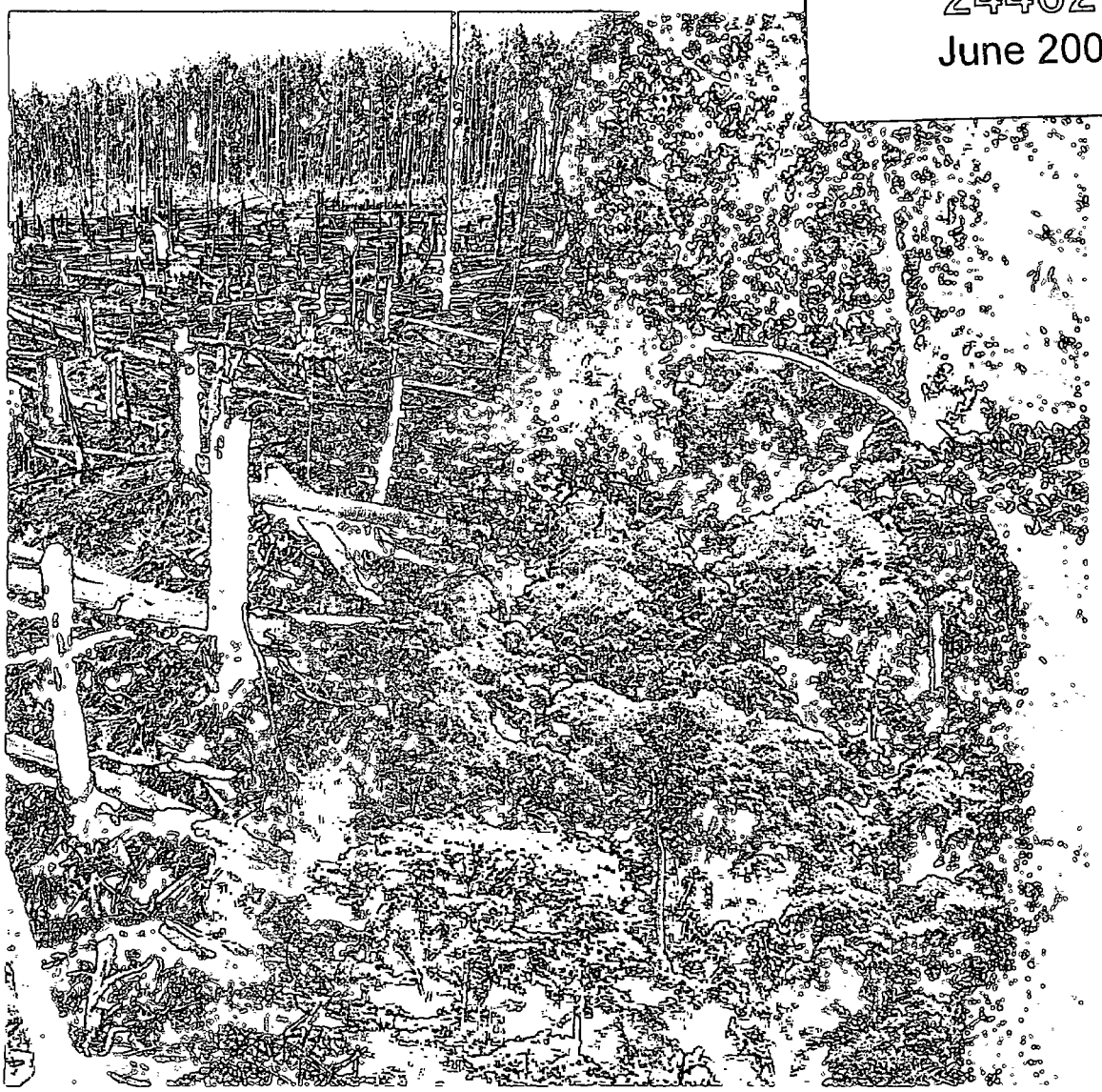
Public Disclosure Authorized

ENVIRONMENT AND SOCIAL DEVELOPMENT EAST ASIA AND PACIFIC REGION DISCUSSION PAPER

June 2002



Where Have All the Forests Gone?

Derek A. Holmes

THE WORLD BANK

Indonesia
Where have all the forests gone?

Derek A. Holmes

June 2002

Environment and Social Development
East Asia and Pacific Region
Discussion Paper

This publication was developed and produced by the Environment and Social Development Unit (EASES), East Asia and Pacific Region of the World Bank. The Environment, Rural Development, and Social Development are part of the Environmentally and Socially Sustainable Development (ESSD) Network.

Copies of this paper are available from:
The World Bank
EASES, Room MC8-241
1818 H Street, NW
Washington, DC 20433
Tele: 202-473-1000
Fax: 202-522-1666

Table of Contents

Foreword iii
Executive Summary v
Forest cover and the spatial plans vi
The results of forest conversion vii
Recommended conservation initiatives viii
Chapter 1. Methodology 1
Chapter 2. Rates Of Deforestation 3
Chapter 3. Forest Cover and Forest Status 6
Chapter 4. Conversion To What? 10
Conversion by large investors 10
Conversion by smallholders 11
Conversion by small investors 12
Forest fires 13
Summary 14
The impact of illegal logging 15
Chapter 5. Analysis of Loss of Lowland Forest 21
Historical overview 21
The definition of lowland forest 23
Sumatra 24
Kalimantan 26
Sulawesi 28
The conversion of mangrove forests 29
Chapter 6. The Future 31
Priorities for immediate action 31
References 37

List of Tables

Table 1: Rates of Forest Loss, 1985-1997 5
Table 2: Forest Status, Forest Cover and Forest Use 8
Table 3: Forest Cover within Forest Status Boundaries 9
Table 4: Data on Land Use and Land Allocation 19
Table 5: Results of Forest Conversion 20
Table 6. Physiographic types and forest cover, Sumatra 25
Table 7. Physiographic types and forest cover, Kalimantan 26
Table 8. Physiographic types and forest cover, Sulawesi 28
Table 9. Mangrove areas by island 30

Table of Figures

Figure 1: Changes in forest cover - Sumatra 25
Figure 2: Changes in forest cover Kalimantan 26
Figure 3: Changes in forest cover Sulawesi 28

Foreword

In Memoriam
Derek A. Holmes 1938-2000*

This posthumous report by Derek Holmes is being published both because of the importance of its subject and also as a tribute to Derek and the enormous concern he had for the use and future of Indonesia's forests. He first worked in Indonesia in 1970, after working as a soil scientist and land capability specialist in Pakistan, Brunei, Malaysia, Chad, and Thailand. He lived in Indonesia from 1974 until he died and in that time traveled more widely, more off the beaten track, and saw more biodiversity loss at first hand than most expatriates and many Indonesians. Wherever he went he watched birds, kept meticulous notes, and wrote his observations. In 1985 he resurrected the Indonesian Ornithological Society with Professor S. Somadikarta and became the editor of its journal *Kukila* that provided a forum for reports on bird occurrence, natural history, and conservation. In his editorial work and in other professional matters he was always concerned with thoroughness, quality, and proper analysis of detail, and all these qualities are reflected in this, his last work.

In his private life, Derek was above all generous in spirit. His genuine and enduring affection and concern for the people of Indonesia were manifested in so many ways, and so quietly, that the extent of his kindness will probably never be known except to the Indonesians who experienced it directly – with help in finding a place to live, perhaps, or with the means to pursue an education otherwise beyond reach.

Those who knew Derek were touched by his passion and dedication in bringing both the joys of bird life and the horrors of ecosystem loss and degradation to the attention of as many people as possible, and, in this, his analysis of deforestation in Indonesia is a triumph. Since early 2000, so many have cited "1.7 million hectares per year" so often as the authoritative and shocking estimate of forest loss that its origin has been forgotten. It came from Derek Holmes, through circulation of an early draft of this report. We trust that the report in its final form will stimulate the action and policy reform he desired so passionately.

Thomas Walton
Lead Environmental Specialist
Environment and Social Development Unit
East Asia and Pacific Region

Zafer Ecevit
Sector Director
Environment and Social Development Unit
East Asia and Pacific Region

* Based in part on an obituary by David Wells in *OBC Bulletin* 33: 7-8, 2001.

Executive Summary

This analysis of recent mapping of the forest cover of Indonesia by the Ministry of Forestry (MoF) has revealed that the rate of deforestation in Indonesia approximately doubled between 1985 and 1997, from less than 1.0 million ha to at least 1.7 million ha each year. This has occurred despite the theoretical existence of a permanent forest estate, and despite considerable national and international concern and donor assistance.

The mapping was conducted at reconnaissance level from satellite imagery by Badan Planologi in MoF. The main objective was to obtain a very rapid overview of the change in forest cover. Wherever available, the new imagery dates from 1996 -1998, but in some areas it was necessary to use 1994 or 1995 images. Consequently, although an average date of 1997 is assumed for the new maps, some of the mapping predates the widespread forest fires of 1997-98 and the extensive illegal logging that followed the political crisis of 1998. The extent of forest on the new maps has been compared with the forest cover mapped by the Regional Physical Planning Program for Transmigration (RePPProT) program of the 1980's. Since the earlier data is centered around 1985, the period over which the changes in forest cover and deforestation rate was estimated approximately 12 years.

The methods (interpretation from digital Landsat satellite imagery) and the scale of mapping (1:500,000) are intended to provide information on the forest cover *only*. This is defined as natural forest that can be recognized as such on satellite imagery. There was no field checking, which means, first, that the presence of forest cover implies nothing about the quality of that forest. Second, while the intent was to exclude timber plantations and other types of agroforestry, some were doubtless included as forest cover because of poor quality imagery and problems of interpretation.

The analysis extended to most of the "Outer Islands" of Indonesia other than Nusa-tenggara. It focused on especially on Sumatra, Kalimantan, and Sulawesi but included Irian Jaya and Maluku.

The new forest cover maps can be inspected at the MoF website, which also carries the maps derived from the previous mapping program (National Forest Inventory, or NFI)[1] MoF area figures are presented on this website for both data sets.

Rates of Deforestation

This analysis of the MoF data concludes that over 20 million ha of forest cover have been lost over a twelve-year period, including 6.7 million ha in Sumatra and 8.5 million ha in Kalimantan. This amounts to an average annual rate of 1.67 million ha nationwide – roughly 4,600 ha per day or 190 ha per hour. Out of this total, the rate in the three islands of Sumatra, Kalimantan, and Sulawesi is 1.45 million ha per year. Those islands still contained 57 million ha of forest in 1997, but this should not be a cause for complacency; only 15% of that forest lay on the lowland non-swampy plains. Dry lowland forest is the type that is usually the richest source of timber and which carries the highest biodiversity. Most of the remainder lies either in the hills and mountains (66%), which are generally too steep for logging according to MoF criteria, or in the alluvial swamps (15%).

[1] http://mofrinet.cbn.net.id/e_informasi/e_nfi/GIS/vegetasi.htm

The predicted extinction of lowland forests

Assuming constant rates of clearing at the 12-year average, a further 6.7 million ha of forest would have been lost since 1997, mainly in the non-swampy lowlands. In fact, the rates probably have not been constant. There is evidence that the deforestation rate had increased from 800,000 ha/year nationwide in the 1980s to around 1.2 million ha/year during the early 1990s. If these figures are even approximately correct, the rate in the mid-1990s has to have been in excess of 2.0 million ha/yr to be consistent with the 12-year average. The enormous destruction of the 1997-98 forest fires was a substantial contributor. However, these fires were not a single event, but rather the culmination of several years of major El Niño-induced fires. Forest fires will be an ever-present threat in future El Niño events, especially in view of the rampant illegal logging that is reported to have occurred everywhere and that heightens the vulnerability of natural forest to fire damage. The next drought will likely see the destruction through fire of many of the remaining areas of priceless heritage.

Assuming the continuation of present trends, it is predictable that non-swamp lowland forest will become extinct in Sumatra by before 2005, and in Kalimantan soon after 2010. The remnants that remain will not be viable, either as timber resources or as habitat for biodiversity. This forest type is already almost extinct in Sulawesi, which is a largely mountainous island. The extinction of the swamp forests could follow about five years later. It is not necessary to assume that all this clearance will have been deliberate, because forest fires will have the same effect in those protected areas and peat swamp forests that are now exposed to heavy logging.

Unless radical and far-reaching steps are taken urgently to enforce existing laws, regulations, and policies, and new policies are established for sound forest management, the only extensive forests that will remain in Sumatra, Kalimantan, and Sulawesi in the second decade of the new millennium will be the low stature forests of the mountains. Further forests may survive in some swamp regions in the high rainfall zones of "NW Indonesia" that are less prone to drought, and possibly in lowland protected areas that benefit from exceptional levels of management or are protected by other means. However, without proper law enforcement and a new paradigm in manage-ment, it is assumed that steady degradation will continue in all the remaining forests.

Forest cover and the spatial plans

There are 69 million ha of land classified as having "permanent forest" status on the islands of Sumatra, Kalimantan, and Sulawesi, according to the latest consensus between MoF and the provincial spatial plans. Some 57 million ha of this (82%) still carry some form of forest cover, however, two-thirds of this forest lies in the mountains. Based upon the forest status boundaries (*TGHK*) that were in force when much of the forest clearance was occurring, total area of forest cover in designated Production Forest was 66%; in Protection Forest it was 77%; and, in Conservation Forest it was 82%. These figures clearly indicate the need for an urgent re-evaluation of forest function in the context of spatial plans and the management of the natural resources of the Outer Islands. They also underscore the importance of up-to-date forest cover maps to be utilized by all parties concerned with natural resource management and further revisions of provincial spatial plans. A continuous process of moni-

toring and updating should become a routine activity.

The results of forest conversion

Without detailed studies, it is difficult to ascertain what land use has replaced the huge area that has been deforested. The government no longer maintains its claim, often heard in the 1980s, that "shifting cultivators" were the primary force in conversion and uncontrolled fires. In fact, genuine, rotational shifting cultivators (swidden agriculture) are now very rare in Sumatra, and they clear very little primary forest elsewhere.

Generally the large investors in plantation crops have been acknowledged to be the principal agent in deforestation; they are certainly the most conspicuous. They have also been held primarily responsible for the forest fires that got out of control and burned huge tracts of logged-over forests. Yet the evidence indicates that they have developed only about 4.8 million ha, or a quarter of the deforested area. This includes 2.4 million ha of oilpalm, of which 1.75 million ha were in Sumatra.

It has been reported, however, that large areas have been clear-felled, ostensibly under license for conversion to tree crops, but in reality with the primary purpose of meeting the raw material needs of the plywood and pulp mills. Such land is presumably lying idle, although nominally under concession. It may amount to several million hectares.

Besides this clear-felling, other sources must be sought for the remaining 12.8 million ha. Media attention on the conspicuous activities of the big companies may have diverted attention away from the steady small-scale encroachment, along most of the length of the forest boundary, by small farmers. These include pioneer and displaced farmers, farmers staking claims, and probably a significant but largely unacknowledged number of small investors. The role of the small investors in tree crop development, and in environmental degradation, would be a useful field for further study.

There is now a need to optimize the agricultural production (and/or timber plantations) from all the recently deforested land, including sound planning for the development of the areas laid waste by forest fires, and for land cleared for its timber and not yet planted a new crop. [The management of forests damaged but not totally destroyed by fire is outside the scope of this study, but should include *inter alia* a crash program of salvage harvesting in order to reduce the volume of flammable timbers, and the protection of surviving trees that would provide the natural stock for regeneration and rehabilitation]. Development planning must also ensure the participation of the local farming communities who have so often been disadvantaged in the corporate development process.

Some recommendations for future development trends

The stakeholders in forest management need to include the traditional communities of the forests whose rights have hitherto generally been overlooked. They also need to include the scientific community concerned with the conservation of biodiversity and with the protective functions of a forest cover in terms of watershed management and carbon sequestration.

There must be no further approvals for estate-based forest conversion other than through a transparent process of participation of all stakeholders. Indeed, in Sumatra and Sulawesi especially, no further forest conversions should be authorized.

This permanent moratorium might also be applied to many small islands where these carry high rates of single-island endemism (such as the Mentawai Islands, Simeleuwe and Enggano, and many of the islands of eastern Indonesia).

Development in the outer islands should give much more emphasis to the development of smallholder agriculture, and especially of tree crops, through securing the rights of the small farmers and seeking ways to promote the more productive use of land that has already lost its forest cover. Much of this terrain is considered suitable for the production of fast-growing softwoods, through a range of agroforestry systems, potentially enabling the small farmer to gradually take over from the large corporations the role of supplying the pulp and timber mills.

Recommended conservation initiatives

In Sumatra, spatial plans must reflect the reality of the present forest distribution, with all remaining hill forests, peat swamp forests and mangrove forests being allocated permanent protection status (either as Protection Forest or as Conservation Areas).

In Kalimantan, comprehensive review of the forest function classification is warranted, with absolute limits being set now on the extent and distribution of further conversions. In consideration of the topography of Sulawesi, it is difficult to envisage where any further permits for conversion might legitimately be granted.

The remaining forests of these three regions have now become far too fragile and too precious to be under the management of a single government department that has exploitation as its primary focus. The people of Indonesia need to be made fully aware of the current situation at the earliest opportunity, and they need to become stakeholders in the future management of the forests that remain. Recent experience has shown that the mere allocation of protection status on paper has very little meaning in practice at provincial or field level.

Forest loss has been so rapid that a review is now required of the Biodiversity Action Plan. Some of the sites proposed have now lost their conservation value, while the intrinsic value of others has increased as the forests around them are progressively cleared. This may be a final opportunity to evaluate the remaining options.

Chapter 1. Methodology

The nationwide mapping of forest cover by the mapping and inventory division (Badan Planologi) of the Ministry of Forestry (MoF) was conducted during 1999 in response to one of the conditions required by the World Bank in its Second Policy Support Reform Loan II to the government of Indonesia. The mapping is at reconnaissance level only, based on interpretation from digital Landsat satellite imagery, without field checks. The mapping scale is 1:500,000.

Maps have been completed for most of the "Outer Islands" of Indonesia[2], including all the provinces of Sumatra, Kalimantan, Sulawesi and Irian Jaya. Provisional maps have also been prepared for Maluku (at 1:1,000,000 scale), but coverage is incomplete and the interpretation still awaits revisions. No analysis has been prepared for Nusa Tenggara. The resulting maps, except for Maluku, together with area measurements, have been placed on the ministry's website.[3]

The maps provide data on forest cover only, in order to show the current distribution and to analyze the regions and rates of forest removal. Forest is defined as natural forest that can be recognized as such on satellite imagery. The presence of a mapped forest cover is *not* a statement on the quality of that forest. Thus the forest may be undisturbed primary forest or natural forest that has been heavily damaged by logging and subject to secondary regrowth. However, pure secondary forest, that is young regrowth that follows total clearance, would not carry the signals of primary forest on the image and would not be mapped as such. Obviously there will be "grey areas" such as extreme logging or serious fire damage where an arbitrary decision has been necessary. Generally extreme fire damage is mapped as non-forest. More problematic may be the areas of mature agro-forest that commonly occur in the hills of Sumatra, or older rubber jungle and other forms of agro-forest, where again arbitrary decisions must be made based on field knowledge.

Because the mapping has been performed by remote sensing only, without field checks, and without coordination with the `provincial offices of MoF, the area figures on forest cover and rates of deforestation must be regarded as *provisional*.

Wherever available, the new imagery dates from 1996 or later, but in some areas it has been necessary to use 1994 or 1995 images. In such cases, the forest and non-forest areas on the provincial forest cover maps are presented in pale colors, in order to emphasize that further revision and updating are required.

This report presents an analysis of the present distribution of forest cover and compares it with previous nationwide mapping programs. There were two such programs, one by RePPProT (1990) during the 1980s[4] and one under the NFI program[5] during the early 1990s. The former of these has been used in this analysis because it provides a longer period for comparison and because there are some differences in the definition of forest in NFI that complicate its use in this analysis. Scotland, Frazer & Jewell (1999) note that according to the NFI, the gross forest area in Indonesia had increased from 117.9 million ha in the

[2] The "Outer Islands" generally refer to all the islands of Indonesia outside Java and Bali.

[3] http://mofrinet.cbn.net.id/e_informasi/e_nfi/GIS/vegetasi.htm

[4] Regional Physical Planning Program for Traansmigration

[5] National Forest Inventory, 1996. Ministry of Forestry and FAO.

RePPProT study to 121.2 million ha ten years later, apparently resulting from a definition of forest that incorporates bush and scrub. RePPProT used remote sensing analysis from air photographs, updated from the latest available satellite imagery, with very limited field checks. The RePPProT data is mostly from the period 1984 to 1986, and for this report it is assumed to represent the situation in 1985. Likewise the new MoF maps are assumed to represent the 1997 situation, but in practice they cover a period from 1996 to 1998 (and in some cases 1994 or 1995). Thus the new forest maps represent the situation in some areas preceding the forest fires of 1997-98, and in other areas following the fires. They are the best that could be prepared with the time and resources available. Moreover, since forest clearing is an ongoing activity, large additional areas will have been cleared subsequent to the 1997 data.

The overall results of the new mapping are presented here in tabular format, with provincial descriptions of the distribution of the remaining forests, especially in relation to existing and proposed conservation areas, in an appendix. Small-scale maps in the appendix depict the distribution of remaining forest related to broad landform regions for each province in Sumatra and Kalimantan.

It has proved to be quite difficult to determine what land uses have replaced the lost forest (see Chapter 4). There is a considerable difference between official figures for forest area lost and new land development. It is likely that substantial tracts of cleared forest are currently lying idle, but there are doubtless land uses that are neither reported in official statistics nor identifiable in satellite imagery.

The analysis leads to a hypothesis (Chapter 5) that it is especially the dryland forest of the lowland plains that is at risk of being completely extinguished within a few years if the current policies and practices remain unchanged. This is the forest that has the greatest biodiversity values, and the forest that would have the greatest potential for sustained timber production under appropriate manage-ment. However, this is also the forest that occupies the land under the greatest demand for conversion to non-forest uses.

Chapter 6 includes some general proposals on the future that land use planning should take. Specific issues examined are: security of land tenure and problems of communal land rights; the development of idle and degraded lands under smallholder tree crops, especially to supply the wood processing industry; the reservation of quality arable land in concession areas for food production by the present farmers; and the introduction of a rehabilitation tax to be applied to land concessions to assist in the reclamation of degraded land once the concession expires.

Chapter 2. Rates Of Deforestation

Table 1 summarizes the measurements of forest area in the RePPProT and current MoF mapping programs. Over the Outer Islands as a whole, over 20 million ha of forest have been lost over the past twelve years. In Sumatra, total forest area has decreased from over 23 million ha to probably less than 16 million ha, with the provinces of South Sumatra and Jambi recording the most rapid rates of forest loss (Lampung already had little forest cover in 1985). In Kalimantan, total forest area has decreased from 40 million ha to about 31 million ha, with East Kalimantan having the highest rate of conversion. Much lower rates of deforestation have prevailed in Sulawesi, mainly because most of the lowland forests suitable for conversion had already been cleared by the mid-1980s. Rates of deforestation in Maluku appear to have been high, but the rate in Irian Jaya has not been dramatic. No mapped information has been seen for the southern islands of Java or Nusa Tenggara. Using the data from Table 1, and assuming no significant changes in forest cover in the unmapped areas, the gross forest area nationwide was about 96 million ha in 1997. Assuming that average rate of forest conversion of nearly 1.7 million ha per year over the past twelve years continues, the total forest area may already have been reduced to less than 90 million ha.

The measurements in Table 1 are derived from Badan Planologi, although adjustments have been made to the figures for Central and East Kalimantan and for all the Sulawesi provinces, in order to allow for substantial areas that lack imagery or have cloud cover. Cloud cover is often most widespread in the hills, in areas where the forest is largely intact, and thus the area of mapped forest was artificially low. The adjusted figures include the measured area of mapped forest plus an estimate of the area of forest in the unmapped area, based on field knowledge and comparison with the RePPProT maps.

A check was made of the area measurements for Sumatra and Kalimantan using the services of a private GIS consultant. The 1:500,000 maps from Badan Planologi were re-digitized, and then compared with the digital RePPProT forest boundaries. The differences in area of forest cover proved to be moderate for Sumatra (by a difference of one or two percentage points), but minor for Kalimantan. The reasons are not clear, but some of the difference will be due to the different base map projections used. There were significant areas shown as "new forest cover", a condition that is assumed not to be possible; generally these resulted from projection problems, but in some cases the original RePPProT map may have been incorrect. When the "new" forest cover is incorporated into the total, the gross 1997 forest area is found to be quite similar to the MoF measurements. However, a completely independent study by the Indonesia - UK Tropical Forest Management program registered the deforestation in Riau as being about one million hectares *higher* than the MoF rate. These anomalies emphasize the reconnaissance scale of the exercise, and the need for more intensive monitoring.

Nearly 1.8 million ha of forest have been lost from Irian Jaya, representing 150,000 ha per year. The figures may be approximate, especially in view of difficulties in interpretation of satellite imagery in the savanna woodlands of the Merauke region. However, deforestation in these eastern regions must not be dismissed. Brown (1999) notes that clear-cutting for conversion has been permitted in an area of virgin forest of over 6 million ha in Irian Jaya.

The overall deforestation rate, 1.7 million ha/year, is substantially higher than any of the previously published estimates, which

range between 0.3 and 1.3 million ha/year (World Bank 1994). Fraser (1998) demonstrates a negative correlation between population density and forest cover, and concludes that 1.0 million ha/year would agree with predictions based on population growth. If this correlation is accepted, then another mechanism must be operating to account for the additional 0.7 million ha. It seems likely that this mechanism is the wholesale conversion to plantation crops that has expanded over the past decade, together with the results of the massive forest fires for which the big plantation companies must also take a large portion of the blame.

While the mean rate over twelve years is taken to be 1.7 million ha per year, it is probable that the rate has actually been increasing. The data from the National Forest Inventory (NFI) provide some evidence that the average annual rate nationwide increased from 800,000 ha in the 1980s to 1.2 million ha between 1985 and 1996 (the latter is based on a loss of 14 million ha). If this is correct, the rate over the last three years must have increased to well over 2.0 million ha per year to yield an average of 1.7 million. Forest fires would have accounted for a large portion of this.

Table 1 shows that South Sumatra province remains the leader in rapid deforestation (65 percent loss), followed by Jambi, and then North Sumatra and Riau. This corresponds to the central region of Sumatra which has the most extensive lowland plains, and also hitherto some of the lowest levels of land-based development. In terms of total area of forest cover lost, however, the highest rate has been in Kalimantan.

The forest fires of 1997 (and early 1998 in East Kalimantan) contributed significantly to the high rates of loss in some provinces. East Kalimantan and South Sumatra were the worst affected, and significant areas of other provinces were also burned, notably West and Central Kalimantan and Jambi. Without the forest fires, the average annual rates of deforestation would be lower. However, the annual average rate arrived at in this analysis has not been adjusted to allow for this bias, in view of the fact that the risk of serious forest fires in future droughts has actually increased. This is a consequence of both the high fire hazard in previously burnt areas and the extent of illegal logging that is currently rampant. Disturbed forest has proved to be more prone to fire damage than intact natural forest.

Table 1: Rates of Forest Loss, 1985-1997

Province	RePPProT (1985)			MoFEC (1997)				RePPProT - MoFEC		
	Total	Forest	%	Total	Forest	%	No data	Forest loss	%loss	Ha/yr
Aceh	5,674,800	3,882,300	68.4	5,669,345	3,611,953	63.7	13,533	270,347	7.0	22,529
N. Sumatra	7,250,100	2,812,000	38.8	7,113,131	1,891,819	26.6	100,508	920,181	32.7	76,682
W. Sumatra	4,169,000	2,590,400	62.3	4,153,618	1,944,015	46.8	597,757	646,385	25.0	53,865
Riau	9,859,700	5,936,500	60.3	9,661,817	5,071,891	52.5	2,506	864,609	14.6	72,051
Jambi	4,873,900	2,765,800	56.7	4,855,923	1,603,079	33.0	232,890	1,162,721	42.0	96,893
S. Sumatra	10,226,300	3,562,100	34.8	10,149,068	1,248,209	12.3	913,789	2,313,891	65.0	192,824
Bengkulu	2,090,400	1,126,600	53.8	2,096,606	899,858	42.9	0	226,742	20.1	18,895
Lampung	3,386,700	647,800	19.1	3,359,906	361,319	10.8	237,929	286,481	44.2	23,873
SUMATRA	**47,530,900**	**23,323,500**	**49.1**	**47,059,414**	**16,632,143**	**35.3**	**2,098,912**	**6,691,357**	**28.7**	**557,613**
W. Kalimantan	14,753,000	8,700,600	59.0	14,546,318	6,713,026	46.1	243,571	1,987,574	22.8	165,631
C. Kalimantan	15,360,400	11,614,400	75.6	15,249,222	9,900,000	64.9	526,643	1,714,400	14.8	142,867
S. Kalimantan	3,749,000	1,795,900	47.9	3,703,550	999,182	27.0	288,120	796,718	44.4	66,393
E. Kalimantan	19,721,000	17,875,100	90.6	19,504,912	13,900,000	71.3	177,707	3,975,100	22.2	331,258
KALIMANTAN	**53,583,400**	**39,986,000**	**74.6**	**53,004,002**	**31,512,208**	**59.5**	**1,236,041**	**8,473,792**	**21.2**	**706,149**
N. Sulawesi	2,655,500	1,553,600	58.5	2,645,243	1,300,000	49.1	441,617	253,600	16.3	21,133
C. Sulawesi	6,032,900	4,359,100	72.3	6,001,253	3,400,000	56.7	645,100	959,100	22.0	79,925
S. Sulawesi	6,245,100	2,879,200	46.1	6,139,434	2,300,000	37.5	349,119	579,200	20.1	48,267
SE Sulawesi	3,681,000	2,477,500	67.3	3,676,422	2,000,000	54.4	305,266	477,500	19.3	39,792
SULAWESI	**18,614,500**	**11,269,400**	**60.5**	**18,462,352**	**9,000,000**	**48.7**	**1,741,102**	**2,269,400**	**20.1**	**189,117**
3 ISLANDS TOTAL	**119,728,800**	**74,578,900**	**62.3**	**118,525,768**	**57,144,351**	**48.2**	**5,076,055**	**17,434,549**	**23.4**	**1,452,879**
Maluku	7,801,900	6,348,000	81.3	7,808,786	5,538,506	70.9	nd	809,494	12.7	67,458
Irian Jaya	41,480,000	34,958,300	84.3	40,871,146	33,160,231	81.1	7,710,915	1,798,069	5.1	149,839
Java & Bali	13,820,400	1,345,900	9.7	nd	nd	nd	nd	nd	nd	nd
Nusatenggara	8,074,000	2,469,400	30.6	nd	nd	nd	nd	nd	nd	nd
INDONESIA	**190,905,100**	**119,700,500**	**62.7**	**167,205,700**	**95,843,088**	**57.3**	**12,786,970**	**20,042,112**	**16.7**	**1,670,176**

All areas are in hectares (ha).

- *The 1997 forest area for Maluku was only a preliminary figure when the author completed the manuscript. Final estimates were obtained from the Ministry of Forestry website in December 2001 and included in this table by the editor.*
- No data = Cloud cover on MoFEC map, or no satellite imagery available. Except where mentioned below, the total is *not included in the forest cover. The RePPProT figure for no data' also has not been included here.*
- In the following provinces, adjustments have been added to the area of forest cover to allow for an estimate of forest within the 'no data' zones:

	Measured forest	Area of no data	Adjusted forest area
Central Kalimantan	8,543,384	1,883,359	9,900,000
East Kalimantan	13,361,195	716,512	13,900,000
North Sulawesi	1,106,031	635,586	1,300,000
Central Sulawesi	2,892,697	1,152,402	3,400,000
South Sulawesi	2,114,703	534,416	2,300,000
SE Sulawesi	1,975,726	329,540	2,000,000

Chapter 3. Forest Cover and Forest Status

Table 2 relates the current forest cover with the total area of land under the control of the forestry department, including gross provincial areas under logging concessions. The forest status areas are the latest preliminary figures available from the ministry in October 1999, following integration with provincial spatial plans (*paduserasi*), and they differ quite significantly from the areas published in the ministry's 1999 statistics.

The latest revision of forest status compared with the former agreed Forest Use Categories (*Tata Guna Hutan Kesepakatan, TGHK* - see Table 3) has resulted in an increase of Conservation Area by 1.82 million ha, an increase in Protection Forest by 3.22 million ha, an increase in Production Forest by 2.32 million ha, but a decrease in Limited Production Forest by 8.13 million ha. The increase in conservation areas reflects the designation of new national parks. The location of the new areas of protection forest has not been ascertained, but presumably it has been derived from former Limited Production Forest in the mountainous areas, which will assist in serving functions of watershed protection. The remaining 4.91 million ha of former Limited Production Forest has probably been reclassified as Production Forest, as a means of replacing areas of Production Forest that have been lost. The implication of the latter is that some areas of steep land may now be opened up to unrestricted logging.

In the three islands of Sumatra, Kalimantan, and Sulawesi, over 69 million ha have permanent forest status under the revision status, yet total forest cover is only about 54 million ha. There is a deficit of at least 12 million ha -- more to the extent that some of the forest cover mapped lies outside the new boundaries. In other words, a maximum of 82 percent of the land under permanent forest status still carries forest cover. Only Aceh, Riau, Bengkulu and Central and East Kalimantan have gross forest cover that is more than 90 percent of their newly-defined permanent forest estates. South Sumatra and Lampung have only a third of their "permanent" forest under a forest cover.

The area of valid concessions (HPH, as obtained from the MoF website) is considerably less than that in the total list of concessions, which nationwide in 1999 amounted to over 51 million ha. Many have been cancelled or not extended. Even then, the gross area of concessions licensed often exceeds the area of forest cover with production forest status. For example, North Sumatra has 2.18 million ha of protected areas in the revised forest estate, and 1.63 million ha of production forest, yet the province's total forest cover is only 1.89 million ha. If all of the protected areas had forest cover, as one would hope, the logical conclusion would be that none of the concessions in North Sumatra contain trees. It would also appear that the new forest status boundaries have been agreed with the spatial plans ***prior*** to the availability of the new forest cover maps. This emphasizes the vital importance of making accurate forest cover maps available to all parties engaged in resource management and revisions of spatial plans.

In practice, of course, substantial proportions of protected areas no longer support forest. This is illustrated in Table 3, which compares forest cover within the principal forest status boundaries (*TGHK*) that were in force during the 1980s (Limited and Normal Production Forest are combined in this table). The measurements were provided by Badan Planologi, and no adjustments have been made for cloud cover or lack of data. These represent *former* forest status boundaries, and the areas for each category differ from the revised forest status areas given in Table 2. For example, boundaries of the new Bukit

Tigapuluh national park (Riau and Jambi) have not been incorporated in the Table 3 figures. Nevertheless, Table 3 provides an indication of the extent of degradation within some of the protected areas.

Table 3 shows that forest cover in the conservation areas of Sumatra, Kalimantan, and Sulawesi averages 82 percent. In individual provinces the percentage is as low as half the area -- in South Sumatra and South Kalimantan, for instance, several large reserves have become totally deforested. Only Aceh, Central Kalimantan, and North Sulawesi still carry forest cover over more than 90 percent of their conservation areas. An even more disturbing pattern emerges for the Protection Forest, with only 77 percent cover in gross, and whole swathes of Protection Forest in North and South Sumatra, Lampung, and South Kalimantan no longer supporting any forest. Aceh, Central and East Kalimantan, and North Sulawesi have the highest percentage of forest cover in protected areas. In view of these figures, it is perhaps not surprising that average forest cover in the Production Forest amounts to only 66 percent. In Lampung this figure is only 6 percent, and in South Sumatra it is 25 percent. These figures are indicative only, and the presence of forest cover on the maps says nothing about the quality of that forest. The many reports of widespread illegal logging, including within the boundaries of national parks, suggest that extensive degradation is likely to be occurring along every forest edge in the region. Furthermore, the fact that nationally, only about 71 percent of the 71 million ha of designated permanent forests of the three islands (according to the former forest status boundaries or TGHK) still carries some form of forest cover (ranging from 33 percent in South Sumatra to 87 percent in Aceh) indicates the urgency for a far-reaching re-evaluation of forest status in the context of national and provincial spatial plans, and a new paradigm of management of a rapidly dwindling resource.

Table 2: Forest Status, Forest Cover and Forest Use

		Forest status[2]						Forest cover		Forest use[3]		
Province	Total land area	Conservn. Forest	Protection Forest	Limited Production Forest	Production Forest	Permanent Forest Status	Conversion Forest	1997 Forest cover[1]	Total forest cover as percentage of permanent forest	Logging concessions	Timber estates allocated	Total allocated for forest industry
Aceh	5,674,800	852,421	1,844,500	37,300	601,392	3,335,613	0	3,611,953	108%	1,087,500	376,564	1,464,064
N. Sumatra	7,250,100	253,885	1,924,535	760,958	871,183	3,810,561	37,797	1,891,819	50%	710,600	486,640	1,197,240
W. Sumatra	4,169,000	846,175	910,533	246,383	407,849	2,410,940	189,346	1,944,015	81%	152,830	0	152,830
Riau[4]	9,859,700	560,237	1,323,801	0	2,649,608	4,533,646	334,521	5,071,891	112%	2,719,603	684,312	3,403,915
Jambi	4,873,900	676,120	191,130	340,700	971,490	2,179,440	0	1,603,079	74%	651,350	189,941	841,291
S. Sumatra	10,226,300	822,300	879,390	298,600	2,269,400	4,269,690	774,100	1,248,209	29%	1,231,850	590,069	1,821,919
Bengkulu	2,090,400	444,882	252,042	182,210	41,830	920,964	70,360	899,858	98%	198,900	5,000	203,900
Lampung	3,386,700	422,500	331,531	44,120	192,902	991,053	153,459	361,319	36%	0	282,835	282,835
SUMATRA	**47,530,900**	**4,878,520**	**7,657,462**	**1,910,271**	**8,005,654**	**22,451,907**	**1,559,583**	**16,632,143**	**74%**	**6,752,633**	**2,615,361**	**9,367,994**
W. Kalimantan	14,753,000	1,435,480	2,355,045	2,421,950	2,235,700	8,448,175	582,320	6,713,026	79%	3,139,810	876,749	4,016,559
C. Kalimantan	15,360,400	680,580	1,014,130	4,593,003	4,448,222	10,735,935	0	9,900,000	92%	4,085,000	391,843	4,476,843
S. Kalimantan	3,749,000	176,615	554,139	155,268	687,834	1,573,856	265,638	999,182	63%	174,000?	549,474	723,474
E. Kalimantan	19,721,000	2,166,212	2,935,478	4,755,494	4,727,488	14,584,672	0	13,900,000	95%	4,602,000	1,290,113	5,892,113
KALIMANTAN	**53,583,400**	**4,458,887**	**6,858,792**	**11,925,715**	**12,099,244**	**35,342,638**	**847,958**	**31,512,208**	**89%**	**11,826,810**	**3,108,179**	**14,934,989**
N. Sulawesi	2,655,500	429,065	341,447	552,573	168,108	1,491,193	34,812	1,300,000	87%	408,650	0	408,650
C. Sulawesi	6,032,900	676,248	1,489,923	1,476,316	483,034	4,125,521	269,411	3,400,000	82%	1,440,925	31,392	1,472,317
S. Sulawesi	6,245,100	843,966	1,928,597	828,255	186,666	3,787,484	102,073	2,300,000	61%	352,000	135,706	487,706
SE Sulawesi	3,681,000	274,069	1,061,270	419,244	633,431	2,388,014	212,123	2,000,000	84%	491,500	61,594	553,094
SULAWESI	**18,614,500**	**2,223,348**	**4,821,237**	**3,276,388**	**1,471,239**	**11,792,212**	**618,419**	**9,000,000**	**76%**	**2,693,075**	**228,692**	**2,921,767**
3 ISLAND TOTAL	**119,728,800**	**11,560,755**	**19,337,491**	**17,112,374**	**21,576,137**	**69,586,757**	**3,025,960**	**57,144,351**	**82%**	**21,272,518**	**5,952,232**	**27,224,750**
Java & Bali	13,820,400	468,233	728,651	394,316	1,633,383	3,224,583	0	?	?	0	0	0
Nusatenggara	8,074,000	567,714	1,571,418	651,257	676,326	3,466,715	352,667	?	?	60,500	170,307	230,807
Maluku	7,801,900	443,345	1,809,634	1,653,625	1,053,171	4,959,775	2,034,932	5,538,506	112%	2,547,425	188,689	2,736,114
Irian Jaya	41,480,000	7,539,300	11,452,990	3,365,475	10,379,684	32,737,449	2,671,275	33,160,231	101%	11,582,673	?	11,582,673
INDONESIA	**190,905,100**	**20,579,347**	**34,900,184**	**23,177,047**	**35,318,701**	**113,975,279**	**8,084,834**	**95,843,088**	**84%**	**35,739,486**	**6,311,228**	**42,050,714**

1. Source: Table 1.

2. Source: advance draft based on *pemaduserasian TGHK dan RTRWP, October 1999, Sekretaris Badan Planologi Hutbun.*

3. Source: MoFEC website for concessions, *Statistik Perusahaan Hutan Tanaman Industri* 1996 for HTI (BPS).

4. The Riau data lists Protection Forest as only 361,967 ha, but then a footnote states that the total does not include 961,834 ha of peat and mangrove forests.

The source table notes that the data on forest status areas are preliminary for Aceh, North Sumatra, Riau, and West, Central and East Kalimantan.

See footnotes to Table 1 concerning forest area data.

Table 3: Forest Cover within Forest Status Boundaries

	Conservation forest			Protection forest			Total Protected area			Production forest			Permanent forest estate		
	TGHK	Forest	%	TGHK	Forest	%	TGHK	Forest	%	TGHK	Forest	%	TGHK	Forest	%
Aceh	832,453	811,498	97	972,290	904,813	93	1,804,743	1,716,311	95	1,812,050	1,425,684	79	3,616,793	3,141,995	87
N. Sumatra	253,557	213,219	84	1,543,337	689,618	45	1,796,894	902,837	50	2,251,312	894,438	40	4,048,206	1,797,275	44
W. Sumatra	539,915	376,098	70	1,242,256	901,199	73	1,782,171	1,277,297	72	1,098,571	699,623	64	2,880,742	1,976,920	69
Riau	378,437	335,531	89	426,017	308,875	73	804,454	644,406	80	4,125,048	2,907,930	70	4,929,502	3,552,336	72
Jambi	645,720	509,910	79	204,642	170,677	83	850,362	680,587	80	1,492,791	802,905	54	2,343,153	1,483,492	63
S. Sumatra	605,836	278,644	46	775,680	376,867	49	1,381,516	655,511	47	2,615,506	648,930	25	3,997,022	1,304,441	33
Bengkulu	307,721	267,907	87	459,612	382,616	83	767,333	650,523	85	249,235	172,633	69	1,016,568	823,156	81
Lampung	388,743	264,035	68	341,243	117,139	34	729,986	381,174	52	309,448	18,383	6	1,039,434	399,557	38
SUMATRA	**3,952,382**	**3,056,842**	**77**	**5,965,077**	**3,851,804**	**65**	**9,917,459**	**6,908,646**	**70**	**13,953,961**	**7,570,526**	**54**	**23,871,420**	**14,479,172**	**61**
W. Kalimantan	1,279,467	1,129,627	88	2,296,136	1,860,959	81	3,575,603	2,990,586	84	4,814,921	2,447,580	51	8,390,524	5,438,166	65
C. Kalimantan	632,708	584,769	92	840,176	804,564	96	1,472,884	1,389,333	94	9,397,431	7,181,488	76	10,870,315	8,570,821	79
S. Kalimantan	127,962	65,174	51	441,148	263,794	60	569,110	328,968	58	1,375,640	793,315	58	1,944,750	1,122,283	58
E. Kalimantan	1,783,624	1,525,213	86	2,866,921	2,741,102	96	4,650,545	4,266,315	92	9,887,197	7,643,158	77	14,537,742	11,909,473	82
KALIMANTAN	**3,823,761**	**3,304,783**	**86**	**6,444,381**	**5,670,419**	**88**	**10,268,142**	**8,975,202**	**87**	**25,475,189**	**18,065,541**	**71**	**35,743,331**	**27,040,743**	**76**
N. Sulawesi	416,727	383,530	92	327,609	287,167	88	744,336	670,697	90	832,523	648,911	78	1,576,859	1,319,608	84
C. Sulawesi	633,160	549,035	87	1,322,124	1,143,232	86	1,955,284	1,692,267	87	2,206,506	1,658,344	75	4,161,790	3,350,611	81
S. Sulawesi	125,019	97,914	78	2,029,571	1,391,288	69	2,154,590	1,489,202	69	1,209,838	717,529	59	3,364,428	2,206,731	66
SE Sulawesi	291,016	223,497	77	529,478	457,826	86	820,494	681,323	83	1,551,231	1,194,109	77	2,371,725	1,875,432	79
SULAWESI	**1,465,922**	**1,253,976**	**86**	**4,208,782**	**3,279,513**	**78**	**5,674,704**	**4,533,489**	**80**	**5,800,098**	**4,218,893**	**73**	**11,474,802**	**8,752,382**	**76**
TOTAL	**9,242,065**	**7,615,601**	**82**	**16,618,240**	**12,801,736**	**77**	**25,860,305**	**20,417,337**	**79**	**45,229,248**	**29,854,960**	**66**	**71,089,553**	**50,272,297**	**71**

Note: areas having cloud cover, or without data, are assumed to have forest cover.

Source: Badan Planologi, 1999

Chapter 4. Conversion To What?

Formerly, the government tended to blame deforestation, and especially the forest fires, on "shifting cultivators", the traditional farmers who practice rotational swidden agriculture. However, during the 1997 fires the government at last acknowledged, in the light of the evidence from satellite imagery, that the large plantation companies were primarily responsible for setting the fires. Corporate development, especially for oilpalm plantations, has become the main agent in accelerating the process of deforestation during the 1990s. In reality, there are now very few genuine "shifting cultivators", the traditional farmers who practice rotational swidden farming. They are now likely to be restricted to the inner regions of the forest that are more remote from population pressures and the influence of a market economy.

The big estates are certainly the most conspicuous agent of deforestation, and the overall impact of swidden farming on forest cover is relatively small. There is a third group consisting of pioneer farmers, spontaneous transmigrants, and farmers who have been displaced by large-scale estate developments, that may have become a main actor in deforestation. They are <u>not</u> shifting cultivators. Further research is necessary to assess the role this group plays in forest conversion.

Conversion by large investors

Without detailed remote sensing studies and site visits, it is very difficult to obtain definitive data on what has replaced the forests that have been lost. Every data source tends to give different area figures (for example, BPS, BPN, MoF) for estate concessions (*Hak Guna Usaha* or *HGU*) under application and allocation. There have been vast areas of land under application for forest conversion, and the intent can be confused with the realization. In Sumatra alone, 9.4 million ha were under application during the mid-1990s. In many provinces the gross area under application exceeds the area that would be available for conversion, as a result of overlapping claims, but many of the claims are of a speculative nature. Some applications for supposed HGU, often in wholly unsuitable terrain, are apparently merely a means to acquire access to the timber. Many applications have probably now lapsed, been withdrawn, or been revoked. During 1999, HGUs already issued were also revoked if the concessionaires were not active in developing them. However, they would not have been revoked if the concessionaires were active in clear felling, whether or not the company had any intention to immediately plant a tree crop.

Table 4 summarizes available data on developments in the large investor sector. Column C gives the total areas allocated for timber estates (*Hutan Tanaman Industri* or *HTI*), but the area actually realized up to 1998 (Column D) is only 37 percent, according to MoF statistics. The actual area planted is small still, perhaps as low as 21 percent (Mulyadi, 2000). Comparing areas under oil palm in 1984 and 1998 shows an increase of 2.4 million ha during the period covered by this analysis, most of it in Sumatra, Kalimantan, and Sulawesi (Column G). However, over 4.3 million ha had been approved in principle by 1995 (Column H). The "conversions" in Column I represent approved change of status from forest to agriculture. These include conversion for transmigration, but well over 80 percent of the total area is for plantations. Timber and oil palm are not the only major tree crops planted by the large investors, but total areas of other crops such as rubber, cocoa and coconut are comparatively small.

Thus it would appear from Table 4 that out of the 17 million ha of forest loss in Sumatra, Kalimantan and Sulawesi, only some 4.3 million have actually been replaced by other tree crops in the large investor sector. In the gap between allocated area and planted area – 4.0 million ha of HTI and more than 2.0 million ha of oil palm – there are doubtless substantial areas of cleared but unplanted forest.

Evidence that this gap is real comes in a report from the Tropical Forest Management program (Brown, 1999), where it is noted that in 1998, 40 percent of the country's legal supply of timber came from land clearing, and that the output from this source had doubled between 1994 and 1997. Out of 10 million m^3 of timber from land conversions in 1997/98, 70 percent came from three provinces: 3.44 million were from East Kalimantan, 1.86 million from Riau and 1.6 million from Central Kalimantan. Yet the timber estate con-cessionaires have only planted at most a third of the land under their control. The area that has been licensed for oilpalm and cleared, but not yet developed, may be equally extensive.

In Sumatra, about 1.7 million ha of oil palm and 0.9 million ha of timber estates have been planted over the past decade. This would mean that only about 220,000 ha have been cleared annually and developed by the large investors – about 40 percent of the Sumatran area deforested each year (the percentages would be smaller for Kalimantan, and relatively very small for Sulawesi). Was a large fraction of the other 60 percent clear-felled merely to supply the mills, without any intention to plant a tree crop?

Conversion by smallholders

In South Sumatra province, Gouyon (1999) estimates that large investors plant about 40,000 ha of tree crops per year. Her data for the province show that the planted area of timber estates as of mid-1998 was 234,000 ha, out of a concession area of 685,000 ha. The area of large plantations increased from 76,000 ha in 1991 to 272,000 ha in 1997 (218,000 were oil palm and 55,000 ha rubber), equivalent to approximately 33,000 ha per year. Meanwhile the total area of smallholder tree crops increased from 944,000 ha in 1991 to 1,156,000 ha in 1997 (largely rubber), equivalent to 35,000 ha per year.

These figures tell nothing of the amount of forest land that was converted to tree crops, especially in a province where there was already a lot of deforested land lying under-utilized. However they do suggest that gross annual smallholder tree crop development is approximately equivalent to the area of large plantations. Unfortunately, statistics from Directorate-General Estates (DGE) include both individual farmers and farmers on nucleus estate schemes, as "smallholders". The latter have been developed by large estate enterprises, so there is a bias in the numbers of independent small tree crop farmers. Most of these schemes are now based on oil palm, however.

By extrapolation, while 220,000 ha have been developed by large investors in Sumatra each year, probably mainly by conversion of forest, a similar area has been developed by smallholders under tree crops. In Table 5, the realization of plantations by the large investors in timber and agricultural estates is combined (Column E), while the recorded growth of smallholder plantations is listed in Column F. The latter figure actually covers 14 years, rather than the 12 used in this analysis, but the figures are indicative. The table suggests that except in Sulawesi, the new smallholder area is considerably less than the estate area: 60 percent in Sumatra and 28 percent in Kalimantan. Alternatively, from the total newly developed tree crop area (Column G), only 37 percent belongs to smallholders in Sumatra and 22 percent in Kalimantan.

Gouyon's estimates make it unlikely that these proportions should be so small.

It is important to emphasize that the areas listed in Columns F and G often do not represent forest conversions, especially in the smallholder sector. Indeed, genuine smallholder settlers, or "pioneer farmers", who are likely to comprise both spontaneous inter-regional migrants as well as farmers displaced by the large estates, may lack the resources to develop tree crops on the lands they have cleared. Furthermore, as so many of the lowlands have been closed to smallholders by issuance of licenses for developments, these pioneers will be clearing forest in the steeper marginal lands that are least suited for the type of subsistence cropping that follows. Others may be clearing land with the primary purpose of staking a claim, and they will commonly plant seedling rubber. Commonly the original clearance is for an upland rice crop, which is then followed by rubber.

Conversion by small investors

The small investor is an additional agent in deforestation. Typically, he or she is an urban-based businessman or government servant who wishes to expand his or her portfolio through the acquisition of farmland and cash crops. They hire rural labor is hired, often small or landless farmers, to clear and manage plots of a few hectares of tree crops, perhaps only one or two hectares at a time. This could be oil palm where processing facilities are readily available, but more commonly it will be a less demanding crop such as rubber, coffee or cocoa, or local specialties such as cinnamon. The small investor may be from the nearest town, but often the more active participants are from the provincial capital or from outside the province. It is likely that many acquire their holdings informally, and thus they do not appear in government statistics on permits for forest conversion. This would definitely be the case where the forest has some exclusive classification such as protection forest[6]. Their entrepreneurial investments might appear in provincial statistics (for example, *propinsi dalam angka*), as a source of achievement in development of tree crop area, where there is no disclosure of the illegal process through which the land may have been obtained. With so much uncertainty, it is not possible to estimate the amount of small investor activity that is captured in Column G of Table 5.

In fact, with the data at hand there may be no way to determine the role of small investors in the high rate of deforestation that has occurred. However, fragmentary information suggests that they could be a major agent of forest cover loss. The author encountered such "urban small investors" during soil surveys in Jambi province already in 1975. Press reports have referred to the role of such investors in the deforestation of Bukit Seligi Protection Forest in Riau (*Riau Post* 16 Nov 1999), and in Ogan Komering Ilir in South Sumatra (*Kompas* 17 Nov 1999). In the latter case, the article also mentions rural migrants clearing land that they then sell before moving on. On the other hand, it appears that such urban investors have played only a minor role in the expansion of smallholder coffee in Bengkulu, where it is apparent that the rural population of "owner-farmers" would not have spare human resources to manage additional plots.

A study by Angelsen and Resosudarmo (1999) emphasizes the variability between provinces and the different factors in operation within sample areas in Riau, West and East Kalimantan and Central Sulawesi. The authors concluded that better-off farmers, immigrants and urban dwellers

[6] A very common instance of such acquisitions lies in the brackish-water fishponds sector; small farmers mostly lack the resources to develop these by themselves, and probably the majority of mangrove conversions have been through outsiders.

with capital are more likely to have utilized the opportunities created by the monetary crisis in Indonesia and to have converted forests to high profitability crops. Even among traditional societies in Riau (Talang Mamak), rubber is replacing shifting cultivation, but on the other hand the increased income from rubber decreases the need for systematic clearance of new ladangs each year. Indeed rubber planting has become the main objective of smallholder clearance.

In the Riau sample area, comprising seven villages, a total of 1,400 ha of fields were opened from forest in 1998; this comprised all types of forest, but 200 ha were from primary forest. The total cleared area thus averaged 200 ha/village/year, which seems a very high figure. In Central Sulawesi, close to Lore Lindu national park, the indigenous people are still mostly clearing for subsistence farming, and it is the migrants from elsewhere in Sulawesi who are opening cocoa gardens. Angelsen and Resosudarmo found that demand from these migrants and from city dwellers were putting an upward pressure on land prices. Indigenous farmers are tempted to sell, and are then forced to open new lands or become laborers.

All these samples illustrate the complexity of the subject. It is an area ripe for further research.

Forest fires

So far this analysis has looked only at the deliberate conversion of forest to some form of agricultural land. Previously, the transmigration program would have been one of the biggest factors, but lately, especially in Sumatra, this program has been largely absorbed by the tree crop sector. The swamp settlements would all come under the category of transmigration, but few new swamp sites have been developed since the mid-1980s, except in the ill-conceived and ill-fated "one-million hectare" peat swamp project in Central Kalimantan.

However, it was mentioned in Chapter 2 that the average annual rates of forest loss would have been biased by forest fires, especially those that occurred during the 1997-98 drought. The estimated area of lowland forest (including swamp forest) damaged by fire in 1997-98 was 3,125,000 ha in Kalimantan, 691,000 ha in Sumatra, and 200,000 ha in Sulawesi (Fortech *et al.* 1999). A draft report by GTZ (IFFM/SFMP 1999) identifies 5.2 million ha of fire damage in East Kalimantan, of which 2.3 million ha were in forest concession areas and 440,000 ha in protected forests. Severity of damage was rated in three classes (GTZ uses four): very severe damage 6 percent, severe damage 66 percent, and light damage 28 percent. Whatever the accuracy of these estimates, the degree of severity necessary for a forest area to be mapped as non-forest in the Badan Planologi mapping has not been pinpointed.

If it is assumed that about half the fire-damaged forest was mapped as forest loss, then this would have contributed about 29,600 ha (5.3%) to the annual rate of forest conversion in Sumatra (final Column of Table 1), and about 130,150 ha (18.4%) in Kalimantan. The definition of "lowland" forest in Sulawesi needs to be ascertained, but it is doubtful that as much as 200,000 ha of true lowland forest even existed on Sulawesi in 1997 (see Chapter 5).

Summary

Clearly it is important to investigate further the entire process of land conversions, from the viewpoints of:

- Officially approved conversions by large investors for tree crop development in the last remaining lowland forests;
- Approved conversions which have really been disguised clear felling to supply the timber industry;
- Conversions by small investors, both formal and informal, and the scale of this activity;
- The development of tree crops by owner-farmers compared with absentee landlords;
- The pressures that result in pioneer farmers moving into marginal lands;
- The ownership of rights to the "'wasteland" category and the formulation of plans to optimize on the new "asset" that replaces the original forest cover.

Each of these activities has its environmental and social impacts, positive and negative. A comprehensive understanding of the processes, the impacts, the incentives that drive them and their spatial distribution is crucial to the future optimal management of increasingly scarce forest resources. Indonesian environmental organizations and government officials agree that there should be no further permits issued for forest conversion until a new inventory of the forests has been completed and a transparent and participatory process for forest allocations is put into effect.

There have clearly been several main agents of deforestation over the past decade, and the area opened by each is known with varying degrees of certainty. Moderately definitive figures are available of the areas developed under tree crop plantations and, with some assumptions, for the forests destroyed (rather than merely damaged) by fire. The figures for small farmers and small investors are merely calculated guesses. Here is a hypothetical approximation beginning from the figure of 17.4 million ha of forest loss in total over twelve years from the islands of Sumatra, Kalimantan, and Sulawesi.

Timber plantations (HTI)	1.94 million ha	11%
Estate crops (HGU)	2.40 million ha	14%
Forest fires	1.74 million ha	10%
Small investors	2.40 million ha	10%
Pioneer farmers	1.22 million ha	7%

These account for only 9.7 million ha -- 55 percent of the total area. It is quite likely that the estimates are low for the last two categories. However, even doubling the areas assumed for them leaves 4.4 million ha unaccounted for. At least one-fourth to about one-half of the cleared forest land is therefore presently lying more or less idle. This depressing conclusion might not be exaggerated. Brown (1999) quotes MoF figures indicating that only 25 percent of the area allocated for timber estates had been planted, implying that anything up to 5.7 million ha of HTI may have been cleared and not planted. This alone would account for 30 percent of the total area deforested.

A first requirement in future developments should be to ensure proper utilization of the several million hectares of unproductive land that used to be covered by forest. The distribution of this land, and existing claims over it, must be accurately determined by the provincial and local authorities. The spatial distribution of the categories of forest conversion can only be ascertained through intensive mapping programs, of the type undertaken by the provincial BAPPEDA's through the LREP program, but it would have to be a multi-disciplinary exercise. It is unlikely that routine progress on LREP, now that international funding has ceased, will provide the necessary answers. A pilot

study would be needed, in say three or four provinces representative of different socio-economic environments, to ascertain in greater depth the process of forest conversion in agricultural development. Video mapping could be a tool for rapid assessment of vegetation cover as one step in the process.

[Editor's note: In response to Derek Holmes' recommendation, the World Bank has begun a pilot project with AusAID funding to test low-level, multispectral video as a means of identifying and mapping the new land uses in areas of recently-converted forest.]

The situation in forest clearance is clearly very dynamic, and the precise figures may not be important. It is more important to seek ways to ensure that forests that are lost are replaced with land use practices that are sustainable, cause the least environmental damage, and contribute to the national or regional GDP with an equitable distribution of the benefits. The pioneer farmers will be of particular concern, because they may be creating the greatest environmental damage overall. Many of them will be practicing subsistence farming on the steep lands to which they have been "pushed" by the policies of allocating large-scale corporate development to the remaining lowlands. It is important to ascertain who these farmers are, where they come from, and how they can be assisted. By contrast, it is likely that the small investors are growing crops that provide a satisfactory protection against erosion. Could both categories be encouraged, with the proper incentives, to plant on already deforested land instead of clearing more land for the purpose themselves?

It is probably the deliberate "legal" clear felling of the forest for the sole purpose of supplying an over-developed timber processing industry that must bear the greatest responsibility for forest loss. The most urgent requirement now must be to identify the areas concerned and plan for the most appropriate use of this land, with the following aims: the optimal use of the land, the most equitable spread of benefits, and the cessation of any further unnecessary forest clearance. The next most urgent need is to deal with the issue of overcapacity.

The impact of illegal logging

Section on conversion by large investors (above) stated that 40 percent of the country's legal supply of timber comes from land clearing. The same source (Brown, 1999) showed that during the period from 1994 to 1997, illegal logging necessary to maintain the operations of the nation's timber mills was producing 20 million m^3/year. As a result of policies operating in the industry, there is now over-capacity in plywood mills to the extent that they can obtain only a third of the roundwood they need from their own timber concessions. The balance can be obtained only from unsustainable land clearing, and from illegal logging, which includes over-cutting in concessions as well as timber theft.. Further analysis (Scotland, Fraser & Jewell, 1999) included the pulp and paper industries and demonstrated that the total raw material shortfall supplied by illegal logging was 37 million m^3 in 1997, rising to as high as 56.6 m^3 in 1998. These figures are not precise, but the fact that they are "in the ballpark" is supported by the abundant anecdotal evidence of the extent of illegal logging which became even more rampant in 1999, and which still continues.

When a logging concessionaire (*Hak Pengusaha Hutan* or HPH) withdraws from an area, or when the permit has expired, there is little incentive for continued management of the forest. This is when the legions of small sawmills spring up. A non-HPH sawmill is required to have a permit (*Surat Tanda Pendaftaran Industri Kecil* or STPIK) from the Department of Industry

Box. 1 Bukit Tiga Puluh National Park
Conservation under extreme pressure

Bukit Tiga Puluh (Thirty Hills) National Park is a new park covering 127,696 ha on the borders of Riau and Jambi provinces in Sumatra. It is especially important because it includes non-alluvial lowland forest. A total of 193 bird species has been identified, following 50 days of field study (Danielsen & Heegaard 1995), and the full list is likely to be much higher. Over 660 'useful plant species' have been described. The area may have particularly high biodiversity because of the presence of hills that would have stood above the Pleistocene seas, and it has been recognized as a 'refugium' for genetic diversity that survived the ice ages (Laumonier 1996). This is also one of the last areas supporting indigenous forest peoples, the Talang Mamak and Orang Rimba.

Although it was only established in 1995, there are already predictions that the park will be destroyed completely in a few years. Formerly the area was under logging concessions, and the companies still hold concessions in the buffer zone. The eastern route of the Trans-Sumatra Highway passes less than 1 km from the park borders in the east. One of the concessions has its base camp between the road and the park, and is logging heavily in the buffer zone. This activity, together with an old logging road that crosses the park, is providing ready access for encroachment and poachers. Part of the concession area in the buffer zone is under application by two companies (with a single owner) for oil palm concessions. Although there has only been agreement in principal (*izin prinsip*), which is an early stage in the process of acquiring a permit, up to October 1998 the companies had already opened and partially planted 2,028 ha, including over 1,300 ha of forest land. The companies have also occupied the traditional lands of local people, who had already lost some of their land to a transmigration settlement. Following a meeting with the Bupati, the companies were obliged to form a partnership with the people, allocating 2 ha of oilpalm to each family. However, the companies have only allocated 10% of the area, or 1,300 ha, whereas the 2,500 resident families would actually require 5,000 ha. In December 1998 the governor of Riau requested that the permit be reviewed, and be withdrawn if it was found that the activities were damaging the park.

In addition to these problems, there are no fewer than 25 sawmills near the park boundaries, most of them unlicensed, with an annual capacity of *ca.* 230,000 m^3. Many of these sawmills are acquiring their timber illegally from the National Park.

and Trade at kabupaten level. It is also required to have an authorized plan for acquiring the timber (*Rencana Pemenuhan Bahan Baku Industri* or RPBI) from the Department of Forestry, from the *kanwil* if the capacity is less than 6000 m^3, otherwise from Jakarta. Inevitably there is a lack of coordination between these institutions. Even when the sawmills have the STPIK, they may either not hold the RPBI or not observe it. Anecdotal evidence and surveys show that many of the sawmills have backing and/or protection from military or police officers or other government officials.

The sawmillers proceed to remove all the remaining timber left by the concessionaire, thus ensuring that there will never be a second round of logging as planned under the Indonesian Selective Logging system (TPI).

The concession area, supposedly classified as permanent production forest, is then ready for encroachment by pioneer farmers, or for conversion to some form of tree crops. The sawmills then turn their attention to any Protection Forest or Conservation Forest that exists within reach, and indeed these may be their primary targets.

As one example, there are some 25 sawmills operating in the neighborhood of Bukit Tigapuluh National Park in Sumatra, and 17 of them have a connection to an official, most often from the army or police (WWF/DFID 1998 - see Box 1). Wetlands International (1997) reports on the numbers of sawmills in Muara Kendawangan and Sungai Jelai in West Kalimantan. *The Jakarta Post* (19 December 1998 and 23 February 1999) reported on the "conspiracy to extract all the saleable timber as quickly as possible" to feed the "hungry sawmills, plywood factories, and pulp mills that line the main rivers" of Central Kalimantan. These illegal operators (with their backers) felt no compunction about logging in the Natural Laboratory for the Sustainable Management of Tropical Peat Swamp Forests, opened by the provincial governor in July 1998 as an international field research facility allied to the University of Palangkaraya.

The construction of a new road through protection forest acts as an open invitation for illegal logging, to the extent that until such time as there are both the political will and capacity to control such activities, no funding agency should consider supporting road construction through these areas, directly or *indirectly* (loans that support road development generally may release government funds for construction in environmentally sensitive areas). For example, a road has been constructed from Wamena, in the Baliem Valley of Irian Jaya, up to Danau Habbema in the alpine zone and beyond. The professed objective is to bring the benefits of development to very isolated tribal communities, but besides the colossal capital costs of construction (air transport would be cheaper), there are the very high direct and indirect impacts of a road in such hypersensitive terrain. In January 1995, the low quality timbers that make up the montane forest in very steep and erodable terrain at 3,000 m altitude were being systematically removed.

At the most local level, every tiny remnant of original forest cover, protected perhaps by its unsuitable soils or swampy environment, is inexorably being stripped of its final reserves of timber (for example the *rengas* trees of the Lampung floodplains, breeding trees of the critically endangered White-winged Duck, see Box 2). Even these small pockets of natural habitat will not be available for the enjoyment or scientific initiatives of future generations.

With legalized conversion on one side, and the relentless and systematic illegal "mining" of the remaining "unconverted" forests on the other, together with the increasing incidence of accidental and deliberate burning during most dry seasons, *in a very few years there will be very little forest remaining in western Indonesia outside the mountains.* Not even national parks are immune, as evidenced by the steady degradation through logging and encroachment that was reported in 1999 in several parks (e.g. Gunung Leuser, Kerinci-Seblat, Bukit Tigapuluh, Barisan Selatan and Tanjung Puting). In the next El Niño drought, the litter left by illegal logging will insure that these parks will be as badly damaged by fires as were Berbak and Kutai national parks in 1997-98. Irian Jaya will succeed in retaining much of its forest cover in the short term, protected by its isolation, but it will suffer increasing onslaughts in the future, until present policies and poor management are changed. For as long as over-capacity remains in the plywood and paper mills, and unless timber plantations are developed sufficiently quickly to meet the demand (See Chapter 6), legal conservation status or slope and altitude of the terrain will never be a barrier to illegal logging, until even the last mountain strongholds have been damaged beyond repair. *The opportunity is still open for major reforms in the forest sector, but time is short.*

Box 2. The demise of the White-winged Wood Duck

The White-winged Wood Duck *Cairina scutulata* is an example of a widely distributed low-density species that is especially at risk from habitat loss, and whose global population is unlikely to benefit greatly from area-specific management. Formerly occurring from India down through the Malayan Peninsula to Sumatra and Java, it is now restricted to a few disjunct populations in the region of NE India and Indo-China on the mainland, and Sumatra (Green 1992). Its habitat is swampy forest, or lowland forest associated with small pools or open marshes. Each population is at risk of early extinction, with little prospect of gene interchange. In Sumatra, the first report in the post-colonial era was from near Jambi in 1975, but it was then found to be common in the Lampung plains during 1976. There was speculation that the Sumatra population was tolerant of extensive habitat degradation, with birds surviving in remnant patches of open woodland and feeding in the ricefields. The presence of the *rengas* tree (*Gluta renghas*) as breeding and roosting sites may have been critical; this tree was protected to some degree by its toxic resin. However, by 1992 it was clear that the Lampung population had 'crashed', and it may now be restricted in that province to the two widely separated national parks only (Way Kambas and Barisan Selatan), with isolated populations that are likely to be well below the limit of viability. It is not known whether the widespread occurrence in 1976 was merely a temporary and unstable phase following forest clearance, or whether its decline was hastened by the onslaught on the *rengas* tree, all other sources of timber having been removed.

There are recent records of the bird up the eastern side of Sumatra north to Riau, and in a few locations along the west coast; Aceh Selatan and adjacent coastal areas of North Sumatra may be key sites for future management programs. Nevertheless no conservation area is likely to hold a viable population if the habitat is merely an 'island'. It seems probable that until very recently the species would have been common all down the west coast of Sumatra, but the swamp forests of this coast, notwithstanding their sheer intractability, have seen some of the fastest rates of conversion over the last ten years. How many of these large-scale conversions were preceded by an EIA, and how many of these EIAs were even aware that this endangered species existed in the designated area? Even where recognized, the management plan would probably have argued that the birds would 'relocate to adjacent forest', or similar platitude, probably without consideration of similar conversion plans in that forest.

The White-winged Wood Duck is just one species for which imminent extinction seems almost inevitable. Other examples would be the Storm's Stork *Ciconia stormii* in Sumatra and Kalimantan, and the White-shouldered Ibis *Pseudibis davisoni*, which is now confined to tiny relict populations in Indo-China, and Kalimantan (probably only the upper Mahakam region) in the latter.

Table 4: Data on Land Use and Land Allocation

Timber estates		New estates (mainly Oil Palm)[3]				
Allocated[1]	Realized to 1998[2]	Oilpalm area 1984	Oilpalm Area 1998	New oilpalm	Conversion for estates agreed in principle (1995)	Conversions approved for estates and transmigration 1994-98
376,564	81,799	32,692	206,405	173,713	315,851	164,762
486,640	100,190	387,146	612,617	225,471	172,829	37,352
0	11,371	4,560	137,952	133,392	162,162	105,571
684,312	291,859	39,793	606,165	566,372	1,650,187	518,259
189,941	98,740	500	236,059	235,559	345,142	105,890
590,069	252,832	6,767	309,761	302,994	127,829	102,045
5,000	2,290	0	57,006	57,006	47,500	67,732
282,835	54,385	17,590	74,530	56,940	90,572	88,955
2,615,361	**893,463**	**489,048**	**2,240,495**	**1,751,447**	**2,912,072**	**1,190,566**
876,749	148,733	13,044	279,535	266,491	257,059	66,080
391,843	102,006	52	110,376	110,324	257,250	353,731
549,474	208,420	0	93,902	93,902	257,250	118,407
1,290,113	497,103	44	78,938	78,894	295,395	262,061
3,108,179	**956,261**	**13,140**	**562,751**	**549,611**	**1,066,954**	**800,279**
0	9,343	0	0	0	10000	25,402
31,392	29,053	0	18,036	18,036	82,790	43,898
135,706	28,002	1,160	83,215	82,055	107,915	52,938
61,594	19,057	0	0	0	19750	21,028
228,692	**85,455**	**1,160**	**101,251**	**100,091**	**220,455**	**143,266**
5,952,232	**1,935,179**	**503,348**	**2,904,497**	**2,401,149**	**4,199,481**	**2,134,111**
188,689	77,656	0	0	0	25,780	16,224
153,250?	39,996	563	31,080	30,517	126,389	132,979
170,307	352,215	8,110	21,502	13,392	643	1,505
6,464,478	**2,404,364**	**512,021**	**2,957,079**	**2,445,058**	**4,352,293**	**2,284,771**

Table 5: Results of Forest Conversion

Province	Forest loss	Development of cleared land					
		Large investors			Smallholder estate crops	Total tree crops	Balance of cleared land
		HTI	Oilpalm	HTI+HGU			
Aceh	270,347	81,799	173,713	280,000	153,857	433,857	-163,510
N. Sumatra	920,181	100,190	225,471	360,000	136,994	496,994	423,187
W. Sumatra	646,385	11,371	133,392	165,000	87,317	252,317	394,068
Riau	864,609	291,859	566,372	950,000	441,759	1,391,759	-527,150
Jambi	1,162,721	98,740	235,559	360,000	255,680	615,680	547,041
S. Sumatra	2,313,891	252,832	302,994	590,000	323,227	913,227	1,400,664
Bengkulu	226,742	2,290	57,006	80,000	67,675	147,675	79,067
Lampung	286,481	54,385	56,940	138,000	128,141	266,141	20,340
SUMATRA	**6,691,357**	**893,463**	**1,751,447**	**2,923,000**	**1,594,650**	**4,517,650**	**2,173,707**
W. Kalimantan	1,987,574	148,733	266,491	470,000	214,794	684,794	1,302,780
C. Kalimantan	1,714,400	102,006	110,324	260,000	105,254	365,254	1,349,146
S. Kalimantan	796,718	208,420	93,902	330,000	46,975	376,975	419,743
E. Kalimantan	3,975,100	497,103	78,894	610,000	100,275	710,275	3,264,825
KALIMANTAN	**8,473,792**	**956,261**	**549,611**	**1,670,000**	**467,298**	**2,137,298**	**6,336,494**
N. Sulawesi	253,600	9,343	0	35,000	47,791	82,791	170,809
C. Sulawesi	959,100	29,053	18,036	60,000	68,407	128,407	830,693
S. Sulawesi	579,200	28,002	82,055	130,000	207,062	337,062	242,138
SE Sulawesi	477,500	19,057	0	60,000	69,682	129,682	347,818
SULAWESI	**2,269,400**	**85,455**	**100,091**	**285,000**	**634,341**	**919,341**	**1,350,059**
3 ISLANDS TOTAL	**17,434,549**	**1,935,179**	**2,401,149**	**4,878,000**	**2,696,289**	**7,574,289**	**9,860,260**

Definitions:

HTI+HGU: All large investors (includes timber estates, oil palm, rubber, cocoa, sugarcane, etc.)

Smallholder estate crops: areas as listed by DG Estates, showing growth between 1984 and 1997.

Chapter 5. Analysis of Loss of Lowland Forest

Historical overview

Traditional areas of settlement and natural fertility. Throughout most of Indonesia, traditional areas of human settlement have been closely related to the fertility of the soil and the ease of producing food. It is the natural fertility of the volcanic soils of Java and Bali that is the primary reason for the high density of the population of these "Inner Islands", which ultimately led to Java's becoming the seat of government for the Indonesian archipelago. Equivalent levels of inherent fertility have much more limited extent elsewhere, in the "Outer Islands" of Indonesia, but it is by no accident of history that traditional centers of population are the central rift valley of the Barisan mountains of Sumatra, the southern and Minahasa peninsulas of Sulawesi, and the "Spice Islands" of Maluku. Even Kalimantan, the possessor of some of the least fertile soils of Indonesia, has its areas of more intensive traditional use, for example in the alluvium of South Kalimantan.

In most of these regions, deforestation had reached an advanced stage long before the commencement of the present century. A description of the Toba highlands of North Sumatra in 1824 showed that there had already been extensive deforestation and that degraded grasslands were widespread (Whitten *et al* 1984). Wallace (1869) complained about the difficulty he experienced in reaching the forest on several of the islands he visited in eastern Indonesia. Elsewhere, it was often the unfavorable climate (Nusatenggara) or unhealthy malarial environment (Irian Jaya) that discouraged intensive settlement, at least in the coastal lowlands. In the plains of Sumatra and Kalimantan especially, the earlier settlements were river-based, while the higher ground of the interfluves, with its more acid soils, retained a forest cover intact through to the modern era.

The colonial era, and the growth of estates. With the acquisition of revenue as the primary motive for colonial occupation, the original objective was control of the spice trade. Next came development to optimize the agricultural production of the fertile lands of Java. The advent of rubber as a major source of revenue saw the commencement of the process of deforestation in the plains of Sumatra and to a lesser extent in Kalimantan. Here too, it was the relatively fertile volcanic tuff plains of North Sumatra that first attracted the planters in 1862 (in the first instance, for tobacco). Expansion outward from the riverine settlements elsewhere was much more hesitant. As late as 1980, there was still no motorable road linking the provincial capitals of the Sumatran plains; the Trans-Sumatran Highway followed a rather contorted route through the more populous mountain regions. Even in the mid-1980s, North Sumatra was still the province with the largest area of estate crops. However, "jungle rubber" had long before taken off as the predominant agro-forestry system for smallholders throughout the plains of Sumatra and at least the western part of Kalimantan.

Deliberate clearance for estate crops was not the only factor in large-scale deforestation, as traditional cultural systems are by no means always benign. Besides the early degradation of the Toba plateau, large tracts of the Kapuas basin of West Kalimantan long ago lost their forest cover. In South Sulawesi, deforestation and degradation had been particularly severe in the Toraja and "Polmas" highlands.

Similarly, photographs show that the slopes of the Baliem Valley of Irian Jaya had

already become seriously degraded by the tribal inhabitants when it was first discovered by Europeans in 1938. The reasons for such degradation are not always apparent. In many regions, poor quality soil is the main reason why forest fails to regenerate once it is cleared.

New Order Government, the early years: population growth, logging, and transmigration. While Indonesia has long supported a timber industry, it was during the 1970s that the systematic logging of the Outer Islands took off, in the process also providing the access that facilitated spontaneous settlement. Logging roads now replaced the rivers as the main means of access into the hinterland, and the standard settlement succession could be seen repeated over and over in the Sumatran plains: newly cleared land with a food crop (*ladang*) at the forest margin, then *ladang* interplanted with seedling rubber, followed by dense secondary growth with the seedling rubber struggling to mature, and finally mature rubber in a dense secondary forest. This "jungle rubber" replicates many of the environmental functions of old-growth forest. The mature rubber lies next to the road, which by now has generally been adopted as a government road, but it may now have been replanted as a monocrop stand of clonal rubber, with or without government assistance. While the acquisition of some degree of usufruct rights may have been a primary reason for the decay of rotational forms of cropping, it is also true that rubber is an ideal smallholder crop. It can be found far in the interior, even in Kalimantan, and now the forest-dwelling tribal people of Riau and Jambi are adopting it.

There was only local expansion of large estates during this period of limited access to capital, and transmigration was becoming the primary engine for the new settlement of the Outer Islands. Transmigration was by no means a new concept, because the large plantations had usually obtained most of their manpower as indentured labor from Java. In the early 1900s, however, the colonial government had introduced it as a deliberate policy, especially in Lampung, the nearest province to Java, with the intention of reducing population pressure on Java. The New Order Government expanded the program tremendously. The initial World Bank-funded transmigration schemes, originally offering an unrealistic five hectares per family, were undertaken in southern Sumatra in the late 1970s, as a prelude to the massive investment in this program that was the hallmark of the 1980s. Unfortunately, the program was based on several false premises: that gently sloping non-volcanic land was suitable for sustained food production, with fertilizers supplying the nutrients necessary for growth, and that such land was almost limitless in the Outer Islands. A further assumption was that land under forest, "being State land", was free from existing claims, and forest land was therefore preferred in the selection process. The first swamp settlements, supposedly under "tidal irrigation", were undertaken at this time, especially in South Sumatra and South Kalimantan.

New Order Government, latter years: transmigration, non-MIGAS products. Although the rate of transmigration settlement was reaching its peak in the mid-1980s, it is still doubtful whether this was the main agent of deforestation in terms of area at that time. The relentless hectare-by-hectare encroachment by "pioneer farmers" along every forest boundary continued to escalate, in response to population growth and increased mobility. Nevertheless the secondary impacts of the mechanical block clearance for the transmigration program were substantial, resulting from the failure at most sites to achieve satisfactory production levels. The more successful sites attracted a flush of

spontaneous migrants, with active government support, increasing pressure on the forests.

However, it was around this period that the government commenced its policy of promoting the diversification of *non-migas* commodities that is products outside the oil and gas sector. The main focus was the development of tree crop plantations, and the current rapid deforestation was a response to this policy. Up to the 1970s, it was the more fertile soils, often in the mountains, but also along the river valleys, and in some volcanic lowlands, that were the traditional centers of settlement. The wide lowland plains of Sumatra and Kalimantan mostly continued to have a cover of rich dipterocarp forest, and they remained in supposedly permanent forest status for the cyclic production of timber.

The definition of lowland forest

It is mainly the lowland forest that is cleared, as this generally has the greatest potential for large-scale development. It is also the forest that often has the highest index of biodiversity, and the highest potential for sustained production of high-value timber. However it is difficult to ascertain precisely how much lowland forest has been lost. This is partly because the RePPProT study adopted 1000 m elevation as the upper limit of its lowland forest-mapping unit (symbol Hh), based on the recommendations of leading botanists at the time. Submontane forest (Hf) is that lying mainly at 1000 - 2000 m, while montane forest (Hm) is above 2000 m. (The various forms of alluvial forest, and other special forest types, are mapped separately.) In Malaysia, a "steepland boundary", or "hill-foot boundary", is widely recognized, even for official planning purposes, and it generally lies at around 150 m above sea level. Land below this boundary would usually be considered as suitable for agricultural development, but land above it would be set aside as the permanent forest estate (for either production, watershed protection, or conservation purposes). Indeed, this contour widely corresponds with the present-day boundary of forest cover in Malaysia. Even in the timber industry, around 300 m is considered as the upper limit of the lowland forest.

Thus the RePPProT definition of forest up to 1000 m altitude fails to differentiate true lowland forest. A comparison of the amount of forest in the unit 'Hh' in 1985 and now will not give a true indication of the rate of loss of this most valuable forest type. A different method must be devised to assess the loss of true lowland forest. Fortunately, the RePPProT land systems mapping provides a usable measure of "lowland plains". Besides a range of alluvial (often = wetland) land systems, it also distinguishes dryland land systems on the basis of amplitude of relief, rather than altitude, as follows:

Plains	
Undulating to rolling	< 50 m amplitude < 15% slope
Hillocky	< 50 m amplitude > 15% slope
Hills	50-300 m amplitude > 15% slope
Mountains	> 300 m amplitude > 15% slope

Most of the low amplitude "plains" units correspond to the non-alluvial lowlands below about 300 m altitude. There are some exceptions, with one or two land systems even reaching altitudes of 1000 m or above, while there are several areas of high altitude plains (for example in the volcanic mountains in Sumatra). Overall, however, with careful interpretation based on general knowledge of the terrain and of the RePPProT metho-dology, the extent of the

"dry lowland plains" can be identified from the RePPProT maps.

The RePPProT summary report also provides breakdowns of vegetation cover by land system, for each of the island regions, which enables a calculation to be made of the total area of forest on the dry lowland plains, as well as other physiographic units, at the time of mapping. This is assumed to represent the 1985 situation, although the actual date of the remote sensing imagery used by RePPProT ranges from 1983 to 1987. In order to estimate the forest cover remaining on each of these physiographic units in 1997, it has been necessary to resort mainly to estimates derived from a visual examination of the maps of each province. Where consultant analysis of RePPProT units has been undertaken (Sumatra and East Kalimantan), the area of remaining wetland forest provides a baseline figure to assist in this estimation.

Sumatra

Gross areas of physiographic types are shown in Table 6, together with the area of each type that was forested in 1985, and the *estimated* area in 1997. The dry lowland plains occupy 18 million ha, but already there were only 5.5 million ha of these under forest in 1985. By 1997 this had been reduced to less than 2.2 million ha. The area figures for 1900 are obviously very approximate estimates, based on what is known of human settlement at the time. They may well under-estimate the forest cover, given that Central Bureau of Statistics lists the non-forest land use in 1963 as only 4.8 million ha. However, the assumed 1900 area figures do place the changes over the past twelve years in perspective.

Apart from the early inhabitants whose settlements were mainly beside the rivers, forest conversion from colonial times until today has focused mostly on the dry lowland plains, at least two-thirds of which had been cleared prior to 1985. Conversion to estates presumably ceased during the Japanese occupation, but began to increase again in the 1970s, escalating sharply during the 1980s and 1990s, in both the estate crops and transmigration sectors. By contrast, other than on the river banks, the alluvial forests declined only very slowly. Mechanization facilitated the conversion of swamp forests in large-scale settlements from the 1970s onwards. Meanwhile the hill and mountain forests show only a slow but rather steady rate of conversion, increasing slightly as pressures grow. Encroachment into the upland forests by pioneer farmers and loggers will surely become more significant in the future.

Figure 1 is derived from the area figures in Table 6. It demonstrates that unless there are urgent and radical changes in existing policies and systems of forest management, most of the dry lowland forests of Sumatra will have become virtually extinct soon after the year 2005. The wetland forests will continue to be cleared, but it is possible that failure to meet expectations of productivity from reclaimed peat swamps will eventually reduce the rate of conversion. It is to be hoped that this will occur in time for perhaps one million ha to remain. Rate of conversion of hill and mountain forest will continue to increase, both from the indigenous upland farmers as well as from increasing migration into these regions as pressures continue to mount in the lowlands.

The total forest areas illustrated in Figure 1 accord closely to the estimates given in Fraser (1998) for 1950 and 1980, although the source of those estimates is not given. However, Hagreis (1931) gives a much lower estimate of only 29.7 million ha already in 1928 (63 percent of land area).

Figure 1: Changes in forest cover – Sumatra

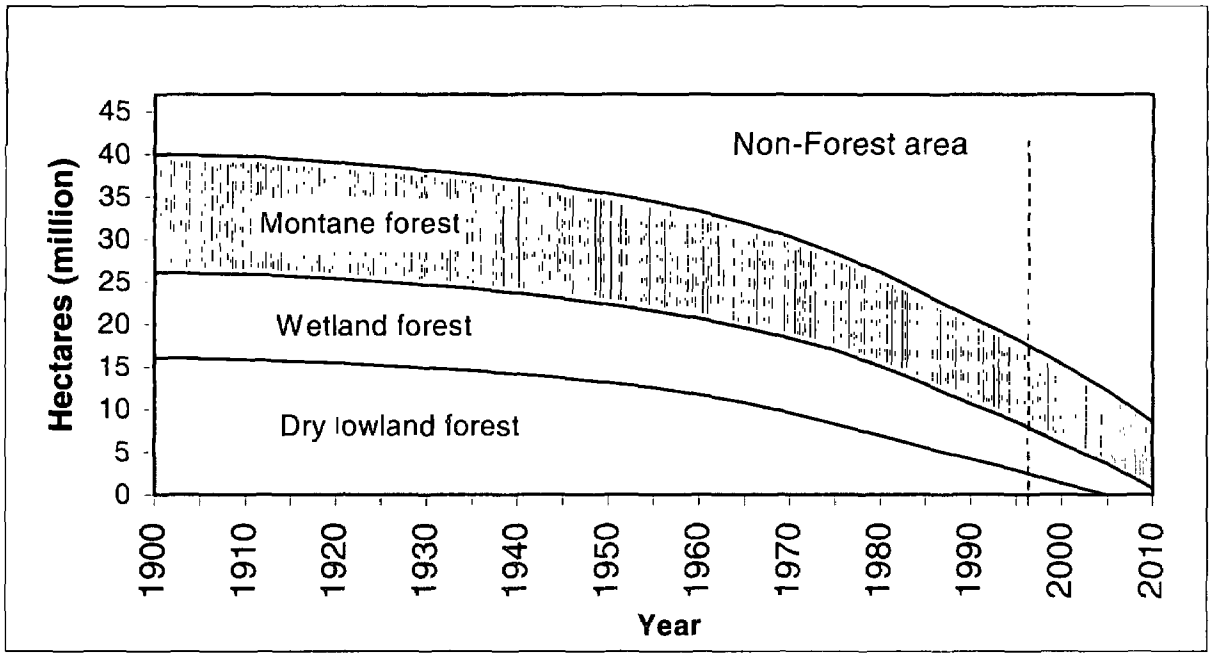


Table 6. Physiographic types and forest cover, Sumatra (ha)

Physiographic types	Gross area	Assumed forest cover in 1900	Area with forest cover in 1985	Approx. area with forest cover in 1997	Estimated reduction in forest area since 1985
Alluvial	12,985,100	10,000,000	7,413,500	5,613,500	1,800,000
Lowland plains	18,240,900	16,000,000	5,559,700	2,168,300	3,391,400
Hills & mountains	15,030,000	14,000,000	10,539,900	9,039,943	1,499,957
TOTAL	**46,256,000**	**40,000,000**	**23,513,100**	**16,821,743**	**6,691,357**

Table 7. Physiographic types and forest cover, Kalimantan (ha)

Physiographic types	Gross area	Assumed forest cover in 1900	Area with forest cover in 1985	Approx. area with forest cover in 1997	Estimated reduction in forest area since 1985
Alluvial	9,790,500	8,500,000	6,494,800	4,994,800	1,500,000
Sandy terraces	3,229,000	3,000,000	2,611,400	1,611,400	1,000,000
Lowland plains	18,796,300	17,500,000	11,111,900	4,707,800	6,404,100
Hills & mountains	21,270,900	21,000,000	19,602,600	19,550,006	52,594
TOTAL	**53,086,700**	**50,000,000**	**39,820,700**	**30,864,006**	**8,958,679**

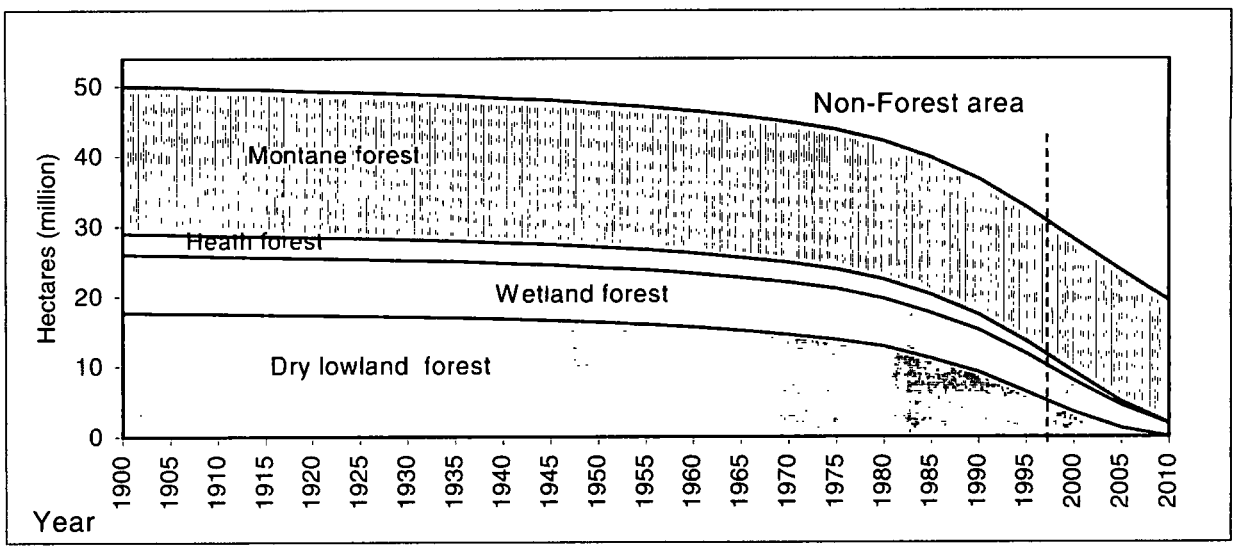
Kalimantan

The corresponding information for Kalimantan is shown in Table 7. The estimate of likely forest cover in 1900 may well be an under-estimate, as the Central Bureau of Statistics lists the non-forest land use in 1963 as only 1.42 million ha.

This analysis assumes that few areas had been deforested at the start of the century, these being mainly in South and West Kalimantan. It is not known when (or indeed precisely why) the extensive deforestation occurred over the Kapuas basin of West Kalimantan, but it was probably mainly a "smallholder" activity.

The rate of conversion is assumed to have increased sharply after the 1960s, particularly with large-scale transmigration commencing in the 1970's, and estate development taking off in the 1980's and especially the present decade. Similar trends occurred in the wetland forests, with reclamation for trans-migration schemes becoming widespread from the 1970s onwards. This culminated in the ill-conceived, ill-fated "million hectare peat swamp project" of the 1990s in Central Kalimantan, and the extensive forest fires that ensued around this project and elsewhere in 1997 and 1998 (see Box 3).

Figure 2: Changes in forest cover Kalimantan



It is evident in Figure 2 that if present rates of conversion and damage continue, the forest on the lowland plains of Kalimantan will experience the same fate as that in Sumatra, taking only a little longer so that it is essentially gone by the year 2010. The rate of conversion of wetland forest is predicted to decrease slightly, consequent upon unrealized expectations from reclaimed deep peats, although with illegal logging, the fire risk will always be high during dry years. The heath forests may disappear entirely, because such forest rarely becomes reestablished after an initial clearing, and the fire risk in the resulting acid scrub is extremely high. Thus, as in Sumatra, within a decade or so, most of the remaining forests in Kalimantan will be confined to the hills and mountains. The increasing incursion of logging roads into these mountains will be the inevitable forerunner of further deforestation.

The total forest areas shown in Figure 2 agree well with the estimates given for 1950 and 1980 by Fraser (1998).

Box 3: The million-hectare peat swamp project, a very costly mistake

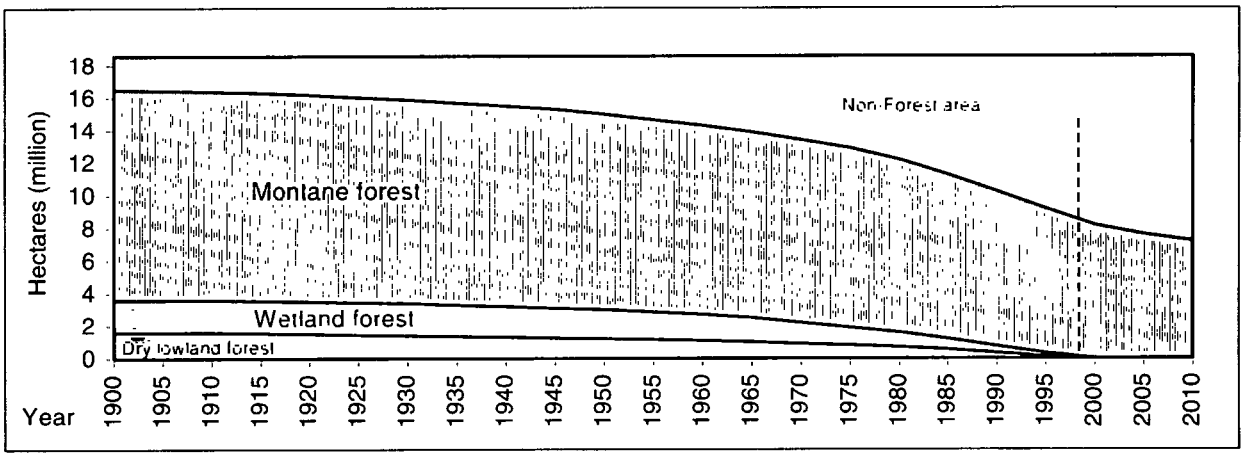
The stated objective of the million hectare peat swamp mega-project in Central Kalimantan (*projek lahan gambut* or PLG), when it was launched by then-President Soeharto in 1995, was to replace land in Java diverted from rice production for industrial and urban development, and to regain Indonesia's self-sufficiency in rice. The concept was based on the supposed success in peat reclamation by the PT Sambu Group in Riau (although this group significantly declined the opportunity to invest in the scheme). The project included a plan to settle 316,000 transmigrant families, each having 2.25 ha. The gross area was 1.7 million ha, with a planned development area of 796,000 ha. However, the environmental assessment conducted by Bogor Agricultural University recommended that only 586,700 ha. should be developed for agriculture (491,000 ha. for rice), while 115,400 ha. should be retained as river reserve and 755,000 ha. as conservation areas (including peat with depth >3 m, as well as black water areas, quartz sands, and mangroves). No proper cost-benefit or sensitivity analysis appeared to have been carried out.

The government not only disregarded widespread and educated criticism of the project on grounds that it was not ecologically feasible and would have serious, unavoidable environmental impacts; it also proceeded with project implementation before the environmental assessment was completed. Up to May 1998, at least Rp 1.5 trillion had been spent on the project, over half of which was expenditure on the primary canals which now cannot be used because of their alignment over deep peat that has subsequently (and predictably) subsided.

The project was officially stopped early in 1999. The government is looking for investors to develop oilpalm in the 50,000 ha of land already cleared and settled. This could be the most suitable crop on the mainly shallow peat and mineral soils that have been cleared, but there has been an understandable lack of interest on the part of investors. However, cancellation has come too late to prevent the enormous waste of funds and the environmental damage. Damage reached its peak during the drought of 1997, when the farmers were struggling to survive under intolerable conditions of hygiene owing to the lack of clean water, while opening up of access permitted extensive logging even in areas designated for conservation and, together with land-clearing activities, resulted in serious fires.

When the fires started in 1997-98, they quickly got out of control in the peat soil. Inevitably, those areas set aside as conservation reserves, already under logging pressure, became targets for wildfires. It was calculated that the volume of biomass contributing to the smoke was 510 t/ha (based on 17 t/cm of depth burnt/ha), compared with 70 t/ha in conversion forest, 15 t/ha in forest and only 5 t/ha in agricultural areas. Approximately 61 percent of the haze-producing emissions in the region in 1997-98 were derived from the dried out peat beds.

Figure 3: Changes in forest cover Sulawesi



Sulawesi

Table 8 contains the corresponding information for Sulawesi. Again, the extent of forest cover in 1900 may well be an under-estimate, as the Central Bureau of Statistics lists the non-forest land use in 1963 as only 0.96 million ha. The underlying assumption for Sulawesi is that at the turn of the century, there was widespread settlement only in the plains of the southern peninsula, the Minahassa peninsula of the north, and the uplands around Toraja. Outside these regions, forest clearance would have been confined to small enclaves around mostly coastal settlements.

The graph for deforestation in Sulawesi (Figure 3) reflects the mountainous character of Sulawesi; only 25 percent of the area is in lowlands. Already by 1985 only a quarter of these lowlands still carried forest, with rapid clearance occurring in the transmigration areas. Only a tiny fraction of the lowland forest remains now, mostly on the west coast of the central region, the Rawa Aopa region of the southeast, and remnant pockets of mangroves. Projection of the curves would indicate extinction of the remaining alluvial and lowland forests within two or three years, unless the forests of Rawa Aopa National Park can be preserved. Fortunately, Sulawesi's remarkable biological values and high endemism are to a large extent a feature of the upland forests, although this should not preclude every effort from being made to protect the last lowland remnants.

The total forest area shown in Figure 3 agrees quite well with the estimated cover given for 1950 and 1980 by Fraser (*op. cit*). However, for 1950, the 75 percent cover estimated by Fraser is lower than the 81 percent shown in Figure 3.

Table 8. Physiographic types and forest cover, Sulawesi (ha)

Physiographic types	Gross area	Assumed forest area in 1900	Area with forest cover in 1985	Approx. area with forest cover in 1997	Estimated reduction in forest area since 1985
Alluvial	1,813,800	1,400,000	667,800	70,000	597,800
Lowland plains	2,925,800	2,200,000	546,300	60,000	486,300
Hills & mountains	13,874,900	13,000,000	10,055,300	8,870,000	1,185,300
TOTAL	**18,614,500**	**16,600,000**	**11,271,385**	**9,000,000**	**2,271,385**

The conversion of mangrove forests

The current mapping of forest cover at small scale carried out by MoF does not provide reliable information on conversion of mangroves, especially where the tidal zone is narrow. Various estimates have been made of total mangrove area, but only those made from remote sensing sources are considered reliable. The only such measurement known was that made by RePPProT from mid-1980s sources, which includes nipa swamp. The data source for the 1993 estimate is not known. No reliable measurement of current mangrove area is available. The data imply that one third of the total area of mangroves in the mid-1980s, or 1.3 million ha, had been cleared by 1993, which would be equivalent to over 160,000 ha per year.

The main reason for clearance is conversion to brackish-water fishponds (*tambak*); other activities are minor in comparison (logging, and industrial or urban development). The main commercial use for mangroves is for chip and pulp production, although there is now only one wood chip factory that is based solely on a mangrove concession (at Tarakan in East Kalimantan). Locally there have been quite extensive small-scale harvesting operations for pulp, firewood, and charcoal, the latter being particularly important on the east coast of Sumatra for export to Singapore and Malaysia. The major concession granted to a Japanese company to harvest the magnificent mangrove forests lining Bintuni Bay in Irian Jaya was cancelled in 1990; this is one of the best developed, most extensive, and least disturbed mangrove areas in Asia.

There are media reports that the rate of conversion of mangroves to *tambak* has increased steeply, with many conversions apparently post-dating the satellite imagery available for the current MoF mapping. These reports relate especially to the remaining mangrove forests in South Sumatra (including the important Sembilang reserve) and East Kalimantan, especially the Mahakam delta and Kutai National Park. In fact, the mangroves in other protected areas such as the Teluk Apar and Teluk Adang reserves in East Kalimantan have also been destroyed, while the important and extensive mangrove forests in Kabupaten Bulungan of East Kalimantan, and along the coast of West Kalimantan, are now under concerted assault.

The most disturbing aspect about *tambak* is that many of them become non-operational after just a few years, or else they are able to support the growth only of milkfish, and not the higher value prawns. This effectively results in double losses -- first of forest, then of fish production. A few may become salt pans in drier regions of the country, or wetland ricefields where conditions permit in the wetter zones, the remainder become wasteland. In Thailand, Sathirathai (1998) has shown that conversion of mangroves into commercial shrimp farming is financially viable for a private individual or company, but it is not economically feasible from society's point of view. Owing to the high investment costs, the local capture fishermen are alienated from their common resource when it is privatized by outside investors. This is especially the case where the mangrove is located along the coast and serves as a nursery ground for small shrimp and other marine life.

The expectations from *tambak* in Indonesia have often not been realized. The yield of shrimp increased from 27,595 tones in 1983 to a peak of 140,131 tones in 1991, but then decreased to 79,494 tones in 1995, despite the substantial increase in area. This decline is believed to be related to disease, increased levels of pollutants, acidification (mangroves are generally associated with acid sulphate soils) and lack of management skills.

Table 9. Mangrove areas by island (ha)

	RePPProT (mid-1980s)	1993 Estimate[1]	Decrease	% decrease
Sumatra	681,700	485,025	196,675	29
Kalimantan	1,014,200	393,450	620,750	61
Sulawesi	237,400	84,833	152,567	64
Java and Bali	34,300	19,577	14,723	43
Nusatenggara	27,500	25,300	2,200	8
Maluku	212,100	100,000	112,100	53
Irian Jaya	1,583,300	1,382,000	201,300	13
TOTAL	**3,788,520**	**2,492,178**	**1,296,342**	**34**

[1] Giessen, W. 1993. Indonesian mangroves : an update on remaining area and main management issues. Presented at International Seminar on "Coastal Zone Management of Small Island Ecosystems", Ambon, 7-10 April 1993.

There are now tens of thousands of moribund or under-producing *tambak* in Indonesia, of which perhaps 80,000 ha are in Java, comprising some 80 percent of the *tambak* on that island. It must be no coincidence that the inshore fishermen along the polluted north coast of Java are also one of the poorest groups in the community, because the mangroves that originally supported their livelihood, and might have assisted in removing some of the toxins affecting marine fish, have been irreparably destroyed.

Overall the potential for sustained production is low and the risks are very high. However, in contrast to the situation in oil palm estates, the most dramatic factor in loss of mangroves may be the "unofficial" clearing for *tambak* by small-scale entrepreneurs, who generally lack the capital and professional capability to ensure proper design and management. After one or two seasons of modest yields, there is a rapid decline and eventual abandonment.

In the meantime, the many thousands of hectares of moribund *tambaks* perform no functions at all. Their reclamation is likely to require considerable innovative skills and resources. The presence of structures that limit tidal penetration is a major constraint to mangrove regeneration, other than by low value species such as *Acrostichum* scrub.

Thus, in many ways, *tambaks* duplicate the impacts of the widespread conversion of forest to tree crop plantations. A common resource is converted to private forms of utilization that seek to maximize short-term profits without adequate attention to long-term sustainability and the external costs. In addition to the ecological services they perform and breeding and nursery grounds and natural pollutant-removal systems. Mangroves form the first line of defense against the predicted rise in sea levels resulting from global climate change. Policies that permit their clearance for short-term benefits are singularly short-sighted.

Chapter 6. The Future

Priorities for immediate action

A moratorium on natural forest conversion. The ruthless conversion of the remaining forests, in all physiographic zones (steeplands, lowlands, wetlands and tidal zones), by both large and small investors and by small farmers, is one of the biggest sources of irreversible environmental damage facing Indonesia at the present time. This was recognized in the conditionalities attached to the World Bank's Policy Reform Support Loan II to Indonesia in April 1999, which specified *inter alia* a moratorium on new conversion of state forest land and alteration of main land use patterns in the forests until certain other conditions had been met.

Overall, this moratorium is reported to have been observed at central government level, but applications to convert key areas of lowland forest continue to be reported, and permits for release from forest land have been made at provincial or regency level, formally or informally. In view of the amount of cleared forest land that is currently lying idle (see Chapter 4), and in the absence of the formulation of a transparent process of consultation, this moratorium needs to continue to be strictly enforced. However, the task has become still more difficult under Indonesia's regional autonomy, which grants considerable natural resource management authority to local and provincial governments.

More care in planning and financing roads. In the context of the need to protect those forests that remain, there are important considerations of rural infrastructure development. Rural road projects financed through foreign loans invariably carry a component for environmental assessment, but the more sensitive proposals are commonly kept out of the loan programs. The loans, however, may well be releasing government funds for sub-projects in just those areas that the funding agency would not permit. Environmental assessment, therefore, should examine the road program in its entirety, at least for any given province, whether or not loan supported. Indeed the real need may be to improve road infrastructure in areas of degraded land, rather than roads serving as instruments in the development of remote areas.

Special attention to mangrove protection. The moratorium fails to address by name the conversion of tidal forests. In view of the major environmental role played by mangroves, especially in an era of global climate change, and of the irreversible damage that very often results from conversion of mangroves to fish ponds, it is recommended that this be corrected. Planning needs to commence now to prepare for the impending specter of sea level rise, with the multitude of difficult and expensive decisions that will have to be taken.

Restore deforested land to productivity through agroforestry. While the moratorium remains in force, a concerted effort must be made to document the current distribution of both land utilization and land allocation, in order to prioritize the productive use of the several million hectares that appear to be currently lying idle. Most of this idle land will be of poor quality and unsuitable for sustained production of arable crops, but it can readily support a tree crop. It needs to be promoted as the primary future source of the country's raw timber requirements. Without the proper application of law, however, the implementation of any such proposals will never be accomplished. Public participation, and the property rights of the local communities, provides possibly the most powerful instruments for ensuring law

enforcement and the suppression of collusive practices in the pursuit of these objectives.

Agroforests, especially the development of small plots of *sengon* (*Albizia falcata* or *Paraserianthes falcataria*) by those smallholders in upland Java who have sufficient security of tenure and sufficient sources of income while awaiting maturity, are proving to be a highly profitable land use with very positive environmental benefits. It should not be beyond our ingenuity to develop systems of private smallholder or communal forest plots in the wastelands of Sumatra and Kalimantan that will in future replace natural forests to supply the insatiable demands of the pulp and plywood mills.

The marginal soils of the Outer Islands can support many varieties of tree crop. The ready adaptability of rubber and coconuts as smallholder crops has been responsible for their enormous popularity. The option that has predominated over the past decade, however, has been the block planting of oilpalm by large investors, with smallholders in a dependent role. If government targets for oilpalm development are realized, most regions of low-intensity and traditional agriculture will soon be overtaken by serried ranks of palms, and those farmers who resist the coercion to participate will become alienated from their lands. Ironically, it is the land rights claims that have discouraged developers, and the transmigration program, from occupying *alang-alang* grasslands, yet it may also be the lack of secure tenure that discourages farmers from reclaiming these same lands.

There have been many efforts to encourage smallholder tree crops outside the large estates sector, with varying degrees of success. Sometimes such schemes founder through their top-down approach and institutional deficiencies, while the impact in terms of total area and number of beneficiaries is quite small. Less than 15 percent of the smallholder rubber area nation-wide (some 2.5 million ha) has been reached by the various rubber projects during more than a decade of effort (Tomich, 1991). Many smallholders successfully develop their tree crop gardens under their own initiative, replanting each year at least as much rubber as the government schemes. They produce 75 percent of the country's rubber, 95 percent of its coffee and most of its coconut/copra output (Potter & Lee 1998). Necessary conditions are, *inter alia*, security of tenure and access to planting materials. The establishment of private nurseries, or commercially run public nurseries in the interim, is a prerequisite, and there have been encouraging moves in this direction.

Without active institutional support, the skills associated with the variety of mixed agroforests that occur widely in the different regions are likely to die out in the face of competition from high-yielding monocrops and pressures from migrant farmers. This is regrettable because the more traditional agroforests duplicate to varying degrees some of the physical, biological and aesthetic environmental functions of natural forests. Like natural forests they can support a range of products. Thus rubber can be mixed with a variety of timber trees in deforested areas where there is a good market for these. Species such as *Alstonia* are identified by Tomich *et al.* (1998). As noted above, smallholder *Paraserianthes* plots, known as "*hutan rakyat*", are becoming increasingly popular on Java. At present, there are policies that depress domestic prices of timber, and which therefore increase the tendency to dispose of "waste" wood by fire. Tomich *et. al.*, (1998) looks further at systems of agroforestry, and especially make the case for the *deregulation* of many species of timber trees.

Agroforests can and should have a role to play in the future, especially where the government has a stake, on environmental grounds, in preserving forest cover. A key to protecting any forest, or any plantations established in degraded land under re-forestation or regreening programs, lies in giving property rights to the farmers who grow them, whether individually or communally. Security of tenure also provides the key to fire control, without which any reclamation of degraded grasslands under *alang-alang* is almost doomed to failure.

Recognize communal land rights. Issues of land tenure are inevitably confusing and sensitive. A full individual, certified right of ownership (*hak milik*) is a luxury held by very few rural farmers in Indonesia. Ironically it is commonly the transmigrant farmers who are the first to obtain this in the Outer Islands, notwithstanding the fact that they may have just been settled on the traditional lands of the host community. Others who are prioritized are participants in government-led programs such as the smallholder tree crop projects. Beyond that, there is a wide variation in systems of communal and traditional rights, extending to the extreme situation of non-agricultural communities in Irian Jaya, where every sago tree growing wild in the forest has its "owner".

Attitudes become polarized, particularly in this era of social and political reform, between the government stance of modernization and those who would seek to give absolute protection to the rights of the sago owners. However, on closer scrutiny, land disputes, even those between community members themselves, are influenced by modern trends, such as individualization of communal land rights and the increasing role and functions of the nuclear family (Atma Jaya 1998). Increasingly part of the population seeks recourse to modern institutions, such as the police and courts, in the pursuance of their objectives, and traditional institutions will continue to be steadily eroded.

It would be both impracticable and undesirable to attempt to accelerate the process of individual land registration throughout the country. Indeed Atma Jaya (1998) implies that the requirement for beneficiaries of the ADB-funded smallholder tree crop project (TCSSP) in the hinterland of Central Kalimantan to hold individual titles has serious negative impacts. However, it is no longer tenable for Government to consider land under communal rights (*hak ulayat*) as State Land and therefore available for allocation to investors, with compensation paid only for standing crops. This is one root of so much current unrest in the Outer Islands. A methodology must be implemented that gives some form of registration and rights.

It is to this end that the process of participatory mapping is being implemented. The objective is to assess and delineate, on a map, the borders of a community's area, and to characterize the land ownership and management system within those borders. Examples are the maps prepared in East Kalimantan, using GPS and complete with co-ordinates, with the assistance of local NGOs such as Plasma and Sistem Hutan Kerakyatan (supported by national and international agencies). The map scale is around 1:15,000, and the cost of mapping one desa was quoted (in April 1999) as being between Rp 5 and 10 million. The next step, after acceptance by the village head, is formal registration with the Bupati. The community would become responsible within these boundaries for management of traditional and collective tenure and management, which will often include individual rights of ownership.

Participatory village mapping, and its registration with the kabupaten government, will be by no means straightforward or free from dispute, especially in the face of increasing pressures from migrant farmers and outside investors. The arrival of an estate developer in a village in East Kalimantan, as described by Gönner (1999), for example, created tensions within the community that were outside the experience of the traditional methods of problem solving. Flexibility must enable compromise to be made where different customs and tenure systems exist within and between villages. A registered map will, however, empower the community to manage its resources according to its own initiatives, and provide a sound negotiating base with developers.

Provide forms of community land tenure. In the meantime, the World Bank's Land Administration Project (see Arcadis Euroconsult 1999) has identified a need for the Basic Agrarian Law to be replaced by a new Land Law which creates broader ownership rights on land, to include communal rights as understood and recognized by traditional (*adat*) communities. The existing law fails to recognize, create and guarantee a private realm of law in land rights.

More immediate recommendations relating to lands occupied by traditional communities include:

- All village land should be considered as communal land, as a starting point, unless the opposite is evident;
- The outer boundaries of the village territory should be established and recorded (without certificate) in a land registry for external protection (thus obviating the need for time-consuming, expensive and culturally disruptive surveys of individual property rights);
- The land register should be kept at local level, in simple format and easily accessible. Entries of communal and individual land rights should be made under indigenous title by the parties involved with the consent of the group concerned under control of the village official;
- A positive system of registration should be introduced in line with the character of traditional land law and tenure in general;
- The use of the land register for land tax purposes would be in accordance with the perceptions and practice common among the rural population that payment of land tax is evidence of ownership;
- The regulation of internal land affairs should be left to the local population and their established institutions and procedures (including traditional) as long as these still exist and are viable.
- Individual plots within the village area should not be registered under national law, unless explicitly requested by the individual owner with the explicit consent of the genealogical group involved and the village community;
- Disputes should in principal be handled by traditional institutions and procedures at the village or family level as far as possible.

The positive effects of following these recommendations include:

- The internal security is guaranteed by leaving the land arrangements to the judgment of the population, and the external security by recording the outer boundaries of the village territory;
- The time, energy and costs of systematic registration are postponed until the communities are ready for and seeking individual registration;
- Communities will have the time to be well informed of the implications of

opting-out of the traditional system into the national system of individual rights, and can make the decision through traditional decision-making processes in accordance with their aspirations and stage of acculturation;

- There should be an option for registration of specific types of communal land in the name of the genealogical group as a whole, with its original terminology, within the precepts of communal rights in the proposed new Land Law.

Implement and follow real land use planning. A substantial data base on the land resources is available at small scale (1:250,000) for the entire Republic (RePPProT, LREP), and the benefits of this have been acknowledged by provincial governments in the preparation of their spatial plans. The ADB-funded Land Resource Evaluation and Planning Project (LREP) commenced with the development of GIS-based processes in the eight provinces of Sumatra. LREP II was the second phase in establishing and developing the data base as input in formulating evaluation and planning policy in a further 18 provinces in Java, Bali and "eastern Indonesia". Ultimately the main product was the production of 1:250,000 Land Zoning maps to support province-wide physical planning. There was also a pilot program of 1:100,000 Land Zoning maps that it is intended to develop at kabupaten level. Only sample sheets have been prepared to date, generally two 1:250,000 map sheets per province, but the hardware has been set up and the procedures are in place. The software includes the digitized RePPProT data that have been made available for each province.

The process takes account of those aspects that relate to the land resource, namely land suitability, availability, current land use, and environmental considerations. The land systems information and current land use were derived from RePPProT but with land use updates from the Land Administration Ministry (BPN). The computerized process integrates the information on land suitability, permitted land use activities according to each land system, and environmentally sensitive areas, to produce Land Zone maps. Each unit on the Land Zone map has a series of defined Land Use Policy Options. This may seem rather basic, but it is the failure to follow the basic principals of land suitability that has resulted in some of the serious mistakes committed in land use decisions. The advantage of the LREP system is that it brings land information within the realm of provincial and, eventually, kabupaten decision-makers.

The consideration of Environmentally Sensitive Areas (ESA's) is included in the zoning process, but a potential weakness here is that sanctuary reserves should include not only existing and proposed reserves, but also *any other areas that require protection for the preservation of plant and animal species diversity*. This latter clause implies the availability of ecological data that may be lacking, and it is here that public participation (in this case the environmental NGO's) can play such an important role in ensuring the flexibility and necessary revisions to the zoning plans.

Require detailed development plans prior to approval. An applicant for an estate concession (HGU) should be required to prepare comprehensive land suitability and topographic survey, as well as a land use survey. The surveys would require to be made prior to application, so that the results would become primary inputs into the process of decision-making. Unsuitable land, such as steep land, deep peats and water storage areas required to maintain down-stream hydrology, would never reach

the planning stage. At the same time, land that is suited to food crop production could be zoned and *reserved* for either that purpose, or for exclusive utilization by the existing communities.

It is at this stage that serious consideration must be given to traditional land use and community rights. Where the large corporations are developing estates and negotiating with the existing farmers, either to acquire their land or to encourage a partnership in development, acknowledgement of the traditional rights of the community must be the first step, through participatory village mapping in the first instance (see previous section). One option would be for the developer to be financially responsible for this operation, preferably facilitating NGO involvement so that there is no sacrifice of transparency and equity. This would provide a sound basis for negotiation.

Such a participatory approach has been proposed by PCI (1998), with the objectives of combining the smooth development of tree crop plantations with the present livelihood means (arable plots, and forest gardens of rubber, fruit trees, rattan etc). The farmers minimize the risks associated with monocrop establishment, any resettlement and the break-up of communities is avoided, and many of the environmental functions of mixed cropping systems are retained. Whatever the estate model proposed (including HTI), the proportion of village land to be retained by the community needs to be determined, probably around 50 percent. The farmers will retain their freedom of choice, and will no longer be coerced into schemes that seek to convert all their lands into monocrops. The aesthe-tically displeasing block approach that has been adopted hitherto would be avoided, with a number of smallholder plantation areas, as well as forest gardens and food crop plots, distributed between villages and interspersed with the nucleus plantation.

References

Angelsen, A. & D. P. Resosudarmo. 1999. Krismon, farmers and forests: the effects of the economic crisis on farmers' livelihoods and forest use in the outer islands of Indonesia. CIFOR, Bogor.

Arcadis Euroconsult and associates. 1999. Land Administration Project - Part C. Support for Long term Development of Land Management Policies. Topic Cycle 4: Evolutionary Change in Indonesian Land Law; Traditional Law (ADAT) Perspectives. Final Report. Bappenas & BPN. IBRD Loan NO. 3792-IND.

ASB-Indonesia. 1995. *Alternatives to slash-and-burn in Indonesia. Summary Report of Phase I.* Edited by M. Van Noordwijk, T.P. Tomich, Retno Winahyu, Daniel Murdiyarso, Suyanto, Soetjipto Partoharjono & Ahmad M. Fagi. ASB-Indonesia Report No. 4, Bogor (ASB & ICRAF).

Atma Jaya (1998). *Pola Penguasaan Tanah Masyarakat Tradisional dan Problema Pendaftaran Tanah: Studi Kasus di Sumatera Barat, Kalimantan Tengah dan Nusa Tenggara Barat. Laporan Penelitian.* Pusat Kajian Pembangunan Masyarakat Atma Jaya bekerjasama dengan Badan Pertanahan Nasional. Indonesian Land Administration Project Customary (Adat) Land Rights Studies.

BAPPENAS. 1993. *Biodiversity Action Plan for Indonesia.* Jakarta.

Brown, D. 1999. *Addicted to rent: Corporate and spatial distribution of forest resources in Indonesia; implications for forest sustainability and government policy.* Indonesia - UK Tropical Forestry Management program, DFID, Report No. PFM/EC/99/06.

Collar, N.J., M.J. Crosby & A.J. Stattersfield. 1994. *Birds to Watch 2: the World List of Threatened Birds.* Cambridge, UK: BirdLife International. BirdLife Conservation Series No. 4.

Danielsen, F. & M. Heegaard. 1995. The birds of Bukit Tiga Puluh, Southern Riau, Sumatra. *Kukila* 7(2): 99-120.

Environmental Investigation Agency (EIA)/Telepak. 1999. *The Final Cut: Illegal Logging in Indonesia's Orangutan Parks.* London and Bogor.

Fortech, Margules Pöyry, and Pusat Pengembangan Agribisnis. 1999. *Planning for fire prevention and drought management project.* ADB TA 2999-INO.

Fraser, A.I. 1998. *Social, economic and political aspects of forest clearance and land-use planning in Indonesia.* In: Maloney, B.K. (ed.): *Human activities and the tropical rainforest.* The Netherlands: Kluwer Academic Publishers.

Garrity, D.P. (Undated). Conservation tillage: A Southeast Asian perspective. Internal paper, ICRAF, Bogor.

Garrity, D.P. (Undated). Addressing key natural resource management challenges in the humid tropics through agroforestry research. Internal Paper, ICRAF, Bogor.

Gönner, C. 1999. *Causes and effects of forest fires: a case study from a sub-district in East Kalimantan, Indonesia.* Draft paper for ICRAF workshop on Environmental Services & Land Use Change, Policy & Research in Chiang Mai, 30 May - 3 June 1999.

Gouyon, Anne. 1999. Fire in the rubber jungle. Fire prevention and sustainable tree crop development in South Sumatra. Forest Fire Prevention and Control Project, MoF and EEC.

Green, A.J. 1992. *The status and conservation of the White-winged Wood Duck* Cairina scutulata. Slimbridge, UK: International Waterfowl and Wetlands Research Bureau Spec. Publ. No. 17.

Hagreis, B.J. 1931. *Ladangbouw* in: *Tectona* XXIV: 588-631, quoted in: Durand Frederic. 1989. *L'Evolution du Couvert Forestier en Indonesie. Histoire et Cartographie des Grands Sous-Ensembles Regionaux.* Memoire de DEA "Connaissance des Tiers-Mondes", Universite Paris VII-Jussieu sous la direction de Denys Lombard, Professer a l'Ecole des Hautes Etudes en Sciences Sociales.

IFFM/SFMP (gtz). Fire damage in East Kalimantan in 1997/98 related to land use and vegetation classes: satellite radar inventory results and proposals for further actions. Draft report, November 1999.

Knapen, H. *Epidemics, droughts, and other uncertainties on Southeast Borneo during the eighteenth and nineteenth centuries.* pp 121-152 in: Boomgaard, P., F. Colombijn & D. Henley. 1997. *Paper landscapes: explorations in the environmental history of Indonesia.* Verhand. Koninklijk Inst. Voor Taal-, Land- en Volkenkunde. 178.

Laumonier, Y. 1996. *The vegetation and physiography of Sumatra.* Geobotany 22. Kluiver.

Muljadi A.T., 2000. "Overcapacity in The Wood Processing Industry" presented at "Removing The Constraints: Post-CGI Meeting on Indonesian Forestry", a seminar conducted by the World Bank in Jakarta, Indonesia, January 26, 2000.

PCI. 1998. *The Development Study on Comprehensive Regional Development Plan for the Western Part of Kalimantan (SCRDP - Kaltengbar).* Draft Final Report. Vol. 2: Main Text, and Technical Report 2. JICA/BAPPENAS.

Potter, L & J. Lee. 1998[a]. *Oil Palm in Indonesia: its Role in Forest Conversion and the Fires of 1997/98.* A Report for WWF - Indonesia Program.

Potter, L & J. Lee. 1998[b]. *Tree Planting in Indonesia: Trends, Impacts and Directions.* Bogor: CIFOR, Occasional Paper No. 18.

RePPProT. 1990. Regional Physical Planning program for Transmigration. Final report dated 1990. Ministry of Transmigration and the Land Resources Division of the Overseas Development Administration, Government of UK.

Riley, J. 1997. The birds of Sangihe and Talaud, North Sulawesi. *Kukila* 9:3-36.

Sathirathai, S. 1998. *Economic Valuation of Mangroves and the Roles of Local Communities in the Conservation of Natural Resources: Case Study of Surat Thani, South of Thailand.* Singapore: Economy and Environment Program for Southeast Asia (EEPSEA).

Scotland, N., A. Fraser and N. Jewell. 1999. *Indonesian Forest Inventory Data.* Indonesia-UK Tropical Forest Management program. Report number PFM/EC/99/07.

Scotland, N., A. Fraser & N. Jewell. 1999. *Roundwood supply and demand in the forest sector in Indonesia.* Indonesia-UK Tropical Forest Management program, Report No. PFM/EC/99/08.

Thiollay, J-M. 1996. *Rain forest raptor communities in Sumatra: the conservation value of traditional agroforests.* In: Bird, D.M., D.E. Varland & J.J. Negro (eds.): *Raptors in human landscapes.* London: Academy Press.

Thiollay, J-M. 1995. The role of traditional agroforests in the conservation of rain forest bird diversity in Sumatra. *Conservation Biology* 9: 335-353.

Tomich, T.P. 1991. *Smallholder rubber development in Indonesia.* In: Perkins, D.H. & M. Roemer (eds.), *Reforming economic systems in developing countries.* Harvard University Press.

Tomich, T.P., M. van Noordwijk, S. Budidarsono, A. Gillison, T. Kusumanto, D. Murdiyarso, F. Stolle & A.M. Fagi (eds.). 1998. *Alternatives to Slash-and-Burn in Indonesia. Summary Report & Synthesis of Phase II.* ASB-Indonesia Report No. 8. ICRAF S.E. Asia.

Wallace, A.R. 1989 (1869). *The Malay Archipelago.* Stenhouse, Scotland: Tynron Press.

Wells, D.R. 1985. *The forest avifauna of Western Malesia and its conservation.* pp. 213-32 in: Diamond, A.W. & T.E. Lovejoy: *Conservation of tropical forest birds.* Cambridge, UK: ICBP Tech. Publ. No. 4.

Whitten, A.J., S.J. Damanik, J. Anwar & N. Hisyam. 1984. *The ecology of Sumatra.* Gadjah Mada University Press. [Reprinted as Volume I of the Ecology of Indonesia Series by Periplus Editions].

Wibowo, P. & N. Suyatno. 1998. *An overview of Indonesian wetland sites - II: an update information - included in the Indonesian Wetland Database.* Wetlands International - Indonesia Program/PHPA, Bogor.

World Bank. 1994. *Indonesia: Environment and Development.* Washington.

Wordwide Fund for Nature/DFID. 1998. Laporan Perkembangan Sawmill di Wilayah Selatan TN. Bukit Tigapuluh & di Sekitar Area KPHP Pasir Mayan. Laporan PFM/KPMP/98/7.

ENVIRONMENT AND SOCIAL DEVELOPMENT
EAST ASIA AND PACIFIC REGION

THE WORLD BANK
1818 H Street, N.W.
Washington, D.C. 20433, U.S.A.

Telephone: 202 473 1000
Facsimile: 202 522 1666