form a herring-bone pattern along the skid trails.

After exploitation the following operations take place :

- Enrichment planting of land bared in exploitation operations and in poorly stocked forest.
- Cleaning and climber cutting to release young trees of commercial value.
- Plugging of erosion gulleys.
- Protection from shifting cultivation grazing and fire.
- Inventory of the residual stand.

The marked residuals are to be fully accounted for and all damage recorded. Other commercial trees to be inventoried by sampling.

Re-logging of worked areas is not permitted until the end of the felling cycle.

Five years after logging a further release operation, a repeat of enrichment planting and thinning if necessary, are to be carried out.

Sanctions consisting of a warning, fines, lowering of annual allowable cut, replanting of logged areas, or annulment of concession agreement can be imposed.

#### 433 - The Indonesian Selective Cutting and Planting System (TPTI)

This amended version of the TPI system was promulgated by a Decree from the Director-General of Forest Utilisation on August 22nd, 1989. It is designed to give a tighter control on felling techniques, skidding and the development of the residual stand. The minimum felling diameter limit is adjusted to stand structure and tree distribution.

Under this revision the following changes of substance or emphasis are made :

- An organisation unit to implement the system, with adequate funds and technically skilled executive staff, must be established three years before fellings start. Infrastructure to execute and control the work must be two years before fellings start.
- A liberation cutting and residual stand inventory is prescribed one year after felling (not coterminous with felling as in the TPI system).
- Seedling procurement for enrichment planting is to be complete by two years after felling.
- A liberation cutting four years after felling, not five years as in TPI is prescribed.
- Thinnings at 9, 14 and 19 years are prescribed.
- Protection and research must continue throughout the life of the stand.
- Thirty-two technical terms are defined, the only items here which attract comment are the definition of "commercial species" as "species which have market value" without any attempt to list these species, and confirmation that nucleus trees must have a minimum dbh of 20, not 35 cm.
- Mapping of the 100 ha felling blocks is prescribed at scales of 1 : 25,000 or larger.



- Inventory of nucleus trees is to be at 100 % intensity (not 5 % as in existing practice), it is to be carried out simultaneously with timber cruising, and with a marking of all nucleus trees and trees to be felled.
- Species acceptable as nucleus trees are preferably the same as those felled, but if less than 25 of these per ha are present, other commercial species or species which support forest industries as raw material can be included, as can trees with a diameter over 50 cm.
- Where nucleus trees are still inadequate in number, TPTI may only be implemented with the consent of the Ministry of forestry.
- All commercial trees of 20 cm and over must be completely tallied, including species name, dbh; also for nucleus trees the position in the canopy, and for trees to be felled, the timber height.
- Standards for bridges are prescribed, including that they are to be of first or second durability class timbers so that they are available for stand tending after exploitation.
- Road base, bearing capacity and grades must follow existing technical specifications.
- Nucleus trees, protected species, sacred trees, and trees less than 50 metres from springs are not to be felled.
- The purpose of the liberation cutting (an undergrowth cutting plus climber cutting) one year after felling is to release seedlings and to make inventory of the residual stand easier.
- Residual stand inventory is to be 100 % for nucleus trees, 10 % for poles and 5 % for saplings. Its purpose is to locate areas lacking in regeneration and to establish the extent of exploitation damage on nucleus trees.
- Damaged nucleus trees are to be replaced by a substitute which is to be marked and recorded.
- A damaged nucleus tree is defined as one where there is damage on 50 % of the crown, or a main branch is broken, where there is bark damage over one quarter of the circumference, or where the roots or one-third of a buttress are damaged.
- Basic rules for growing of enrichment planting material are given. Species to be favoured are those felled in the block and other dominant commercial species of high value. Material may be from seed, wildings or cuttings.
- Rules for planting of bared areas and for enrichment planting of poorly-stocked forest are given.
- Rules for tending three years after felling, (this operation is not included in the synopsis of the system) are given ; it consists of climber cutting to free nucleus trees, underbrushing, beeting-up of planting, pest and disease control, and fertilisation or establishment of mycorrhiza if necessary. Trees which do not impede nucleus trees are not to be cut or girdled. Rattan is not to be cut since it may have a value.

- A further tending at four years is described, consisting of underbrushing to release plantings, and cutting or girdling of weed trees (? to release nucleus trees). Thinnings to release nucleus trees (including the removal of poor nucleus trees if necessary) are prescribed at 9, 14 and 19 years.
- Protection against rill erosion, fire, illegal clearing, pests and diseases and the protection of fauna and flora and their habitat is prescribed. This includes cleaning block and compartment boundaries, fire precautions, patrolling and assisting local people to a better way of life.
- Forest guards, to a number prescribed by the Ministry of Forestry, are to be employed.
- An experimental plot is to be made in each management unit and research and protection are to be maintained continuously.
- Each stage of TPTI is to be reported on every month, quarter, and annually to the Directorate of Forest Utilisation.

#### 434 - The Indonesian Selective Cutting Systems (TPI and TPTI) : a critical appraisal

The Indonesian Selective Systems have been the subject of examination by many authors and authorities in recent years. The following papers are among the more recent and important :

- 1) Armitage, Ian and Kuswanda, Muhammed (1989). Forest management for sustainable production and conservation in Indonesia. DGFU/FAO UFT/INS 065/INS Forestry Studies Field Document No. 1-2 Jakarta. Chapters 4, 5 and 9.
- 2) DGFU/FAO (1990) Situation and outlook of the forestry sector in Indonesia. Vol. 1. Issues, findings and opportunities. UFT/INS/065/INS Forestry Studies Technical Report No. 1 Jakarta. Chapter iii.
- 3) DGFU/FAO (1990) Ibidem Vol 2. Forest Resource Base. Chapter 4.
- 4) World Bank (1990) Indonesia, sustainable development of forests, land and water : A World Bank Country Study, Chapter I.
- 5) Weir, J.S. and Manan, Syafii (1989) Environmental & conservation Aspects of forestry in Indonesia UTF/INS/065/INS Forestry Studies Field Document No. VIII - 1 Jakarta. Chapter 7.
- 6) Chandrasekharan, C (1990). Some issues relevant to natural forest management in Indonesia. Paper submitted to Asean Seminar on management of tropical forests, Jakarta 1990.
- 7) Mok, S.T. (1990) Sustainable management and development of tropical forests in Asean. Asean Seminar, Jakarta 1990.
- 8) Chang, H.T. (1991). Asean Forest Resource Data Base, Indonesia. Asean Institute for Forest Management, Kuala Lumpur.
- 9) Soetarso, P.(1990) Forest management systems in Indonesia. FRI Samarinda.
- 10) Suwanda, H.A. Improvement fellings, an alternative to the TPI System. Asean Seminar, Jakarta 1990.

- 11) Burgess, P.F. and Laurent, D. (1989). The Forest management practices of P.T. Kayu Lapis, Indonesia. Report to ADB and Ministry of Forestry GOI.
- 12) Burgess, P.F. and van Lavieren, B. (1989). A report on the environmental impact of the operations of P.T. Astra International Inc. Report to IFC and IUCN.

The main issues concerning the Indonesian Selection systems are these :

- i) Are selection fellings more suitable for the species and conditions than clear cutting or the Shelterwood Uniform system ?
- ii) Are fellings under the Indonesian Selection system sustainable ?
- iii) What are the economic implications of selection, clear cutting and Shelterwood Uniform Systems ?
- iv) If Selection fellings are silviculturally, environmentally and economically desirable and sustainable, is the TPTI System a satisfactory medium for implementing them ?
- v) If the answer to (iv) is in the affirmative is the system as published being satisfactorily implemented ?
- vi) Can a better system be devised ?

The above issues are now considered in order.

#### 434.1 Selection fellings -vs- clear cutting or the Uniform system.

Selection fellings are generally considered to have the following advantages and disadvantages :

##### A) Advantages

- 1) By maintaining a constant forest cover, protection is given against erosion and land slips.

This advantage is less real in the wet tropics than it is in temperate forests. The growth is established very quickly indeed on cleared land in the wet tropics. Even so, heavy tropical rainfall can cause severe erosion, particularly on granite and some volcanic soils, where natural drainage has been disturbed by earthmoving or where troughs caused by yarding logs became temporary watercourses; the presence of a forest over will do little to prevent this. Also, the heterogenous nature of tropical rain forest means that even after a so-called clear cut (unless it is one to be followed by burning and planting) there is still substantial forest cover left. Thus, all three systems (except where clear cutting is followed by burning and planting) maintain an adequate forest cover in the wet tropics, but such a cover will not prevent gully erosion due to bad logging practices.

2) Damage by wind is minimised

In Indonesia wind is not a factor of importance ; the moist forests lie outside the typhoon belt.

3) All seed years can be used and seedlings are well sheltered.

This is true, and very important. Seed years at 4 to 5 year intervals are usual in Dipterocarp forests and clear cutting with natural regeneration can only be relied upon if the forester has absolute control over when coupes are opened to felling ; in practice, under present conditions, he rarely has that control.

4) The system is highly flexible and silviculture is little trammelled by management

This is true.

5) There is no need to maintain as high a proportion of young stems to old as in Uniform forest where there must be equal areas of each age-class. Hence a much larger proportion of the growing stock and yield can be in the form of trees of large size

This is true in intensively managed temperate forest, but less so in heterogenous tropical rain forest where much of the stand consists of non-commercial species.

6) Trees can be retained as long as they are making valuable increment ; a tree need never be felled merely because it has reached a certain age. The crowns of the dominant trees are well developed and stand more or less isolated, so that increment continues with undiminished vigour to an age at which in uniform stands it would be falling rapidly

The valuable Dipterocarps have wide spreading crowns and in uniform forest must be widely spaced if they are to maintain increment. This is why Meranti (*Shorea* spp) is generally an unsatisfactory plantation tree, and in old well-regenerated Meranti stands in West Malaysia increment is very low and clear bole length poor.

Tropical rain forest has a mosaic structure, islands of young regeneration in gaps caused by the falling of moribund old trees adjoin groups of poles and groves of mature trees ; selection forest approaches this structure.

It is much more likely that satisfactory increment can be maintained in managed tropical rain forest under selection fellings than under attempts to produce a pure even-aged stand.

7) Aesthetically selection forest is often considered attractive

Not important at present but will eventually become so. Selection working has a "green" image which no forester can ignore under present conditions ; whether the image is deserved is another matter !

## B) Disadvantages

### 1) Considerable silvicultural skill is needed in marking fellings

The TPTI as at present practised does not demand great silvicultural skill since the fellings are in truth little more than exploitation fellings to fixed diameter limits. The skill will be required in inducing and developing regeneration and that problem has not yet been addressed. This is, in the longer term, a very real disadvantage.

### 2) Felling and extraction must be carried out with skill and care

This is probably the most important disadvantage. Any system where fellings take place in close proximity to future crop trees which are larger than sapling size gives an opportunity for extensive damage if felling and extraction are not skillfully carried out and carefully controlled. It is virtually impossible to ensure this over an annual felling area of some 800,000 ha. unless there is a drastic reorganisation of logging staff, concession management and Forestry Department supervision.

### 3) The Selection System favours shade bearers

This is true of single tree selection working, but light-demanders can be managed by group selection methods. The fast growing Dipterocarps in greatest demand as timber trees (Meranti, Red, White and Yellow, Mersawa, and White Seraya, Parashorea spp) are all light demanders. The lower-growing, dense-wooded, usually sinker species of the Eushorea group together with Kapur and Keruing are almost all shade bearers.

### 4) Thinning, as a revenue-producing operation is not possible

If it is necessary to stimulate growth of nucleus trees by liberating them from competition the work must be done by girdling and no harvest from it is possible. This objection carries less weight in extensive tropical forests than in temperate ones, since thinning-sized produce is rarely marketable.

### 5) Degradation of the growing stock due to constant selection of the best trees for removal

This degradation applies to both the genetic constitution of the major timber species, and also to the rise in the proportion of the less favoured tree species. This disadvantage does not apply when the selection system is properly applied and cuttings are made in all age classes to remove undesirable trees at the same time as the desirable ones. It would be idle to pretend however that this is the case in Indonesia, or that it ever can be under concession working where the concessionnaire has no long-term interest in the forest.

### 6) Frequent disturbance by fellings on short cycles degrades the forest environment and damages residuals and young regeneration

This is very true, particularly where exploitation damage is not as well controlled as it should be or, even worse, where relogging takes place before the end of the felling cycle.

Conclusion on selection fellings vs. clear cutting or the Uniform System :

To sum up, the important advantages of the Selection System under Indonesian conditions are : (i) the spreading of the regeneration period over several seed years, and (ii) the deep stand structure which prevents all the wide-crowned crop trees from competing in the same canopy level.

The important disadvantages are : (i) the need for great skill and constant supervision in marking if exploitation damage is to be controlled at an acceptable level, and (ii) a tendency to favour shade bearers which are economically undesirable, and (iii) degradation of the stand due to constant removal of the best trees, and (iv) frequent disturbance of the forest environment and damage to regeneration caused by short felling cycles. It should be borne in mind that the Shelterwood Compartment system (or Uniform System), but not the Clear Cutting System, also has advantages (i) and disadvantages (i), (ii) and (iv).

("Silvicultural Systems" by R.S. Troup, ed. E.W. Jones, Oxford 1952 has been consulted for some of the basic information in this section).

434.2 Are fellings under the Indonesian Selection Systems, as prescribed, sustainable ?

The Systems assume the following parameters :

- . Minimum stocking of nucleus trees before exploitation 25 trees/ha.
- . Size range of nucleus trees. 20 to 50 cm dbh.
- . Loss of nucleus trees during exploitation. Not stated, but a figure of 10% is reasonable.
- . Mortality of nucleus trees during cycle. Not stated, but 1% per annum is suggested by FAO.
- . Felling cycle 35 years.
- . Diameter increment 1 cm per annum (dbh).

Based on these parameters, the stand of nucleus trees at the end of the cycle would vary from 55 to 85 cm dbh and consist of 16 trees per ha. The mean tree would be 70 cm dbh assuming the stand to be evenly distributed in size and would have a volume of 4 m<sup>3</sup> (timber length 15 m, form factor 0.7). The stand at the end of the 35 year cycle would thus be 64 m<sup>3</sup> per ha, which at 35 % harvesting loss would yield 48 m<sup>3</sup> per ha, which is an acceptable cut.

But there are many indications that the assessment of increment at 1 cm per annum dbh is too high.

Probably the most reliable set of data in this respect is from The Philippines where some 900 CFI plots, measured over nearly 20 years, showed an average increment of 0.50 cm per annum for Dipterocarp species (Uebelhor et al, 1990), but it can be accepted that in some of these plots liberation thinnings to keep the crop trees growing had not been carried out and it is probably safe to accept an increment of 0.6 cm per annum, which accords well with other data from Malaysia and the rest of the Region.

At this rate of increment to produce a tree of 50 cm dbh (the lower commercial limit) at the end of a 35 year cycle would require a tree of 29 cm dbh, and a tree of 50 cm dbh at the start of the cycle would reach 71cm dbh at the end of it. The mean tree would be 50 cm dbh, which with 15 m timber length and a form factor of 0.7 would have a volume of 2.1 m<sup>3</sup>. By simple proportion the stocking of nucleus trees reaching exploitable size at the end of the cycle would be about 13 (after allowing for loss in exploitation and subsequent mortality) so that the stocking would be only about 27 m<sup>3</sup> per ha, which would not be an economic cut.

A further difficulty is that many, probably most, inventories of nucleus trees prior to exploitation show that in fact the putative stocking of 25 stems/ha, of commercial species 20 to 50 cm dbh is very far indeed from being achieved.

We have inventory data from eleven surveys in dryland Dipterocarp forest in Kalimantan and Sumatra and from one peat swamp forest in Kalimantan. These are randomly selected in the sense that they were not chosen with this current paper in mind ; they just happen to be the only data available. These data are summarised on the table 21 overleaf.

Table 21 : Nucleus Trees : stems per hectare

PROVINCE	KALIMANTAN					SUMATRA	DRYLAND DIPTERO CARP FOREST	K'TAN
CONCESSION	DYAK BESAR VINCENT	DYAK BESAR VINCENT	PT BASUIMEX	PT RIMBAYU BARITO	PT BASUIMEX	KERUING SAKTI		PT KAHAJAN LUMBER
Area surveyed, ha.	21,000	3,000	95,000	500	3,400	110,000		3,500
% of sample	20	5	5	20	5	0.18		100
Purpose of survey	5 Year Plan	AFP 1989	5 Year Plan	AFP 1989	AFP 1989	Recon- naissance		Peat swamp AFP
SPECIES							Mean	
<u>I. Current commercial spp</u>								
<b>A. Light Hardwoods</b>								
Mesanti	3.34	3.78	1.43	1.18	0.93			2.19
Mersawa		0.03	0.08		0.01			
Ramin			0.05		0.02			24.75
Geronggang		0.02	0.06		0.01			
Jelutong	0.01	0.06	0.03		0.04			1.41
Nyato			0.02		0.01			
<b>B. Medium Hardwoods</b>								
Kapur		0.22	0.14		0.48			
Keruing	0.02	0.12	0.34	2.15	0.01	1.04		
Nyerakat	0.07	0.12	0.14		0.03			
Kempas					0.01			
Menggris	0.02							
<b>C. Heavy Hardwoods</b>								
Bangkirai	0.13	0.18	0.35	1.08	0.04	1.20		
Belian	0.18							
<u>II. Other Species</u>								
<b>A. Light Harwoods</b>								
	1.37	1.45	0.25	3.01	0.29	3.05		3.11
<b>B. Medium Harwoods</b>			0.13		0.07	2.90		
Fruit trees	0.04	0.06	0.03		0.01			
TOTAL	5.18	6.04	3.05	7.42	1.96	8.22	5.31	31.46
All species 20cm and up	21.55	19.64	20.37	n/a	13.23	n/a	n/a	61.46



Table 22 : EXAMPLES OF FOREST SURVEY RESULTS ON SIX CONCESSIONS TOTALLING 1 070 000 ha

	KLI KALIMANTAN BARAT			HALISA			PARAKANTJA DJAYA RAYA			TELAGBAKTI PERSADA			RISAMA INDAH FOREST Ind			GAMAMULA RAYA		
CONCESSION AREA (ha)	177 000			100 000			80 000			91 000			425 000			197 000		
DIAMETER CLASS (cm)	35-49	50-59	35-59	35-49	50-59	35-59	35-49	50-59	35-59	35-49	50-59	35-59	35-49	50-59	35-59	20-49	50-59	20-59
. Dipterocarp. floater .....	2,70	1,69	4,39			6,67	4,28	2,46	6,74	3,59	2,11	5,70	0	0	0	4,38	1,28	5,66
sinters .....	2,01	1,21	3,22			1,37	1,18	0,63	1,81	0,44	0,21	0,65	0	0	0	1,96	0,42	2,38
TOTAL Dipterocarp. ....	4,71	2,90	7,61			8,04	5,46	3,09	8,55	4,03	2,32	6,35	0	0	0			
. Non-Dipterocarp. floater .....	0,92	0,76	1,68			2,33	0,75	0,37	1,12	1,56	0,82	2,38	0,61	1,15	1,76	1,37	0,26	1,63
sinters .....	1,01	0,45	1,46			1,25	3,76	2,10	5,86	2,95	1,54	4,49	1,10	1,45	2,55	0,66	0,12	0,78
TOTAL non-Dipterocarp. ....	1,93	1,21	3,14			3,58	4,50	2,47	6,98	4,51	2,36	6,87	1,71	2,60	4,31			
TOTAL export-species .....	6,64	4,11	10,75	6,91	4,69	11,62							1,71	2,60	4,31			
. Non export-floaters .....	0,71	0,38	1,09			0,84							0,29	0,21	0,50			
sinters .....	1,23	0,44	1,67			2,39							0,20	0,15	0,35			
TOTAL non-export .....	1,94	0,82	2,76	1,94	1,28	3,23							0,49	0,37	0,85			
TOTAL COMMERCIAL .....	8,58	4,93	13,51	8,86	5,97	14,85	9,96	5,56	15,52	8,54	4,68	13,22	2,21	2,98	5,17	12,59	2,81	15,40
. Other species : Floaters .....	1,10	0,66	1,76	0,64	0,31	0,96	0,96	0,51	1,47	4,25	2,88	7,13	0,60	0,66	1,26			
Sinters .....	4,26	1,76	6,02	2,89	1,57	1,84	1,84	0,80	2,64	0,68	0,16	0,84	0,90	0,95	1,85			
TOTAL .....	5,36	2,42	7,78	3,53	1,89	2,81	2,81	1,30	4,11	4,90	3,04	7,97	1,51	1,61	3,11			
GENERAL TOTAL	13,94	7,35	21,29	12,39	7,87	19,28	12,77	6,86	19,63	13,44	7,72	21,19	3,72	4,59	8,31			

In these samples in dryland Dipterocarp forest the stocking of nucleus trees 20 - 49cm dbh ranged from 1.96 to 8.22 trees per hectare with an unweighted mean of 5.31.

This is a far cry indeed from the minimum of 25 trees per ha. prescribed as the minimum required before the TPTI System may be operated.

The consistency of these data is remarkable, and they include moreover all species which reached 20cm dbh in the surveys. We have grouped species which are currently non-commercial as "II Other Species", and ideally these should be deducted from the total ; to do so, however, would make no difference to the conclusion which must be that these forests cannot support fellings under the TPTI system.

It should be noted that these surveys form part of working plans approved by the Forestry Department and that the forests covered by them are currently being worked under the TPTI system!

The peat swamp forest at Kahajan Lumber in Kalimantan shows a very different picture due to the presence of Ramin. It is well-known that Ramin forests tend to contain a good representation of age classes and these forests could clearly be worked under the TPTI system.

We also provide in Table 22, data coming from 6 green books forest inventories in Indonesia. These show that the total number of trees per hectare of commercial species of diameters between 35 and 49 or 59 cm is always under 20. Under these conditions, it seems hardly possible that the TPI should be applicable.

Other authors have expressed concern at the inadequacy of nucleus tree stocking compared with TPTI targets ; see p. 109 of DGFU/FAO (1990) Vol. 2. Forest Resource Base.

The conclusion must be that on the evidence before us as regards both stocking of nucleus trees and their increment, the TPTI system is not sustainable on a cycle anywhere approaching 35 years.

#### 434.3 The economic implications of the TPTI System

FAO has examined the TPTI and a variant of the Malayan Uniform System to determine which is financially or environmentally more attractive. The findings are that the so-called Uniform System (which in this case is a Clear Cutting System, not a true Uniform System which is a Shelterwood System with a relatively long regeneration period and several fellings per rotation) is financially more attractive than Selection working, though this conclusion is sensitive to economic assumptions (e.g. changes in timber prices or discount rate).

Note : In the summary of the FAO findings in source 5, p. 13 it is also stated, surely erroneously, that the post-harvest value of forest worked under the MUS is low, it produces a second stand of less valuable species, and that there has been widespread conversion of logged areas to agriculture on the grounds that they have no further economic value for timber production. The Malayan Uniform System is essentially the removal of the timber stand in one operation, from over established regeneration. Whether regeneration is present or not depends primarily on seed years, which occur at intervals of 4 or more years and, while seedlings may be brought on by underbrushing, if left untended in virgin forest the vast majority die out before the next seed year. The timing of the operation of timber removal is thus vital, and if the stand is removed when there is no or little regeneration the seed source is lost and the forest becomes impoverished.

For political and commercial reasons Malaysian Foresters have, during the last few decades, lost the power to control the timing of the opening of the forests to exploitation, and it is this, not the failure of the MUS, which has led to regeneration failure and the alienation of worthless logged-over forests.

The situation has been exacerbated by re-logging of worked forest as markets became less discriminative and working areas increasingly difficult to obtain. The Malayan Uniform System, a Clear Cutting system, thus possesses the great defect of inflexibility, but a true Uniform System or Shelterwood Compartment system such as the Regeneration Improvement Felling (or RIF System) practiced before the War in the Peninsula, does not, due to its longer regeneration period, have this defect.

The World Bank further states that regardless of the system used, at discount rates of 6 % or 10 %, the more timber that is removed from the area in the first year the more financially attractive the Net Present Value.

Felling with no regeneration costs is (not surprisingly) more attractive financially than a nominal investment in restoration of the forest.

This may explain the Concessionnaires' disregard for timber destruction in the initial logging phase and that a change in concession length may not be sufficient to modify Concessionnaires' behaviour.

#### 434.4 Is the TPTI a satisfactory medium for implementing selection fellings ?

The system has many of the elements required to regulate selection fellings with the following exceptions :

- a) The question of recruitment of young regeneration is inadequately addressed.

As shown by Uebelhor et al (1990) the trees to be harvested at the third cut must already be present at the time of the virgin forest exploitation and the system has no mechanism to ensure that this is so.

- b) The cycle, nucleus tree stocking, and expected increment are incompatible.

The solution must be a considerable lengthening of the cycle.

- c) There is no list of preferred, acceptable and non-commercial species.

This will clearly vary from forest to forest but there is an urgent need for a statement of which species are acceptable as nucleus trees and also which the Concessionnaire is obliged to remove and which he may remove at his option.

- d) There is no provision for stand monitoring by means of CFI plots.
- e) Undue reliance is placed on planting to redress regeneration failure.

The history of enrichment planting in poorly regenerated Dipterocarp forest is largely one of failure, due often to inadequate release and tending. Much planting of landings and roadsides is little more than cosmetic.

#### 434.5 Is the TPTI system as published being satisfactorily implemented ?

Our comments relate to the period up to the end of 1991 ; there may well have been great improvement since then. The major areas where implementation was unsatisfactory were :

- Use of the System where the pre-felling inventory showed a grossly inadequate stocking of nucleus trees.
- No marking of nucleus trees.
- No post felling inventory to assess survival of nucleus trees.
- Scattered selection of coupes, leading to creaming of the forest.
- ReLogging permitted.
- Lack of post-harvest tending.
- No directional felling.
- No pre-survey of skid trails.
- No maintenance of roads after exploitation.
- No control of erosion after exploitation.
- Excessive felling and yarding damage.
- Coupe boundaries not re-instated after exploitation.

#### 434.6 Can a better System be devised ?

Any new system must take account of the following :

- a) Removal of the whole timber stand in one operation cannot be relied upon to regenerate the forest.
- b) Advantage must be taken of intermediate sized commercial species where they occur and they are vigorous and free of serious defects.
- c) The system must not be unduly sensitive to felling and extraction damage.
- d) Undesirable species and defective individuals of desirable species must be removed along with the commercial trees.
- e) Yield control should be divorced from silviculture.
- f) Light demanders should be favoured.
- g) The felling cycle should be long enough to prevent constant disturbance of the ecosystem.

- h) As a corollary to (a) use should be made of more than one seed year before removing the seed source.

In Sources 1a, p. 113 et.seq. and 1, p. 21 et.seq. DGFU/FAO have made recommendations for an improved system which agree to a remarkable degree with our own opinions. These recommendations, with our comments, are as follows :

- a) Seedling regeneration should form the basis of the new stand. This implies the adoption of a 60 year rotation and cutting cycle.

Comment : we agree wholeheartedly with this. But seedling regeneration does not "just grow" ; it has to be induced and tended. This will involve some form of under-canopy manipulation to follow seed-years so that regeneration is released sufficiently in forests programmed for felling within the next 5 - 7 years to enable it to survive until released finally by the felling. The cycle of 60 years is adequate ; Burgess and Laurent (1989) only suggested a 70 year cycle since it fits in with two 35 year cycles under the old TPI System (see source 1a, p.113).

- b) All sound trees of good form and species known to reach timber size (i.e. 50 cm dbh) to be retained in the residual stand. These are to be a "bonus" and if they occur in sufficient stocking over a considerable area the cutting cycle may be reduced.

Comment : Agreed. But an acceptable species list is required, since, for example, it would be most undesirable to retain Rengas (which has an irritant sap), or Eugenia (which is very hard wooded and slow growing) though both reach timber size. There are many other examples of undesirable species. The only practicable way to implement a reduction in the cutting cycle is to reduce it only where a whole compartment (or a substantial sub-compartment) has a good stand of advance growth and then to allot such compartments to a second felling cycle which is one half of a complete rotation (see (a) above).

- c) Enrichment planting and total line planting to be confined to areas designated for intensive management. Such areas must be accessible, with good soil, and planting must be with high value species, Dipterocarp or non Dipterocarp. Long term tending and release is essential.

Comment : These are precisely our views. Scattered cosmetic planting is a waste of money and the trees are rarely harvested.

- d) It is not intended that the new stands will be similar to or better than the original stand ; their composition be based on the regeneration present after logging. Proper logging practices are thus necessary to ensure that valuable natural regeneration is not unnecessarily lost through excessive logging damage. Stands outside the intensive forest management areas referred to in (c) above will be managed on a minimum intervention basis ; broadly this will involve regeneration sampling followed by the prescribed treatment at about 10 year intervals.

Comment : we agree that it is unrealistic to expect a regenerated stand to be richer than the old one over extensive areas, as long as no adequate, silvicultural treatment is carried out in this purpose . To rely, however on the chance regeneration present at the time of felling is also unrealistic ; every effort should be made to improve this by monitoring seed years and by intervention to extend the life of regeneration present so that it remains available until a felling is made.

- e) Relogging between the first cut and the maturity of the new stand should be strictly prohibited.

Comment : This control is absolutely vital. There will be considerable political and commercial pressure to permit relogging as species and grade standards decline with an increasing timber shortage, and great firmness will be needed to resist it effectively.

- f) Yield control should be by area rather than by volume.

Comment : we have advocated this for many years. Volume yield control is influenced by the felling cycle (and in the TPTI this is fixed at 35 years) and it is unverifiable once the timber has left the concession, and its only merit is in ensuring a constant outturn for the Concessionnaire. In practice, even the last is illusory. Weather, labour conditions, markets, plant breakdown and many other factors affect a Concessionnaire's outturn and there is no reason, up to now, why a theoretical volume yield should be precisely fixed. The greatest merit of area control is that the area cut over can be verified on the ground for many years after felling and the coupe area depends on nothing more than the productive area of the series divided by the cycle.

There are three further matters which should be included in new silvicultural practice.

Firstly, there should be an intervention about 5 to 7 years before logging, immediately after a Dipterocarp seed year, when an undergrowth cutting or "tebas" is done to release the new regeneration and enable it to put on enough growth to reduce mortality. In this operation all undergrowth, except regeneration of desirable trees, is cut with a "parang" (anything which cannot be so cut is left), all stemless palms are cut and all lianes cut in two places. The main reason for cutting lianes is to reduce felling damage later.

Secondly, all treatments other than that described above should be preceded by a diagnostic linear sampling using 10 m x 10 m units in continuous strip plots and recording all sizes of regeneration from seedlings to trees (but only the largest or the most desirable species on each unit) together with the treatment, if any, required for its release.

Thirdly, at the time of the pre-felling inventory permanent Continuous Forest Inventory (CFI) plots should be laid down and enumerated and these are then treated in exactly the same way as the rest of the compartment and remeasured at 10 year intervals to enable total stand increment to be assessed.

A further point concerns marking trees for felling. Each tree is numbered serially above and below the felling cut. The TPTI rules prescribe also the painting of an arrow on the tree pointing to the direction of fall. Usually the Concessionnaire uses a zinc number tag, often inserted into a "parang" cut on a buttress, and these are intended to be collected by the faller as evidence that he has found the tree and felled it.

In Peninsular Malaysia the system is, or was, further elaborated by the use of a secure hammer-mark above and below the felling cut to prevent unauthorised tree marking by a contractor or faller.

The marking system can be improved and simplified by accepting the convention that all marks are placed on the side of the tree opposite its prescribed direction of fall ; this ensures that the marks remain visible after felling and are not obscured by the felled bole. The upper number should be in paint and be emphasised with a paint cross. The lower number remains on the stump and is on a zinc tag which hangs on a two inch wire nail. These tags are prenumbered using a hammer and numbering punches, the tags being slung on a wire in numerical sequence before being taken to the field for use. The tags should not be removed from the stump by the faller ; they are there to enable the felling to be verified by Forestry Department staff.

#### Newly proposed silvicultural system

To sum up, the proposed silvicultural system is as follows :

#### **Year**

- |                |  |
|----------------|--|
| F - 5 to 7     | After a seed year, undergrowth cutting and climber cutting.  |
| F - 1          | Marking of residual trees (advance growth 20 - 49 cm dbh) and trees for felling 50 cm and up. Survey and demarcate skid trails. Lay out CFI plots.   |
| F              | Fell and extract marked trees.   |
| F + 1/2        | Plug erosion gulleys and repair drainage on abandoned roads.   |
| F + 1/2 to F+1 | Linear sampling on 10 m x 10 m units, recording also residual trees marked for retention and any damage to them. Treat to release regeneration as indicated by survey. Re-enumerate CFI plots. |
| F+10 + 20 etc. | LS 10m x 10m and treat as indicated. Re-enumerate CFI plots.   |
| F+35           | Intermediate fellings if sustainable.  |
| F+60           | Second felling.  |

#### **44 - Responsibilities and rights of Forestry Department vis a vis concessionnaires and the local population**

The legal framework for Forestry is fully described in Source 3 Chapter 27. The following is a summary of the main provisions.

The Constitution of 1945 is the supreme law and source of law in Indonesia, and the activities of the Forestry Department are regulated by the Basic Forestry Law of 1967(BFL).

Decisions by the Minister of forestry to implement the BFL are promulgated by Ministerial Decision (SK, or "Surat Keputusan Menteri").

A Ministerial SK may in turn delegate authority to the Directors-General (for example the Director-General of Forest Utilisation) who then issue their own SKs which are generally detailed documents on the procedures and internal departmental administrative requirements for carrying out a given policy.

Some SKs delegate authority to Regional Forestry Officers ("KANWIL") while some Statutes and Regulations (issued by Central government under the Constitution) may delegate authority to the Provincial Governors who control the Provincial Forestry Services ("DINAS KEHUTANAN").

Forest production policy is relatively centralised.

#### 441 - Basic forestry law :

The BFL sets forth the basic tasks of Government concerning forest management :

- . Determining, organising, and planning the purpose, supply and use of forests according to the interest and benefit of the State and population.
- . Managing the forest in a broad meaning.
- . Determining and arranging the legal relationship between people or legal entities with forests and managing legal activities on forest lands.

The BFL, having delegated authority over forests to the Minister, specifies in Article 9 the following areas of activity and authority for the Ministry :

- . Protection, production, cultivation, regreening and maintenance of forests.
- . Management of conservation and recreation forests and flora and fauna.
- . Forest Inventory.
- . Forest research.
- . Extension and training.
- . Implementation of Government Regulations and/or Ministerial and other SKs which have been promulgated over the past two decades for all these areas of activity.

The BFL allows forest land to be classified as official forest areas by Ministerial Decree, providing the areas with spatial and legal tenure.

Permanent forests are divided into protection, production, nature conservation and recreation forests.

Various subsequent regulations provide for, amongst other matters, a Consensus Forest land-use Plan for each Province.



Forest protection and security are governed by Government Regulation 28/1985 which requires forest protection measures to be undertaken by the State, and subsequent regulations provide for increased State control over human activities in forest areas, especially for people living in, or on the borders of, forest areas.

#### 442 - Forest production

The BFL provides the framework for forest production and subsequent government Regulations which provide specifically for the harvesting and management of production forests, mainly through the issuance of Rights to Exploit Forest ("HPH") or Rights to Collect Forest Produce ("HPHH").

The former are forest concession agreements while the latter were small licences issued by the Provincial Forest Service for areas up to 100 ha. and for up to two years ; the provision to issue "HPHH" was revoked in January 1989.

The requirement for the application, observance, and renewal of Concession agreements (e.g. submission of 20 year, 5 year and annual working plans, submission of inventory, production, log transportation, and a host of other reports, and proposals for planning, construction and maintenance of roads, other infrastructure and facilities, etc.) are described in the concession agreements and in various Government Regulations.

Forest revenues are collected from charges established by various Government Regulations.

They include :

- . Concession Licence fee.
- . Land and improvement tax.
- . Forest products royalty.
- . Reforestation fee.
- . Scaling and grading fee.
- . Sawn timber export tax.

#### 443 - Customary ("Adat") Law

Many concession areas are also under previous or existing customary (adat) rights.

These include :

- . Rights on specific trees, both tended and growing wild and other forest resources (e.g. hunting and fishing rights).
- . Rights of use in land utilised currently or in the past for long-fallow shifting cultivation.
- . Commercial "right of disposal" over land held to be the homeland and property of a particular group or community.

The place of these "adat" rights in relation to forest concessions is unclear under the law.

The Basic Agrarian Law of 1960 holds that "adat" Law is valid so long as it does not conflict with national law and policy. Legal policy on "adat" has, however, never been elaborated in regulations implementing the Basic Agrarian Law.

In any case, land and resource tenures in forest areas have been governed exclusively by the Basic forestry Law since its passage in 1967, which states that :

"All forests in the territory of the Republic of Indonesia are controlled by the State (which therefore has the authority to) specify and determine legal relations between individuals and the forest.

The enjoyment of "adat" rights, whether individual or communal to exploit forest resources directly or indirectly may not be allowed to disturb the attainment of the purposes of this law."

Article 6 of Government Regulation 21/1970 concerning the rights to exploit forest (HPH) and the (now revoked) rights to collect forest produce (HPHH) covers "adat" rights in HPH areas but makes no mention of compensation, i.e.

- i) The rights of the "adat" community and its members to harvest forest products shall be organised in such a manner that they do not disturb forest production.
- ii) Implementation of the above provision is delegated to the Company which is to accomplish it through consensus with the "adat" community, under the supervision of the Provincial Forestry Service.
- iii) In the interests of public safety, "adat" rights to harvest forest products in a particular area shall be frozen while forest production activities are under way.

A 1988 SK, related to HPH says only that :

"The right of local communities to harvest forest products under local "adat" law remains valid within the HPH area and must be respected by the Company.

The Company is responsible for all damages to property held under rights (other than the HPH, within the HPH area), whether personal or other rights, of land ownership."

SK 54/1975 concerning Guidelines for HPH Work Area Border Demarcation, states that "the demarcation of HPH work area borders does not affect rights of third parties within the HPH work area".

However, which "other rights" are recognised, and the latitude of the term "harvesting forest products" are unclear under both the SKs related to HPH and other applicable laws and regulations.

At least some "adat" rights are clearly recognised as indicated by Presidential Instruction 1/1976 on the Synchronisation of Implementation of Agrarian Affairs with the Forestry, Mining, Transmigration and Public Works Sector, i.e.

" Where a piece of land (intended as part of an HPH) is controlled by the local "adat" community under a valid right, that land must be cleared (of those rights) at the outset with the payment of compensation. Where the holder of an HPH needs to close off an area with the result that the local community cannot enjoy its "adat" rights, the HPH holder must give compensation to the community".

As with the laws discussed above it is not clear what constitutes a "valid right" under this instruction.

Government policy on shifting cultivation is directed wholly at stamping it out and it is unlikely that such "adat" rights are protected.

Indeed, the SK related to HPH states that the Company has a duty to "prevent and stop encroachments by other parties that degrade the forest within the work area including, inter-alia shifting cultivation and unauthorised cutting."

Communal rights over unused land are not given much weight under Government policies. As noted above, broad Government policy holds that "adat" must not be contrary to the national law or the interests of the State.

Indonesian scholars have taken this to mean : first, that "adat" is secondary to the sovereignty of the State and exists only by its authorisation : and second, that "adat" may not serve to thwart national economic development, particularly in the assertion of communal rights over unused land.

Compensation is, however, sometimes paid for rights over unused land and for standing trees (most typically rubber and fruit trees). Where the State disposes of land subject to such rights in favour of a third party (such as an HPH holder), the third party sometimes pays compensation known as "recognition" to the "adat" community. It has, however, been noted that the payment comes from the new proprietor and is not compensation for loss of ownership, for none exists legally. It is a payment for loss of the (future) right to dispose. This payment is in no way sanctioned by any law, but it is a matter of practical necessity and is always made.

Compensation is also sometimes paid for adat-held trees, again as a practical necessity in view of the potential cost of hostile relations with the surrounding community. Such payments are a matter of expediency, not law. National law gives no clear directives on the obligations of the HPH holder to the "adat" community and its rights in forest lands and resources.

The laws and regulations pertaining to the right to collect non-timber forest products are unclear.

While the rights of local communities to collect forest produce from State forests are generally recognised, their implementation is always subservient to the interests of the State, and subject to a consensus meeting between the local community and concession holder under the guidance and supervision of the Provincial Forestry Service. Although the concession holder is required to grant the request to collect forest produce from his concession area, the mechanism and procedure for convening and conducting such a meeting have not been described and it has been observed that such meetings have rarely, if ever been held.

Part of the ambiguity may have been due to the use of the term "forest products" and not separate the term into its components (e.g. logs, rattans, resins, etc.) or the end users of the products collected (e.g. for own use or for sale). While customary rights may be intended to allow forest products to be collected for "own use" it may be argued that selling of the products collected to supplement one's income falls within the definition of "own use". The question of scale of collection and sales then arises.

FAO urges that the issue of rights to collect forest products requires resolution urgently and fairly.

#### **45 - Planning of operation, and cost analysis**

##### **451 - Working plans**

An elaborate system of Working Plans is prescribed under the Concession Agreements.

The Working Plans prescribed are :

- . A 20 year Working Plan ("RKD"), covering the entire period of the Concession.
- . 5 year Working Plans ("RKL").
- . Annual Working Plans ("RKT"), including an estimated annual budget of funds to be spent on forest management.

These Working Plans are to be in a form prescribed by the Forestry Department but the preparation of the Plans is by the Concessionnaires' technical forestry staff. The Plans are to include provisions relating to forest management as well as to forest exploitation and are to be prepared in the light of the latest scientific knowledge and advances in forestry. The Plans are to be based on forest inventory and include a division of the forest into blocks to prescribe the annual felling area, the method and standards of utilisation and extraction, the requirements for forest protection and silvicultural measures to be applied.

##### **The 20 year plan**

We have seen only very few of them. It is a complex document in Bahasa Indonesia and is not now available for reference ; it is understood that these Plans are no longer required by the Forestry Department.

#### 451.2 Five year plan

Such a plan is to be prepared within two years of the granting of a Concession agreement. These Plans consist of :

- (a) General physio-graphical description, allocation of forests to silvicultural systems, division into 5 year Working Plan areas and 100 ha. blocks.
- (b) Description of the forest. Forest types and inventory data.
- (c) Objectives : management, silviculture, socio-economic.
- (d) Regulation of yield by 100 ha. blocks, working rules, felling, bucking, skidding, loading methods and plant to be used, annual allowable cut and diameter limits, cutting targets for each year of plan.
- (e) Logging and Utilisation Plan. Blocks to be worked each year, expected harvest, annual operations plan for roads, both construction and maintenance, log transport, scaling, log pond arrangements, log production by species and size, details of milling plants.
- (f) Timber stand improvement. Post-harvest inventory, proposals for stand treatment and enrichment planting.
- (g) Procedure for plan modification.
- (h) Details of the Company, its affiliates, and major shareholders.
- (i) Summary of 20 year Plan.
- (j) Distribution of production for 5 year period by species.

#### 451.3 The Annual Working Plans :

These are based on 100 % inventory of the annual coupe. They include information on the Company and its affiliates, location of the concession, its area, annual allowable cut (maximum and minimum), objectives of 5 year plan, area to be worked, volume to be produced, precise location of coupe, results of previous year compared with targets, summary of inventory results, targets for current year road building, mapping, blocks to be cut, inventories, production by species, manpower, equipment (logging and milling). There is also an organisation chart of the Company, a statement of the previous year's logging, a statement of the composition of the cruising Teams and their equipment, list of foresters, and list of equipment.

#### 451.4 Comments :

The Working Plans for both 5 year and annual periods are prepared in a standard format and much of the information is reproduced from standard sources and is well-known. There is much duplication between the two kinds of Plan and they really make very uninspiring reading.

Obviously there must be some standardisation in Working Plan format but these Plans could be simplified a great deal by recording much of the background information once and for all on a standard data sheet, which would not be part of the Plan, and reducing the annual plan to a simple tabular summary of the year's proposals.

The annual plans for some 500 concessions are submitted to the Forestry Department every year for approval and presumably analysis, but it does seem that this is little more than a rubber-stamping operation ; We have seen at least ten plans where approval has been given to working on the TPI System while the plans contain inventory data which clearly proves that such fellings are unsustainable and contrary to the rules of the System.

#### 452 - Costs

As in most countries, concessionnaires in Indonesia are extremely reluctant to disclose information on costs.

D. Laurent conducted a comprehensive study in 1981 in both dryland and swamp forests of Central Kalimantan, the main results of which were published only several years later (source 55, 56, 57 in bibliography).

A study by Cossalter (1991) of the operations of a logging company at Tarakan in North-eastern Kalimantan, producing 125,000 to 160,000 m<sup>3</sup> per year (75 % floaters) is thus of very great interest.

The Company, in 1989 and 1990 worked an average of 3,258 ha. per year and total log yield averaged 43 m<sup>3</sup>/ha. Yarding is by tractor to company-built logging roads and average road haul is about 40 km to the river. Logs are rafted, or if sinkers transported by scow, some 120 nautical miles to Nunukan where they are loaded on ship for transport to Java mills.

Average costs varied between US\$ 52 and 55 per m<sup>3</sup> on board, ready for transport (including fees and taxes).

This is made up as follows :

Production costs	47.00 to	50.00/m <sup>3</sup> delivered at log pond for sea transport
Ship loading and transfer	2.00	2.00/m <sup>3</sup>
Jakarta overheads	3.00	3.00/m <sup>3</sup>
US\$	52.00	55.00/m <sup>3</sup>

The study also examined the cost of production of pulpwood from the relic stand in logged-over forest in Sumatra which is clear-felled for plantation establishment.

The work is carried out by small contractors, material being harvested in 2 m long bolts. Longer trees are skidded by tractor, but smaller material is either carried or rolled manually, or extracted by manual skidway ("Kuda Kuda") to roadside ; one contractor uses a wheeled skidder. The mean volume extracted was 80 m<sup>3</sup> solid measure over bark/ha. Transport is by 5, 8 or 13 ton two axle trucks, loading and unloading being carried out manually. The average road haul to mill was 120 km.

The costs were :

Felling, extraction and loading	US\$	3.00/metric ton
Construction of spur road	"	1.00 " "
Transport by road	"	8.00 - 11.50 " (depending on distance)

In more intensive operations using Clark Ranger F666 Wheeled skidders, Bell Ultra Logger pre-bunchers/loaders, TDT55 tracked skidders, Oiong/Taiwan 90 kw 3 drum yarders, or Clark F668 wheeled skidders, it was, predictably, found that ground skidding was cheaper than cable yarding.

Average direct costs in the intensive operations were :

Felling	US\$	0.84 per metric ton
Extraction	2.13	"
Cross-cutting at landing	0.61	"
Stacking	1.16	"
Loading on truck	0.50	"
Unloading and stacking at mill	0.34	"
Total	US\$	5.58 per metric ton

Lower costs of small contractors are attributed mainly to creaming the forest. It is estimated that other costs, including road construction and maintenance, planning and administration, workshops, taxes and fees amount to US\$ 7.80 per metric ton, making a total cost of US\$ 13.60 plus truck transport.

In addition to the above studies, FAO (Source 2, p. 166) quoting an MOF study in 1987, give the following breakdown of total costs in a large integrated sawmill in Riau, Sumatra :

Table 23 : Percentage of total Production cost of sawn-timber, by item

	Logs	Other materials	Labour	Admin	Maintenance	Depreciation	Other
%	58.0	16.0	13.0	8.0	0.9	3.2	1.5

There are no direct costs for power : presumably this is derived from mill waste.



## 5 - EXPLOITATION AND TRANSPORT OF WOOD

### 51 - Preparatory Works

#### 511 - Mapping

There are no government topographic maps of concession areas.

A basic reconnaissance inventory has been carried out of many such areas, at intensities generally less than 0.5 % , and the results promulgated in "Green Books" ; but these do not include topographic maps.

The Concessionnaires are obliged to produce full air survey cover of their concessions at a scale of 1:20,000 and vegetation and topographic maps at 1:20,000 within 2 and 3 years respectively of the issue of the Agreement.

In practice, it has rarely been possible to comply with this requirement due to cloud cover and other difficulties.

Maps of current workings at acceptable scales are, however, generally produced to support applications for coupe.

#### 512 - Forest Inventory

Apart from the "Green Book" reconnaissances mentioned above, all forest inventory is undertaken by the concessionnaires.

These inventories are obligatory for the preparation of working plans and are :

- 2 % intensity for 20 year overall planning
- 5 % intensity for 5 year management plans
- 100 % intensity for Annual working plan.

Regeneration is also sampled :

- 1.5 % intensity for seedlings.
- 1.25 % intensity for saplings.
- 2.5 % intensity for poles.

In practice only the 5 % and 100 % inventories are consistently carried out.

### 513 - Collection of other data

Climatic data are not regularly collected in concession areas ; rainfall at least should be monitored.

Growth data are also not collected on a regular basis ; a series of CFI plots is needed.

Log production data are reported for the previous year in the annual Working Plans.

No economic data is provided (production, transport, ... costs, losses, benefits, debt,...)

### 514 - Working Plans (See section 451)

### 515 - Control of working

Reports of each year's operations are made by the concessionnaires in the subsequent year's Annual Working Plan, and compared with the targets set ; these include worked over area, roads, log production by species, planting, inventory. Field inspections are made by Forestry Department staff, but we have little information on how effective these are.

In general it cannot be said that control over concessionnaires' operations is adequate, but the size of the problem (over 500 concessions) must be borne in mind when assessing this.

## 52 - Infrastructure

### 521 - Siting of camps

It is usual to have one camp at the rafting point where the main extraction route reaches the river, and a main forest camp near the centre of logging operations.

Small camps for cruisers (temporary, using fly sheets or temporary huts), fallers and sometimes road construction teams (rather more permanent, with barrack-type accommodation) are usually established nearer road head.

These camps do not usually have any substantial impact on the environment.

### 522 - Mills are usually in towns or at riverside

They may cause some river pollution from bark and mill waste, and in towns with fly-ash from boilers ; they have no impact on the forest.

### 523 - Main access routes

These are almost always roads.

Main roads will have a cleared width of 30 m, with the actual road formation 10 m wide. Secondary roads are daylighted to 22 m with a 6 m formation. The building of these roads causes a considerable amount of disturbance to the environment and adequate care is rarely taken over the disposal of loose fill down hillsides.

Lack of adequate survey leads occasionally to re-alignment of roads being necessary and poor choice of river crossings can be a major source of environmental damage.

Ponding due to the use of small hollow logs as culverts is common.

Maintenance of road drainage after extraction has ceased is virtually non-existent.

All these matters need tighter control by both Concession management and the Forestry Department.

### 53 - Actual exploitation

#### 531 - Coupe issue and control

Coupes are only issued after approval of the Annual Working Plan which must be supported by 100 % inventory.

A major criticism of coupe issue is that Concessionnaires tend to select coupes in good forest, not necessarily contiguous with the previous year's workings and this leads to 'creaming' of the forest.

Good forest and poor forest must be worked together and, in any but the flattest forest, each drainage must be worked systematically to its headwaters or to the limit of the productive forest. The desirability of imposing area control rather than volume control has been discussed in Section 43.

Coupe boundaries in general follow block boundaries except where parts of blocks only are included due to topographical difficulties, presence of protected areas, or lack of coupe availability.

#### 532 - Felling is controlled by block boundaries

Cossalter (Source 9) records that three to four felling gangs operate at the same time in each 100 ha block, which implies a felling block size of about 25 ha.

This is a very large size for a felling block ; in Sabah the major Concessionnaires limited felling blocks to about 5 ha in order to achieve full exploitation and adequate control.

For reasons of safety it is essential that only one gang of fallers is allowed in a felling block (which must be clearly demarcated with painted trees on a cut line) and that fallers work in pairs.

Cossalter (Source 9) records that fallers in East Kalimantan achieve a productivity of 800-900 m<sup>3</sup>/month/gang.

Directional felling is necessary, see 533 below.

### 533 - Yarding

Yarding is almost always by Crawler tractor equipped with a winch and about 70 m of cable, usually D7 or its equivalent (about 200 hp).

Except for clear felling for plantation development cable yarding is forbidden in Indonesia.

Wheeled skidders have been tried on many occasions but have not, over the long term, proved popular.

Yarding distance with tractors varies from 500 to 750 m, or occasionally, 900 m.

Where the terrain is not too steep logs are yarded as tree lengths, the logs being bucked by chain saw at the landing.

In general, tree length yarding causes less damage than yarding short logs without chokers since it reduces the number of passes along the skid trail ; in steep sidelong ground (which is more and more frequent), however, tree length yarding may cause excessive damage on the downhill side due to the log rolling.

Logging arches have been tried in many operations, but they reduce the ability of the tractor to manoeuvre in thick forest on steep slopes to an unacceptable extent.

Damage to regeneration can be greatly reduced if the skid trail is carefully laid out after marking for felling, and directional felling imposed, so that the trees lie in a herringbone pattern alongside the skid trail ; they can then be yarded without being turned.

### 534 - Landings

Landings must be carefully sited and be well drained. The maximum size of landings is limited by forestry Department regulations and their siting also theoretically requires approval. The need for the control of their size is doubtful ; no operator will spend money clearing unnecessarily large landings.

### 535 - Loading

The wheeled front-end loader with a log grapple has replaced all other loading methods. The plant is mobile, can serve more than one landing and can be moved to pick up lost loads on the logging road system.

It does, however, cause damage to landings, especially in wet weather, hence the requirement that they be sited where good drainage can be assured.

### 536 - Hauling

Skid trails reach as far as landings which are at the limit of the road system where log trucks can operate.

Road hauls, on company-built roads vary widely from 70 km or more down to a few kilometers ; a fairly usual value might be about 40 km.

The large American log trucks, Pacific, Kenworth and others used in Sabah and the Philippines, with a GCW of about 158000 lbs. (70 tons), engines of 250/335 bhp and carrying some 55 m<sup>3</sup> of logs are now rarely used in Indonesia, largely because of their high initial cost.

The Concession Agreements forbid the use of second-hand plant, thus the many good trucks of the above kind available in Sabah and the Philippines as logging operations cut out could not be used in Indonesia.

Rather similar and more lightly-built trucks, Renault, Mercedes, Volvo and Nissan with 260/280 bhp engines, have therefore been used and these often carry loads of over 45 m<sup>3</sup>, but their operating life is relatively short.

Non paved roads are frequent.

The utilization of roads during rainy days is not as carefully practiced as in other parts of the world. This along with the lack of adequate road building in many cases result in heavy road maintenance expenses and high utilization costs of equipment.

#### 537 - Unloading

This is generally carried out by a wheeled front-end loader, though rigs based on an A-frame to lift and dump the whole load and also super-elevated ramps to dump the load off the moving truck have also been used.

### 54 - Control of exploitation

#### 541 - Demarcation of coupes

Coupes are made up of 100 ha. blocks and the block boundaries serve to define them except where part blocks are included. In that case an extra boundary is cut.

Boundaries are demarcated as cut lines, c.2 m wide and emphasised by paint marks on bordering trees.

This work is carried out by the Concessionnaire and in theory it is checked by the forestry Department.

The coupes form the permanent compartments for future stand description.

#### 542 - Pre-felling inventory See 512

#### 543 - Marking for felling See 434

#### 544 - Selection of trees for retention See 435

545 - Planning and survey of skid trails See 435

546 - Spar trees

Not applicable in Indonesia.

547 - Feeder roads

These are generally 6 m wide between ditches with a running width of 4 m and a cleared width of 22 m (Cossalter, 1991).

A road density (main and feeder) of 9.3 km/1000 ha gives a theoretical yarding distance (if both sides of the roads are logged) of 540m, which is reasonable. The ratio of main road to feeder road should be about 1:3.4 giving ideal densities per 1000 ha. of :

Main road	2.1
Feeder road	7.2
	----- (data from Sabah Timber Co. Ltd.)
Total	9.3

Road densities observed in Indonesia show that average road network (according to the study of maps supplied by several companies in Central Kalimantan) appears to be 10 to 15 km per 1000 ha.

Main roads represent 20 to 30 % of that total network.

Figures from P.T. Kayu Lapis (Burgess & Laurent) and a logging company near Tarakan (Pt Rimba Mutiara Pertiwi)(Cossalter, 1991) show on average more main roads constructed than spur roads :

Table 24 : Road networks in forest concessions

COMPANY	CONCESSION	Main Road	Spur Road
P.T. Kayu Lapis	Telagabakti	48	15 km
		6	15
	Kalbar	150	76
	Halisa	15	23
	Sarmiento/Parakantja	158	268
	PDR	90	52
(RMK) P.T. Rimba Mutiara Pertiwi	Tarakan	17	3
TOTAL		484	452 km

It is difficult to reconcile these data ; possibly much advance main road had been built, many spur roads recorded as skid trails, or very long skid trails were used. Certainly in any well-developed logging operation the sum of feeder roads must exceed the length of main road.

Average figures for spur roads are :

. width of running surface	4 to 5 m
. distance between ditches	6 to 7 m
. width of insolated area along the road	10 to 20 m on each side of the road

#### 548 - Main roads and landings

Average figures for the main roads are :

. width of running surface	6 to 7 m
. distance between ditches	7 to 8 m
. width of insolated area along the road	15 to 25 m on each side of the road

Cossalter (1991) records a carriageway width of 10 m between ditches and 8 m wide running surface ; Sabah Timber Co. standard was 7.5 m. carriageway and this proved adequate. The impact of road construction on the environment has been considered under Section 52, as has the construction of landings.

#### 549 - Post felling inventory

This is not generally carried out ; the necessity for it is great and this is discussed in Section 43.

#### 54.10 - Imposition of penalties

We have no data on the frequency with which penalties are imposed, or on their severity, or on their deterrent effect.

This is not a matter which is generally freely discussed.

The recent imposition of very severe penalties has been discussed in Chapter 3.

#### 54.11 - Scaling

This is carried out at the log pound, by Concessionnaires' staff, and production records are submitted to the Forestry Department.

There is said to be a system of percentage check-scaling operated by the Forestry Department but we have no detailed information.

#### 55 - Transport outside the forest

This is invariably by road and rafting.

This has been considered in Sections 52 and 53.

Apart from the approval of road alignments in the 5 year and Annual Working Plans there appears to be no Government control.

Up to now, there is no necessity for Forestry Department checking stations since revenue is collected on mill output figures.

#### **56 - Post-harvest work**

The protection of worked coupes is delegated to the Concessionnaires, while Government, under the Concession agreements insists upon unrestricted public access to logging roads.

The result is predictable and it must be said that there is very little protection of worked-over coupes from either clearing for cultivation or from illegal salvage logging.

Silvicultural work is also delegated to Concessionnaires and apart from live planting and planting-up of landings and roadsides, almost no silvicultural work is carried out.

The effectiveness of the planting work is doubtful.

Logging of cull and residual trees and conversion by chain saw to planks and scantings is commonplace ; there is no demand for cull logs and short lengths from felled trees, since better material is available for the felling.

One reason for this activity is the extreme difficulty for "kampong" (= village or rural) people to obtain converted timber for house building and repair by legal means ; all small timber licences and the sawmills which depended on them were revoked in the 1980's.



## **6 - CONCLUSION AND RECOMMENDATIONS FOR IMPROVEMENT**

### **61 Policy**

- i) Detailed and coherent National Forest and Land Use Policy statements are required (Section 3.1).
- ii) A land administration and survey organisation is required to register landtitles, settle and survey boundaries and limit shifting cultivation to secondary forest (Section 3.2).
- iii) Economics of forest products production and trade should be provided to decision-makers.

### **62 The permanent forest estate and its protection**

- i) A proper reservation system with full boundary survey and legal enquiry on the ground is required for all permanent forests (Section 2.3).
- ii) Completion of the National Forest Inventory is urgently necessary to assess the true extent of the resource (Section 2.1).
- iii) Government should assume the primary responsibility for protecting the permanent forests (and especially worked coupes) from illegal cutting and clearing. The Concessionnaires should provide assistance with patrols. (Section 5.3.5)
- iv) Public access to logging roads in Concessions should be severely restricted. (Section 5.3.5)
- v) The licensing of small areas of forest and of sawmills to convert the produce should be resumed so that village people have access to legally sawn timber in order to reduce the pressure to cut trees illegally in worked coupes. (Section 5.3.5)

### **63 The exploitation and silviculture of concession areas**

- i) The decree by the Directorate of Forest Utilisation prescribing only selection and clear cutting systems in concession working should be amended (Sections 3.1 and 3.2).
- ii) The TPTI system appears to be incompatible with sustained yield management on the grounds of both expected increment and inadequate stocking of nucleus trees. An in-depth reassessment of the system should be made and if the present findings are confirmed the system should be amended to a Shelterwood Compartment system relying primarily on seedling regeneration but accepting and protecting truly commercial advance growth as a bonus (Sections 3.2 and 4.3.4).
- iii) As a corollary of (ii) the rotation and felling cycle should be extended from 35 to at least 60 years. This may not involve a reduction of outturn on a National scale since at least until 1986, the production did not exceed one half of the national annual allowable cut (Section 3.5).

- iv) Lists of preferred and acceptable species for regeneration and of obligatory and optional species for exploitation are required. These will vary from one concession to another (Section 4.3.4).
- v) Yield control should be by area, not volume (Section 4.3.4).
- vi) The sawn timber export tax should be reviewed. At present it discourages the exploitation of heavy hardwoods (sinkers) (Section 1.1.2).
- vii) Coupes must be selected systematically so that both well and poorly stocked forest are worked together, coupes are contiguous, and drainages worked out completely to their headwaters or to the limit of productive forest (Sections 3.6.2, 4.3.4 and 5.3.1).
- viii) Working plans should be simplified and be more rigorously checked by the Forestry Department before approval (Section 4.3.4).
- ix) The tree-marking rules, both for trees to be felled and for nucleus trees to be retained and protected, require proper enforcement and some amendment in detail (Section 4.3.4)
- x) Relogging before the completion of the approved felling cycle must be prevented (Section 4.3.4).
- xi) Skid trails must be laid out and surveyed before exploitation starts. Trees must, as far as possible, be felled to form a herringbone pattern along them (Section 4.3.4).
- xii) Trees should be yarded in tree lengths except in very steep sidelong ground, where chokers must be used to reduce the number of passes (Section 5.3.3).
- xiii) Felling blocks should be reduced to about 5 ha. to enhance control over fallers (Section 5.3.2).
- xiv) Road survey before construction should be improved, river crossings selected with greater care and culverts must be adequate in size to prevent ponding (Section 5.2.3).
- xv) Loose fill from road and skid trail construction must be disposed of more carefully (Section 5.2.3).
- xvi) Roads must be maintained after completion of logging, their drainage repaired and maintained, and erosion rills and gulleys plugged (Section 4.3.4).
- xvii) Felling and yarding damage to young regeneration, pole sized residual trees, and to the ground surface must be reduced (Section 4.3.4).
- xviii) Coupe boundaries must be re-cut and cleared of felling slash after completion of exploitation (Section 4.3.4).
- xix) Inventories of nucleus trees before and after exploitation must be made and Continuous Forest Inventory Plots must be established and measured (Sections 3.2, 4.1.2-5, and 4.3.4).
- xx) If intermediate fellings (at c.35 years) are to be sanctioned, the presence of adequate regeneration to supply the third cut must be verified at the time of the second cut (Section 4.3.4).

- xxi) Seed years must be monitored and regeneration improvement cuttings made to establish regeneration after them and before felling opens (Section 4.3.4).
- xxii) Post-harvest treatments to release regeneration must be carried out, based on regeneration sampling of all sizes on 10 m x 10 m quadrants (Section 4.3.4).
- xxiii) There is undue reliance on planting as a panacea for all natural regeneration failure. Planting must be properly planned and limited to areas of intensive management (Section 4.3.4).

#### **64 Administration of Concession Working**

- i) Forestry Department staff should, wherever possible, live in the Concessions which they administer and not in Jakarta or provincial towns (Sections 3.2 and 3.4).
- ii) Government infrastructure in Concessions is grossly inadequate. Forestry Department staff there must be provided with adequate housing, school and medical services, electricity and water and, above all, transport so that they are not dependent on Concession staff for their daily requirements (Sections 3.2, 3.4, 3.6.2, 4.3.4, and 5.3.1).
- iii) There should be a Government maintained Rest House in each Concession for visiting Forestry Department and other Government staff (Section 3.4).
- iv) Forestry Officers of all ranks should maintain an official diary to be submitted to their immediate superiors every month (Sections 3.4, 3.6.2, 4.3.4 and 5.3.1).
- v) Early action should be taken to commence the preparation of a Foresters' Tree Identification Manual' (Section 3.6.2).
- vi) Climatic data, especially rainfall, should be collected and recorded in all Concessions (Section 5.1.3).
- vii) Consideration should be given to the formation of a uniformed Forestry Department staff or Rangers, Foresters and Forest Guards to enforce control over concession working (Section 3.4).

## **ANNEXES**



**Annex 1****REFERENCES, SOURCES AND SELECTED BIBLIOGRAPHY**

Note : For ease of reference in the text of this Report a series of source numbers has been allocated to the references in this Appendix. Not all the publications are specifically referred to in the Report ; they are included here as a guide to further reading. Many reports, moreover, have been included in the major review by the Directorate-General of Forest Utilisation and FAO referred to as Source numbers 1, 1a, 2, 3, 3a, and 14. Some reports are confidential and have not been quoted in the text. Source No.

D-GFU/FAO, Situation and outlook of the Forestry Sector, 1990.

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**Annex 2****STATE OF FOREST RESSOURCES 1980 : INDONESIA**

<b>TOTAL LAND AREA</b> .....	181157
<b>FOREST AREA</b>	
Total broadleaved* .....	116575
Coniferous .....	320
Bamboo .....	-
Plantations .....	1918
Total .....	118813
percent of land .....	65.6
*of which :	
closed broadl. ....	118575
open broadl .....	3000
<b>OTHER WOODED AREA</b>	
Fallow .....	17360
Shrubs .....	23900
Total .....	41260
<b>TOTAL FOREST + WOODED</b> .....	160073
Percent of land area .....	88.4
<b>ANNUAL RATE OF DEFORESTATION</b>	
<b>AVERAGE 1981 - 1985</b>	
Annual deforested area .....	- 620
Percent of total forest .....	-0.5
<b>ANNUAL RATE OF PLANTATION</b>	
<b>AVERAGE 1981 - 1985</b>	
Annual plantation area .....	384

Note : areas in 1000 ha.



**Annex 3****BASIC STATISTICAL DATA ON INDONESIA**

We remind hereafter the main available statistical data on Indonesia, so as to better assess its relative position and to present its complexity and its trends.

Except otherwise indicated, the following data in this annex come from the FAO Economic data bases.

**1 - Population and demographics of Indonesia**

We indicate in the following table the evolution of the main data on demography and population regarding Indonesia since 1960.

**Table 1. Population and other demographics of Indonesia**

	1960	1970	1980	(2) 1990	1990	2000	2010	2020
					projection			
Total Population (million)	86.55	107.04	135.67	178.2	66.44	196.86	225.6	250.95
Population Growth rate (% year : exponential)	2.11	2.33	2.14	(3) 1.8	1.74	1.42	1.12	0.87
Life Expectancy (Years)	39.93	45.08	49.97	62	55.97	61.02	65.81	69.43
Infant Mortality rate (per 1000 births)	145.00	120.00	95.00	61	74.04	54.82	39.26	29.41
Rural Population (as % of total)	86.54	84.21	80.64	69	74.67	67.47	59.52	51.59
Rural population growth (% per year)	1.85	2.02	1.42		0.79	0.22	-0.27	-0.67

Note :

- 1) Future Projections are prepared by the united nations based on the medium scenarios on fertility, mortality, and international migration.
- 2) Source : world development report, 1992, world bank.
- 3) Annual growth rate, 1980-1990

## **2 - The labour force and the age distribution of population in Indonesia**

We here after indicate in the following table the evolution of the distribution of the population per age class and the distribution of the labour force per economic sector since 1965 (Agriculture, Industries, Services).

**Table 2 : Age distribution, education, and labor forces of Indonesia**

	1965	1975	1980	1985	(2) 1990	1965- 75	1975- 85	(2) 2025
Age distribution (as % of total) Age 0-14	43.72	43.81	41.97	40.42	35.8			23.0
Age 15-64	53.34	53.65	54.45	56.06	60.3			68.3
Age 65 +	2.94	2.53	3.58	3.52	3.9			8.7
Labor force available (million)	41.01	50.53	56.25	63.43				
Rate of Change ((% per year)						2.32	2.55	
Labor employed (million)								
Agriculture Labor share (%)	71.00	62.00	57.00					
Industrial labor share (%)	9.00	12.00	13.00					
service labor share (%)	21.00	27.00	30.00					

Note :

1. The rate of change in labor forces was calculated by simple arithmetic average for the period specified.
2. World development report 1992, world bank.

### **3 - Land use in Indonesia**

We indicate here after the evolution of the land use in Indonesia since 1965.

Indonesia is well endowed with arable land representing 9 % of the total area and forests covering 67 % of the country.

The food supply per capita is increasing fast (+ 35.8 % between 1965 and 1985)

**Table 3 : Land use of Indonesia**

	1965	1975	1980	1985	1987		1965-75	1975-85	(3) 1990
					area	%			
Total land area (million ha)	181.16	181.16	181.16	181.16	181.16	100			
Arable land area (million ha)	12.30	14.52	14.20	15.50	15.80	9			
- Rate of change (% per year)							1.80	0.67	
Permanent pasture (million ha)	12.50	12.26	12.00	11.85	11.80				
Agricultural land (million ha)	29.78	32.00	31.50	32.73	33.02	18			
Forest land (million ha)	123.80	122.22	121.80	121.49	121.49	67			
- Rate of change (% per year)							-0.13	-0.06	
Rate of change (Thousands of ha per year)									(4) -1000
Agriculture population per ha of arable land	5.84	5.41	5.65	5.24	5.12				
Food supply (calori/person/day)	1799.8	2156.7	2438.3	2444.1					

Note :

1. The rate of change in land areas was calculated by simple arithmetic average.
2. Agriculture area = arable land + permanent crop land + permanent pasture.
3. Source : World development report, 1992, world bank.
4. All forests : 1982-1990.

Imports of cereals (1828 millions tons in 1990) have decreased by 5 % since 1974, in spite of the population increase.

#### **4 - Main economic indicators**

We indicate in the table below the evolution over the last two decades of the main economic indicators of Indonesia.

We note that the total foreign debt represented 30 % of the GNP in 1980 and has increased to 66 % in 1990.

The foreign debt service induces a very heavy pressure on the Indonesian Economy (in 1990 : 30.9 % of the total exports of goods and services)

Table 4 : Economic indicators of Indonesia

	1965	1975	1980	1985	1987	(3) 1990	1965-75	1975-85
Gross National Product Total (million dollar)	3142.68	27340.32	70245.61	85972.37		(4) 102271		
Per capita (dollar)	30.00	210.00	480.00	530.00		570		
Per capita GNP Growth (% per year : 1965- 1990)						4.5		
Fixed investment as % of GDP)	7.79		2.75	5.60				
Growth in construction (% per year)							42.03	
Growth in consumption (% per year)							6.53	5.97
Inflation rate (% per year)							2581.03	31.14
Interest rate/lending (% per year)					21.67			
Total foreign debt - total (million dollar)			20888.20	35952.60	51865.20	67908		
As % of GNP			29.74	41.82		66.4		
Foreign debt service (million dollar)		1003.30	2809.20	5026.80	6482.40			

Note :

1. The rates of change were calculated by the simple arithmetic average over the period.
2. The monetary values are in current prices, while the growth rates are in real terms.
3. World development report, 1992. World Bank.
4. Calculated.

### **5 - Production structure of the Economy in Indonesia**

We indicate here after a table of the evolution since 1965 of the contribution of the raisons economic sectors to the total production of the country.

Its shows a sharp decrease of the contribution of Agriculture to the Gross Domestic Product between 1965 and 1980 and a relative stability of this sector since them.

**Table 5 Production structure of the Economy : Indonesia**

YEAR	1965	1975	1980	1985	(3)1990	1965-75	1975-80
GDP Contribution by sector							
- Agriculture %	55.99	30.18	23.97	23.58			
- Industrial %	12.57	32.90	41.24	29.76			
- Services %	27.90	30.13	28.19				
- Public & other %	3.54	6.79	6.59				
Gross domestic product (Bil National Currency)	6.01	30.47	72.67				
(Million US\$)	(3)5980				107290		
Per capita agri production (1000 National Currency)		0.05	0.13	0.31			
Forestry GDP (Mil. National currency)		500.00	1141	937.00			

Note :

1. The annual growth of agricultural production was calculated by simple arithmetic average.
2. The monetary values are in the current price.
3. World Development Report, 1992. World Bank.

## **6 - External trade of Indonesia**

We indicate here after a table of the evolution since 1965 of the external trade exchanges of Indonesia.

They show a relative recent balance of imports and exports, after a period of very sharps increase of exports (+ 9.6 % per year) and an even sharper increase of imports (+ 13 % per year) between 1965 and 1980.

In 1987, the foreign debt service represented 25 % of the value of marchandise exports.

**Table 6 : External trade of Indonesia**

Year	1965	1975	1980	1985	1987	(3) 1990	1965-75	1975-85	1980-1990
Total merchandise exports (Mil. dollar)	707.66	7102.5	23950	18587	14500	25553			
- Growth rate (% per year)							90.37	16.17	2.8
Agriculture Products exports (Mil.dollar)	382.32	867.84	2736.9	2475.2	2692.8				
- As % of total exports (%)	54.03	12.22	11.43	13.32	18.57				
- Growth rate (% per year)							12.70	18.52	
Forest Products exports (Mil. dollar)	3.09	473.24	1879.4	1558.2	2320.7				
- Growth rate (% per year)							1520.5	22.93	
Total merchandise imports (Mil. dollar)	694.60	4769.8	10834	10259	12500	21837			
- Growth rate (% per year)							58.67	11.51	1.4
Agriculture Products imports (Mil. dollar)	48.73	682.69	1555.3	903.52	1124.5				
- As % of total imports (%)	7.02	14.31	14.36	8.81	9.00				
- Growth rate (% per year)							130.08	3.23	
Forest products imports (Mil. dollar)	9.20	69.91	155.29	204.90	259.93				
- Growth rate (% per year)							66.00	19.31	

Note :

- 1) The growth rate of imports/exports was calculated by simple arithmetic average for the period.
- 2) The monetary values are in the current price
- 3) World development Report, 1992. World Bank.

**Annex 4**

The following pictures were taken in Indonesia in early 1989, in the operating concessions of one of the largest companies.

They demonstrate that :

- 1)- Neither Indonesia, nor the company are hiding the actual situation.
- 2)- Regulations and their application were not fully adequate to achieve sustained production at the time they were taken.
- 3)- Changes in the harvesting activity were urgently needed to avoid such a negative impact.

*Note : However, such results are among the most negative ones that can be seen.*

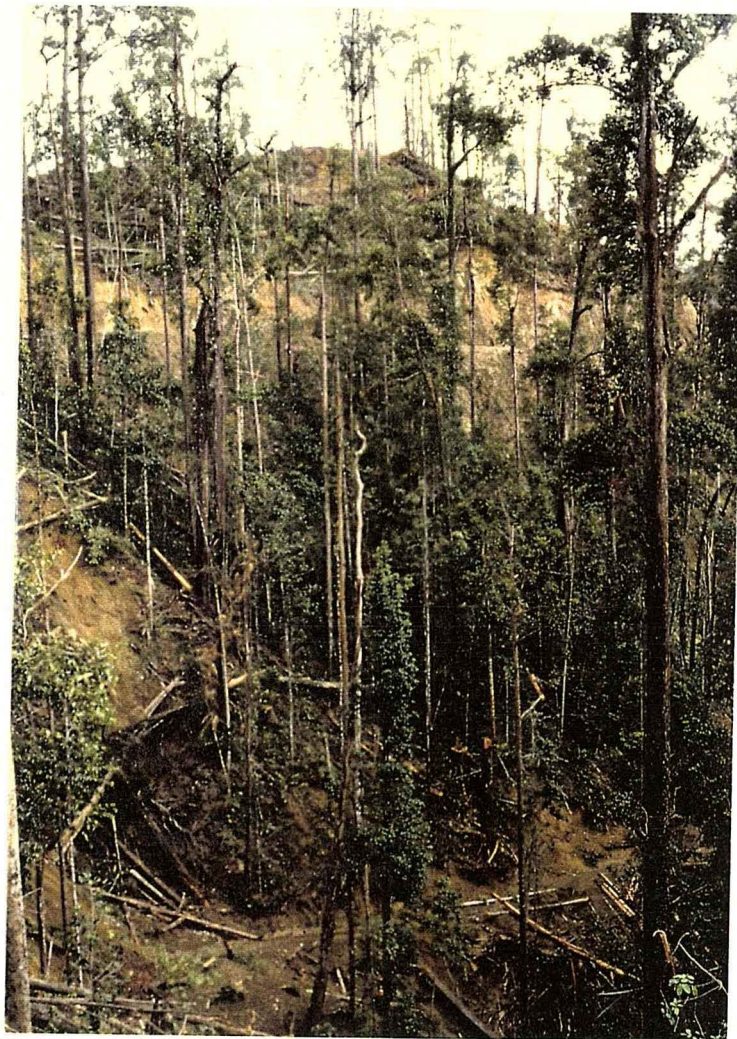
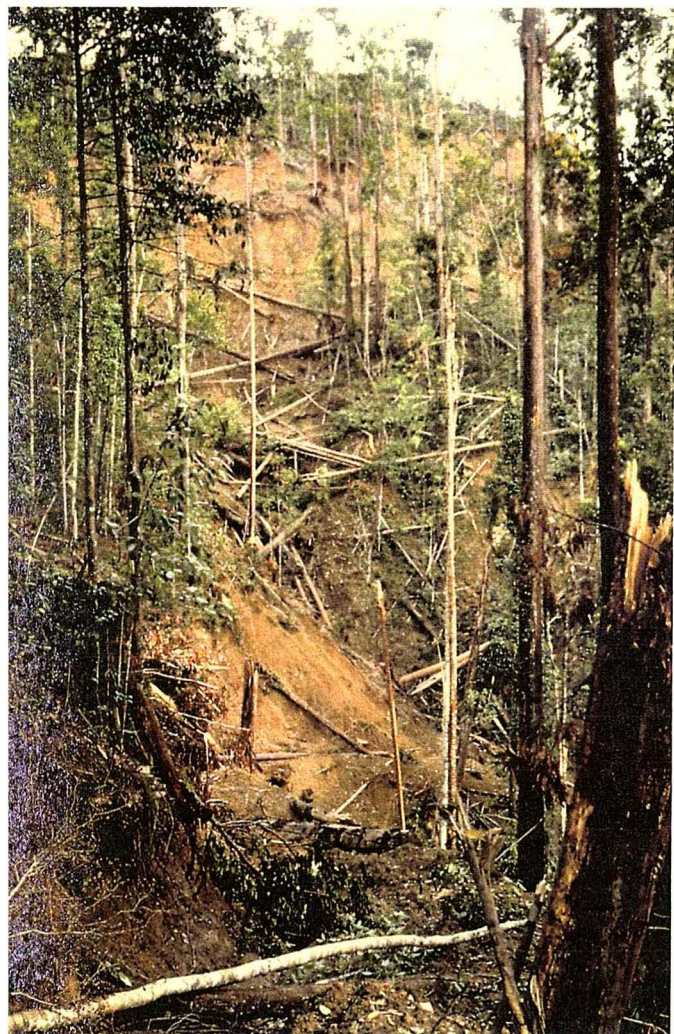




P.T. Kayu Lapis Indonesia  
OBI Island - Moluccas  
two views of the forest in a relatively  
low intensively harvested area.  
Secondary roads and skidding trails can  
be seen.







When harvest is more intensive, skidding trails and landings on 70-90 % steep slopes are more numerous and cannot be else than destructive







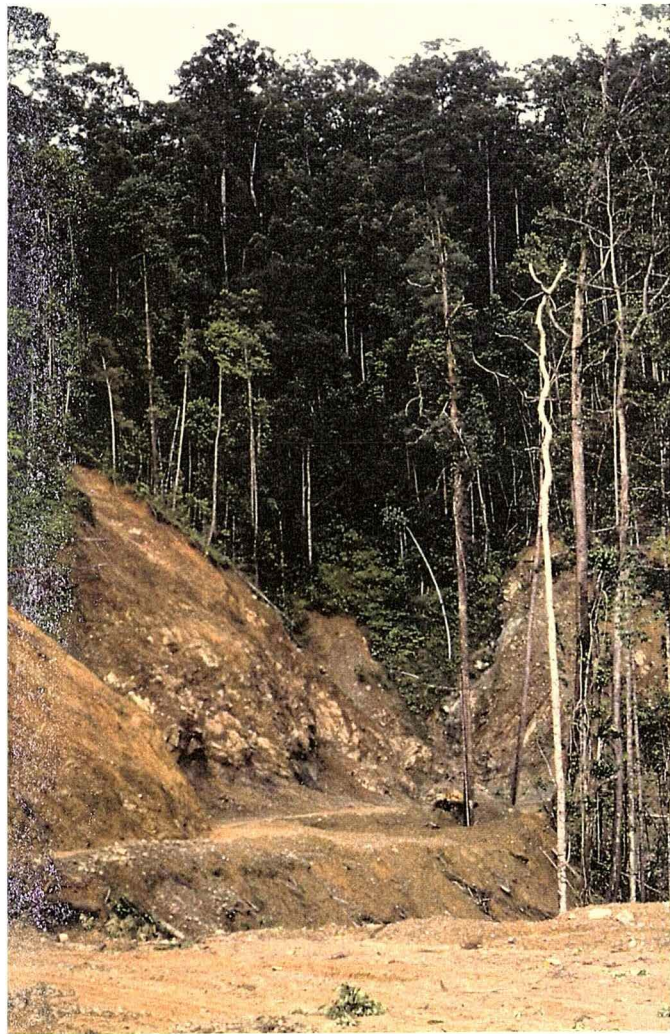
When logging is intense on unstable soils, damages by winds are inevitable.

How about the second cycle in 35 years ?

Fortunately this is one of the rare examples of the kind



Road building on steep slopes and unstable soils  
results inevitably in vast areas of very disturbed and more  
unstable terrain



Notice front-end bucket loader  
Komatsu D 75 S on the road  
side

Notice the road (approximately  
8 m wide) along hill side







Road building and utilisation must be carefully planned



in steep terrain, road network should be as limited as economically feasible

West Kalimantan





Rice fields and shifting cultivation invade logged over areas or even productive forests.

Central Kalimantan

