

I. FOREST STATUS

1.1 Ecoregion of Indonesia

Geographically Indonesia archipelago situated in two difference ecoregions, Indo-Malay and Australasia ecoregion which is separated by invisible line. The line/border created by the existence of a deep-sea shelf that cuts between Bali and Lombok, and Borneo and Sulawesi. It was Alfred Russel Wallace who published the finding on Zoological Geography of the Malay Archipelago in 1859.

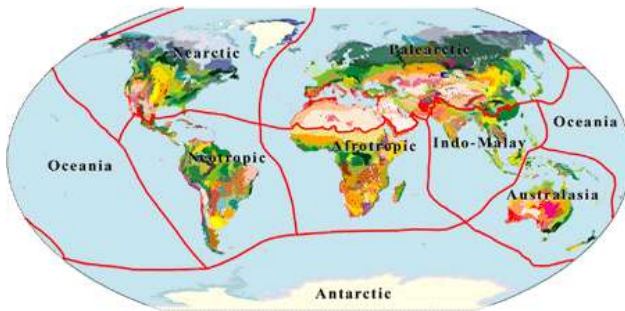


Figure 1.1. World Ecoregion (Source : WWF)

Indo-Malay habitat and its biodiversity originated from the mainland of Asia continent, meanwhile, Australasia biodiversity influenced by the existence of Australy continent (Figure 1.1). Type of Flora and

Fauna of the ecoregion is very different. Dipterocarp species that is very abundant in Borneo (287 species) are found less in Sulawesi (7 species) (FWI, 2002). Elephant and Rhino distribute in Java and Sumatra but are not found in Sulawesi. Marsupial are found all over Moluccas and in Sulawesi but none have been detected in Java and Borneo. Australia ecoregion is very rich with Parrots while Indo-Malay is very poor (Wallace, 1859).

The above condition make Indonesia to be a central of biodiversity (mega diversity). Eventhough only occupied 1.3% of the earth surface, Indonesia diversity contribute to about 10% world's plant, 12% of mammal, 16% of reptile and amphiby, 17% of birds and more than 25% of fresh water fish species. Moreover, some of them are endemic species, whereas only can be found in the region such Anoa, Babirusa, and Komodo.

1.2 Forest Ecosystem

a) Lowland tropical rainforest

The ecosystem indicated by large amount of biomass, epiphytes and lianas. There is no dry season, and growth take place continously. It cover 780 000



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Figure 1.2. Dipterocarp species

square km (41% of Land), and distributed in Sumatera, Kalimantan, Sulawesi, Maluku, and Papua.

The formation may or may not be characterized by dominant taxonomic group. Sometime it is dominated by species of the family Dipterocarpaceae, but in the other region the diversity of plants is very high and no taxonomic group dominates (Pancel, 1993).

Lowland tropical rainforest cover large area of Tropical asia, and it has very high biodiversity.

b) Monsoon forest and savana

Monsoon forest is a type of rainforest that develops in tropical regions with a high annual rainfall but marked dry and rainy seasons. The forest consisting of deciduous trees and shrubs that lose their leaves in the dry season. Savanna is



Baluran National Park

Figure 1.3. Savanna of Baluran National Park

dominated by grasses field with intersperse trees (Figure 1.3).

The ecosystems are relatively less diverse compare to lowland tropical forest. Monsoon forest and savanna are distributed in East Java, Nusa Tenggara, Sulawesi, and southern part of Papua.

c) Mangrove forest.

Mangrove is unique inter-tidal wetland ecosystem which receive inputs from regular tidal flushing and from freshwater streams and rivers (<http://www.afcd.gov.hk>). It is characterized by high temperature, fluctuating

salinity, alternating aerobic and anaerobic conditions, periodically wet and dry, unstable and shifting substratum.

The plants have a specific adaptation on poor soils, and less oxygen. The most common root adaptation of the mangroves are the aerial roots, often in the form of peg like structures, or pneumatophores which stick out of the substrate around the mangrove trees. Another type of aerial roots are the stilt roots which support the trees in the constantly shifting substrate (Figure 1.4).



Figure 1.4. Mangrove in inter-tidal wetland and its morphology adaptation

Mangrove forest distribute in East coast of Sumatera, East and southern coast of Kalimantan, and Papua. The area is estimated of about 44,000 km² (2.3% of lands area). Mangrove vegetation that can be found is Bakau-bakau (*Rhizophora apiculata* and *Bruguiera apiculata*), Api-api (*Avicennia alba* and *A. officinalis*), Buta-butua (*Excoecaria agallocha*), and Nipah (*Nypa fruticans*).

d) Swamp Forest (Fresh water swamp forest)

Freshwater swamp forests grow on fertile alluvial soils, and the wide variety of soils is reflected in a diversity of vegetation types that ranges from grassy marshes to palm or *Pandanus*-dominated forest and forests similar in structure and composition to lowland rain forests. Trees with buttresses, stilt roots, and pneumatophores are common in some areas (Whitten et al. 1987). Trees in freshwater swamp forests endure prolonged periods of flooding, causing the soils to become anaerobic. Pneumatophores, specialized respiratory structures on the roots, are common on many tree species and assist in respiration during oxygen-poor periods. Emergent



(a) Grassy marsh



(b) Emergent tree (*Koompassia* sp)



(c) Pandanus



(b) Pneumatophores,

Figure 1.5. Fresh water swamp forest at Berbak National Park

trees attain heights of 50-60 m. These forests are floristically very variable; the dominant species include *Adina*, *Alstonia*, *Camptosperma*, *Coccoceras*, *Dillenia*, *Dyera*, *Erythrina*, *Eugenia*, *Ficus*, *Gluta*, *Lophopetalum*, *Memecylon*, *Metroxylon*, *Pandanus*, *Pentaspadon*, *Shorea*, and *Vatica* spp. (<http://www.worldwildlife.org>).

Dipterocarp species is richer than in peat swamp forest. *Dipterocarpus coriaceus*, *D. costulatus*, *Dryobalanops oblongifolia*, *Hopea mengarawan*, and *Shorea* and *Vatica* spp represent Dipterocarps. *Hopea* and *Vatica* spp. are commonly present, intermingled with such non-dipterocarps as *Intsia palembanica*, *Koompassia malaccensis*, *Melanorrhoea*, *Palaquium*, *Pometia* and *Sindora* spp (<http://www.thewoodexplorer.com>)

The total of swamp forest area was estimated of about 180,000 km². It is distributed in east coast of Sumatra island, west and southern coast of Borneo, and Southwest of Papua. In Java the ecosystem already converted into paddy

field, due to its fertility and accesible. It only remain in Rawa Danau Protected forest, Banten.

e) Peat Forest

The major difference between peat swamp forests and freshwater swamp forests is the existence of deep peat. Commercial species than can be found in the ecosystem is Blangeran (*Shorea blangeran*), Pelempung (*Shorea leprosula*), Kapur naga (*Calophyllum soulatri*), Bintangur (*Calophyllum pulcherimum*), Kempas (*Koompasia malaccensis*), Resak (*Vatica ressak*), Ramin (*Gonystylus*



Figure 1.6. Peatland Forest of Central Kalimantan (adopted from Boehm and Siegert, 1999)

bancanus), Malam-malam (*Diospyros macrophylla*), Nyatoh (*Palaquium pseudocuneteum*), Krupuk (*Lophopetalum multinervium*), Jelutung (*Dyera costulata*,

Papung (*Dyera lowii*), Terentang (*Comnosperma curiculata*), Ponak (*Tetramerista glabra*) and Geronggang (*Cratoxylon arborescens*) (Faculty of forestry, 2000)

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Figure 1.7. Peat Forest Structure

f. Heath forest

Heath forest associated with low-fertility sandy soils, dominated by trees of small trunk diameter such as *Tristaniopsis obovata* (Benn.). It largely distributes in Borneo. It is normally not subject to commercial forest exploitation. Gelam (*Melaleuca leucadendron*) is also dominant in heath forest in Bangka and Belitung island.



Figure 1.8. (a) Gelam in Bangka, (b) : Heath forest in East Kalimantan

g. Mountainous tropical forest

Mountainous forest distribute on the elevation between 1000 – 3000 meter asl. Floristically less diverse by the increasing of elevation. The trees height is rarely reach to more than 10 meters. Due to high humidity, there are many fern, bryophytes and Epiphytes, and orchid. Estimated area is about 141,000 km² or about 7.4% of lands.

h. Forest on limestone

This kind of forest grow on ultrabasic rock or limestone, mostly distribute in Sulawesi. Species that can be found is Casuarina and Boea spp

1.3. Forest Coverage

Forest cover mapping have been conducted by the Department of Forestry with assistance from World Bank in 1997. The objectives of the project was to identify forest land cover and non forest cover. It is reconnaissance study, by using Landsat TM data without ground truth. The data varies from Landsat taken in 1994, 1995 and the most recent is taken in 1998. The result is assumed to be 1997 land cover data, that have been printed in map with 1:500 000 scale.

The most recent data is result of study conducted by the Department of Forestry-Planologi Agency in 2001-2002, for the purpose of land rehabilitation. However, publish statistic data on forest cover are not available yet.

Based on 1997 data, Forest still occupied 54.25% of land, in which Irian-Maluku are having largest forest cover (87.2%), followed by Kalimantan (55.88 %), Sulawesi (43.81%) and Bali and Nusa Tenggara (Table 1.1 and Table Appendix 1)

Table 1.1. Forest and non forest area in 1997

No.	Province	Land cover					
		Forest		Non Forest		Others	
		Ha	%	Ha	%	Ha	%
1	Sumatera	16.632.143	35,34	28.328.360	60,20	2.098.912	4,46
2	Kalimantan	29.616.787	55,88	20.255.656	38,22	3.131.561	5,91
3	Sulawesi	8.089.157	43,81	7.721.250	41,82	2.651.945	14,36
4	Bali & Nusa Tenggara	2.149.003	29,37	5.166.845	70,63	10	0,00
5	Maluku & Irian	42.440.296	87,22	6.021.331	12,37	195.897	0,40
6	Jawa	2.916.100	22,01	10.293.200	77,70	38.301	0,29
	Total	101.843.486	54,25	77.786.642	41,43	8.116.626	4,32

Source : Forestry Planning Agency

(a) Forest Cover of Sumatra

Forest area in Sumatra distributes mainly in mountainous area of western and northern part of the island (Figure 1.9). Historically, forest exploitation have been conducting in Sumatra since decades ago, when the Dutch Government have

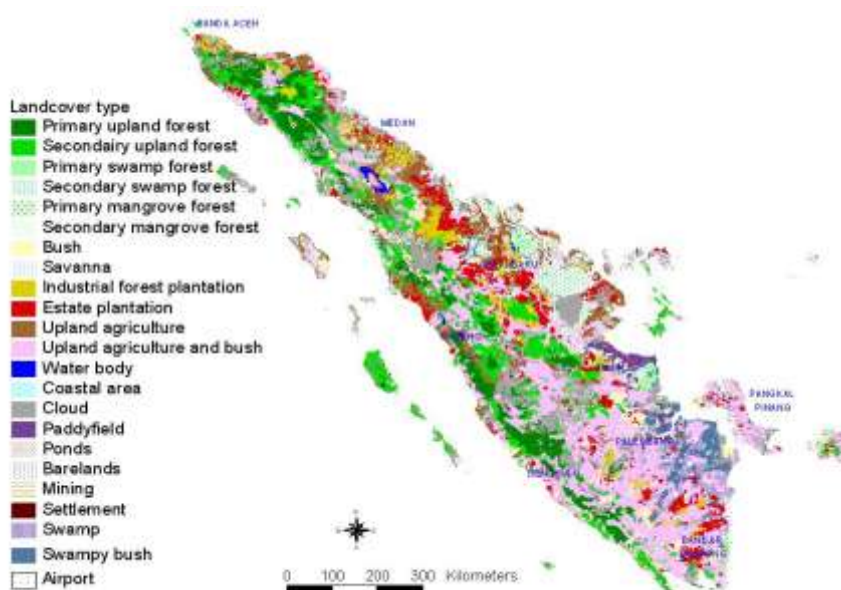


Figure 1.9. Landcover in Sumatra (Forest Planning Agency, 2003)

introduced cash crops plantation such as rubber, coffee and oilpalm in the form of Government Estate Plantation. After proving the success, the local people have adopted the technique to plant the cashcrops and adapt to their cultivation system. As a result, these cash crops have been spreading to the whole lowland Sumatra islands, especially lowland of east coast area.

Lowland area of Sumatra island also have been subject to the forest concession, forest plantation and transmigration, since early 1970s. Some transmigration area in South Sumatra and Lampung were developed before 1960s

(b) Forest cover of Kalimantan

Forest cover in Kalimantan distribute in mountainous area of northern part of Kalimantan (Figure 1.10). As in Sumatra, most of lowland area of Kalimantan

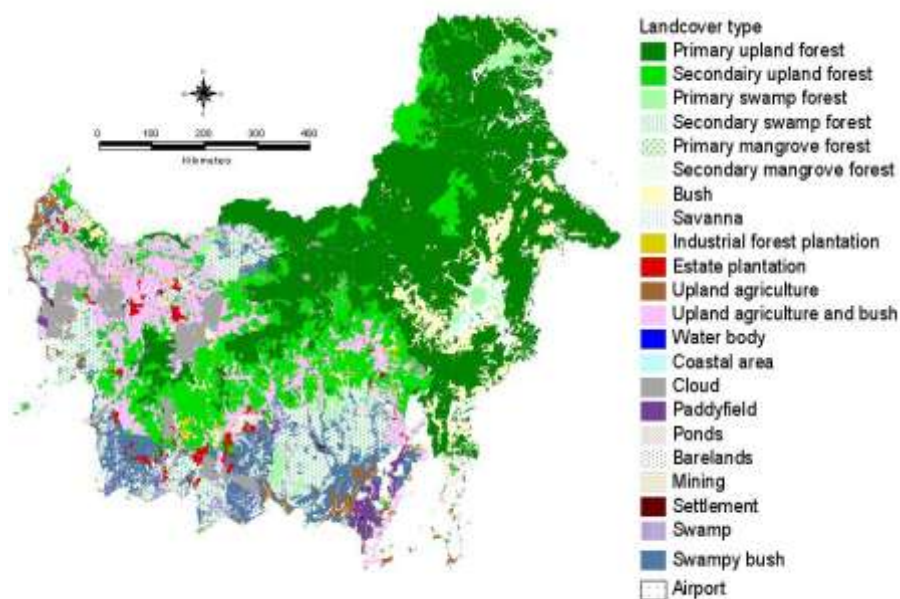


Figure 1. 10. Land cover of Kalimantan (Forest Planning Agency, 2003)

have been converted to agricultural areas. Rubber cultivation have been adapted to local shifting cultivation technique. Rubber trees are planted along the rivers or canal in swampy/peat ecosystem.

Lowland area of Kalimantan also have been subject to the forest concession, forest plantation and transmigration. In 1996, 1.5 million hectares of fresh water swamp forest were converted into paddy field in Central Kalimantan.

(c) Forest cover of Sulawesi

Forest area of Sulawesi distribute in the mountainous part in the middle of the islands. Most of the are protected/conseravation areas. Unlike of sumatra and Kalimantan, Cacao is the major thread of forest margin in Sulawesi (Figure 1. 11)

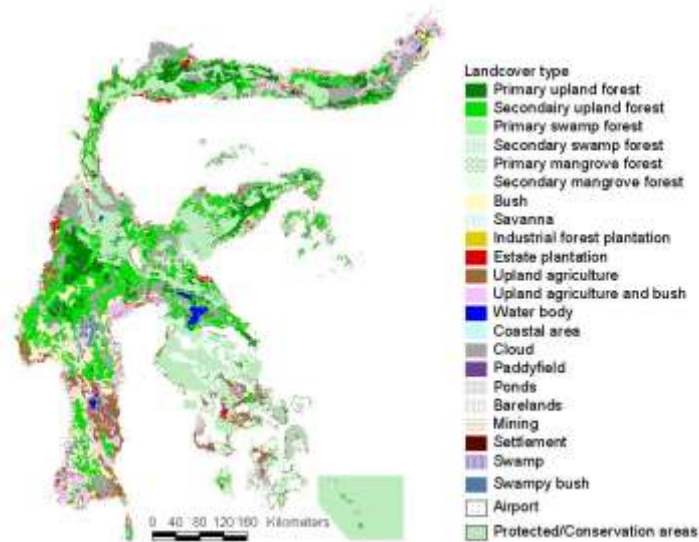


Figure 1. 11. Forest cover of Sulawesi (Forestry Planning Agency, 2003)

(d) Forest cover of Bali

In comparison to Sumatra, Kalimantan, and Sulawesi, Bali is more populated. Forest cover in Bali mostly distribute in Northern part of Bali. Most of the land area of Bali have been converted into agricultural area (Figure 1.12).

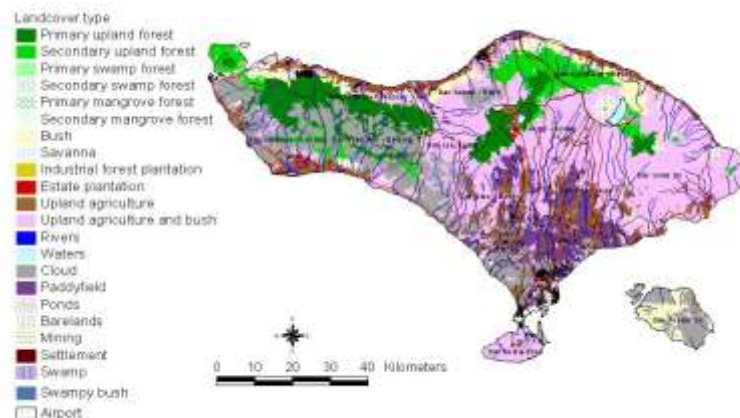


Figure 1.12. Land cover of Bali (Forestry Planning Agency, 2003)

(e) Forest cover of Java

Java island is the most populated area in Indonesia. The forest have been subject to conversion into agricultural area and settlement, since decades ago (Verburg, Veldkamp and Bouma, 1999). Rubber, Tea, Coffes, and Cacao plantation have been introduced and paddy field cultivation have been settled in the coastal area of northern part of the island. Forest cover mainly distribute at mountainous area, in the form of Protected forest/conservation area (Fig. 1.13).

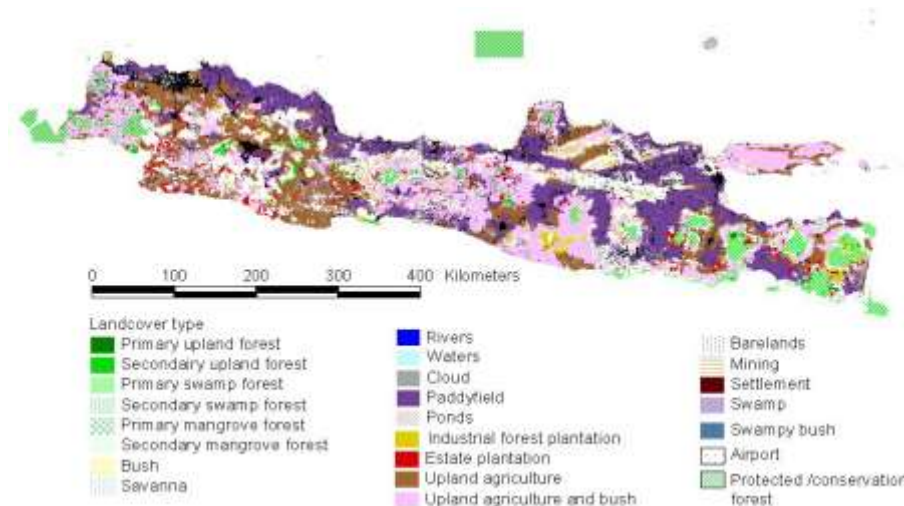


Figure 1.13. Land cover of Java (Forestry Planning Agency, 2003)

1.4. Forest Clasification (Forest Land-use)

The Minister of agriculture in 1980 stipulated rule on forest land-use classification. After having an agreement with the Provincial Government, during 1982 –1985, a series of 1 : 500 000 –scale maps on provincial basis were produced by The Directorate for Forest Inventory and Land-use Planning (INTAG). The maps intended to provide information for provincial planning. Based on the maps, forest are divided into following categories :

- (a) Nature reserve (*PPA : Perlindungan dan Pelestarian Alam atau HAS : Hutn Suaka Alam*)
- (b) Protection forest (*HL : Hutn Lindung*)
- (c) Limited Production Forest (*HPT : Hutn Produksi Terbatas*)
- (d) Normal Production Forest (*HPB : Hutn Produksi Biasa*)
- (e) Conversion Forest (*HPK : Hutn Produksi Konversi*)

The classifiction is calculated spatially based on slope, soil erodibility, and rainfall intensity, which has difference value/points and weight (Table 1.2)

Table 1.2. Classification of Slope, Soil and rainfall intensity for TGHK

Class	Slope (%)	Points	Soil Erodibility	Points	Rainfall Intensity	Points
1	0 – 8	20	None	15	<13.6	10
2	9 – 15	40	Low	30	13.6 – 20.7	20
3	16 – 25	60	Medim	45	20.8 – 27.7	30
4	26 – 45	80	High	60	27.8 – 34.8	40
5	> 45	100	Very high	75	>34.8	50

(Source : RePPPProT, 1990)

The site index is calculated by summing the number of points attribut table in respect of each of the three criteria. The threshold value of site index for determining the forest land category or Concensus Forest Land-use Plans (Tata Guna Hutan Kesepakatan/TGHK) is presented in Table below.

Table 1.3. Threshold value of site index for TGHK

Site Index	Forest land category
< 125	Normal Production Forest (HPB), or Conversion Forest (HK)
125 - 174	Limited Production Forest (HPT)
> 175	Protected Forest (HL)

(Source : RePPPProT, 1990)

TGHK was revised two times after the publication in 1984, which is in 1996 and 2000. The total forest land tends to decline from 143.9 million ha in 1984 to 120,4 million ha in 1996 and to 112.5 million hectare in 2000. The most significant decline is Convertible Production forest from 30.5 million hectare in 1984 to only 3.6 million hectareb (Table 1.4).

Table 1.4. TGHK classification comparison since 1984 to 2000

Forest Usage	Area of Forest Land (ha. millions)		
	1984 (TGHK)	1996 (TGHK)	2000 (Aggregate)
Protected Forest	30.3	33.5	29.9
Conservation Forest	18.7	20.5	20.6
Restricted Production Forest	30.5	23.1	26.1
Production Forest	33.9	35.2	32.3
Convertible Production Forest	30.5	8.1	3.6
Total Area of Forest Land	143.9	120.4	112.5

Source : Kartodihardjo, 2002

1.5. Deforestation

Deforestation is mechanism or process of forest clearance or conversion into other land-use. The Food and Agriculture Organization (FAO) of the United Nation (UN) defines deforestation as the sum of all transition from natural forest classes to all other classes. It was estimated that tropical forest was deforested by 6 – 16.8 million hectare per year (Grainger, 1993; Barbier *et al.*, 1991; Myers, 1994). Most recent estimate of deforestation have been made by FAO (2003). Based on the FAO data, between 1990 – 2000, the world has lost of about 9.3 million hectare or 930 thousands hectare tropical forest per year, or of about 0.2% per year. Most of deforestation have been occurring in the developing countries in Latin America, Africa and asia. Among the world countries, Burundi is having the highest rate of deforestation (Table 1.5).

Based on FAO estimate, Deforestation rate of Indonesia between 1990 – 2000 is about 1.2 % per year. This figure is lower than estimated figure of Ministry of Forestry which is about 1.5 % per year (Table 1.6). Comparison among the province, Sumatera Selatan (South Sumatera) is having the highest rate of deforestation follows by Kalimantan selatan, Lampung, Jambi and Sulawesi Tengah (Fig. 1.14).

Table 1.5. Forest change in selected tropical countries

Country	Land area Total 1999 ('000 Ha)	Forest Total 2000 ('000 Ha)	Forest % of land area 2000	Forest Change 1990-2000 ('000 Ha)	Forest Annual rate of change 1990-2000
1. Burundi	2,568.0	94.0	3.7	-15.0	-9.0
2. Haiti	2,756.0	88.0	3.2	-7.0	-5.7
3. Saint Lucia	61.0	9.0	14.8	-1.0	-4.9
4. El Salvador	2,072.0	121.0	5.8	-7.0	-4.6
5. Micronesia	69.0	15.0	21.7	-1.0	-4.5
6. Comoros	186.0	8.0	4.3	n.s.	-4.3
7. Rwanda	2,466.0	307.0	12.4	-15.0	-3.9
8. Indonesia	181,157.0	104,986.0	58.0	-1,312.0	-1.2
9. Malaysia	32,855.0	19,292.0	58.7	-237.0	-1.2
10. World	13,063,900.0	3,869,455.0	29.6	-9,391.0	-0.2

Source: Food and Agriculture Organization of the U.N.: The State of the World's Forests (2003)

Table 1.6. Deforestation rate of Indonesia by Province and Islands

Province	RePPPProT (1985)	Dephutbun (1997)	RePPPProT – Dephutbun (1985 – 1997)	
	Forest (Ha)	Forest (Ha)	Deforestasi (Ha)	% Deforestation
Sumatra	23.323.500	16.632.143	6.691.357	28,7
Kalimantan	39.986.000	29.616.786	10.369.214	25,9
Sulawesi	11.269.400	8.089.157	3.180.243	28,2
Maluku	6.348.000	5.538.506	809.494	12,8
Irian Jaya	34.958.300	33.548.021	1.410.279	4,0
Jawa dan Bali	1.345.900	.	.	.
Nusa Tenggara	2.469.400	.	.	.
INDONESIA	119.700.500	93.424.613	22.460.587	18,8

Source : RePPPProt, 1990: Forestry Planning Agency

Cause of deforestation can be categorized into two, which direct and indirect factor. Direct factor refers to direct activities that caused forest clearance or conversion. while Indirect factor refers to indirect mechanism/condition that push the actor to convert or clear the forest. The two kind of causes are some time confusng. To distinguish the direct and direct cause let take one example. A farmer clear the forest area for farming. The farmer clear the forest because he

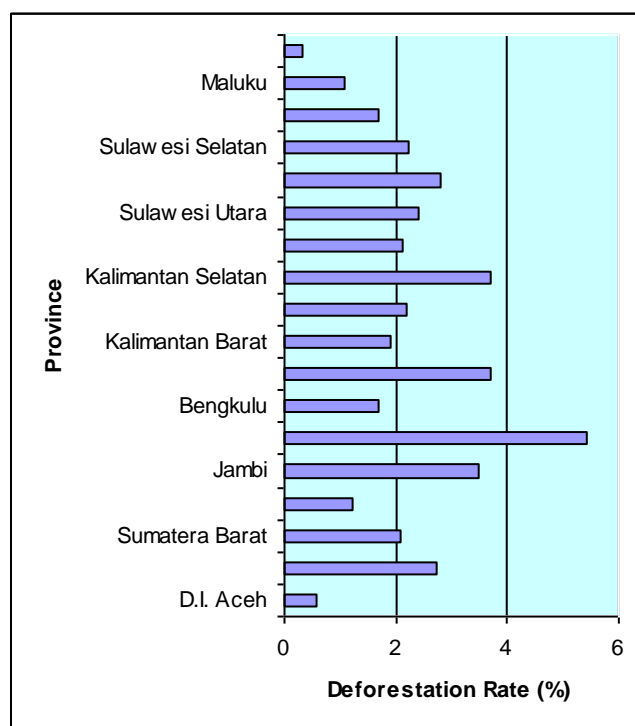


Figure 1.14. Deforestation rate of Provinces

does not have a agricultural land. He does not have a land since he does not have a money to buy a piece of land. Thus, in this theoretical example, there is a causation chain that starts with poverty, finally forest conversion. In this case conversion of forest for agricultural land is direct cause, farmer as an agent and poverty is indirect causes.

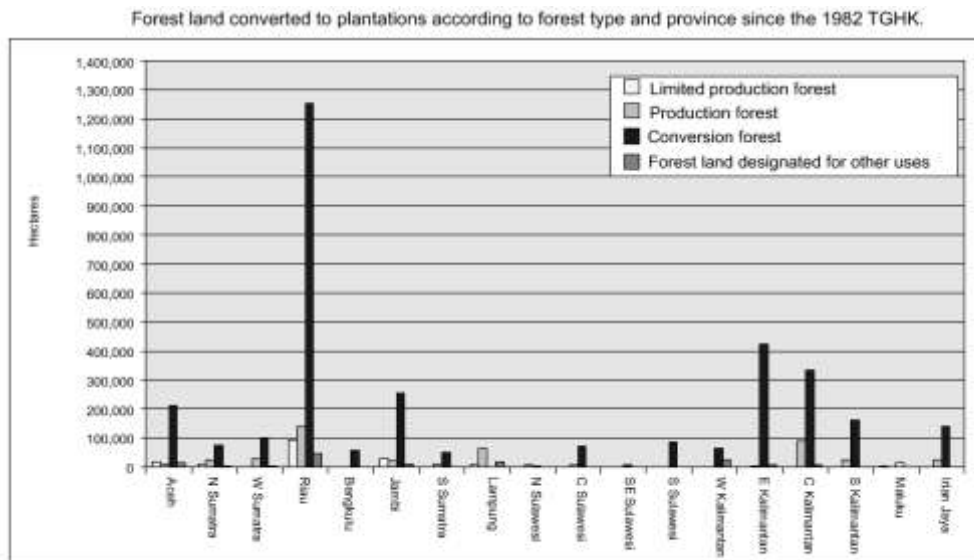
(a) Agent and Direct cause of deforestation

(1) Forest Pioneer – Shifting Cultivation

Forest pioneers are defined as people who may utilize slashing and burning of the existing vegetation but with primary attention of establishing permanent or semi-permanent agricultural production. Forest pioneer also planted subsistence foodcrops and cash crops. The land is not fallowed but is used continuously until the fertility have declined, and they do not have a plan to return to the same site (Sunderlin and Resosudarmo, 1996). These kind of activities is sometime confusing with the shifting cultivation. Under shifting cultivation system, after one – two years foodcrops cultivation, the land will be let in a fallow period until the fertility and vegetation recoverd again. Under low population density, shifting cultivation may not cause deforestation, however, RePPProT (1990) stated that shifting cultivation has large role on deforestation. They found that in Sumatra, Kalimantan and Irian there are 14 million ha, 11 million ha and 2 million ha of shifting cultivation practice, respectively.

(2) Cash crops estate

Expansion of cash crops estate started in 1980s when policy to boost non-oil export revenue. Oil palm is commodity that have been paid attention. The area of oil palm has reached 3 million ha in 2000, from the initial stage in 1967 was about 200 thousands ha. Most of the area originated from forest land. Fig. 1.15. shows magnitude of forest conversion of each provinces for plantation development since 1982. Based on the figure above, Riau province have converted forest area to plantatation is more than 1.5 million ha, followed by East Kalimantan and Central Kalimantan (more than 400 thosands ha).



(Source : Forestry Planning Agency, 1999)

Figure 1.15. Forestland conversion for plantation development

(3) Transmigration

Transmigration is aimed at reducing the population pressure in Java island, by moving people to out side Java. Since 1982, conversion of forest area for transmigration estimated is about 798,865 ha (Table 1.7). The area originated not only from Convertible Forest (HPK) , but also from Protected Forest (HL), Nature Reserve (HAS) and Fixed Production Forest (HPT). Province South Sumatera, Irian, Jambi and Riau are having large forest conversion for transmigration.

Tabel 1.7. Forest Conversion for Transmigration

No	Province	Implemented Land Conversion (Ha)					Total
		HL	HSA	HPT	HPK	APL	
1	DI. Aceh	-	-	10,781.12	23,465.98	1,521.25	35,768.35
2	Sumatera Utara	68.00	-	12,118.00	7,792.00	3,167.44	23,145.44
3	Sumatera Barat	495.00	-	-	12,804.75	793.25	14,093.00
4	Riau	-	-	7,253.30	55,775.78	9,168.70	72,197.78
5	Jambi	-	-	-	50,167.53	25,533.00	75,700.53
6	Bengkulu	-	-	2,613.50	3,342.95	8,371.00	14,327.45
7	Sumatera Selatan	-	5,775.50	2,400.00	37,590.67	17,430.00	63,196.17
8	Lampung	-	-	623.00	2,206.00	130,233.20	133,062.20
9	Nusa Tenggara Barat	-	-	-	2,325.00	-	2,325.00
10	Nusa Tenggara Timur	-	-	-	1,137.00	-	1,137.00
11	Kalimantan Barat	627.00	-	2,757.56	5,927.50	37,657.00	46,969.06
12	Kalimantan Tengah	-	-	7,447.98	34,149.51	-	41,597.49
13	Kalimantan Timur	-	-	2,625.64	31,824.95	-	34,450.59
14	Kalimantan Selatan	-	617.00	-	20,374.50	11,110.50	32,102.00
15	Sulawesi Utara	-	-	1,593.00	3,496.56	-	5,089.56
16	Sulawesi Tengah	60.00	1,979.00	2,960.00	6,251.23	15,164.00	26,414.23

No	Province	Implemented Land Conversion (Ha)					Total
		HL	HSA	HPT	HPK	APL	
17	Sulawesi Tenggara	-	-	1,510.00	1,138.50	7,624.15	10,272.65
18	Sulawesi Selatan	1,120.00	-	2,230.00	27,203.85	19,385.72	49,939.57
19	Maluku	2,062.00	-	5,580.00	14,822.58	-	22,464.58
20	Irian Jaya	1,997.00	-	6,696.30	76,348.58	9,571.00	94,612.88
Jumlah/Total		6,429.00	8,371.50	69,189.40	418,145.42	296,730.21	798,865.53

Source: Forestry Planning Agency

Note :

HL : Protected Forest , HSA : Nature Reserve , HPT : Fixed Production Forest,
 HPK : Convertible Production Forest , APL : Other Land Uses

(4) Open Mining

Some evidence found in Bangka and Belitung, that mining may cause permanent forest conversion. Open mining of sands, kaolin, and lead without rehabilitation program after mining closure will cause deforestation. Most of area in Bangka and Belitung have been degraded due to this open mining.



Figure 1.16. Kaolin mining, Belitung

(5) Industrial Forest Plantation

Industrial Forest Plantation started in 1980s, when the Government launched a plan to establish Industrial Forest Plantation (Hutan Tanaman Industri/HTI). It was plan that HTI will substitute supply of natural forest, rehabilitate degraded land and promoting nature conservation. At that time HTI received various subsidies from the government, including loan from Reforestation Fund (Dana Reboisasi/DR).

By the law HTI should be established in degraded land, however, some companies did not obey the regulation. Based on suitability study of HTI development in 1998, Kartodihardjo and Supriono (2000), found that 22% area of HTI was natural forest. We also found some evidence in Riau and South Sumatra, some HTIs was developed on natural forest stands (Figure 1.17).



Figure 1.17. Natural forest conversion for HTI development

(6) Forest fire

Forest fire cause by the availability of 3 factors, which are fuel , climate and fire. In tropical countries most of forest fire caused by anthropogenic causes, in which fire is ignited by human. Big forest fire event have occurred in 1982/1983, 1994, 1997 and 1998. The forest fire ravage forest and land approximately 3.5 million, 4.8 million ha, 627 thousands ha, and 507 thousands ha of forest and land, for 1982/1983, 1994, 1997 and 1998, respectively (Ministry of Environment, 1998).

Forest fire estimation in 1998, is under estimated. Based on calculation of SPOT vegetation image (Prasetyo, 2002), forest fire in 1998, have affected 3.5 million ha of forest and land.

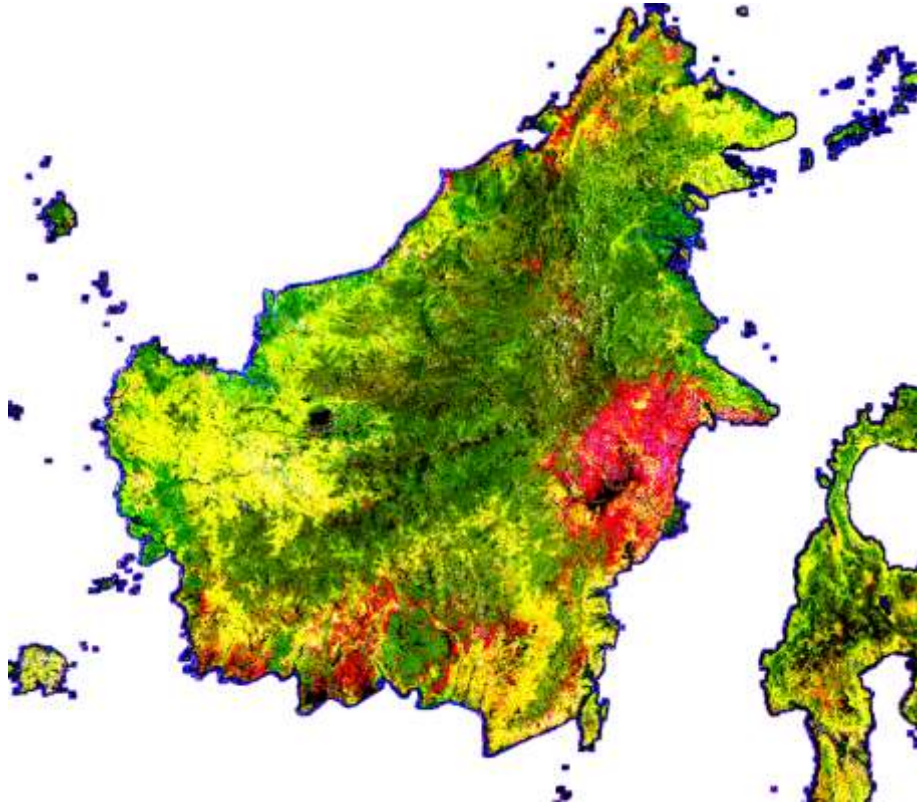


Figure 1.18. SPOT Vegetation, red colour indicated fire affected areas

(b) Indirect Factors

(1) Imbalance wood supply and demand

Total demand of national wood industries in 1997/1998 was estimated of about 84.14 million m³, meanwhile legal timber supply only can produce 51.53 million m³. Therefore the demand exceeded of about 32.6 million m³ (Table 1.8). Insufficient demand force companies to exploit the forest beyond the sustainability yield, and therefore will lead deforestation. Some illegal logging have been identified also related to the supply insufficiency condition.

**Table 1.8. Estimated demand and Supply imbalance
(adopted from FWI, 2001)**

Sources of timber supply and demand	Volume (Roundwood equivalent) (000 m³)
Logs from domestic production	29 500
Log supply equivalent from imports	20 427
Log supply equivalent from other sources (mainly recycled paper)	1 600
Total Supply	51 527
Domestic demand (Timber processing industries)	35 267
Log equivalent of exports	48 873
	84 140
Net wood balance	-32 613

(2) High economic cost

Hariadi (2002) stated that beside official fee, there are many unofficial levied for Forest Concession Company. The unofficial fee were used for coordination cost, informaton cost and strategic cost. The unofficial fee would cost Rp. 267600 – Rp. 290500 per cubic meters.

1.6. Investment on Forestry

Detail data of FDI on Forestry is difficult to be collected, since very limited publication published. Since the economical crisis in 1997 followed by the political instability and public unrest, almost of all sector of FDI have been decreasing. FDI approved on Forestry sector tends to decrease, except investment on paper industry, which showed an remarkable increase in 1997, however, the figure shrink to very low figure in the year of 2000 (Table 1.9)

Tabel 1.9. FDI of forestry sector approved by the Government
(in million US \$)

Year	Industrial Forest Plantation	Wood Industry	Paper Industry
1995	0	263	2540.5
1996	135.5	101.1	2907.3
1997	0	69.7	5353.3
1998	0	70.8	40.8
1999	8.8	113.2	1411.8
2000	10	208.2	141.9

Source : Bank of Indonesia, 2002

1.7. Forest Plantation

Forest plantation basically divided into two types, which are HTI and Community Forest. HTI is located within National Forest Land, while Community Forest is located on Private Land. Data on community forest is not available, since there have been very limited information on its area and distribution. Based on Agricultural survey (1993) there are more than 827 thousands families engaged in community forest, to produce woods/logs. Suryokusumo (Suara Karya, 2003) stated that area of community Forest estimated about 1 million Ha. *Paraserianthes falcataria* (sengon), *Acacia* sp (Akasia), *Agathis*, *Aleurites* sp (Kemiri) and Bamboo are some common species used in the Community Forest. Right to manage Community Forest (Hutan Rakyat) is regulated under Ministerial Decree No. 677/Kpts-II/1998.

Industrial forest plantation

Until December 1999, there were 98 of timber plantation companies granted license for plantation development (*Surat keputusan Hak Pengusahaan Hutan, Hutan Tanaman Industri/ SKHPHHTI*), with designated total area of about 4,6 million ha. While a year later, the granted companies reach to 100 unit which cover about 4.7 million ha of land. In March 2001, total granted companies reach 102 unit, with total area of about 4.8 million ha (Table 1.10).

Table 1.10 Number company and area of plantation granted forest plantation development permit by province in 2001

No	Province	Total	
		Unit	Area (Ha)
1	DI Aceh	6	233.870
2	North Sumatera	6	318.705
3	West Sumatera	2	35.292
4	Riau	12	693.582
5	Jambi	10	205.405
6	South Sumatera	3	380.100
7	Lampung	4	149.067
8	West Kalimantan	11	580.086
9	Central Kalimantan	10	286.975
10	South Kalimantan	6	332.260
11	East Kalimantan	22	1.211.555
12	South Sulawesi	2	42.300
13	Central Sulawesi	2	23.441
14	South East Sulawesi	1	37.845
15	Maluku	4	64.568
16	Papua	1	206.800
TOTAL		102	4.801.851

Source : Directorate General of Forest Production Development, 2002

Regardless of some incentives had been given by the government (such as free loans from the reforestation fund, support companies borrowing establishment capital from banks or other financial institution), the HTI establishment has been very slow. According to the plan (in 1984) target of HTI area establishment was about 4.5 million ha by the year 2000. In realization of the plan, by 1989 only 67500 ha and by late 1995 only 520 000 ha of HTI was established. During 1996 to 2000, there were 1,054,897 ha additional Plantation Forest (Table 1.11).

In total, estimated HTI establishment area in 2000 was about 1.6 million ha, or only about 30% from the target planned. Spatial distribution of Plantation Forest in Kalimantan and Sumatra islands are presented in Fig. 1.19 and Fig. 1.20.

Almost of all Plantation Forests out site Java are managed by private companies, PT. INHUTANI (State Enterprise on Forestry) or Joint venture between PT. INHUTANI and Private Companies. PT. INHUTANI I,II and III are operating in Kalimantan, while PT. INHUTANI III and IV in Sumatra.

Table 1.11. Industrial Plantation Forest Development Implementation by Province during last five years

No	Province	Implementation				
		1996/1997 (Ha)	1997/1998 (Ha)	1998/1999 (Ha)	1999/2000 (Ha)	2000 *)
1	DI Aceh	15.245	12.275	5.454	959	472
2	North Sumatera	7.507	7.887	5.196	2.358	1.022
3	West Sumatera	2.490	1.151	420	315	0
4	Riau	69.216	52.613	34.199	51.014	29.429
5	Jambi	21.017	19.027	13.260	23.007	16.294
6	South Sumatera	21.290	6.144	4.994	4.085	6.431
7	Bengkulu	825	300	13	0	0
8	Lampung	7.601	1.500	2.744	0	92
	SUMATERA	145.191	100.897	66.280	81.738	53.740
9	West Java	0	0	0	0	0
10	Central Java	0	0	0	0	0
11	North Java	0	0	0	0	0
	JAVA	0	0	0	0	0
12	West Kalimantan	38.291	31.089	14.000	4.265	10.791
13	Central Kalimantan	27.887	20.621	11.976	5.854	2.351
14	South Kalimantan	44.145	4.010	7.465	3.762	689
15	North Kalimantan	95.559	72.036	61.788	37.245	10.679
	KALIMANTAN	206.512	127.756	95.229	51.126	24.510
16	Bali	0	0	0	0	0
17	NTB	658	695	112	0	0
18	NTT	1.936	1.309	0	0	0
19	East Timor	632	342	0	0	0
	NUSA TENGARA	3.226	2.346	112	0	0
20	South Sulawesi	2.253	1.518	605	225	22
21	Central Sulawesi	5.100	4.646	2.721	72	335
22	South East Sulawesi	2.235	2.702	400	543	0
23	North Sulawesi	2.215	2.199	758	0	0
	SULAWESI	11.803	11.065	4.483	840	357
24	Maluku	11.350	11.087	7.535	3.789	1.140
25	Papua	12.460	12.698	6.866	0	0
	MALUKU & PAPUA	23.810	24.545	14.401	3.789	1.140
	TOTAL	390.542	266.609	180.506	137.493	79.747

Source : Directorate General of Forest Production Development

Note : *) Data April – December 2000

PT. INHUTANI managed forest area (include Plantation Forest area) of about 3.67 million ha. Among of the area, only 0.5 million ha (14%) is managed by themselves and the rest (3.16 million ha or 86%) is managed under joint venture scheme.

Table 1.12. Total area of Industrial Plantation Forest Managed by PT. INHUTANI I – V

No	State Enterprise	Area (Ha)	
		Joint Venture	Self-Managed
1	PT. INHUTANI I	1.254.672	101.716
2	PT. INHUTANI II	241.946	94.648
3	PT. INHUTANI III	748.660	247.500
4	PT. INHUTANI IV	435.578	-
5	PT. INHUTANI V	482.233	53.567
TOTAL		3.163.089	500.431

Source : Directorate General of Forest Production Development

Realization of Plantation Forest development in PT.INHUTANI area was very low. Until 1999, only about 33 % of planting area plan was realized, for all type of Plantation Forest scheme (Table 1.13)

Table 1.13. Plan and Realization of Plantation Forest planting, in PT. INHUTANI based on type of Plantation Forest.

Industrial Industrial Plantation Forest Unit	Area (Ha)	Realization until 1999/2000	2000	
			Target (Ha)	Realization (Ha)
PT.INHUTANI I				
Self-managed	101,716	42,736.14	42,736.14	4,901
Joint venture Non Trans	1,055,317	336,414.04	46,110	22,054
Joint venture Trans	199,355	73,342.90	12,426	3,673
PT.INHUTANI II				
Self-managed	94,800	46,912	5,699	1,058
Joint venture Non Trans	126,041	31,276	1,650	359
Joint venture Trans	106,905	9,349	2,800	1,876
PT.INHUTANI III				
Self-managed	220,000	88,500.08	1,660	924.02
Joint venture Trans	647,415	123,633.33	24,950	1,890.56
PT.INHUTANI IV				
Joint venture Non Trans	163,071	35,451	1,168	6,086
Joint venture Trans	116,197	53,951	4,777	2,721
PT. INHUTANI V				
Self-managed/Swakelola	56,547	38,051.53	2,374	2,167
Joint venture Non Trans	449,523	240,729.76	25,464	14,479.00
Joint venture Trans	35,730	13,987.63	5,889	2,401.18
Total	3,372,617	1,134,334.41	177,703.14	64,590

Source : Directorate General of Forest Production Development

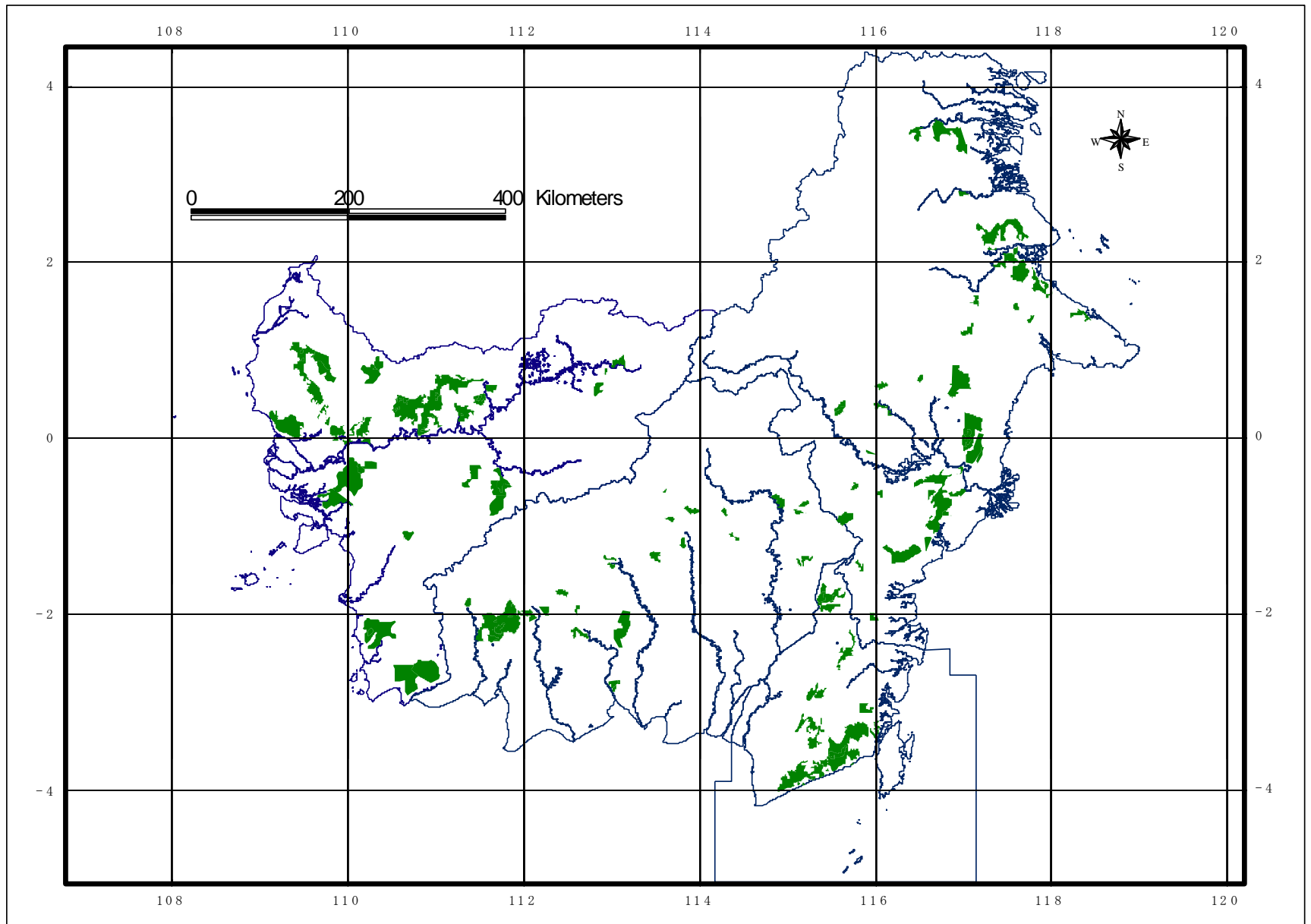


Figure 1.19 Distribution of Forest plantation in Kalimantan island (Green areas)

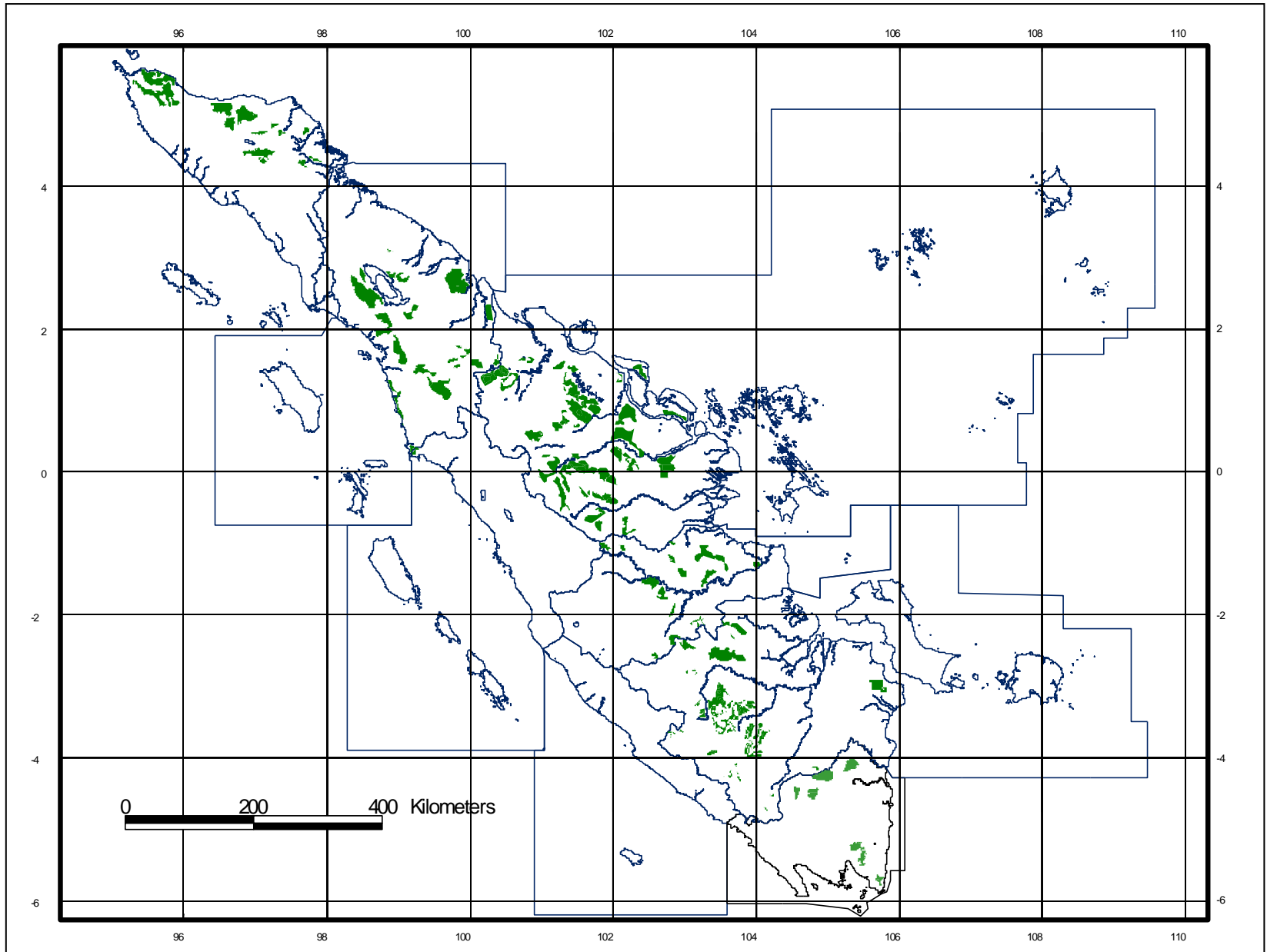


Figure 1.20. Distribution of Forest Plantation in Sumatra island (Green areas)

1.8. Land Degradation

Unsustainable forest exploitation resulted in land degradation. In 2003 Forest Planning agency conducted a study to identify degraded land in National forest Land and Non National Forest Land. The study classified the degree of degradation into 3 priorities.

- First Priority Land : barelands, upland farming, and mixed between upland and bush
- Second priority : secondary upland forest, secondary swamp forest and secondary mangrove forest.
- Third priority : Savanna, mining, settlement, and paddy field

First priority land that need to be rehabilitated is 43.6 million hectare, second and third priority is 36.3 million hectare, and 16.4 million hectare, respectively. Detail of degraded land of each province based on watershed priority is described in Table Appendix 2.