The State of the Forest

INDONESIA

FOREST WATCH INDONESIA • WORLD RESOURCES INSTITUTE • GLOBAL FOREST WATCH

The State of the Forest: Indonesia

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This report should be cited as: FWI/GFW. 2002. *The State of the Forest: Indonesia*. Bogor, Indonesia: Forest Watch Indonesia, and Washington DC: Global Forest Watch.

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ISBN 1-56973-492-5 ENGLISH
Available in Indonesian as *Potret Keadaan Hutan Indonesia*
ISBN 979.96730.0.3 INDONESIAN
Library of Congress Control Number: 2001099749

Printed in the United States of America on chlorine-free paper with recycled content of 50%, 20% of which is post-consumer.

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ACKNOWLEDGMENTS

Forest Watch Indonesia (FWI) and Global Forest Watch (GFW) wish to thank the following individuals for their support, contributions, and review comments on this report:

Internal Review Meeting, Held at the Wisma Bogor Permai, 27-28 April, 2001

Rina Agustine, National Secretariat FWI, Bogor; Wardiyono, CIFOR, Bogor; Restu Achmaliadi, Jaringan Kerja Pemetaan Partisipatif, Bogor; Albertus T. Mulyono, FWI Simpul Bogor; Chehafudin, Aliansi Relawan untuk Penyelamatan Alam, Yogyakarta; Dwi Prabowo YS, FWI Simpul Bogor; Hariadi Kartodiharjo, Faculty of Forestry, IPB/Bappedal, Bogor/Jakarta; Rajidt Ch Malley, FWI Simpul Sumatra/Yayasan Leuser Lestari, Medan; Togu Manurung, National Secretariat FWI, Bogor; Lyndon B. Pangkali, FWI Simpul Papua, Jayapura; Christian Purba, FWI Simpul Bogor; Muhammad Ridwan, National Secretariat FWI, Bogor; A. Ruwindrijarto, Telapak Indonesia, Bogor; Lisken Situmorang, ICRAF, Bogor; Wishnu Tirta, FWI Simpul Bogor; Yasir Al Fatah, FWI Simpul Kalimantan, Banjarmasin; Muchlis L. Usman, Yayasan Cinta Alam/ FWI Simpul Sulawesi, Kendari.

Expert Review Meeting, Held at the Wisma Bogor Permai, 29-30 June, 2001

Dian Agista, Birdlife-Indonesia Programme, Bogor; Rina Agustine, National Secretariat FWI, Bogor; Restu Achmaliadi, Jaringan Kerja Pemetaan Partisipatif, Bogor; Albertus T. Mulyono, FWI Simpul Bogor; M. Ali Arsyad, Pusat Pembentukan Wilayah Pengelolaan dan Perubahan Kawasan Hutan, Badan Planologi Kehutanan, Departemen Kehutanan, Jakarta; Charles Victor (Chip) Barber, World Resources Institute, Manila; Chehafudin, Aliansi Relawan untuk Penyelamatan Alam, Yogyakarta; Chrystanto, Pusat Perpetaan Badan Planologi Kehutanan, Departemen Kehutanan, Jakarta; Wilistra Danny, Direktorat Penanggulangan Kebakaran, Departemen Kehutanan, Jakarta; Sadikin Djajapertjunda; Dwi Prabowo YS, FWI Simpul Bogor; Elfian Effendi, Natural Resource Management Program/EPIQ, Jakarta; Yasir Al Fatah, FWI Simpul Kalimantan, Banjarmasin; Hargyono, Direktorat Bina Pengembangan Hutan Tanaman, Ditjen BPK, Departemen Kehutanan, Jakarta; Bambang Hero Saharjo, Forest Fire Laboratory, IPB, Bogor; Imam, Planning Directorate, Ministry of Forestry, Jakarta; Rajidt Ch. Malley, FWI Simpul Sumatera/ Yayasan Leuser Lestari-Medan; Togu Manurung, National Secretariat FWI, Bogor; MuhammadYusram Massijaya, Faculty of Forestry IPB, Bogor; Emily Matthews, Global Forest Watch/World Resources Institute, Washington, DC; Muayat Ali Muhsi, Konsorsium Pendukung Sistem Hutan Kerakyatan, Bogor; Abdon Nababan, Aliansi Masyarakat Adat Nusantara, Jakarta; Rainny Natalia, FWI Simpul Bogor; Nuswanto, Direktorat Jenderal Perlindungan Hutan dan Konservasi Alam, Departemen Kehutanan, Jakarta; Lyndon B. Pangkali, FWI Simpul Papua, Jayapura; Christian Purba, FWI Simpul Bogor; Boen M. Purnama, Pusat Rencana Kehutanan, Badan Planologi Kehutanan, Departemen Kehutanan, Jakarta; Haryanto R. Putro, Faculty of Forestry IPB, Bogor; Widodo S. Ramono, Direktorat Konservasi Kawasan, Direktorat Jenderal Perlindungan Hutan dan Konservasi Alam, Jakarta; Muhammad Ridwan, National Secretariat FWI, Bogor; William M. Rombang, Birdlife-Indonesia Programme, Bogor; A. Ruwindrijarto, Telapak Indonesia, Bogor; Harry Santoso, Pusat Pengukuhan dan Penatagunaan Kawasan Hutan Badan Planologi Kehutanan, Departemen Kehutanan, Bogor; Iman Santoso, Forest Inventory and Monitoring Project, Ministry of Forestry, Jakarta; William Sunderlin, CIFOR, Bogor; Jatna Supriatna, Conservation International-Indonesia Programme, Jakarta; Wishnu Tirta, FWI Simpul Bogor; Silverius Oscar Unggul, Yayasan Cinta Alam/ FWI Simpul Sulawesi, Kendari; Arbi Valentinus, FWI Simpul Bogor/Telapak, Bogor; Joko Waluyo, Sawit Watch/ Walhi, Jakarta.

Global Forest Watch and Forest Watch Indonesia would also like to thank the many other individuals who provided data, valuable comments on data, and much wise advice during the preparation of this report. These individuals are too numerous to list, but we are particularly grateful to Derek Holmes, consultant to the World Bank, and Neil Scotland, UK Department for International Development (DFID).

Peer Review of Final Draft

Timothy H. Brown, Natural Resource Management Program, United States Agency for International Development, Jakarta; Dirk Bryant, Tony Janetos, Ralph Ridder, Frances Seymour, and Dan Tunstall, World Resources Institute, Washington, DC; Nigel Sizer, The Nature Conservancy, Jakarta; William Sunderlin, CIFOR, Bogor; Thomas E. Walton, World Bank, Jakarta.

Funders

Global Forest Watch would like to thank the following donors for their overall support of Global Forest Watch Activities: AVINA, the United States Agency for International Development (USAID), the Department for International Development (DFID) UK, IKEA, the Netherlands Ministry of Foreign Affairs, the Turner Foundation, the Biodiversity Support Program (BSP), and the World Resources Institute.

Forest Watch Indonesia would like to thank the Natural Resources Management-EPIQ Program of the United States Agency for International Development (USAID), the Netherlands Committee for the World Conservation Union (NC-IUCN), and the Department for International Development (DFID) UK, for their specific support of Forest Watch Indonesia activities in Indonesia. FWI would also like to thank IKEA for providing funds to GFW in support of low access mapping in Indonesia.

FOREWORD

Indonesia is endowed with some of the most extensive and biologically diverse tropical forests in the world. Tens of millions of Indonesians depend directly on these forests for their livelihoods, whether gathering forest products for their daily needs or working in the wood-processing sectors of the economy. The forests are home to an abundance of flora and fauna unmatched in any country of comparable size. Even today, almost every ecological expedition that sets out to explore Indonesia's tropical forests returns with discoveries of new species.

But a tragedy is unfolding in Indonesia. The country now finds itself the unwelcome center of world attention, as domestic and international outrage mounts over the rampant destruction of a great natural resource. Indonesia's "economic miracle" of the 1980s and 1990s turns out to have been based, in part, on ecological devastation and abuse of local people's rights and customs. For example, one of the country's fastest growing sectors, the pulp and paper industry, has not established the plantations necessary to provide a secure supply of pulpwood. Instead, pulpmills rely largely on wholesale clearing of natural forest. The economy is plagued by lawlessness and corruption. Illegal logging has been rampant for years and is believed to have destroyed some 10 million ha of forest. Indonesia's wood-processing industries operate in a strange legal twilight, in which major companies that – until the economic crisis of 1997 – attracted billions of dollars in Western investment, obtain more than half their wood supplies from illegal sources. Wood is routinely smuggled across the border to neighboring countries, costing the Indonesian government millions of dollars in lost revenues each year.

Although the evidence of destruction is mounting, the picture has been muddied by conflicting data, disinformation, claim and counterclaim. The need for an objective appraisal of the situation is urgent – one that will provide a sound information base for every individual and organization seeking to bring about positive change.

The data difficulties are formidable, but this report sets out to meet that need. It provides a comprehensive summary of the scale and pace of change affecting Indonesia's forests and identifies the forces and actors that are driving deforestation. Forest Watch Indonesia and Global Forest Watch have compiled the best available official data and reports from environmentalists in the field to address the following questions: How much of Indonesia's forest cover is left, and how much has been lost over the past 50 years? What is the condition of remaining forest cover today? What are the major driving forces behind deforestation, and who are the principal actors? Given current political and economic conditions in Indonesia, what are the prospects for forest policy reform?

Our findings do not provide grounds for much optimism, despite clear signs of change in Indonesia. The major bilateral and multilateral donors are now working actively with the Indonesian govern-

ment to develop a strategy and action plan for reform. The Indonesian Ministry of Forestry is committed to implementing specific actions at the national level and has recently endorsed a wide-ranging regional plan to combat illegal logging.

Yet even if current policy reforms are successful, it is clear that Indonesia is in transition from being a forest-rich country to a forest-poor country, following the path of the Philippines and Thailand. Millions of hectares of former forest are now covered in degraded forest remnants, scrub, and the ubiquitous alang-alang grass. With this loss of forest, Indonesia is losing biodiversity, wood supply, income, and ecosystem services.

Degraded forest lands can be replanted and managed to provide wood, tree crops, fruits, and other nontimber products. Ecosystem services such as freshwater regulation and soil retention can be restored. Part of the tragedy of Indonesia's forests is that the current industrial timber plantation program, and the system of forest conversion to plantation crops, have not contributed to sustainable forest management but rather have accelerated deforestation. Officially, decisions in the forest sector are no longer oriented toward clearance and conversion but, in reality, clearance and conversion continue. The system should be restructured to require the establishment of new plantations on the vast areas of degraded land that are already available for planting. The requirement should be enforced.

Indonesia is at a crossroads where much of its natural resource base has been destroyed or degraded, but much still remains. Land development for plantations to supply timber and valuable export crops is a vital part of the country's economic strategy. In coming years, the easier route will be to allow logging operations and plantations – and the wasted land that accompanies their development – to spread over the remaining natural forests, rewarding developers with huge unearned windfall profits from forest clearance. The harder but ultimately more sustainable route will be to reclaim the land that currently lies idle and conserve the primary forest that remains. Sixty four million hectares of forest have been cut down over the past 50 years. There is no economic or ethical justification for another 64 million hectares to be lost over the next 50 years.

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KEY FINDINGS

Indonesia is experiencing one of the highest rates of tropical forest loss in the world.

- Indonesia was still densely forested as recently as 1950. Forty percent of the forests existing in 1950 were cleared in the following 50 years. In round numbers, forest cover fell from 162 million ha to 98 million ha.
- The rate of forest loss is accelerating. On average, about 1 million ha per year were cleared in the 1980s, rising to about 1.7 million ha per year in the first part of the 1990s. Since 1996, deforestation appears to have increased to an average of 2 million ha per year.
- Indonesia's lowland tropical forests, the richest in timber resources and biodiversity, are most at risk. They have been almost entirely cleared in Sulawesi and are predicted to disappear in Sumatra by 2005 and Kalimantan by 2010 if current trends continue.
- Nearly one half of Indonesia's forests are fragmented by roads, other access routes, and such developments as plantations.

Deforestation in Indonesia is largely the result of a corrupt political and economic system that regarded natural resources, especially forests, as a source of revenue to be exploited for political ends and personal gain.

- Logging concessions covering more than half the country's total forest area were awarded by former President Suharto, many of them to his relatives and political allies. Cronyism in the forestry sector left timber companies free to operate with little regard for long-term sustainability of production.
- As part of the effort to boost Indonesia's export revenues, and to reward favored companies, at least 16 million ha of natural forest have been approved for conversion to industrial timber plantations or agricultural plantations. In many cases, conversion contradicted legal requirements that such plantations be established only on degraded land or on forest land already allocated for conversion.
- Aggressive expansion of Indonesia's pulp and paper industries over the past decade has created a level of demand for wood fiber that cannot currently be met by any sustainable domestic forest management regime.
- Forest clearance by small-scale farmers is a significant but not dominant cause of deforestation.

Illegal logging has reached epidemic proportions as a result of Indonesia's chronic structural imbalance between legal wood supply and demand.

- Illegal logging, by definition, is not accurately documented. But a former senior official of the Ministry of Forestry recently claimed that theft and illegal logging have destroyed an estimated 10 million ha of Indonesian forests.
- Massive expansion in the plywood, pulp, and paper production sectors over the past two decades means that demand for wood fiber now exceeds legal supplies by 35-40 million cubic meters per year.
- This gap between legal supplies of wood and demand is filled by illegal logging. Many wood processing industries openly acknowledge their dependence on illegally cut wood, which accounted for approximately 65 percent of total supply in 2000.
- Legal logging is also conducted at an unsustainable level. Legal timber supplies from natural production forests declined from 17 million cubic meters in 1995 to under 8 million cubic meters in 2000, according to recent statistics from the Ministry of Forestry. The decline has been offset in part by timber obtained from forests cleared to make way for plantations. But this source appears to have peaked in 1997.
- Industrial timber plantations have been widely promoted and subsidized as a means of supplying Indonesia's booming demand for pulp and taking pressure off natural forests. In practice, millions of hectares of natural forest have been cleared to make way for plantations that, in 75 percent of cases, are never actually planted.

More than 20 million hectares of forest have been cleared since 1985, but the majority of this land has not been put to productive alternative uses.

- Nearly 9 million ha of land, much of it natural forest, has been allocated for development as industrial timber plantations. This land has already been cleared or will be cleared soon. Yet only about 2 million ha have actually been planted with fast-growing species, mostly *Acacia mangium*, to produce pulpwood. The implication: 7 million ha of former forest land are lying idle.

- Nearly 7 million ha of forest had been approved for conversion to estate crop plantations by the end of 1997, and this land has almost certainly been cleared. But the area actually converted to oil palm plantations since 1985 is about 2.6 million hectares, while new plantations of other estate crops probably account for another 1-1.5 million ha. The implication: 3 million ha of former forest land are lying idle.

- No accurate estimates are available for the area of forest cleared by small-scale farmers since 1985, but a plausible estimate in 1990 suggested that shifting cultivators might be responsible for about 20 percent of forest loss. This would translate to clearance of about 4 million ha between 1985 and 1997.

- The transmigration program that relocated people from densely populated Java to the outer islands was responsible for about 2 million ha of forest clearance between the 1960s and the program's end in 1999. In addition, illegal migration and settlement by pioneer farmers at the margins of logging concessions, along roads, and even in national parks has greatly accelerated since 1997, but reliable national-scale estimates of forest clearance by forest pioneers have not been made.

- Large-scale plantation owners have turned to the use of fire as a cheap and easy means of clearing forest for further planting. Deliberate fire-setting, in combination with unusually dry conditions caused by El Niño events, has led to uncontrolled wildfires of unprecedented extent and intensity. More than 5 million ha of forest burned in 1994 and another 4.6 million ha burned in 1997-98. Some of this land is regenerating as scrubby forest, some has been colonized by small-scale farmers, but there has been little systematic effort to restore forest cover or establish productive agriculture.

The Indonesian government is facing mounting pressure domestically and internationally to take action, but progress is slow and not all policy reforms in process are necessarily good news for forests.

- In the freer political atmosphere that followed the fall of President Suharto in 1998, environmental activists have demanded greater accountability from both the government and the private sector. Access to official information has improved, but efforts to prevent the worst abuses of corporate power have met with limited success.

- Numerous forest-dependent communities, sensing the weakening of central power, have erupted violently against logging and plantation operations that they consider to be plundering their local resources. Longstanding problems of unclear land tenure rights are the root cause of many such conflicts. The government is no longer willing to protect corporate interests as it once did, but neither does it appear to have any coordinated plan for dealing with the problem.

- Since 1999, Indonesia's principal aid donors have coordinated their assistance through a consortium called the Consultative Group on Indonesia (CGI), chaired by the World Bank. Improved forest management has been declared a priority, and the Government of Indonesia has committed to a 12-point plan of policy reform. But continuing political turmoil seems likely to undermine these efforts. In April 2001, the then-Forestry Minister acknowledged many failures, saying that Indonesia should not have agreed to "such unrealistic targets." As one example, the government imposed a moratorium on further conversion of natural forest in May 2000, but the ban is widely disregarded in the provinces.

- Indonesia is moving rapidly toward a new system of "regional autonomy," but the provincial and district governments that will benefit from decentralization are largely without the capacities or funds needed to govern effectively. Raising short-term revenue will be a top priority and, as a result, intensified exploitation of forest resources is already occurring in many regions.

FWI/Sulawesi

CHAPTER 1
INDONESIA'S FORESTS: WHAT IS AT STAKE?

1.1 100 Million Hectares of Tropical Forest

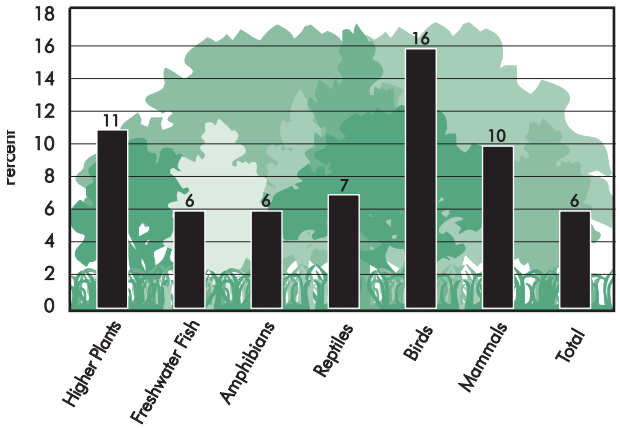
Indonesia is home to some of the most magnificent tropical forests in the world. In extent, they rank third behind Brazil and the Democratic Republic of Congo (formerly Zaire), and their biological richness is unique. The major forest types of Indonesia range from evergreen lowland dipterocarp forests in Sumatra and Kalimantan to seasonal monsoon forests and savanna grasslands in Nusa Tenggara and nondipterocarp lowland forests and alpine areas in Irian Jaya (sometimes referred to as Papua). Indonesia also contains the most extensive mangrove forests in the world, estimated at 4.25 million hectares in the early 1990s.

Most of these habitats are under serious threat. Indonesia today is losing nearly 2 million ha of forest *every year*. Deforestation on this scale, at this speed, is unprecedented. Environmental organizations are sometimes accused of hyberbole in their claims of imminent destruction. In the case of Indonesia, predictions of catastrophic habitat loss and species decline are not exaggerated. The most recent and authoritative survey of the country's forest cover predicts that lowland dipterocarp forests – the richest tropical habitat of all – will have vanished from Sumatra and Kalimantan by 2010 if current trends continue unchecked (Holmes, 2000).

1.2 A Rich Natural World Is Disappearing

Although Indonesia comprises only 1.3 percent of the earth's land surface, it harbors a disproportionately high share of its biodiversity, including 11 percent of the world's plant species, 10 percent of its mammal species, and 16 percent of its bird species. (*See Figure 1.1.*) The majority of these species are found in the country's forests.

Figure 1.1 Biotic Richness: Percent of World's Species Found in Indonesia



Source: *World Resources 2000–2001. Washington DC: World Resources Institute: 246–248.*

Indonesia's 17,000 islands span the Indomalayan and Australasian realms; the archipelago contains seven major biogeographic realms and an extraordinary diversity of habitat types. *(See Box 1.1.)* Many islands have been isolated for millennia, so levels of endemism are high. Of 429 locally endemic bird species, for example, 251 are unique to single islands. Most of Indonesia's insects are also found nowhere else, with many genera confined to individual mountaintops. The country's three main centers of species richness are Irian Jaya (high species richness and endemism), Kalimantan (high species richness, moderate endemism), and Sulawesi (moderate species richness, high endemism).

Indonesia provides the habitat for some of the world's most beloved mammals, including the orangutan, tiger, rhinoceros, and elephant. As recently as 1930, three subspecies of tiger, Balinese, Javan, and Sumatran, ranged across the country. Of these three, the Balinese tiger (*Panthera tigris balica*) became extinct in the late 1930s and the Javan tiger (*Panthera tigris sondaica*) in the 1970s. Today, only the Sumatran subspecies remains. Because of their solitary lifestyle and nocturnal habits, an accurate census of Sumatran tigers is nearly impossible. They are believed to number around 400-500, living mostly in five national parks on Sumatra. An informal census in 1978 estimated the number of tigers on the island at approximately 1,000. Despite tigers' ability to live in a wide range of habitats, forest fragmentation and agricultural development as well as the demand for tiger products have contributed to the decline of the population (Tiger Information Center, 2001).

Box 1.1 The Wallace Line

The Indonesian archipelago is split almost in half by an invisible line. The English biologist Alfred Russel Wallace first described this line in the 1850s (Wallace, 1859). Wallace observed that birds present on one island were not present on another island only 40 km away. He later found that this startling pattern was true when applied to countless other animal and plant species. For example, the famous dipterocarp trees that make up the bulk of lowland forests in Indonesia show a remarkable divide across the Wallace line. Over 287 species are found on Borneo, whereas only 7 are found 80 km eastward on Sulawesi, at the same latitude. The line, which now bears Alfred Wallace's name, is created by a deep-sea shelf that cuts between Bali and Lombok, and north between the islands of Borneo and Sulawesi. Few species found on one side of Wallace's line are found on the other. Wallace speculated that west of Bali, species were Asian in origin, whereas east of Bali they seemed to have come from Australia. This stunning separation of species is one of the primary sources of Indonesia's incredible biodiversity. In fact, the isolation of Indonesia's wide archipelago, which spans over 4,800 km, is what has created such a diverse range of species. Indonesia ranks among the top five countries in the world in its diversity of plants, mammals, birds, and reptiles (CI, 2001).

References

Conservation International. 2001. Online at: http://www.conservation.org (January 9, 2001).

Wallace, Alfred Russel. 1859. "On the Zoological Geography of the Malay Archipelago" (S53, 1859). Paper presented to the Linnean Society on 3 November and published in their *Zoological Proceedings* in 1860.

Other mammal species are not faring much better. The Sumatran and Javan rhinoceros are both on the World Conservation Union's (IUCN) Red List of critically endangered species. The Javan rhinoceros (*Rhinoceros sondaicus*) is the rarest large mammal species in the world, with an estimated 54-60 individuals in 1995, most of them in a single protected area, Ujung Kulon National Park. The Sumatran rhinoceros (*Dicerorhinus sumatrensis*) is known to exist on the Malay Peninsula, Sumatra, and Borneo. In all populations, rhino numbers have declined more than 50 percent over the past decade. Only about 400 rhinos are known to exist in Indonesia.

Habitat fragmentation and conversion have also hit primate species particularly hard. The Primate Specialist Group of IUCN has recently designated 2 species, the Sumatran orangutan (*Pongo pygmaeus*) and the Javan gibbon (*Hylobates moloch*), among its top 25 most endangered primates. The Javan gibbon numbers between 300 and 400 in the scant remaining forest of Java. On Sumatra, orangutans are found only in the provinces of Aceh, North Sumatra, and

West Sumatra. As with most endangered mammals, habitat loss and fragmentation are the key causes of population decline. However, hunting for food and sport, the illegal pet trade, and management ineffectiveness in the national parks have also contributed to population declines (IUCN, 2001).

1.3 People Also Depend on the Forests

A large though undetermined number of communities live in or depend on Indonesia's forests. Estimates made over the past several decades have varied wildly on the precise number of people – from 1.5 million to 65 million – depending on definitions used and the policy agenda pursued (Zerner, 1992:4).

Nontimber Forest Products

In mid-2000, the Ministry of Forestry[1] reported that 30 million people "depend directly on the forestry sector for their livelihoods," but did not define the degree of dependency (MOF, 2000). Many of these people live by traditional "portfolio" economic strategies that combine shifting cultivation of rice and other food crops with fishing, hunting, harvesting and selling of timber, and gathering nontimber forest products (NTFPs) such as rattan, honey, and resins for use and sale. The cultivation of coffee, rubber, and other tree crops is also an important source of income (De Beer and McDermott, 1996:74). One particularly valuable nontimber forest product is rattan cane. Indonesia dominates world rattan trade; its abundant supply of wild and cultivated rattan accounts for 80-90 percent of global supply (FAO, 2001:4).

Millions of people use forest plants and herbs known for their medicinal properties. Medicinal plants and other nontimber forest products are poorly appreciated and difficult to document because many of them are not reflected in formal market transactions recorded in economic statistics. The total value of exports of "wildlife and plants" for the 1999-2000 fiscal year was more than $1.5 billion, according to the Ministry of Forestry, but the components of this aggregated total are not specified (MOF, 2000). Nonmarket use values are also likely to be high: if each of the estimated 30 million forest-dependent people used forest products worth only $100 each year, their total value would be $3 billion.

Environmental Services

The range of benefits provided by Indonesia's forests extends far beyond forest products. More than 16 million people live in the country's 15 largest watersheds. Their forests help protect freshwater supplies by stabilizing soil on hillslopes and regulating the speed and timing of river flow. Yet these watersheds lost more than 20 percent of their forest cover between 1985 and 1997.

Indonesia's forests also store great quantities of carbon. According to the FAO, forest vegetation in Indonesia totals over 14 billion tons of biomass – more than any other country in Asia and equal to about 20 percent of the biomass in all of Africa's tropical forests. This quantity of biomass stores,

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roughly, about 3.5 billion tons of carbon.[2] Given the extensive forest clearance in Indonesia and the relatively small area that has been replanted (*see Chapter 3*), it appears likely that land cover changes have created a net source of carbon in recent decades, thus contributing to global warming.

Environmental services are hard to quantify. Much anecdotal evidence exists and many local studies confirm that ecological functions have declined with deforestation, but consistent information at the national scale is lacking. The importance of environmental services being lost is still harder to evaluate in dollar terms. Scholars have attempted to assign economic value to environmental goods and services that are not exchanged in recognized markets. Using a variety of assumptions and methodological approaches, researchers have ascribed values to tropical forests ranging from hundreds to thousands of dollars per ha. One such study by the Forestry Department of Bogor Agricultural Institute (IPB) in Java concluded that the theoretical economic value of biodiversity and carbon storage dwarfs the revenues currently obtained from roundwood production (Bogor Agricultural Institute, 1999).

While such studies are not robust enough to be taken too literally,[3] they provide a useful reminder that conventional appraisals of forest value, based on timber prices, are too narrow and they neglect the interests of local forest dependent people. They also neglect the interest and concern of people worldwide who care about the fate of Indonesia's forests. Many people respond to tropical forests with a sense of awe, excitement, and reverence. It may be argued that monetary valuation techniques are not always relevant and that the spiritual and aesthetic qualities of Indonesia's forests lie beyond the reach of both mainstream and ecological economics.

1.4 Timber Products Are a Major Source of National Revenue

Indonesia is a significant producer of tropical hardwood logs and sawnwood, plywood and other boards, and pulp for papermaking. More than half the country's forests, some 54 million hectares, are allocated for timber production (although not all are being actively logged), and a further 2 million ha of industrial wood plantations have been established, supplying mostly pulpwood. The volume and value of Indonesian wood production are hard to determine with precision: data provided by FAO, the International Tropical Timber Organization, and the Indonesian government are compiled differently and do not tally. The majority of Indonesian wood production is used domestically and domestic prices are generally much lower than international market prices. Nevertheless, the importance of the forestry sector to the Indonesian economy is clear. In 1997, the forestry and wood processing sectors accounted for 3.9 percent of Gross Domestic Product (GDP), and exports of plywood, pulp, and paper were valued at $5.5 billion. This amount was nearly half the value of oil and gas exports, and equal to nearly 10 percent of total export earnings. (*See Table 1.1.)*

The forestry sector shared in the tremendous growth and export drive of the economy in the 1980s and 1990s, but this expansion was achieved at the cost of wholly unsustainable forestry practices. The wood processing industries in Indonesia now require about 80 million m^3 of wood annually to feed sawmills, plywood manufacturing plants, pulp mills, and papermaking plants. This quantity of wood is far more than can be produced legally from the country's forests and timber plantations. As a result, more than half the country's wood supply is obtained from illegal logging.

1.5 Assessing the State of the Forest

Only a century ago, Indonesia was still densely forested, with trees covering an estimated 80-95 percent of the total land area, depending on the island being considered. Total forest cover at that time has been estimated at about 170 million ha. Today it is approximately 98 million hectares, at least half of which is believed to be degraded by human activity. The rate of deforestation is accelerating: Indonesia lost about 17 percent of its forests between 1985 and 1997 alone. On average, the

Table 1.1 Indonesia's Leading Exports, 1997

Category	Export Earnings	Average Annual Growth 1992–1997
	(US$ Billion)	%
Oil and Gas Exports	11.7	2
Non-Oil Exports		
Garments	4.2	5
Plywood	3.5	2
Textiles	3.4	7
Electrical Appliances	3.3	26
Pulp and Paper	2.0	37
Palm Oil	1.7	29
Copper	1.5	18
Rubber	1.5	8
Shrimp, Lobster, Tuna	1.1	6
Handicrafts	1.0	14
Other Non-Oil Exports	21.5	18
TOTAL	**56.3**	**11**

Source: Bank of Indonesia, reported by U.S. Department of Commerce - National Trade Data Bank, September 3, 1999. Online at: http://www.tradeport.org/ts/countries/indonesia/trends.html

country lost approximately 1 million ha of forest each year in the 1980s and about 1.7 million ha per year in the 1990s. Since 1996, deforestation appears to have accelerated again to approximately 2 million ha per year. At this rate, virtually all of Indonesia's lowland forests – the most valuable for both biodiversity and timber resources – will be gone within the next decade (Holmes, 2000).

The threats to Indonesia's forest are numerous, ranging from large-scale logging operations to small-scale clearance by family farmers, from clear-cutting to make way for industrial agriculture to devastation by repeated fires. Illegal logging is undertaken at every level of society, by supposedly legitimate timber groups, the military, corrupt officials, and wildcat operators. Yet despite the importance of Indonesia's forests, and the speed at which they are disappearing, accurate, up-to-date information on forest extent and condition is either nonexistent or hard to obtain. No integrated record of forest area has been kept over the years, so information has to be pieced together from different sources. On top of the practical difficulties, access to Indonesian forestry data was hampered under the Suharto regime by government secrecy, industry intimidation, and bureaucratic obstruction. (*See Box 2.1 and Annex 1.*)

The *reformasi* era that followed the fall of Suharto in 1998 has encouraged a resurgence of interest and critical investigation into the management of the country's affairs. Nongovernmental organizations (NGOs) and other civil society groups have been prominent in pressing for the release of official information and publicizing the results. As information emerges, the extent to which Indonesia's natural resources – forests above all – have been abused and wasted has become clear. The story is now beginning to be told.

This report was prepared by Forest Watch Indonesia (based in Bogor, Indonesia) and Global Forest Watch (based in Washington DC, United States). Its purpose is to provide a comprehensive information source on the state of Indonesia's forests that will serve as a baseline for future reporting. The report suffers from all the imperfections of the information sources: data are missing, often outdated, sometimes conflicting. The exact extent and distribution of Indonesia's forests still cannot be mapped, precise regional deforestation trends are not known, the biological condition of many forests is not well studied, and the operations of the country's forest industries remain secretive and are often illegal. Nonetheless, this report attempts to compile and harmonize the best of the official information that is available. It also includes information gathered in the field by FWI staff and their colleagues in other NGOs. We acknowledge the help and cooperation of some officials of the Ministry of Forestry who provided valuable new information on forest management issues. When data sources conflict, we attempt to provide an explanation. Where data are missing, we say so, and when we have conducted our own analyses of forestry data, especially relating to forest condition, we make this clear. It is our hope that as better information becomes available, future State of the Forest reports will provide an increasingly accurate and reliable resource for policymakers, environmental organizations, forest industries, and all those who believe that better information will lead to better decisionmaking.

FWI Papua

1.6 Structure of the Report

Chapter 2 provides a summary of what is known about the current extent and distribution of forest cover, trends in deforestation, and the condition of remaining forests. Chapter 3 examines the causes of deforestation through an analysis of the economic activities affecting forests: logging under the concession system, illegal logging, conversion of forests to industrial timber plantations or agricultural estates, and small-scale farming. Chapter 4 documents the causes, scale, and impacts of forest fires over the past 25 years. Chapter 5 provides a brief summary of the current policy and institutional environment, reviews the current national agenda for forest policy reform, and assesses the prospects for its implementation.

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CHAPTER 2
FOREST COVER, CHANGE, AND CONDITION

2.1 Forest Cover and Change

Original Forest Cover: From the Preagricultural Era to 1900

Given current climate and topography, we know that forests would blanket Indonesia today if people did not need to clear trees for agriculture, infrastructure, and settlements. We cannot be sure how much forest covered Indonesia in the distant past but, based on estimates of potential vegetation cover (that is, the areas potentially covered by different forest types, given the appropriate climatic and ecological conditions and no human intervention), we can reasonably conclude that the country was almost completely forested (MacKinnon, 1997). Only narrow coastal strips and the steepest mountain slopes would have been unable to support tree growth.

As late as 1900, Indonesia was still a densely forested country. According to modeled estimates by the World Bank, forest cover in the three major islands of Sumatra, Kalimantan, and Sulawesi at that time still totaled 103 million ha (Holmes, 2000). This represents a reduction of only about 13 percent from their original forest cover, as estimated by MacKinnon.

Indonesia's Forests in 1950

In 1950, what was then called the Indonesian Forest Service produced a vegetation map of the country; it concluded that nearly 84 percent of Indonesia's land area was covered in primary and secondary forest and plantations of such estate crops as tea, coffee, and rubber. *(See Table 2.1.)* The survey aggregated plantations in the "forest" category and thus did not provide an estimate of their extent, but it is clear that plantations and smallholder plantings of tree crops covered only a small area in 1950. Dutch colonial records from 1939 estimated that large-scale plantations included approximately 2.5 million ha "in exploitation," of which only 1.2 million ha were actually planted. The sector stagnated during the 1940s and 1950s and would reach the 1939 level of area planted again only in the 1970s. Smallholder tree crop area was only 4.6 million ha in 1969, and a large part of this area was planted in the 1950s and 1960s (Booth, 1988). In 1950, teak plantations on Java covered an additional 824,000 ha (Peluso, 1992:Annex C). The major cause of forest clearance that had occurred up to 1950 was agriculture, notably rice cultivation.

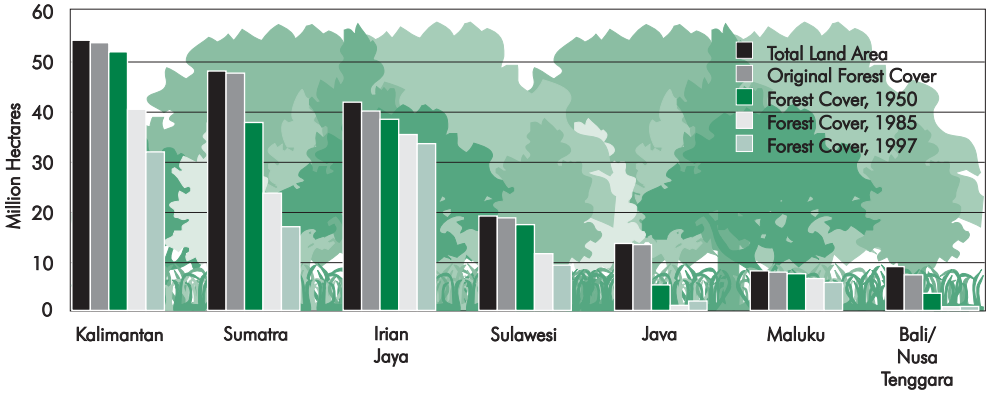
It seems reasonable to conclude that all timber and estate crop plantations covered no more than 4

Table 2.1 Forest Cover in 1950 (Hectares)

Island	Primary Rainforest, Protected Forests, Swamp and Wilderness Forest, Plantations	Tidal Forest	Secondary Forest	Total Forest	Savanna, Grassland, and Nonirrigated Rice Fields	Irrigated Rice Fields	Total Land Area
Sumatra	33,400,000	570,000	3,400,000	37,370,000	8,600,000	900,000	46,900,000
Kalimantan	47,500,000	700,000	3,200,000	51,400,000	3,500,000	—	54,900,000
Sulawesi	14,700,000	50,000	2,300,000	17,050,000	2,600,000	—	19,700,000
Maluku	6,900,000	—	400,000	7,300,000	1,300,000	—	8,600,000
Irian Jaya	38,400,000	2,300,000	—	40,700,000	300,000	—	41,000,000
Java	4,400,000	70,000	600,000	5,070,000	4,100,000	4,100,000	13,300,000
Bali/Nusa Tenggara	3,000,000	—	400,000	3,400,000	5,600,000	300,000	9,300,000
TOTAL	**148,300,000**	**3,600,000**	**10,300,000**	**162,290,000**	**26,000,000**	**5,300,000**	**193,700,000**
Percent of Total Land Area	77%	2%	5.3%	84%	13%	3%	100%

Source: Based on L. W. Hannibal. 1950. Vegetation Map of Indonesia. Planning Department, Forest Service, Jakarta, in: *Forest Policies in Indonesia. The Sustainable Development of Forest Lands.* (Jakarta, Indonesia: International Institute for Environment and Development and Government of Indonesia, 1985). Vol. 3, Ch. 4.
Notes: Numbers may not add due to rounding. — = zero or no data.

Figure 2.1 Deforestation from the Preagricultural Era to 1997



Sources: *Land Area from WCMC, 1996. Original Forest Cover from MacKinnon, 1997. Forest Cover 1950 from Hannibal, 1950. Forest Cover 1985 from RePPProT, 1990. Forest Cover 1997 (Kalimantan, Sumatra, Sulawesi, Maluku and Irian Jaya) from Holmes, 2000. Forest Cover 1997 (Java, Bali/Nusa Tenggara) from GFW calculations based on GOI/World Bank, 2000).*

million ha in 1950, leaving approximately 145 million ha of primary forest and another 14 million ha of secondary and tidal forest.

Deforestation Since 1950

Figure 2.1 summarizes the extent of forest loss from preagricultural times to 1997. Deforestation became a real concern in Indonesia only in the early 1970s, when large-scale commercial logging concessions were established for the first time. Despite the fact that logging concessions were intended to establish a system of long-term timber production, they sometimes led to serious forest degradation followed by clearance and conversion to other forms of land use. (*See Chapter 3.2.*) A picture of the situation in the mid-1980s can be obtained from a nationwide mapping exercise undertaken as part of the government's transmigration program (RePPProT, 1990). According to this survey, forest cover in 1985 was about 119 million ha, representing a decline of about 27 percent from the forested area in 1950. Between the 1970s and the 1990s, the annual deforestation rate was estimated at 0.6-1.2 million ha (Sunderlin and Resosudarmo, 1996).

A more recent forest cover mapping effort carried out in 1999 by the Indonesian government with support from the World Bank (GOI/World Bank, 2000) concluded that the average annual deforestation rate for 1985-1997 was actually about 1.7 million ha. Hardest hit during this period were Sulawesi, Sumatra, and Kalimantan, all of which lost more than 20 percent of their forest cover. If these deforestation trends continue (as they have since 1997), nonswamp lowland forest will disappear in Sumatra by 2005 and in Kalimantan soon after 2010 (Holmes, 2000). A more detailed description of these data sources is provided in Box 2.1.

In total, Indonesia appears to have lost more than 20 million ha of forest cover between 1985 and 1997 – about 17 percent of the forest area existing in 1985. Table 2.2 presents the deforestation estimates developed by Holmes, based on a comparison of RePPProT data with his analysis of satellite imagery from around 1997.

These estimates should be regarded as approximations. The forest cover data for 1997, in particular, suffer from a number of uncertainties. First, they are based entirely on satellite imagery that was not verified by field checks. Analysis by Global Forest Watch indicates that about 6.6 million ha classified in the World Bank study as natural forest might be under timber or estate crop plantations.[4] Second, the images were obscured in many areas by cloud cover or are otherwise unclassified. In the three major islands of Sumatra, Kalimantan, and Sulawesi, "no data" areas cover a total of 5.3 million ha, or 18 percent of the "measured" forest area (Holmes, 2000:Table 1). The World Bank study makes the assumption that, on average, just over half these areas are forested, based on their location and what is known of the terrain and level of development there.

Table 2.3 presents deforestation estimates developed by Global Forest Watch, based on modified versions

of the RePPProT and GOI/World Bank datasets. We chose the World Conservation Monitoring Centre's modification of RePPProT because it represents a consistent digitized spatial dataset that could be used with the GOI/World Bank dataset for the purposes of GIS analysis. We chose to exclude "no data" areas in both datasets in order to compare only areas positively identified as forested in 1985 with areas positively identified as forested in 1997. This estimate is not necessarily more accurate than that developed by Holmes; its purpose is to complete estimates for the missing islands (*see note to Table 2.2*) and provide a form of cross-check.

Map 1 presents the same information visually. It shows the extent and distribution of net changes in natural forest cover between 1985 and 1997. The map highlights the fact that when the two forest cover layers are overlaid, more than 17 million ha must be recorded as "no data," an area equal to nearly 18 percent of that reported as forest in 1997. It also highlights areas of data conflict – those identified in the World Bank study as natural forest but reported to be under plantations by the National Forest Inventory of 1996. The significant extent of "no data" and data conflict areas (nearly 24 million ha) reminds us that current deforestation estimates are uncertain.

A more detailed illustration of forest cover change in Kalimantan is presented in Map 2. Natural forest cover in Kalimantan declined from 40 million to 32 million ha between 1985 and 1997. Clearance for oil palm and timber plantations has been a leading cause of deforestation in the province of West Kalimantan. Central Kalimantan has been hard hit by fires and clearance for the ill-conceived "million hectare rice

Box 2.1 Data Sources and Difficulties

No integrated record of forest area has been kept in Indonesia, so any analysis of current forest cover and recent deforestation must be based on a variety of national and subnational scale sources. The analysis of Indonesian forest cover presented in this report is based primarily on four sources of information.

- The Regional Physical Planning Programme for Transmigration (RePPProT, 1990) included a mapping exercise carried out by the Ministry of Transmigration with funds and technical assistance provided by the British Government. The entire country was surveyed, using existing reports, aerial photographs, and satellite or radar imagery with selective field checking. The areas covered, dates and scales of the hand-colored draft maps, aerial photographs and satellite images varied considerably. Although the main purpose of the exercise was to identify land suitable for transmigration, it provided maps and data on land cover, including different forest types. The data are from various years but are generally taken to describe the situation in 1985.

- The RePPProT dataset was subsequently modified by the World Conservation Monitoring Centre (WCMC, 1996). Land cover classes were reduced in number and harmonized, and various areas of missing or conflicting data were clarified. Complete map coverage for the country was provided at a scale of 1:250,000.

- The National Forest Inventory (NFI) (GOI/FAO, 1996) was undertaken by the Ministry of Forestry with financial support from the World Bank and technical assistance from the Food and Agriculture Organization of the United Nations (FAO). The final report provided a set of forest cover and land use maps at a scale of 1:250,000. They were based on MSS satellite data dating from 1986 to 1991 and supplemented by a field inventory. The inventory was conducted by sampling all forest lands below 1,000 m using a systematic sample design with plot-clusters in a 20 km x 20 km grid. In addition, the study created a Geographic Information Systems (GIS) database utilizing maps from the RePPProT and other surveys as well as NFI data. The data, as with RePPProT, are from various years but are generally taken to describe the situation in the early 1990s.

- A new set of forest cover maps has recently been developed by the Government of Indonesia, working with technical assistance from the World Bank. The mapping was conducted at reconaissance level from Landsat satellite imagery by the Planning Department of the Ministry of Forestry. The resulting dataset (GOI/World Bank, 2000) categorized only forest and nonforest land cover and was not corroborated with field checking. The result may be some misclassifications, notably some identification of plantations as forest. The scale of mapping is 1:500,000. Most of the new imagery dates from 1996 to 1998 but in some areas data from 1994 or 1995 had to be used. An average date of 1997 is assumed for the maps, but some predate the forest fires of 1997 as well as the extensive logging that followed the political crisis of 1998. Thus although the maps provide the most recent national-level information on forest cover available at the time of writing, they are already somewhat outdated. The GOI/

Box 2.1 *(continued)*

World Bank dataset was analyzed by Derek Holmes, a consultant working for the World Bank; his unpublished study (Holmes, 2000) and expert advice proved invaluable in the preparation of this report.

A major problem in dealing with these national datasets is their lack of direct comparability. The RePPProT and NFI surveys provide maps at the same scale, but they use different classification schemes for forest, with the NFI being the less detailed. In addition, the NFI appears to include the category "bush and scrub" among its forest types, which leads to the strange result that Indonesian forest area in the 1990s appears larger than it was in the mid-1980s (Scotland et al., 1999). The GOI/World Bank dataset is mapped at a coarser scale, and the absence of ground truthing means that conclusions must be regarded as provisional. The data provide information on forest/nonforest cover only, but the accompanying World Bank study includes supplementary analysis to estimate loss of forest cover in different forest types. As far as possible, the World Bank study tried to produce results comparable with the RePPProT study so that 12-year trends would become clear.

Such technical difficulties are only the beginning when it comes to understanding Indonesian forest cover and forestry practices. Until recently, researchers had to deal with government secrecy, bureaucratic obfuscation, and industry intimidation. The secrecy is beginning to lift, and official cooperation is more often forthcoming, but access to good information is still hampered by overlapping administrative responsibilities, rapid personnel changes, and a lack of capacity. Often the information simply does not exist. The forestry industry may be less all-powerful than it was, but private citizens who attempt to monitor illegal corporate activity still face considerable risks. (*See Box 3.3.*) Some sense of the challenges and frustrations involved in uncovering statistics is provided by two researchers, unconnected with this report, who have long experience in the field. Their stories can be read in Annex 1.

Sources

GOI/FAO. 1996. *National Forest Inventory of Indonesia: Final Forest Resources Statistics Report*. Field Document No. 55. Jakarta: Directorate General of Forest Inventory and Land Use Planning, Ministry of Forestry, Government of Indonesia (GOI); and Food and Agriculture Organization of the United Nations (FAO). June.

GOI/World Bank, 2000. Digital files on CD-ROM.

Holmes, Derek. 2000. *Deforestation in Indonesia: A Review of the Situation in 1999*. Consultant report to the World Bank. Jakarta: Draft of 3 July.

RePPProT. Final report dated 1990. *The Land Resources of Indonesia: A National Overview*. Regional Physical Planning Programme for Transmigration (RePPProT). Jakarta: Land Resources Department of the Overseas Development Administration, London (Government of UK), and Ministry of Transmigration (Government of Indonesia).

Scotland, N., A. Fraser, and N. Jewell. 1999. *Indonesian Forest Inventory Data*. Report No. PFM/EC/99/07. Jakarta: Indonesia-UK Tropical Forest Management Programme.

World Conservation Monitoring Centre (UNEP-WCMC). 1996. *Tropical Moist Forests and Protected Areas: The Digital Files. Version 1.* Cambridge: World Conservation Monitoring Centre, Centre for International Forestry Research, and Overseas Development Administration of the United Kingdom.

project," a failed attempt to establish rice cultivation in former peat swamp forest. In East Kalimantan, forests have been both extensively converted to plantation crops and damaged by fire. South Kalimantan, the most densely populated province, has been developed for oil palm, coconuts, and transmigration settlements. All four provinces are also affected by legal and illegal logging.

Our analyis produces a lower overall estimate of natural forest cover in 1997 than that of Holmes and a slightly higher rate of deforestation, but the differences are minor. However, if we assume that the National Forest Inventory data are reliable and that 6.6 million ha of natural forest identified by Holmes are, in fact, plantations, then total natural forest cover might have fallen as low as 92-93 million ha by 1997. The average annual rate of deforestation between 1985 and 1997 would then amount to 2.2 million ha. In the absence of ground truthing, this higher estimate cannot be substantiated.

Despite these difficulties, the overall trend is clear. If deforestation since 1997 has continued at the same constant rate identified by Holmes, another 7-8 million ha of tropical forest will have been cleared as this report goes to press. In fact, it is likely that deforestation rates have actually increased since 1997, driven by the enormous forest fires of 1997-1998, the economic crisis, and the subsequent breakdown of political authority and law enforcement. According to the World Bank's analysis, deforestation accelerated throughout the 1985-1997 period, with a steep increase to about 2 million ha/year occurring after 1996.

Table 2.2 Forest Area and Deforestation, 1985–1997 (GOI/World Bank Estimates)

	1985			1997				
Island	**Land Area** (Ha)	**Forest Cover** (Ha)	**Forest as % Land Area**	**Land Area** (Ha)	**Forest Cover** (Ha)	**Forest as % Land Area**	**Forest Change 1985–1997** (Ha)	**Forest Change** (%)
Sumatra	47,530,900	23,323,500	49	47,059,414	16,632,143	35	6,691,357	-29
Java and Bali	13,820,400	1,345,900	10	nd	nd	nd	nd	nd
Nusa Tenggara	8,074,000	2,469,400	31	nd	nd		nd	nd
Kalimantan	53,583,400	39,986,000	75	53,004,002	31,512,208	60	8,473,792	-21
Sulawesi	18,614,500	11,269,400	61	18,462,352	9,000,000	49	2,269,400	-20
Maluku	7,801,900	6,348,000	81	nd	*5,543,506*	nd	*804,494*	*-13*
Irian Jaya	41,480,000	34,958,300	84	40,871,146	33,160,231	81	1,798,069	-5
Total	**190,905,100**	**119,700,500**	**63**	**189,702,068**	***100,000,000***	***50***	***20,504,994***	***-17***

Sources: 1985 Land Area and Forest Cover from RePPProT (Regional Physical Planning Programme for Transmigration), "The Land Resources of Indonesia: A National Overview." (Jakarta, Indonesia: Land Resources Department of the Overseas Development Administration, Government of UK, and Ministry of Transmigration, Government of Indonesia, 1990). 1997 Land Area and Forest Cover from D. Holmes, "Deforestation in Indonesia: A Review of the Situation in 1999." (Jakarta, Indonesia: World Bank, 2000).
Notes: nd = no data. Holmes did not live to complete his analysis and did not make estimates of forest cover for the islands of Java, Bali, or Nusa Tenggara. Numbers in italics are Holmes's estimates based on assumptions about areas not mapped in 1997. The total forest area of 100 million ha is Holmes's preliminary estimate based on assumptions about forest loss rates over the study period. It appears to overestimate by about 2 million ha.

Table 2.3 Forest Area and Deforestation, 1985–1997 (GFW Estimates))

	1985			1997				
Island	**Land Area** (Ha)	**Forest Cover** (Ha)	**Forest as % Land Area**	**Land Area** (Ha)	**Forest Cover** (Ha)	**Forest as % Land Area**	**Forest Change 1985–1997** (Ha)	**Forest Change** (%)
Sumatra	47,581,650	22,938,825	48	47,574,550	16,430,300	35	-6,508,525	-28
Java	13,319,975	1,274,600	10	13,315,550	1,869,675	14	595,075	47
Bali	563,750	96,450	17	563,150	76,700	14	-19,750	-20
Nusa Tenggara	6,645,625	686,775	10	6,639,925	450,450	7	-236,325	-34
East Timor	1,498,500	374,400	25	1,497,525	9,850	1	-364,550	-97
Kalimantan	53,721,675	39,644,025	74	53,721,225	29,637,475	55	-10,006,550	-25
Sulawesi	18,757,575	11,192,950	60	18,753,025	7,950,900	42	-3,242,050	-29
Maluku	7,848,175	5,790,800	74	7,846,600	5,820,975	74	30,175	1
Irian Jaya	41,405,500	35,192,725	85	41,403,850	33,382,475	81	-1,810,250	-5
Total	**191,342,425**	**117,191,550**	**61**	**191,315,400**	**95,628,800**	**50**	**21,562,750**	**-18**

Sources: 1985 forest areas are GFW estimates based on UNEP-WCMC, "Tropical Moist Forests and Protected Areas: The Digital Files. Version 1." (Cambridge: World Conservation Monitoring Centre, Center for International Forestry Research, and Overseas Development Administration of the United Kingdom, 1996). 1997 forest areas are GFW estimates based on the digital dataset developed by the Ministry of Forestry, Government of Indonesia and the World Bank. (Jakarta, Indonesia: GOI and World Bank, 2000). CD-ROM.
Notes: The apparent increase in forest area in Java between 1985 and 1997 is probably owing to plantation establishment. The poor quality of the spatial data for plantations in Java did not allow verification of this assumption. For further information on calculation of forest area and problems associated with "no data" areas, see Annex 3: Technical Notes, Table 2.3.

Table 2.4 Loss of Lowland Forest in Sumatra, Kalimatan, and Sulawesi, 1900-1997

Island	Assumed Forest Cover in 1900 (Ha)	Forest Cover in 1985 (Ha)	Forest Cover in 1997 (Ha)	Estimated Loss, 1985–1997 (Ha)	Estimated Loss, 1985–1997 %
Sumatra	16,000,000	5,559,700	2,168,300	3,391,400	61
Kalimantan	17,500,000	11,111,900	4,707,800	6,404,100	58
Sulawesi	2,200,000	546,300	60,000	486,300	89
Total	**35,700,000**	**17,217,900**	**6,936,100**	**10,281,800**	**60**

Source: D. Holmes, "Deforestation in Indonesia: A Review of the Situation in 1999." (Jakarta, Indonesia: World Bank, 2000).
Note: Lowland forest area for the three islands in 1900 is an estimate, based on what is known of human settlements at the time.

Loss of Lowland and Mangrove Forests

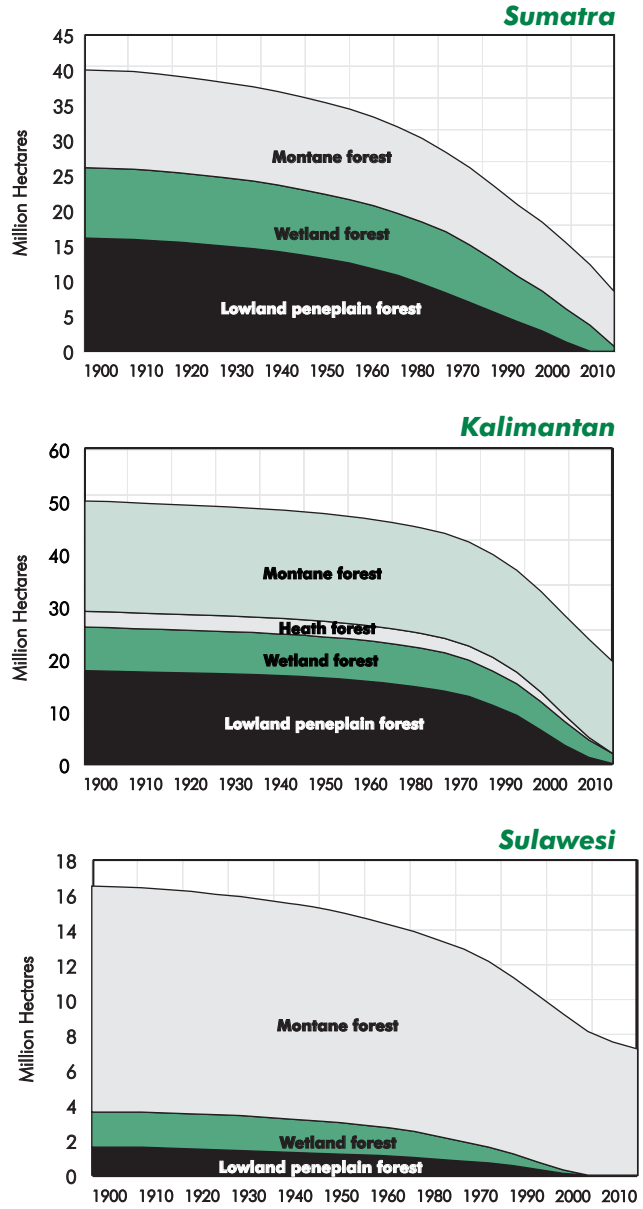
Throughout Indonesia, forest clearance began in the lowland areas, where topography and soil fertility were most favorable to human settlement and agriculture. Clearance for plantation crops in the Colonial era and for transmigration programs in the 1970s and 1980s also occurred largely in lowlands or gently sloping foothills. Commercial logging concentrated first on lowland forests, which are accessible, commercially valuable, and have the greatest potential for large-scale development. Unfortunately, lowland forests are also the most biologically diverse, harboring many of the most prized tree and animal species in Indonesia.

It is difficult to provide good estimates of how much lowland forest has been lost. Vegetation classification types used in the 1985 RePPProT survey and the National Forest Inventory of 1996 are not directly comparable, and the remote sensing survey supported by the World Bank in 1997 did not distinguish among different forest types. However, preliminary estimates by Holmes indicate that, although lowland deforestation was significant even before 1985, losses of this forest type have accelerated sharply since then. (*See Table 2.4.*) Approximately 60 percent of Indonesia's lowland forest in the three major islands was cleared between 1985 and 1997.

Figures 2.2, 2.3, and 2.4 illustrate the estimated loss of lowland and other dominant forest types in the three islands between 1900 and 1997; they also project the forest loss expected by 2010, assuming continuation of current deforestation trends. They indicate that lowland forest area in Sulawesi has already been reduced to statistical insignificance. In Sumatra, it will disappear altogether by about 2005 and in Kalimantan, soon after 2010.

Map 3 illustrates the spatial distribution of losses in lowland, submontane (upland) and montane forests

Figures 2.2, 2.3, 2.4 Changes in Forest Cover



Source: *Holmes, 2000*

between 1985 and 1997. For purposes of this analysis, Global Forest Watch adopted simple elevation thresholds to define the three forest types: lowland forest below 300 m, submontane or upland forest at 300-1,000 m, and montane forest at above 1,000 m. These thresholds are lower than those adopted in the RePPProT, and are comparable with those used by Holmes in his analysis of lowland forest loss (Holmes, 2000).

Estimates of Indonesia's mangrove forest area are notoriously unreliable and outdated. According to the World Mangrove Atlas, the most reliable estimate dates from 1993, when the country's mangroves are believed to have covered approximately 4.25 million ha (Spalding et al., 1997:54-58). This estimate was based on the 1985 RePPProT survey, updated with maps provided to the World Conservation Monitoring Centre by the Asian Wetlands Bureau. However, other estimates for the mid-1980s are as low as 3.8 million ha or even 2.2 million ha. The Indonesian government reports that some 1 million ha of mangroves were lost between 1969 and 1980 alone, owing primarily to conversion to rice fields, aquaculture, and other agricultural uses (BAPPENAS, 1993). Continuing losses can be attributed to the development of shrimp ponds, logging activities, and local exploitation for fuelwood and building materials. Conversion to shrimp ponds is especially prevalent in East Java, Sulawesi, and Sumatra. Production of woodchips and pulp from mangroves is also increasing; chip mills have been built in Sumatra and Kalimantan, and a major mill has been built in Bintuni Bay, Irian Jaya, formerly one of the largest and most pristine mangrove areas in the world. The National Forest Inventory of 1996 estimates mangrove forest area at 3.5 million ha, implying a loss of 750,000 ha in just 3 years. However, accurate assessment of recent mangrove losses is almost impossible; it can only be stated that their destruction continues.

2.2 Forest Condition Today

Official Forest Function and Use

Virtually all forests in Indonesia are state-owned, and administratively defined forest lands are quite accurately mapped by the government in terms of their intended function and use. The Ministry of Forestry is responsible for land under Permanent Forest Status, that is, land that has been allocated for use as conservation forest, protection forest, limited production forest or production forest. (*See Glossary for explanation of these terms*.) However, these administrative definitions of forest land use do not correspond with actual tree cover. Thus the extent and condition of Indonesia's remaining forests are difficult to establish from official statistics.

The Ministry of Forestry is in the process of preparing updated maps of land under Permanent Forest Status as well as maps of vegetative cover within conservation and protection forests. Officials from the Ministry indicated that this new information would be made available for publication by Forest Watch Indonesia but, unfortunately, the data were not provided. In their absence, the most recent information remains that available from the *Ministry of Forestry Strategic Plan 2001-2005* and the data compiled by the World Bank (Holmes, 2000).

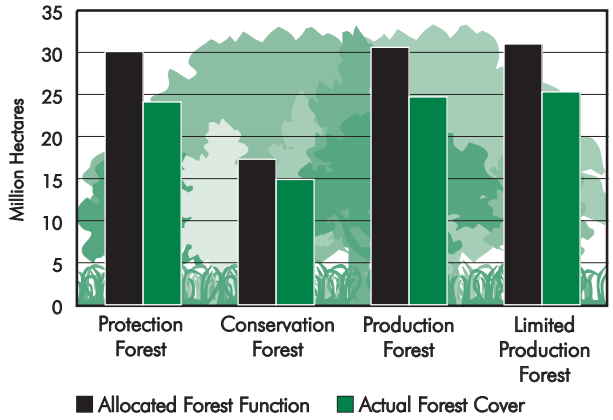
"Official" and "Actual" Forest Cover

Annex 2, Table 1 presents the World Bank's estimate of the area of land officially defined as Permanent Forest Status (114 million ha) and contrasts it with an estimate of land that was actually forested in 1997 (98 million ha). It appears that actual forests cover only 86 percent of the land defined as "forest" in Indonesia.

Another study provides more detail on actual forest cover within the various categories of permanent forest status (Fox, Wasson, and Applegate, 2000). It provides somewhat different estimates of the total area under Permanent Forest Status (109 million ha) and forest cover (89 million ha) but arrives at a comparable estimate of 82 percent for the amount of Permanent Forest Status land actually covered by forest. In every category, actual forest cover is smaller than the area officially allocated to that category, with the greatest shortfall found in protection forest (forest maintained for soil and water protection). (*See Figure 2.5*.)

In 1997, the Ministry of Forestry revised the land area under Permanent Forest Status, with the result that it decreased, possibly by as much as 20 million ha. (*See Table 2.5 and note*.) All categories of forest function were also revised: the areas allocated for protection forest and conservation forest increased, as did the area slated for timber production. The areas allocated for limited production and for conversion to nonforest uses decreased. These changes are not purely administrative; the area of conversion forest decreased in large part because it has already been converted. (Note, however, that the latest unpublished revision of Permanent Forest Status land *increases* the area of forest land allo-

Figure 2.5 Allocated Forest Function and Actual Forest Cover, 1997



Source: J. Fox, M. Wasson and G. Applegate. "Forest Use Policies and Strategies in Indonesia: A Need for Change." *Jakarta. Paper prepared for the World Bank. May, 2000.*

cated for conversion. See p. 45.) According to Holmes's analysis, it is likely that the additional protection forest area has been redesignated from limited production forest on steep slopes, a change that should aid in soil conservation. However, it seems likely that a great deal more land has been moved from limited production forest to production forest status, which may mean that other steeply sloping land will be opened for logging. The increase in conservation forest is probably explained by the establishment of new national parks and other protected areas, although such status is no guarantee of protection from logging and other forms of degradation. In the absence of spatial data, it is not possible to say where these changes in forest land classification occurred.

Table 2.5 Revisions to Permanent Forest Status Between 1986 and 2000

	1986		2000		Change 1986–2000	
Forest Classifications	**Area** (Ha)	**Area as % of Total**	**Area** (Ha)	**Area as % of Total**	**Area** (Ha)	**% Change**
Production	31,850,000	23	35,200,000	29	3,350,000	11
Limited Production	30,520,000	22	21,800,000	18	-8,720,000	-29
Protection	29,680,000	21	31,900,000	27	2,220,000	8
Conservation	18,250,000	13	23,300,000	19	5,050,000	28
Conversion	30,540,000	22	8,200,000	7	- 22,340,000	-73
TOTAL	**140,840,000**	**100%**	**120,400,000**	**100%**	**- 20,440,000**	**-15**

Sources: For 2000: Ministry of Forestry, "Ministry of Forestry Strategic Plan 2001–2005," (Jakarta, Indonesia, 2000). For 1986: RePPProT (Regional Physical Planning Programme for Transmigration), *The Land Resources of Indonesia: A National Overview*. (Jakarta, Indonesia: Land Resources Department of the Overseas Development Administration, Government of UK, and Ministry of Transmigration, Government of Indonesia, 1990).
Note: The total area of land with Permanent Forest Status in 2000, according to the Ministry data cited in this table, is considerably larger than that calculated by Holmes or by Fox, Wasson and Applegate, who also relied on Ministry data. It is possible that the data cited here include aquatic protected areas. The Ministry of Forestry included protected areas of lakes, rivers, and some coastal zones in the recent Permanent Forest Estate revisions. Disaggregated data are being prepared but were not available at the time of writing. Numbers may not add due to rounding.

The reality gap between official forest area and actual forest cover can be dramatic. In South Sumatra and Lampung provinces, for example, only one third of "permanent forest" land is covered with trees. In South Kalimantan, the proportion is less than two thirds. Despite such problems, official forest land use statistics form the basis for resource management decisions and spatial planning.

Forest Degradation

Forest Watch Indonesia analyzed spatial data from the National Forest Inventory in an attempt to determine the level of degradation in major forest types. The analysis concludes that in the mid-1990s, Indonesia had 59 million ha of natural forest unallocated for use as a concession of any kind, 41 million ha of degraded and potentially degraded forest, and 9 million ha

Box 2.2 Impacts of Logging on Dipterocarp Forests

The towering trees that make up the lowland forests of Indonesia are often referred to as "cathedral-like." Canopies in the Indonesian rainforest can reach nearly 50 m into the sky. The stalwarts of these forests are species of the family Dipterocarpaceae. They account for up to 80 percent of the tallest canopy trees, up to 10 percent of all tree species (Ashton et al., 1998:44-66), and constitute as much as 70 percent of the canopy tree biomass in the Indonesian forest (Curran and Leighton, 2000:101-128). Dipterocarps are late-successional trees, invading only forests that already have a closed canopy. They are extremely widespread, growing across lowland and mid-elevation forests in Southeast Asia and the Indian subcontinent. Dipterocarps are also some of the most valuable hardwoods in the world; a single tree may be worth many thousands of dollars. As a result of Indonesia's current economic crisis and decades of corruption, dipterocarp forests are being commercially logged at unprecedented and unsustainable rates.

The direct impact of logging on forests is obviously a net loss of trees. However, the indirect impacts play an important role in the future health of lowland forests. Logging poses real obstacles to seedling survival (Appenah and Mohd. Rasol, 1995). Young plants must not only contend with the trampling, skidding, and disruption caused by logging but also compete with faster growing pioneer species that can outgrow them to reach the precious light in the canopy. One study has shown that cutting back pioneer species and creating gaps in the canopy to generate more light increased survival of dipterocarp regeneration by 30 percent. In unmanaged areas, dipterocarps occupied only 25 percent of the area that they would normally cover (Kuusipalo et al., 1997).

However, the impacts of logging on these forests extend well beyond the boundaries of a logging concession. One of the most remarkable characteristics of dipterocarps is their reproductive pattern. After several years of little to no reproductive activity, nearly all dipterocarps and up to 88 percent of all canopy species may enter into a period of rapid flowering and fruiting. This phenomenon, first described by Dan Janzen, is known as mast fruiting. Janzen theorized that by fruiting synchronously, dipterocarps are able to overwhelm their seed predators with fruit and allow a greater percentage of their seeds to survive (Janzen, 1970; Janzen, 1974). This strategy works only when predators are naturally dispersed over a large geographical area. If predators are concentrated in smaller areas because of forest fragmentation and selective logging, their numbers may be sufficient to consume even a glut of seed production. The impact of a logging road can thus affect forest health several kilometers away.

A recent study has shown that mast fruiting episodes occur almost exclusively during El Niño Southern Oscillations (ENSOs). These events also appear to be critical to regional seed production and recruitment (Curran and Leighton, 2000). Despite the pronounced ENSO episode in 1997-1998, Curran and Leighton have found that since 1991, their study site, Gunung Palung National Park, has had nearly total seedling recruitment failure (Curran et al., 1999). Although Gunung Palung itself contains large areas of nondegraded, intact dipterocarp forest, it is almost completely surrounded by degraded land and logging concessions. The researchers believe that dipterocarp reproductive strategy is particularly vulnerable to disruption because success depends on the ability of predators to range over a large geographic area of forest. These studies underscore the need for effective forest management areas and a reassessment of the area and locations currently designated for logging.

Sources

Appanah, S. and A.M. Mohd. Rasol. 1995. "Dipterocarp fruit dispersal and seedling distribution." *Journal of Tropical Forest Science* 8(2): 258-263.

Ashton, P.S., T.J. Givnish, and S. Appanah. 1998. "Staggered flowering in the Dipterocarpaceae: new insights into floral induction and the evolution of mast fruiting in the aseasonal tropics." *American Naturalist* 132(1): 44-66.

Curran, L.M. and M. Leighton. 2000. "Vertebrate responses to spatiotemporal variation in seed production of mast-fruiting dipterocarpaceae." *Ecological Monographs* 70(1): 101-128.

Curran, L.M., I. Caniago, G.D. Paoli, D. Astianti, M. Kusneti, M. Leighton, C.E. Nirarita, and H. Haeruman. 1999. "Impact of El Niño and logging on canopy tree recruitment in Borneo." *Science*: 286: 2184-2188.

Janzen, D.H. 1970. "Herbivores and the number of tree species in tropical forests." *American Naturalist* 104: 501-528.

Janzen, D.H. 1974. "Tropical blackwater rivers, animals and mast fruiting by the Dipterocarpaceae." *Biotropica* 4: 69-103.

Kuusipalo, J., S. Hadengganan, G. Ådjers and A. Porkas S. Sagala. 1997. "Effect of gap liberation on the performance and growth of dipterocarp trees in a logged-over rainforest." *Forest Ecology and Management* 92: 209-219.

deforested by conversion to industrial timber or estate crop plantations or to transmigration sites. (*See Table 2.6.*) For purposes of this analysis, degraded forest is defined as forest area within logging concessions. Concessions that are being actively logged or have been logged in the past (sometimes 2 or 3 times) are invariably degraded. *(See Box 2.2.)* Some inactive or expired concessions may more correctly be described as potentially degraded. In the absence of attribute data regarding the status of concessions, it is not possible to provide separate estimates of degraded and potentially degraded forest. The area defined here as natural forest is characterized only by the fact that it is not under immediate threat of logging or conversion. It should be noted that officials from the Ministry of Forestry who were invited to review this report claimed that these data were no longer valid but they offered no alternative information.

Low Access and Accessed Forest

In an alternative approach to estimating the condition of Indonesia's forests, Global Forest Watch tried to determine how much of Indonesia's remaining forest is still relatively intact (called here "low access" forest) and how much is accessed, that is, disturbed by human activities. Low access forest is defined as forest land not in close proximity to roads, navigable rivers, human settlements, or other forms of development. (*See Glossary and Annex 3 for more detailed definitions of low access and accessed forests.*) Low access forests are the most important for providing habitat to Indonesia's rich biodiversity; their extent, contiguousness, and degree of protection are important indicators of conservation status.

Table 2.6 Natural Forest, Degraded Forest, and Deforested Area, Mid-1990s

Province	**Natural Forest Area (Unallocated)** (Ha)	**Degraded Forest** (Ha)	**Deforested Area** (Ha)
Aceh	2,360,745	1,025,858	362,835
Bengkulu	834,968	171,422	34,771
Jambi	1,197,210	1,071,679	522,858
Riau	1,487,067	2,671,417	1,705,401
West Sumatra	1,784,572	498,107	139,780
North Sumatra	2,183,429	386,006	365,656
Lampung	551,872	6,915	87,423
Total Sumatra	**10,399,863**	**5,831,404**	**3,218,724**
West Kalimantan	3,928,582	2,644,665	545,685
South Kalimantan	667,951	599,666	266,169
Central Kalimantan	536,450	8,447,911	2,089,952
East Kalimantan	5,961,932	8,845,655	1,368,415
Total Kalimantan	**11,094,915**	**20,537,897**	**4,270,221**

Table 2.6 *(cont.)* Natural Forest, Degraded Forest, and Deforested Area, Mid-1990s			
Province	**Natural Forest Area (Unallocated)** (Ha)	**Degraded Forest** (Ha)	**Deforested Area** (Ha)
South Sulawesi	2,090,449	558,778	79,184
Central Sulawesi	2,986,684	937,100	75,994
Southeast Sulawesi	2,402,327	0	34,347
North Sulawesi	998,230	510,384	14,145
Total Sulawesi	**8,477,690**	**2,006,262**	**203,670**
Bali	76,417	0	0
East Nusa Tenggara	874,752	0	0
West Nusa Tenggara	629,122	74,188	685
Irian Jaya	23,806,213	10,287,807	1,105,466
Maluku	3,142,390	2,707,486	101,210
TOTAL	**58,501,362**	**41,445,044**	**8,899,976**

Source: Forest Watch Indonesia estimates based on National Forest Inventory, 1996.
Note: For more details on the methodology underlying this table, see Annex 3: Data Sources and Technical Notes.

We did not wish to underestimate the area of low access forest, so for this analysis, we overlaid the GOI/World Bank forest cover dataset with the NFI vegetation cover dataset in order to fill, wherever possible, the "no data" areas in the GOI/World Bank data. *(See p. 9.)* By doing so, we clearly inflated total forest area because the NFI dataset dates from the early 1990s and forest loss since then has been substantial. However, because this analysis is concerned with the area of low access forest – forest that is by definition relatively remote from access routes and development – this methodology was felt to be acceptable.

The analysis indicates that a total of just over 52 million ha may be defined as low access forest. A further 33 million ha meet most of the criteria for low access forests but are within logging concessions. It may be assumed that much of this forest area is far from intact. Map 4 shows the extent and distribution of low access forests, both outside and within concessions. Half of all low access forest outside logging concessions (25.6 million ha) is located in Irian Jaya, 9.2 million ha are in Kalimantan, 7.7 million ha in Sumatra and 6.5 million ha in Sulawesi. Only 2.4 million ha remain in Maluku and in remnant areas in Java, Bali, and Nusa Tenggara.

Fragmentation of Low Access Forests

For many species, the total area of low access forest is less important than the contiguous area of individual forest blocks. When habitat is broken into fragments by roads or other developments, some species populations are reduced to the point at which they are no longer viable. Low access forests, whether formally protected or not, take on the

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character of islands, where wide-ranging species are fated for extinction at the local level. Map 5 depicts the distribution of remaining unfragmented forest in three size categories: 20,000-50,000 ha, 50,001-1 million ha, and over 1 million ha. The size categories reflect the generalized experience that populations tend to decrease in smaller fragments of habitat and that species requiring large home ranges will be absent (Thiollay, 1989; Bierregaard et al., 1992).

Protected Areas

Indonesia was one of the first countries to sign the Convention on Biological Diversity (CBD) and to prepare a National Biodiversity Strategy and Action Plan. During the 1990s, many of the Action Plan priorities were implemented, including expansion of the Protected Area (PA) system and creation of several new conservation areas such as Bukit Tigapuluh National Park in Riau Province, extensions to Gunung Leuser, and two new parks in Nusa Tenggara. Despite this activity, the conservation situation in Indonesia is, in the words of the World Bank, "dire" (World Bank, 2001:32).

The significant loss of natural habitats, especially lowland forests but also coastal, marine, and freshwater ecosystems, means that the country is "almost certainly undergoing a species extinction spasm of planetary proportions" (World Bank, 2001:32). Although habitat loss is probably the main reason for continued biodiversity loss in Indonesia, habitat fragmentation and degradation, hunting, and poaching are also important factors.

To determine how much of Indonesia's low access forest is under some degree of protection, we overlaid the low access forest grid with the most recent spatial data available from the World Conservation Monitoring Centre (UNEP-WCMC). A total of 9.2 million ha of low access forest are protected under World Conservation Union (IUCN) categories I-IV, and a further 2.5 million ha are included in the weaker protection categories V and VI.[5] The distribution of low access forests in all six protection categories is shown in Map 6. Almost half the low access forest protected under categories I-IV is in Irian Jaya; another 2 million ha are in Sumatra, and 1.5 million ha in Kalimantan. To provide a more detailed picture of the protection status of low access forest, Map 7 shows the distribution of protected areas in Kalimantan.

Protected area boundaries are proving a poor defense against the illegal logging, agricultural encroachment, and poaching that afflicts so much of Indonesia's forests. According to our analysis, approximately 1.3 million ha of low access forest are simultaneously protected and within logging concessions. Illegal settlement and logging are rampant even in some of the most well-known protected areas which are sites of important donor programs. According to the World Bank, some 30,000 ha of forests in the northern area of Sumatra's Bukit Barisan Selatan National Park have been lost in the past few years, and major problems with illegal loggers continue in the national parks of Gunung Leuser and Bukit Tigapuluh (Sumatra), and Tanjung Puting and Gunung Palung (Kalimantan) (World Bank, 2001:34). (*See Box 3.3*.) Development of estate crop plantations can also be a problem inside national parks. Box 2.3 illustrates the complexity of the economic, social, cultural, political, and environmental interests that must be reconciled.

Box 2.3 Oil Palm Development in Gunung Leuser National Park

Gunung Leuser National Park is one of Indonesia's oldest and largest national parks, covering nearly 900,000 ha in Aceh and North Sumatra provinces at the northern end of Sumatra. During the Dutch colonial era, much of the area was already gazetted as nature reserve; some areas where people lived within the boundaries were declared as settlement "enclaves" in 1935. One of these areas, covering 4,200 ha, was Sapo Padang, an enclave in the part of the park lying in North Sumatra. By 1953, however, residents abandoned Sapo Padang and the area had reverted to secondary forest by the 1990s.

In November 1995, the regent of Langkat regency proposed to build a road through the national park to the former enclave, and 34 families rapidly relocated to the old Sapo Padang village site, apparently sensing economic opportunity. Some of the families formed a local cooperative (KUD) in March 1996, and in August 1997 made a proposal to develop an oil palm plantation in the enclave. The regent granted their request that October, and the head of the national park agreed to construction of the road.

To implement the oil palm scheme, the Sapo Padang KUD formed a partnership with an oil palm factory called PT Amal Tani, owned by the immediate family of Jamin Ginting, the commander of the nearby Kodam I Bukit Barisan military unit. The director of Amal Tani became an executive of the KUD. The military unit's charitable foundation, Yayasan Kodam I Bukit Barisan, also entered the picture, agreeing to cooperate with the KUD as implementers of the government's Poverty Alleviation Program.

The scheme called for clearance of 4,250 ha of forest and development of oil palm in the area. For the plan to work, the access road was essential. The principal function of the military foundation in the partnership was to organize all "administrative details" related to obtaining permission to build the road, while the Sapo Padang KUD took charge of forest clearance and planting.

The military foundation efficiently discharged its part of the deal, and the then-Forestry Minister granted permission in January 1998 for the 11 km road to be built. In June 1998, the local office of the Forestry Service issued a decree (No. 6201/1/783) stating that the Sapo Padang enclave was no longer legally a part of the national park.

This controversial decision disturbed many stakeholders because building the road would clearly lead to forest destruction in the park. Some local residents are convinced that the decision will invite newcomers and planters who will slash and burn their way ever deeper into park territory. Many people believe, based on prior experience, that oil palm development will not be restricted to the enclave area. But as is often the case in such situations, local opinions vary, with some people eager to profit from the development of hitherto inaccessible national park forest land.

The facts were uncovered and publicized through field investigations carried out by the Leuser Conservation Foundation (YLL), a local NGO, during 1997 and 1998. YLL's reports were taken up by another NGO, the Titian Foundation, which publicized the case to numerous parties and the press. As a result, a consortium of NGOs brought several lawsuits against those involved in the Sapo Padang oil palm scheme.

In 1999, two local university-based NGOs—Generasi Pecinta Kelestarian Alam (Generation of Nature Lovers) and Himpunan Mahasiswa Pecinta Lingkungan Penyayang Alam (Association of Student Nature Lovers)—brought a lawsuit in the Medan State Court, while another group—Forum Komunikasi Pengacara 61 (the Lawyers' Communication Forum 61, or FKP) brought a parallel case in the National Administrative Court. Both suits charged a variety of civilian officials from national, provincial, and local government, the military foundation, the Sapo Padang KUD, and PT Amal Tani (as well as PT Kencana, another partner firm in the scheme), accusing them of violating a number of environmental, forestry, and administrative laws and regulations.

In July 1999, the Administrative Court threw out FKP 61's suit on the grounds that the organization did not have standing to bring suit because it was a lawyers' association rather than an environmental organization. In September 1999, however, the local NGOs won their case in the Medan State Court, which ordered the defendants to pay 300 million rupiah (approximately US$30-35,000 at mid-2001 exchange rates) in compensation for damage to the park caused by the project, and further ordered them to restore the area to its former condition. The defendants appealed to the North Sumatra High Court, which had not ruled on the case by the beginning of 2001. The legal process did not stop the project, however, and the local press continues to report extensive logging and clearing, road-building, and oil palm planting in the project area within the park. By the time the courts ultimately rule on the case, it may be too late to remedy the damage.

Source: Field investigations by the Leuser Conservation Foundation (YLL), and YLL review and monitoring of administrative and court decrees and decisions and local press reports, 1997-2000.

FWI Papua

CHAPTER 3
DEFORESTATION AND FOREST DEGRADATION

3.1 The Dynamics of Deforestation: An Overview

Deforestation in Indonesia is largely the result of a corrupt political and economic system that regarded natural resources, especially forests, as a source of revenue to be exploited for political ends and personal gain. The country's growing wood-processing and plantation crop industries proved lucrative over the years, and their profitability was used by the Suharto regime as a means to reward and control friends, family, and potential allies. Over the past 30 years, the country vastly increased its output of forest products and plantation crops grown on former forest land. Indonesia today is a major producer of logs, sawnwood, plywood, woodpulp, and paper as well as such plantation crops as palm oil, rubber, and cocoa. This economic development was achieved with virtually no regard for the sustainable management of forests or the rights of local people.

- More than half of Indonesia's forests are allocated for timber production on a selective felling basis. Many logging concessions override traditional patterns of land ownership or use rights. Lack of corporate oversight and accountability means that forestry management is poorly supervised and, over time, many production forests have been overexploited. The government now classifies nearly 30 percent of surveyed logging concessions as being in a "degraded condition." Below a productivity threshold, degraded concessions are vulnerable to reclassification to a category that allows plantation operators to apply for a conversion license. If granted, the forest may then be cleared completely and converted to a timber or estate crop plantation.

- Industrial timber plantations have been widely promoted and subsidized as a means of both supplying Indonesia's booming demand for pulp and taking pressure off natural forests. Nearly 9 million ha of land have been allocated for development as industrial timber plantations, but much of this land was natural forest. The land has either been cleared already or is likely to be cleared soon. Only about 2 million ha have actually been planted, leaving up to 7 million ha of cleared and unproductive land.

- The boom in estate crop plantations, especially oil palm, is another cause of deforestation. Nearly 7 million ha of forest had been approved for conversion to estate crop plantations by the end of 1997, and this land has almost certainly been cleared. But the area actually converted to oil palm plantations since 1985 is about 2.6 million hectares, while new plantations of other estate crops probably account for another 1-1.5 million ha. This leaves close to another 3 million ha of cleared forest land lying idle. Many of the same companies that operate logging concessions also own estate crop plantations, and corrupt relationships have developed in which

operators apply for a license to establish a plantation, clear the forest, use the timber for pulp, then move on and abandon the cleared land.

- Logging concessions, timber plantations, and forest clearance combined provide less than half the wood needed by Indonesia's wood processing industries. Imports are relatively small, and illegal logging makes up the shortfall. Indonesia today is plagued by organized wood theft on a massive scale: 50-70 percent of wood supplied to the forest products industry each year is cut illegally. The total area of forest lost to illegal logging is not known, but a former senior official of the Ministry of Forestry, Titus Sarijanto, recently claimed that theft and illegal logging have destroyed an estimated 10 million ha of Indonesian forests.[6]

- The role of small-scale traditional agriculture, relative to other causes of deforestation, has been the subject of great controversy. No accurate data are available for the area of forest cleared by small-scale farmers since 1985, but a plausible estimate in 1990 suggested that shifting cultivators might be responsible for about 20 percent of forest loss. This calculation would translate to clearance of about 4 million ha between 1985 and 1997.

- The transmigration program, lasting from the 1960s to 1999, relocated people from densely populated Java to the outer islands. According to estimates by the Ministry of Forestry, the program was responsible for nearly 2 million ha of forest clearance over that period. In addition, small farmers and opportunistic small-scale investors have contributed to deforestation by establishing cash crops, especially oil palm and cocoa, in forests opened up by larger-scale logging or plantation operations. Recently, "spontaneous" transmigration has increased with the movement of people looking for greater economic opportunity or seeking to avoid social unrest and ethnic violence. Reliable national-scale estimates of forest clearance by these migrants have not been made.

- Deliberate fire-setting by large-scale plantation owners to clear land and by local communities to protest plantation or logging operations has led to uncontrolled wildfires of unprecedented extent and intensity. More than 5 million ha of forest burned in 1994 and another 4.6 million ha burned in 1997-1998. Some of this land is regenerating as scrubby forest, some has been colonized by small-scale farmers, but little systematic effort has been made to restore forest cover or establish productive agriculture.

As this brief summary makes clear, deforestation must be seen as a complex phenomenon in which all these factors interact. An overview of some of these interactions is provided in Figure 3.1.

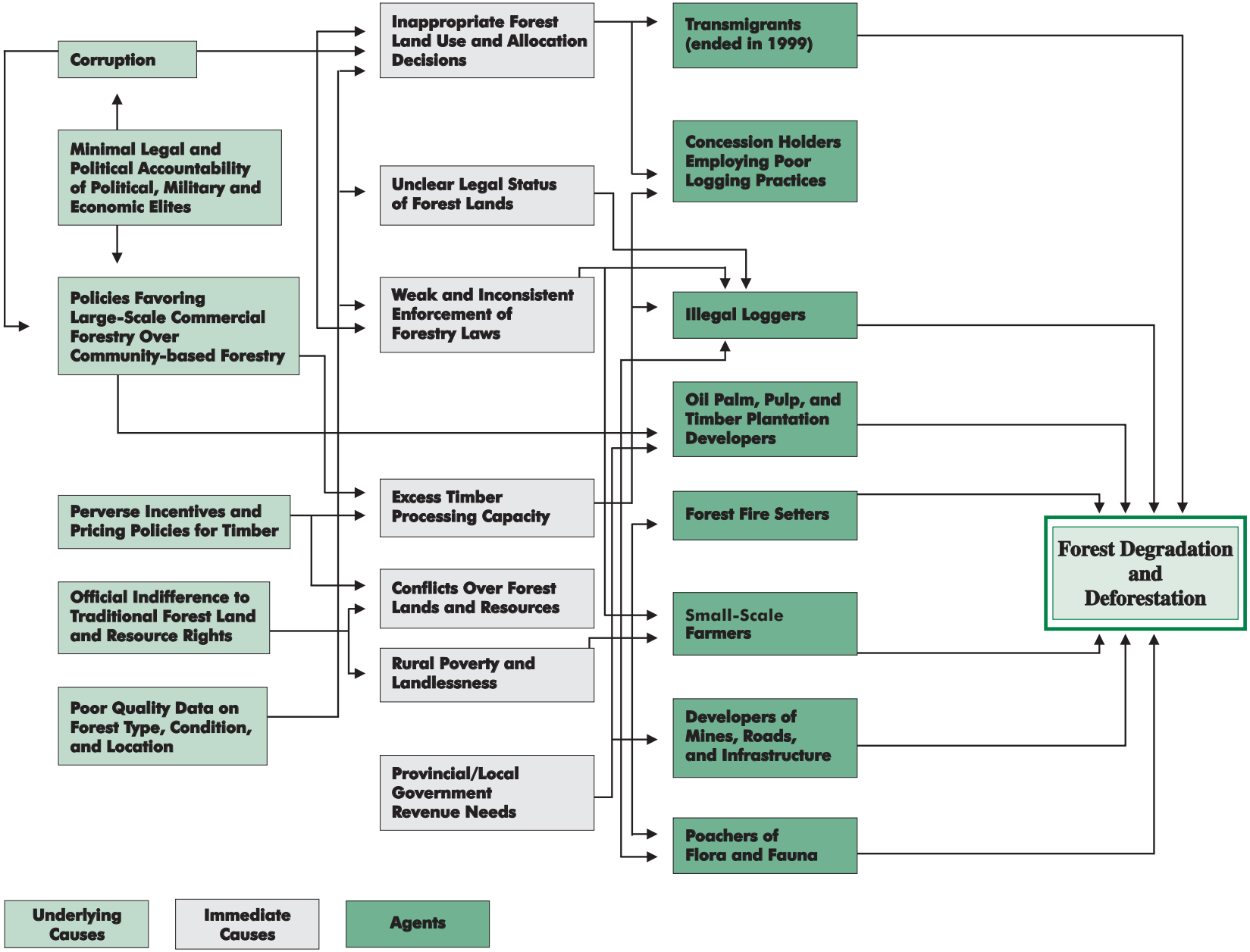
3.2 Timber Extraction: Logging Concessions (HPHs)

Even though logging concessions are intended to maintain forest lands in permanent production, the concession system has, in fact, been a major cause of deforestation and forest degradation.

When Suharto's "New Order" regime came to power in the late 1960s, economic planners took immediate steps to develop Indonesia's weak economy and create the legal framework to permit private firms to harvest and export timber. Sumatra and Kalimantan were the first targets of forest exploitation because they had the largest stocks of commercially valuable tree species and were closest to Asian markets.

The 1967 Forestry Act provided the legal basis to award timber harvesting rights, and many large 20-year logging concessions (*Hak Pengusahaan Hutan* or HPHs) were granted soon after. Exports of unprocessed logs rose sharply in the 1970s, providing foreign exchange, capital to build Indonesia's emerging business empires, and employment. From 1969 to 1974, for example, nearly 11 million ha of logging concessions were granted in East Kalimantan alone (GOI and IIED, 1985). Only 4 million m^3 of logs were cut from Indonesian forests in 1967, mostly for domestic use, but by 1977 the total had risen to approximately 28 million m^3, at least 75 percent of which was exported (Romm, 1980). Gross foreign exchange earnings from the forestry sector rose from $6 million in 1966 to more than $564 million in 1974. By 1979, Indonesia was the world's leading producer of tropical logs, with a 41 percent share ($2.1 billion) of the global market.

Figure 3.1 Processes of Forest Degradation and Deforestation in Indonesia



This figure represented a greater export volume of tropical hardwoods than the exports of Africa and Latin America combined (Gillis, 1988:43-104).

Roads, towns, and other infrastructure were built in Sumatra and Kalimantan in the wake of the timber bonanza, and the island populations grew substantially. East Kalimantan, which was undergoing a simultaneous oil boom, doubled its population between 1970 and 1980, transforming the landscape as agricultural settlers followed the loggers into the forests (Mackie, 1984:63-74).

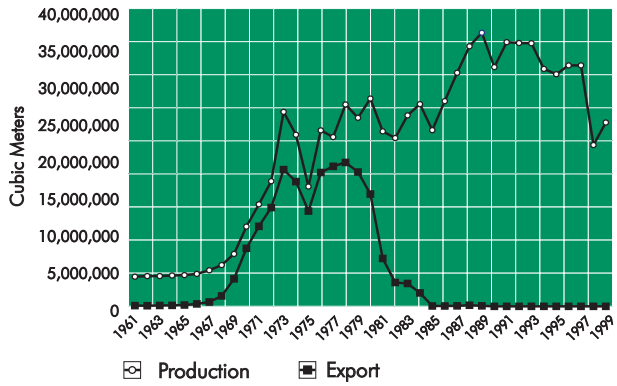
Consolidation in the Timber Industry

The timber industry went through a period of consolidation when a ban on log exports was imposed in the early 1980s, creating a few mammoth timber firms that concentrated on plywood production. Industry concentration was further encouraged by an HPH regulation requiring companies that sought a concession license to own a processing facility or have a corporate relationship with one. This requirement tended to limit concession ownership to big groups that owned plymills. The number of plywood mills in the country rose from 21 in 1979 to 101 in 1985, and production rose from 624,000 m^3 in 1979 to nearly 4.9 million m^3 in 1985, then doubled again to over 10 million m^3 in 1993. Nearly 90 percent of production in that year was exported. (*See Figures 3.2 and 3.3.*)

From the 1980s onward, the timber industry became increasingly concentrated in the hands of a small number of firms connected to the government. By 1994, the top 10 timber groups controlled 28 million ha (45 percent) of the logging concessions in the country, a figure that rose to 64 percent in timber-rich East Kalimantan (Brown, 1999:12-13). These big firms formed a cartel (Apkindo) that not only made Indonesia the world's largest plywood producer but also succeeded in raising international plywood prices (Gellert, 1998). Suharto's family and inner circle were important players in the industry. According to the watchdog group Indonesian Corruption Watch, Suharto's family alone controlled more than 4.1 million ha of logging concessions.[7] (*See Annex 2, Table 2.*)

By 1995, some 585 concessions covered 63 million ha, approximately one third of the nation's total land area (Brown, 1999:13). In the mid-1990s, however, many concessions were withdrawn, in part because of violations by concession holders and in part because the value of timber stands in many concessions was declining, a situation that reduced their attractiveness as long-term commercial operations. Brown estimates that the total number of concessions fell to 464, while the area of forest under concessions fell to 52 million ha. (*See Figure 3.4.*) The majority of withdrawn concession licenses were in Sumatra and Kalimantan; concession area continued to expand in Irian Jaya, which is still rich in unlogged forest resources. In practice, the "withdrawal" of over 100 concessions did not mean that they ceased operations. Numerous concessions whose 20-year contract period had ended were either transferred to five state-owned forestry corporations (Inhutani I-V) or reconstituted as joint ventures between private firms and one of these

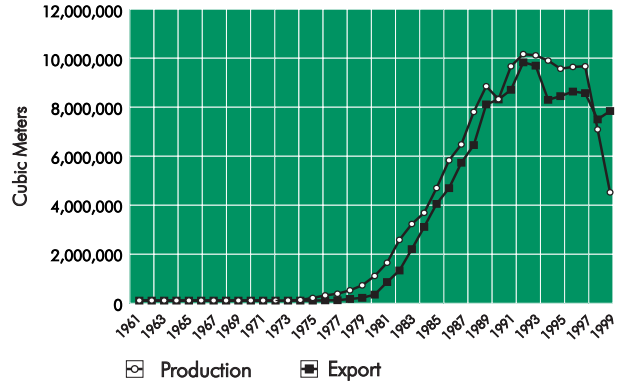
Figure 3.2 Production and Export of Logs, 1961–1999



Source: *FAOSTAT. FAO online database.*

Note: *Exports of logs have not been zero since 1986. ITTO reports log exports of nearly 300,000 m^3 in 2000 and this excludes illegal trade.*

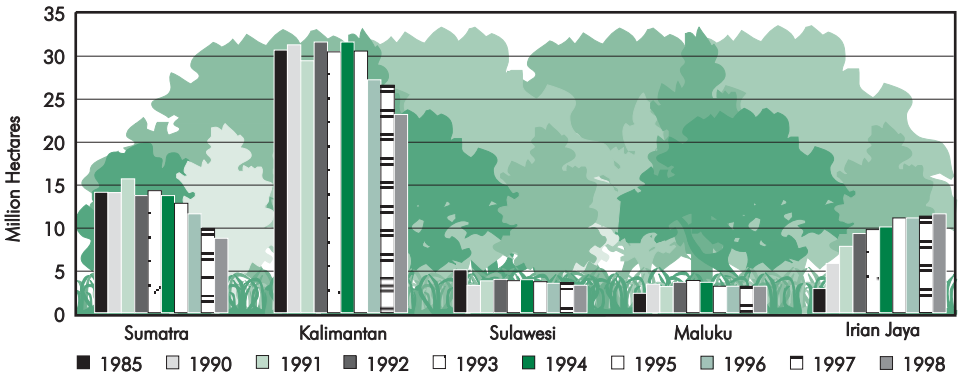
Figure 3.3 Production and Export of Plywood, 1961–1999



Source: *FAOSTAT. FAO online database.*

Note: *It seems implausible that production levels fell below export levels after 1998. ITTO and the Indonesian Ministry of Forestry record smaller decreases in production after 1997. (See Note 18.)*

Figure 3.4 Concession Area in Major Provinces, 1985–1998



Sources: *Forestry Statistics Indonesia, 1998; Concession names and locations from Agriculture Census, 1993, BPS; CIC, Study and Directory of Forest Management Rights (HPH) in Indonesia, 1999.*

Notes: *The data underlying this chart are presented in Annex 2, Table 3. Data from 1996 onward are for HPHs believed to be currently active.*

state firms. By mid-1998, only 39 million ha remained wholly in the hands of private concession holders; 14 million ha were being managed by the five Inhutani firms, 8 million ha were under state-private joint ventures, and an additional 8 million ha had been slated for conversion to nonforestry uses (Fox et al., 2000). The armed forces also benefited from the redistribution of concessions. Their concession area nearly doubled, to 1.8 million ha. (Brown, 1999:12, 40).

Despite this major shake-up in the industry, the top 10 timber companies were virtually unscathed; their ranking and control over concession area changed little. (*See Table 3.1.*)

Area and Status of Logging Concessions

In preparing this report, we were not able to obtain spatial data that would have identified the distribution of active and inactive concessions today. In fact, the true status of many concessions – whether they are in active operation, officially inactive but actually in operation, or no longer operating – remains hard to establish. In early 2000, the Ministry reported that 387 concessions were still actively operating, out of a total of 500 licensed to operate over a total forest area of 55 million ha.[8] However, a subsequent Ministry analysis released in July 2000 stated that 652 recognized concessions existed, covering an area of 69 million ha. Of these, 293 were apparently still operating under valid licenses (nearly 34 million ha), 288 had expired licenses but had not returned the land to government control (nearly 30 million ha), and 71 (about 5.5 million ha) had been formally returned to government control. (*See Table 3.2.*)

In January 2001, the Ministry of Forestry awarded 11 new concessions with forest areas totaling 599,000 ha. All but two were in Central or East Kalimantan and most ranged between 40,000 and 50,000 ha. The exceptions were one concession of 45,000 ha in Riau province, Sumatra, and one much larger concession, of 175,000 ha, in Irian Jaya.[9] The extent and distribution of logging concessions in the early 1990s, the most recent years for which spatial data are available, are shown in Map 8.

Concession Mismanagement and Forest Condition

The close connections between the Suharto regime and most of the major timber groups resulted in a lack of oversight and transparency, which was one reason for poor forestry management. Concession holders took little responsibility for forestry practices in the field, and there is no good evidence that the situation has improved. In early 2000, the Ministry of Forestry reported that "most" of the forest under logging concessions was in "damaged condition."[10] It appears that timber firms regularly violate various provisions of the Indonesian Selective Cutting

Table 3.1 Ranking of Top 10 Timber Groups by HPH Holdings, 1994–1995 and 1997–1998

1994–1995		1997–1998	
Timber Group	**Area of HPH** (Ha)	**Timber Group**	**Area of HPH** (Ha)
Barito Pacific	6,125,700	Barito Pacific	5,043,067
Djajanti	3,616,700	Djajanti	3,365,357
Alas Kusuma	3,364,200	KLI	2,806,600
KLI	3,053,500	Alas Kusuma	2,661,376
Inhutani I	2,422,000	Inhutani I	2,609,785
Bob Hasan Group	2,380,800	Bob Hasan Group	2,131,360
Korindo	2,225,000	Armed Forces/Navy	1,819,600
Surya Dumai	1,801,400	Korindo	1,589,228
Satya Djaya Raya	1,663,500	Kodeco	1,081,700
Tanjung Raya	1,530,500	Sumalindo	1,057,678
Subtotal	28,183,300	Subtotal	24,165,751
TOTAL (including other groups)	**62,543,370**	**Total (including other groups)**	**51,251,052**
Top 10 as % of Total (including other groups)	**45%**	**Top 10 as % of Total (including other groups)**	**47%**

Source: D. Brown, "Addicted to Rent: Corporate and Spatial Distribution of Forest Resources in Indonesia." (Jakarta, Indonesia: Department for International Development (DFID), Indonesia-UK Tropical Forest Management Programme (ITFMP). 7 September, 1999:12–13, 40–41.
Note: Total concession area differs slightly from that presented in Annex 2, Table 3.

Table 3.2 Logging Concession Status and Area, Reported in 2000

Logging Concession Status	Number of Units	Area (Ha)
20-Year Concession Grant Still Operating	293	33,950,000
20-Year Concession Grant Expired	288	29,980,000
Expired Concessions Formally Returned to State Control	71	5,470,000
TOTAL	**652**	**69,400,000**

Source: *Penataan Kembali Prengelolaan Hutan Produksi di Luar P. Jawa Melalui Restrukturalisasi Kelembagaan Usaha di Bidang Kehutanan* [Reorganizing Management of Production Forests Outside Java by Restructuring Forestry Sector Management Institutions]. (Jakarta, Indonesia: Ministry of Forestry and Estate Crops, 2000). Online at http://www.dephut.go.id/informasi/umum/restrukturisasi.htm.

Box 3.1 Common Illegal Practices of Timber Companies

When opening a new area for cutting, companies often build substandard logging roads without drainage systems (gutters, culverts, etc.), leading to erosion and landslips. Bridges are constructed by piling up timber logs, causing forest water channels to become clogged. Water then seeps into the surrounding areas, creating waterlogging which rots tree roots. Felling activities are frequently contracted out to other parties, who operate without supervision. Subcontractors tend to cut for short-term profit – as much as they can as fast as they can – which results in cutting of trees with diameters smaller than the felling limit (50 cm at breast height), removing trees from river and stream banks, or felling on steep slopes. Protected trees may also be cut indiscriminately. Cutting often occurs outside designated cutting blocks (which are specified each year in an annual plan) and even outside concession boundaries. Cut logs are often not collected or stored at the designated sites. In many concessions, it is not difficult to find numerous former unofficial log storage sites where the forest has been cut and the land so degraded that scrub is the only regrowth. Concessionaires are required to replant 2 years after they have logged an area, but some have been observed to plant only a small area where forestry officials are most likely to visit. Seedbeds may be established but owing to the difficulties of producing seedlings from dipterocarps, saplings often do not survive.

Source: Reports from the field by environmental activists.

Table 3.3 Forest Condition in 432 Current and Expired Logging Concessions

	Concession Areas (320 Units)		Expired Concessions Managed by State Forestry Corporations Inhutani I–V (112 Units)		TOTAL	
Forest Condition	**Area** (Ha)	**%**	**Area** (Ha)	**%**	**Area** (Ha)	**%**
Primary Forest	18,300,000	45	600,000	11	18,900,000	41
Logged Forest in Good-Moderate Condition	11,100,000	27	2,500,000	44	13,600,000	29
Degraded Forest, Scrub, and Agriculture	11,600,000	28	2,600,000	45	14,200,000	30
TOTAL	**41,000,000**	**100**	**5,700,000**	**100**	**46,700,000**	**100**

Source: *Penataan Kembali Prengelolaan Hutan Produksi di Luar P. Jawa Melalui Restrukturalisasi Kelembagaan Usaha di Bidang Kehutanan* [Reorganizing Management of Production Forests Outside Java by Restructuring Forestry Sector Management Institutions] (Jakarta, Indonesia: Ministry of Forestry and Estate Crops, July 2000). Online at http://www.dephut.go.id/informasi/umum/restrukturisasi.htm.
Note: 7.3 million ha of 18.9 million ha (39 percent) of primary forest remaining in the area surveyed is located in Irian Jaya. The survey was based on analysis of 1997–1999 Landsat Images.

System (TPTI), which they are obliged to follow under the terms of their 20-year concession contracts (World Bank, 2001:19). (*See Box 3.1.*)

A report by the Ministry of Forestry in July 2000 indicated that in a survey of nearly 47 million ha of forest land under active or expired concessions, about 30 percent was degraded, reduced to scrub, or converted to agriculture, and only 40 percent was still classified as primary forest in good condition. (*See Table 3.3.*)

Growing environmental activism and increasingly frequent public protests have begun to put pressure on the government to take some action against offenders. On May 5, 1999, the Minister of Forestry withdrew a 39,300-ha logging concession granted in 1992 to the Medan Remaja Timber (MRT) company in Aceh Province, Sumatra. The process to revoke MRT's license began after environmental NGOs delivered information concerning the company's poor performance to the Minister. Around the same time, local people vented their anger and opposition by setting fire to the MRT

FWI Sumatra

base camp, blockading the company's logging road, and seizing the heavy equipment, making it impossible for the loggers to operate.[11]

Indonesia has been developing a system for certifying well-managed logging concessions since the mid-1990s but, until early 1999, not one logging company was ready to be certified. In April 1999, the Diamond Raya Timber Company was awarded a "bronze medal," the lowest level of certification, by LEI, the Indonesian Ecolabelling Institute. The company failed to pass a subsequent Joint Certification Protocol agreed by LEI and the Forest Stewardship Council (FSC) but was again awarded a bronze medal by LEI in April 2001. However, in July 2001, the company was heavily criticized by the Rainforest Foundation and WALHI, Indonesia's largest national environmental organization. The company's concession in Riau province, Sumatra, is inhabited by the highly endangered Sumatran tiger, and Diamond Raya is accused of failing to take any protective measures or to conduct environmental impact studies of its operations. Illegal logging is also allegedly rampant inside the concession.[12]

The number and total area of concessions have declined since the mid-1990s, and concessions are providing a smaller share of the country's timber supply than formerly. However, nearly half of Indonesia's remaining tropical forests are still under logging licenses and are either degraded or at risk of degradation unless current practices are changed. An additional threat is posed by the new regional autonomy policy, which gives local authorities much greater power to grant logging concessions. (*See Chapter 5*.) After many years of seeing logging revenues captured by the central government, local authorities are eager to exploit forest resources for local benefit. Without strong institutional frameworks and responsible planning, forests are being logged even more intensively for the sake of short-term gain.

3.3 Timber Extraction: Illegal Logging

Dependence on Illegal Supply

Illegal logging is widespread and systematic in many parts of Indonesia and, in 2000, appeared to be the source of 50–70 percent of the country's wood supply. An analysis that year by the Ministry of Forestry officially stated what has been common knowledge for some time:

> *Illegal logging has come to constitute a well-organized criminal enterprise with strong backing and a network that is so extensive, well established and strong that it is bold enough to resist, threaten, and in fact physically tyrannize forestry law enforcement authorities. …Illegal cutting occurs in concession areas, unallocated forest areas, expired concessions, state forestry concessions, areas of forest slated for conversion, and in conservation areas and protected forests.*
>
> *Indeed, illegal logging is increasing in conservation areas, since these areas have better timber potential than production areas. The actors in illegal logging are: (a) laborers from communities in the forest areas and also many who are brought there from other areas; (b) investors, including traders, concession holders, or holders of legal timber cutting permits (IPK), and buyers of illegal timber from processing industries; and (c) government officials (both civilian and military), law enforcement personnel, and certain legislators.*[13]

Box 3.2 What Do We Mean by Illegal Logging?

Illegal logging is an emotive term that requires some definition. This report uses the term to describe all forestry practices or activities connected with wood harvesting, processing, and trade that do not conform to Indonesian law. There are essentially two kinds of illegal logging. The first is carried out by legitimate operators who violate the terms of their licenses. The second involves outright timber theft, whereby trees are felled by people who have no legal right to cut trees at all.

Data collection and analysis by the Natural Resources Management (NRM) Program of USAID focused on the wood intake and production of Indonesia's sawmills and plywood plants. One conclusion was that any discussion of industry overcapacity and the link to illegal logging must recognize that "illegal logging" can take many forms beyond the illegal removal of trees from the forest. Examples can be found in the forest concession (HPH) system and the industrial timber plantation (HTI) system.

HPH/Forest Concessions Linked to Wood Processing Facilities

- Harvesting more than the annual allowable cut (AAC)
- Harvesting in Protection Forest areas (steep slopes and river banks)
- Underreporting harvest volumes and tax payable
- Ignoring selective cutting guidelines
- Harvesting outside concession boundaries
- Falsifying log transport documents

HTI/Industrial Timber Plantations Linked to Pulp Mills

- Clear-cutting natural forest, then failing to replant
- Not planting at rates required to maintain long-term production
- Replanting with low-quality species
- Replanting at low density
- Persistently supplementing plantation supply with "bridging" supply from conversion forest
- Accepting falsified log transport documents

Big wood processing operations are responsible – directly or indirectly – for the majority of illegal logging because they consume the most wood and because small companies lack the capacity to overharvest at significant levels. Illegal logging is also undertaken by small-scale operators who might harvest a few logs from the forest each week and sell them to larger legitimate operators. These small teams of illegal loggers are frequently funded and directed by the major companies. Illegal logs from such sources are then mingled undetectably with the legal harvest.

Source: "Indonesian Forestry Sector: Discusson of Data Analysis and Current Policy Issues." Presentation by the EPIQ/Natural Resources Management Program, United States Agency for International Development (USAID) at Winrock International. Arlington, VA. August 1, 2000.

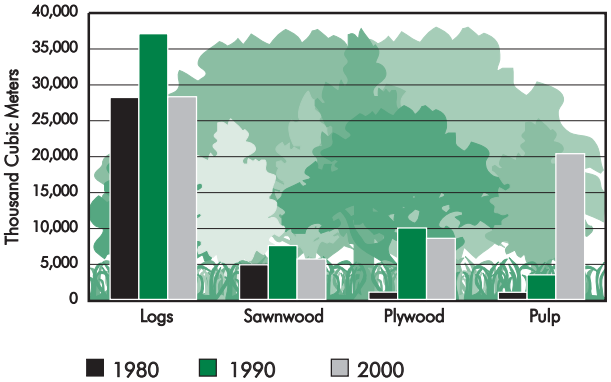
Illegal timber brokers flourish throughout the country, supplying wood processors who cannot obtain adequate supplies legally.[14] Corruption among civilian and military officials, many of whom are closely involved in illegal cutting and marketing, is pervasive.[15] Official involvement in illegal logging has become so blatant and widespread that provincial legislators in Sumatra's Jambi province felt obliged to make a public appeal to military, police, and justice officials to stop supporting illegal loggers' operations.[16] The Indonesian Plywood Association (Apkindo) complained in June 2000 that illegal loggers in Sumatra and Kalimantan were exporting at least 1 million m^3 of timber to China and undercutting the legal export market.[17]

Illegal logging is not always a clearly defined term. Box 3.2 explains how it is used in this report. Map 9 illustrates the distribution of reported cases of illegal logging in Indonesia between 1997 and 1998.

The Gap Between Supply and Demand

How has such a situation arisen? The short answer is that Indonesia has pursued a policy of aggressive expansion in the forest products sector with insufficient regard for the long-term sustainability of supply. (*See Figure 3.5.*) Indonesia's annual log production rose from about 11 million m^3 in the 1970s to a peak of about 36 million m^3 in the early 1990s. More rapid expansion occurred in the processed wood products sector as the government encouraged a shift away from the production of lower-value unprocessed logs toward value-added products. The first boom was in plywood production, which took off during the 1980s and 1990s as part of the country's drive to increase exports. (*See Figure 3.3.*) Production has declined somewhat

Figure 3.5 Industrial Roundwood Production, 1980–2000



Source: *ITTO (Logs, Sawnwood and Plywood). Indonesian Pulp and Paper Association (Pulp)*

Notes: *Pulp production data are in roundwood equivalent, using a conversion rate of 4.9 cubic meters consumed to produce 1 metric ton of pulp. ITTO production data for Indonesia are consistently higher than those from FAO. ITTO log production data for 2000 are provisional and may be revised downward. They are dramatically higher than the 2000 log production data provided by the Indonesian Ministry of Forestry.*

Table 3.4 Timber Supply from All Legal Sources (m^3)

Source of Production	1995	1996	1997	1998	1999	2000
Production Forest (HPH)	17,012,949	15,595,766	16,224,228	11,867,274	8,599,105	7,661,219
Conversion Forest (IPK)	5,845,475	7,232,482	9,524,572	7,249,878	6,239,278	4,643,993
Community Forests	149,023	603,151	1,213,928	719,074	957,056	232,134
State-Controlled Timber Plantations (Perhutani) in Java	1,795,630	1,911,757	1,604,034	1,718,561	1,890,900	897,615
Industrial Timber Plantations (HTI)	514,692	474,268	425,893	480,210	4,844,493	3,779,828
TOTAL	**25,317,769**	**25,817,423**	**28,992,654**	**22,034,997**	**22,530,833**	**17,214,789**

Source: Ministry of Forestry, March 2001.
Notes: Ministry of Forestry data on roundwood production are consistently lower than those reported by FAO and ITTO. Data for the year 2000 could not be cross-checked because FAO log production data for 2000 were not available at the time of writing, and ITTO data were still provisional. The Ministry production figure of 17.2 million cubic meters must, at this stage, be treated with caution.

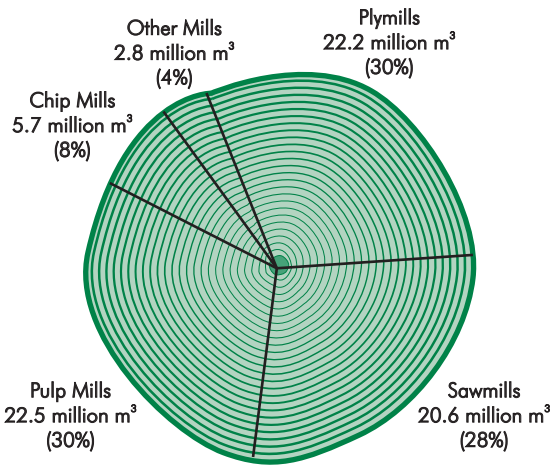
following the economic crisis of 1997, although startling data discrepancies exist among different sources.[18]

The pulp and paper industries have grown even more dramatically. Since the late 1980s, production capacity has increased nearly 700 percent. (*See Figures 3.7 and 3.8 in next section.*) Indonesia has become the world's ninth largest pulp producer and eleventh largest paper producer. This prodigious investment in plywood, pulp, and paper processing capacity has far outpaced efforts to develop adequate feedstocks from plantations, and the industry's expansion has come largely at the expense of the country's natural forests. (Plantations are discussed in greater detail in the following section.) Total wood demand in Indonesia today is conservatively estimated at 76-80 million m^3. (*See Figure 3.6.)*

Against this picture of rapidly increasing demand for wood is a story of static or declining supply. (*See Table 3.4.*) According to the latest estimates from the Ministry of Forestry, output from Indonesia's production forests has declined precipitously, probably because most of the economically desirable concessions have been thoroughly logged. Wood from conversion forests – forests cleared to make way for agricultural or industrial wood plantations – appears to have peaked in 1997, possibly because the economic and political crisis has discouraged expansion in the plantation sector. Output from industrial timber plantations remained below targets for some years but, according to recent MOF data, production rose sharply in 1999. The increase seems too large to be entirely plausible, but it may be explained by large-scale planting undertaken around 1990 and 1991. Even at this level of production, however, plantations still supply only about 5 percent of total (legal and illegal) wood consumption.

Indonesia suffers from a chronic structural imbalance between supply and demand, and the shortfall

Figure 3.6 Installed Capacity in the Wood Processing Industries, 1999



Source: *Ministry of Forestry, Directorate of Forest Protection.*
Note: Total installed capacity = 76 million metric tons.

is made up largely from wood obtained illegally. Reliable data on illegal logging, by definition, are not available for undocumented and underground activities. However, the Government of Indonesia and several independent researchers have made estimates that give a good sense of the magnitude of the problem. Most estimates of illegal logging are based on comparisons of known legal supplies of wood with documented output from the wood processing industries.

A study that compared the production capacity of plymills and sawmills in 1998 with the legal supply of wood from concessions and plantations linked to those mills and from associated forest clearance concluded that the gap that year between known legal supply and mill output was nearly 21 million m^3 (Brown, 1999:49). The study used conservative assumptions about mill production efficiency, and it did not include the pulp sector, which by 1998 was a significant consumer of wood. The estimate is based on probably the most careful study yet of the plywood and sawnwood sectors but as an estimate of total illegal logging in the country, 21 m^3 is undoubtedly much too low.

Another study of the situation in 1997 and 1998 compared national wood supply (legal production plus imports) with national wood consumption (domestic use plus exports) (Scotland, 2000). The study found that consumption exceeded supply by 32.6 million m^3. (*See Table 3.5.*) The extent of domestic demand, as well as the volume of timber smuggled out of the country, is uncertain. The size of imports is also difficult to ascertain, because most imports are of pulp, waste paper, and wood chips, all of which must be converted to roundwood

Table 3.5 Estimated Timber Demand and Imbalance, 1997-1998

Sources of Timber Supply and Demand	Volume (Roundwood Equivalent) ('000 m^3)
Logs from Domestic Production	29,500
Log Supply Equivalent from Imports	20,427
Log Supply Equivalent from Other Sources (Mainly Recycled Paper)	1,600
TOTAL SUPPLY	**51,527**
Domestic demand (Timber Processing Industries)	35,267
Log Equivalent of Exports	48,873
TOTAL DEMAND	**84,140**
Net Wood Balance	**–32,613**

Source: N. Scotland, "Indonesia Country Paper on Illegal Logging." Prepared for the World Bank-WWF Workshop on Control of Illegal Logging in East Asia. Jakarta, 28 August, 2000. Draft.
Note: A subsequent estimate by the same author, based on higher estimates of domestic consumption and revised roundwood equivalent conversion factors, calculated a net wood balance of -56,612,000 m^3 in 1998. This estimate was not widely accepted but it is plausible.

Box 3.3 Illegal Logging: A Tale of Two National Parks

The ubiquity of illegal logging in Indonesia and the pervasive corruption and lawlessness that allow it to flourish are starkly illustrated by the assault on Indonesia's national parks. Bukit Tigapuluh National Park in Sumatra and Tanjung Puting National Park in Kalimantan are only two of the more egregious cases in which Indonesia's last reserves of intact forest are being systematically pillaged by illegal loggers operating with the connivance of civilian and military officials.

Bukit Tigapuluh National Park covers 127,698 ha of hilly and mountainous rainforest as well as some mangrove forest in the Sumatran provinces of Jambi and Riau. In addition to serving as an important watershed for the region, the park is rich in biological diversity. The park has 700 recorded plant species, some 246 of which are commonly used by local people for medicinal and other purposes. It is home to 192 recorded bird species (one third of Sumatra's total) and 59 recorded mammal species, including threatened species such as the Sumatran tiger (*Panthera tigris*), Asian elephant (*Elephas maximus*), Malay tapir (*Tapirus indicus*), clouded leopard (*Neofelix nebulosa*), and the Asian small-clawed otter (*Aonyx cinerea*). The area was declared a national park in 1995, encompassing sites previously classified by the government as protection forest and limited production forest. A logging concession had operated in the production forest area prior to establishment of the park.

Bukit Tigapuluh's rich biodiversity and watershed functions are gravely threatened by illegal logging to feed local illegal sawmills, which multiplied from 4 in 1997 to at least 23 in 1999. This expansion was driven largely by the depreciation of the Indonesian rupiah against the dollar following the 1997 Asian economic crisis, which greatly increased the local rupiah selling price of timber for export. The most sought after commercial species are meranti (*Shorea* spp), balam (*Palaquium walsurifolium*), keruing (*Dipterocarpus* species), bayur (*Pterospermum* species), and sapat (*Ludekia borneensis*).

Logging, milling, and trading of illegal timber from the park and adjacent areas are carried out systematically and in the open, with little or no interference from Forestry Department officials or the police, who are indeed alleged to be actively involved in the business. Illegal logging originally concentrated on the abandoned concession of PT Patriadi, outside the park, but it has moved along three rivers into the park itself. The illegal timber boom in the area has increasingly drawn outside capital and labor into the area, law enforcement is effectively nonexistent, and the outlook for Bukit Tigapuluh's remaining forests is discouraging.

An even more egregious and well-documented case is that of Tanjung Puting National Park in the province of Central Kalimantan, which covers 400,000 ha on an alluvial peninsula jutting south into the Java Sea. The park includes a variety of ecosystems, including tropical heath forest, peat swamp forest, and mangrove forest, and is the habitat of over 200 bird species, 17 reptile species, and 29 mammal species. Nine of Borneo's primate species are found in Tanjung Puting, including approximately 2,000 orangutans. The area, a wildlife reserve since the 1930s, was officially declared a national park in 1984 and is also officially listed by the UN as a Biosphere Reserve.

The park's rich flora includes considerable stands of commercial tree species, notably meranti (*Shorea species*) and ramin (*Gonystylus species*). Ramin has been a particular target for illegal loggers since the early 1990s, and illegal cutting of this valuable timber has soared in recent years with the erosion of civil order and law enforcement that accompanied the economic and political crises that began in 1997-1998 and continue today. Ramin is a rare wood that grows only in lowland tropical forest areas, and it has been essentially logged out in many other parts of Indonesia. The attraction for illegal loggers is clear – sawn ramin sells for approximately \$600 per m^3 on international

Box 3.3 *(continued)*

markets, and moulded ramin for as much as $1,200 per m^3. Major buyers include Malaysia, Singapore, Taiwan, China, the United States, and various European nations.

Illegal logging for ramin and other species occurs throughout most of Tanjung Puting, particularly along the Sekonyer, Buluh Besar, and Seruiyan rivers, which either border or bisect the park. Field investigations by the Environmental Investigation Agency (a UK-based NGO) and Telapak Indonesia (an Indonesian NGO) during 1999 and 2000 revealed that only one third of the park's forests are still intact.

In Tanjung Putting, illegal logging is a large-scale, well-organized commercial operation carried out with the tacit or active support of local military, police, and forestry officials. Abdul Rasyid, a local timber baron who also represents Central Kalimantan in Indonesia's National Assembly (the MPR), has been reported by numerous sources, including officials of the central government, as the mastermind of the operation. Illegal loggers can be ruthless in protecting their interests. Two observers from EIA and Telapak were badly beaten and held hostage for 3 days in January 2000 by employees of Tanjung Lingga, Rasyid's timber company.

Actual logging is carried out by teams of local loggers who are supplied with chainsaws and other equipment and are paid less than $1 per m^3 for the ramin they cut. The wood is then processed in Rasyid's nearby factory by workers paid less than $1 per day. In some cases, police and forestry officials are bribed to "confiscate" loads of illegally cut ramin. Indonesian law provides that confiscated timber is to be auctioned, and the company then buys the timber cheaply through a crooked auction process, receiving all necessary papers declaring the wood to have been legally obtained. Illegal ramin is thus "laundered" and becomes legal in the eyes of Indonesian law.

Despite extensive video and other documentation of the widespread illegal logging at Tanjung Puting and the central role of Abdul Rasyid in the operation, little action has been taken by the government to end the pillage of the park. Evidence to support a case against Rasyid was forwarded by the Forestry Department to the National Police in October 2000, but to date no action has been taken. Under pressure from national and international NGOs, the government did place ramin on Appendix III of the Convention on International Trade in Endangered Species (CITES) in April 2001, with a zero export quota for 2 years.

As *Newsweek* magazine noted in September 2001, "Tanjung Puting has come to symbolize the corruption and lawlessness of Indonesia's forestry sector." Indeed, the inability or unwillingness of the government to bring Abdul Rasyid to justice in such a high profile illegal logging case – in a park often cited as a "crown jewel" of the Indonesian protected areas system – bodes ill for the remaining scraps of officially protected intact forest lying within Indonesia's poorly managed system of protected areas.

Sources:

Department for International Development (DFID) and Worldwide Fund for Nature (WWF). 1998. *Laporan Perkembangan Sawmill Wilayah Selatan Taman Nasional Bukit Tigapuluh dan di Sekitar Areal KPHP Pasir Mayang*. [Report on Development of Sawmills in the Southern Region of Bukit Tigapuluh National Park and in the area around KPHP Report on sawmill development in the district South TN Tigapuluh Hill and surrounding area KPHP Pasir Mayang.] DFID and WWF. Report PFM/KPHP/98/7.

Environmental Investigation Agency and Telapak Indonesia. 1999. *The Final Cut: Illegal Logging in Indonesia's Orangutan Parks*. London, UK and Bogor, Indonesia.

Environmental Investigation Agency and Telapak Indonesia. 2000. *Illegal Logging in Tanjung Puting National Park: An Update on the Final Cut Report*. London, UK and Bogor, Indonesia.

"Raping Borneo." *Newsweek*, September 10, 2001.

equivalent volume. In addition, large quantities of pulp and paper are traded in both directions (imports and exports), imported pulp is processed into exported paper, and so on. The shortfall of 33 million cubic meters should be regarded as a rough approximation, but it is good enough to indicate the scale of the problem. Illegal logging in 1997–1998 appears to have accounted for more than half of total domestic production.

The imbalance between supply and demand in Indonesia appears to be worsening. The latest data available from the Ministry of Forestry indicate that legal domestic wood production in 2000 fell to a new low of just 17 million m^3. Domestic production is supplemented by imports. Although imports of roundwood are negligible in Indonesia, imports of pulp and paper are an important source of supply. Data for pulp, waste paper, and paperboard are not yet available for 2000, but imports amounted to 3 million m^3 (roundwood equivalent) in 1999 (APKI, 2001). If imports were similar in 2000, then total wood supply in that year was a little over 20 million m^3. Consumption data for the wood products industry in 2000 are not available either, but industry capacity is conservatively estimated at about 74-80 million m^3. If it is assumed that industry output is approximately 75 percent of capacity, then total roundwood demand was 55-60 million m^3. (This is a reasonable assumption given that pulp mills, which account for about 30 percent of total demand, produced at 84 percent of their capacity in 2000.) Demand for wood in 2000 thus exceeded supply by 35-40 million m^3 which, it must be assumed, was supplied from illegal sources. If these calculations are even approximately correct, illegal logging accounted for about 65 percent of Indonesia's total wood supply in 2000.

In early 2000, a senior official of the Ministry of Forestry admitted that "the wood-processing industry has been allowed to expand without reference to the available supply of timber, resulting in vast overcapacity. The shortfall in the official timber supply is being met largely by illegal logging, which has reached epidemic proportions."[19] Box 3.3 illustrates how illegal logging proceeds unhindered even in Indonesia's national parks.

The international aid agencies and lending institutions in the Consultative Group on Indonesia (CGI) have often warned that continued aid to the forestry sector is contingent on more effective action to eradicate illegal logging.[20] (*See Chapter 5.*) It is clearly recognized that while the supply/demand imbalance continues, illegal logging will not be brought under control. Most analysts agree that the solution lies not in combatting illegal loggers in the forest but in measures directed at the demand side. Promising actions include a moratorium on further growth in the capacity of the wood processing industries, probably followed by downsizing; elimination of direct and hidden government subsidies to the pulp industry; credible monitoring of plantation development and penalties for companies that fail to meet their planting obligations; and enforcement of agreed due diligence practices on the part of financial institutions that invest in pulp and paper facilities in order to avoid funding projects that use illegally obtained wood.

E.G. Togu Manurung

3.4 Industrial Timber Plantations (HTIs)

In the mid-1980s, the government launched an ambitious plan to establish vast areas of fast-growing timber plantations (*Hutan Tanaman Industri* – HTIs), especially in Sumatra and Kalimantan. The program accelerated with the issuance of a Government Regulation in 1990.[21] At the outset, the government justified the HTI program in terms of supplementing supplies of timber from the natural forests, rehabilitating degraded lands, and promoting nature conservation.[22] To this ostensible end, timber plantation entrepreneurs receive various government subsidies, including loans on generous terms from the "Reforestation Fund," which is collected from logging concession holders.[23]

HTI concessions are granted for production of both pulpwood and nonpulpwood (usually sawnwood for construction). They can be established indepen-

dently or in conjunction with existing HPH logging concessions. A special category was created for HTI concessions linked to transmigration sites (HTI-Trans), where the transmigrants work on the plantations. HTI-Trans concessions usually produce wood for nonpulp uses. According to official figures, some 7.9 million ha had been allocated for all three types of HTI concession development by the end of 2000, but only 23.5 percent of that area had actually been planted. (*See Table 3.6.)*

According to unpublished data provided by the Ministry of Forestry, the area of land allocated for HTI concessions by May 2001 had risen to 8.8 million ha, but data on the area planted were not available.

Forest Conversion to HTIs

The fact that less than one quarter of lands allocated for HTI concessions by 2000 had actually been planted is a symptom of several interrelated structural problems with the HTI program. The 1990 Regulation clearly states that HTIs are to be granted only on nonproductive areas of permanent forest estate and may not be granted in areas already under a logging concession (HPH). In practice, however, HTI concessions have frequently been established on still-productive forest land. According to calculations based on plantation company feasibility studies, as of June 1998, 22 percent of land managed as HTIs had been productive natural forest prior to plantation establishment (Kartodihardjo and Supriono, 2000:4). Many HTI concessions involve the conversion of a much higher proportion of natural forest area. Table 3.7 illustrates six such cases, where an average of 72 percent of the total HTI area was formerly natural forest. Box 3.4 provides further illustrative examples.

The economic rationale for establishing HTIs in still-forested areas is clear. First, establishing plantations on truly degraded lands is more expensive because it often requires considerable investment in land preparation to rehabilitate soil fertility. Second, HTI concessions include the right to obtain Wood Utilization Permits (IPKs), essentially licenses to clear-cut and use remaining standing timber. When HTIs are established in areas with considerable standing timber, the IPK provision furnishes the company with a large supply of essentially free timber. This dynamic, combined with the large supply of timber available from illegal sources, considerably diminishes incentives for wood-processing companies to follow through with the planting and harvest of HTIs.

Less than one fifth of the approximately 2 million ha allocated for sawnwood HTI development has actually been planted. HTIs established for production of pulp have done slightly better, with just under one quarter of the nearly 5 million ha allocated for pulp production planted. (*See Table 3.6.*) But it is clear from the overall low percentage of HTI area planted – only 23.5 percent of the total area allocated for all types of HTI – that planting and harvesting plantation trees is not the major reason for HTI development. Rather, growth in HTI area is being encouraged by generous financial subsidies and rights to clear-cut standing timber. (*See Note 23.*)

In addition, many HPH concession holders find it economically advantageous to convert degraded

Box 3.4 Some Cases in Which Companies Have Developed Industrial Timber Plantations in Productive Natural Forest

- The entire HTI area of PT Rimba Equator Permai, covering 21,010 ha, was formerly an HPH of PT Barito Pacific Timber, with an area of 1,586 ha in virgin forest.
- Of the total forest concession area of 73,153 ha owned by PT Sinar Kalbar Raya, an area of 28,065 ha was formerly an HPH production forest owned by PT Pesada Kawi ITC, and 3,250 ha was formerly an HPH area of PT Ponti Jaya.
- The entire area of PT Adindo Foresta Indonesia's HTI, covering 111,355 ha, was formerly production forest for five HPH companies, namely PT Inhutani I, PT Pulau Laut, PT Segara Timber, PT Dana Mulia Bhakti, and PT Karya Jaya Parakawan.
- The entire area of PT Tanjung Redeb Lestari's HTI, covering 180,900 ha, was formerly an HPH production forest area. The timber harvest potential of trees with a diameter exceeding 30 cm dbh was greater than 25 m^3 per ha.
- The entire HTI area of PT Riau Andalan Pulp and Paper, covering 121,000 ha, was formerly production forest for 9 HPH companies with the potential for producing commercial timber of up to 24 m^3 per ha.

Source: Feasibility studies prepared by each company pursuant to the granting of their licenses.

areas of their concessions to HTIs. As a World Bank study noted in 1998, "logging operations can degrade a site with little risk of serious penalty, and in the process set themselves up to receive a license to convert the site so damaged into an HTI or tree crop estate."[24] Forestry Ministry data published in 1998 reveal that more than 2.7 million ha of HPH concessions had been converted to HTI concessions. (*See Table 3.8.*)

Development of the Pulp and Paper Industries

A key factor underlying the development of HTI concessions has been the rapid development of the pulp and paper industries over the past decade. Installed annual pulp production capacity grew from 1 million tons in 1990 to nearly 5 million tons in 2000 and is expected to exceed 6 million tons in 2001. Annual paper processing capacity increased from 1.2 million tons to 8.3 million tons over the same period (Barr, 2000:3). *(See Figures 3.7 and 3.8.)* As a result, both allocation and actual planting of HTI-pulp plantations have greatly exceeded the HTI area established for sawnwood production.

Capacity expansion in the pulp and paper industries has involved investments in large-scale mills with high fixed costs. Most facilities have entailed initial capital investments of between US$600 million and US$1.3 billion. Because of these high fixed costs, pulp and paper producers tend to run their mills continuously at or near full capacity and are reluctant to countenance any slowdown in production.

Four large Indonesian conglomerates together accounted for nearly all the paper industry's growth in the 1990s: the Sinar Mas Group, the Raja Garuda

Table 3.6 Allocation and Planting of Industrial Timber Plantations (HTIs) to December 2000, By Province and Type of HTI

Province	HTI Area Allocated (Ha)	HTI Area Planted (Ha)	Percent of Allocated Area Planted	Number of Companies
HTI-Pulp				
Aceh	207,899	55,290	26.6	2
North Sumatra	412,060	59,428	14.4	2
Jambi	78,240	86,918	111.1	1
Riau	550,190	289,280	52.6	3
South Sumatra	340,100	222,334	65.4	2
South Kalimantan	268,585	86,259	32.1	1
East Kalimantan	793,237	325,517	41.0	5
Central Kalimantan	185,511	0	0	2
West Kalimantan	735,306	42,785	5.8	5
Irian Jaya	1,389,200	0	0	6
TOTAL	**4,960,328**	**1,167,811**	**23.5**	**29**
HTI-Sawnwood				
Aceh	6,050	0	0	1
North Sumatra	176,893	26,778	15.1	7
Jambi	154,030	20,481	13.3	6
Riau	257,888	52,843	20.5	12
South Sumatra	58,130	3,623	6.2	3
Lampung	175,152	57,125	32.6	7
Nusa Tenggara Timur	55,074	5,945	10.8	2
South Kalimantan	77,575	26,608	34.3	5
East Kalimantan	439,719	105,020	23.9	12
West Kalimantan	152,780	45,497	29.8	3
Central Kalimantan	79,000	5,000	6.3	6

Table 3.6 (cont.) Allocation and Planting of Industrial Timber Plantations (HTIs) to December 2000, By Province and Type of HTI				
Province	**HTI Area Allocated** (Ha)	**HTI Area Planted** (Ha)	**Percent of Allocated Area Planted**	**Number of Companies**
HTI-Sawnwood (*continued*)				
South Sulawesi	57,000	4,910	8.6	3
Central Sulawesi	80,101	5,532	6.9	3
Southeast Sulawesi	72,845	5,942	8.2	2
Maluku	24,851	8,843	35.6	3
Irian Jaya	198,000	0	0	4
TOTAL	**2,065,088**	**374,147**	**18.1**	**79**
HTI-Trans				
Aceh	32,064	12,158	37.9	5
North Sumatra	6,200	3,856	62.2	1
West Sumatra	6,675	2,354	35.3	1
Riau	83,190	41,124	49.4	6
Jambi	34,835	14,712	42.2	4
South Sumatra	21,000	3,625	17.3	1
West Kalimantan	217,930	33,689	15.5	13
Central Kalimantan	132,495	61,625	46.5	13
East Kalimantan	183,989	75,934	41.3	14
South Kalimantan	41,040	20,943	51.0	4
South Sulawesi	13,300	3,930	29.6	1
Central Sulawesi	13,400	8,742	65.2	1
Maluku	49,717	26,515	53.3	3
TOTAL	**835,835**	**309,207**	**37.0**	**67**
Grand total	**7,861,251**	**1,851,165**	**23.5**	**175**

Source: Industrial Timber Plantations Directorate, Ministry of Forestry, 2001

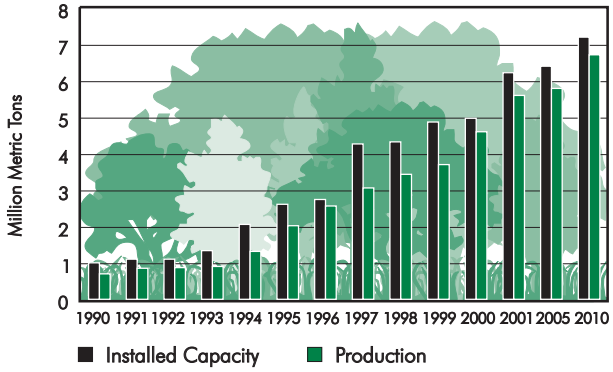
Mas Group, the Bob Hasan Group, and the Barito Pacific Group. (All four are also major logging concession holders and two, Sinar Mas and Raja Garuda Mas, are among the top ten oil palm conglomerates.) Sinar Mas and Raja Garuda Mas operate large pulp processing mills that are directly linked to affiliated paper production mills. Both groups established holding companies, Asia Pulp and Paper (APP) and Asia Pacific Resources International, Ltd (APRIL). Incorporated in Singapore, they attracted enthusiastic and substantial investment from foreign investors. However, the groups' glittering prospectuses did not survive the more open atmosphere following the political changes of 1998, including revelations about the insecurity of future sources of cheap fiber supply. Both APP and APRIL are now in severe financial trouble, facing massive debt and legal action from creditors.[25]

Although pulpwood plantations can be economically attractive to investors because of strong demand and a growing period shorter than that for sawnwood plantations, they still supply only a small fraction of the raw material needed for the booming pulp industry. Production of 1 ton of pulp requires 4.9-5.4 m^3 of roundwood. Thus pulp production in 2000 consumed 23-25 million m^3 of wood – more than the entire legal wood supply that year. (*See Table 3.4.*) At the same time, production of pulpwood from HTIs was only 3.8 million m^3. Production data for industrial plantations must be treated with caution, however. At present, therefore, as much as 85 percent of the industry's pulpwood needs is coming from clearing natural forests, many of them lying within HTI concessions. One recent study estimates that pulp production led directly to

deforestation of about 835,000 ha between 1988 and 1999 (Barr, 2000:10). Nearly all this area was cleared to supply just four large pulp mills, and a single mill, Indah Kiat Pulp and Paper, owned by Sinar Mas/APP, was responsible for over one third of the total area deforested (Barr, 2000:10). The Indah Kiat mill accounts for nearly 80 percent of APP's pulp production capacity and over 40 percent of Indonesia's total pulp production.

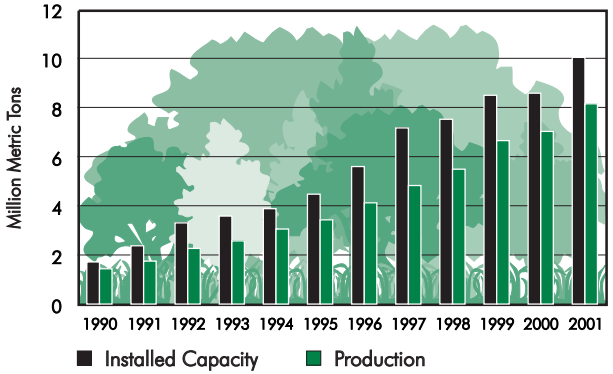
The country's second largest mill, Riau Andalan Pulp and Paper (RAPP), part of the APRIL holding company, further illustrates the disturbing trend toward use of natural forest to supply wood. RAPP began operating in 1995 and, as of December 2000, had installed capacity of 1.3 million tons per year. Assuming an average conversion rate of 5 m^3 of roundwood to 1 ton of pulp, RAPP consumed up to 6.5 million m^3 of wood in 2000. About 80 percent of the mill's pulpwood has been sourced from natural forest clearance on the company's nearby HTI concession site, and most of the balance has come from a plantation development project. RAPP has announced plans to expand capacity further to 2 million tons per year by 2004. The company has embarked on a vigorous planting program and claims that by 2004, its *current* roundwood needs will be met from plantations, and its *expanded* roundwood needs (10 million m^3 per year) will be met by 2008. Industry analysts familiar with RAPP's plantation program, however, are highly skeptical that the required area will in fact be planted or the necessary yields obtained (Barr, 2000:14-20). The holding group's current financial crisis also casts doubt on their expansion plans.[26]

Figure 3.7 Installed Capacity and Production in the Pulp Industry, 1990–2001 (with projections to 2005 and 2010)



Sources: *Indonesian Pulp and Paper Association, 29 August 2000. 2005 and 2010 projections from Jaakko Poyry, 1998. Cited in C. Barr. 2000. Profits on Paper: The Political-Economy of Fiber, Finance, and Debt in Indonesia's Pulp and Paper Industries. CIFOR: Jakarta. November 30.*

Figure 3.8 Installed Capacity and Production in the Paper and Paperboard Industry, 1990–2001



Source: *Indonesian Pulp and Paper Association.*

Note: *Paper and paperboard includes: Newsprint Paper; Writing and Printing Paper; Sack Kraft Paper; Liner and Fluting; Boards; Cigarette Paper; Wrapping Paper; Tissue Paper; and Other Paper (not including recycled paper).*

The two giant mills, Indah Kiat and Riau Andalan Pulp and Paper, are located within 100 km of each other in Riau province, Sumatra. With such a concentration of demand, it is not surprising that the pulp industry is unable to meets its raw material needs from plantations or other legal supplies and thus makes extensive use of illegally obtained wood.

The government is aggressively pushing for the development of similar facilities over the next decade. With the continuing vast imbalance between the supply of plantation pulpwood and the pulp industry's demand for raw materials, it seems inevitable that the pulp industry will be a powerful

Table 3.7 Forested versus Nonforested Area in Six Industrial Timber Plantation (HTI) Concessions

Company	Total Area (Ha)	Forest Area (Ha)	Nonforest Area (Ha)
PT. Eucalyptus Tanaman Lestari	298,900	253,525 (84.8%)	15,330 (15.2%)
PT. Okaba Rimba Makmur	283,500	256,464 (90.5%)	27,036 (9.5%)
PT. Maharani Rayon Utama	206,800	203,570 (98.4%)	3,230 (1.6%)
PT. Jati Cakrawala	19,170	6,563 (34.2%)	12,607 (65.8%)
PT. Riau Abadi Lestari	12,000	7,015 (58.4%)	4,985 (41.6%)
PT. Mentaya Kalang	10,000	6,651 (66.5%)	3,349 (33.5%)
Rounded Average		**72%**	**28%**

Source: Feasibility studies prepared by each company and provided to the Ministry of Forestry, pursuant to granting of their licenses.
Note: Forest area = primary forest and logged forest; nonforest area = scrub, lands under local cultivation, settlements, and grassland.

engine of deforestation over the coming decade. And although the amount of pulp harvested on HTI plantations is likely to grow, it is also likely that the development of HTI concessions will continue to serve primarily as a cover for clear-cutting natural forest. The results will be intensified deforestation, with associated negative impacts on biodiversity and hydrological functions and an increase in the area of degraded lands. In addition, HTI development has already given rise to significant local social conflicts in the many cases where allocated HTI areas overlap with agricultural and forest areas claimed by local communities. Such conflicts are likely to spread as HTI areas expand.

Table 3.8 HPH Logging Concessions Converted to HTI Concessions to 1998, by Province

Province	HPH Area Converted to HTI Concessions (Ha)
Aceh	133,010
Jambi	168,648
Riau	534,094
West Sumatra	3,847
South Sumatra	113,251
North Sumatra	120,234
Sumatra	**1,073,084**
West Kalimantan	486,827
South Kalimantan	194,513
Central Kalimantan	286,255
East Kalimantan	614,913
Kalimantan	**1,582,508**
South Sulawesi	16,963
Maluku	68,551
Irian Jaya	14,945
TOTAL	**2,756,051**

Source: Ministry of Forestry, 1998.

3.5 Oil Palm and Other Large-Scale Industrial Estate Crops

Estate crops – the generic term for agricultural crops grown in a plantation system – include tea, coffee, cocoa, rubber, sugarcane, coconut, and oil palm. The oil palm (*Elaeis guineensis*) originated in West Africa. It was brought to Indonesia in 1848 by the Dutch and planted in the Botanical Gardens in Bogor, Java. Oil palms now cover more than 3 million ha, rivaling rubber plantations in extent and export value. Palm oil is extracted from the fruit of the tree and is widely used as cooking oil and as an ingredient in soap, margarine, and a variety of other products.

The majority of existing oil palm plantations are located in Sumatra, but expansion is proceeding rapidly in Kalimantan, especially West Kalimantan. Further rapid development of this crop is expected to occur in East Kalimantan, Sulawesi, and Irian Jaya. Although rubber, tea, and coconut plantations are each more extensive than oil palm plantations, they are older, more established crops that have experienced much lower growth rates. They are not generally considered a major factor in recent deforestation; even so, their cumulative impacts are probably underemphasized. (*See Chapter 3.6.*)

The distribution of estate crops on Sumatra is shown in Map 10. The map is based on information from the National Forest Inventory and is out-of-date, but it remains the most recent spatial information available. In particular, the information appears to underreport more than 600,000 ha of oil palm plantations in North Sumatra province (Casson, 2000:48).

The Rise of Palm Oil

Palm oil production is booming in developing countries because the oil palm is relatively cheap to grow and produces yields up to five times those of other oil crops. Indonesia is second only to Malaysia in its production of palm oil. According to *Oil World Annual 2001*, global production in 2000 was 21.8 million tons, of which Indonesia accounted for 7 million tons (32 percent).[27] Palm oil is an important source of Indonesian export revenue, generating more than US$1 billion in 1999 (at 1993 constant prices) (Scotland, 2000). However, more than 40 percent of the annual harvest is consumed domestically. According to provisional data for the 2000-2001 reporting period, Indonesia consumed about 3 million tons of its palm oil production and exported about 4.3 million tons. By far the largest importer was India, followed by China and the Netherlands.

The growth of the palm oil industry in Indonesia has been phenomenal, with production growing 36-fold since the mid-1960s. The industry is dominated by three classes of producer: state-owned, smallholder, and large-scale private. The Suharto government, with World Bank assistance, invested in state-run companies from the late 1960s, and the area of oil palm on state-owned plantations rose steadily over the next decade. Smallholder estates expanded after 1979, again owing to government intervention and World Bank support. (*See Chapter 3.6.*) Plots of land were prepared by private developers, then transferred to small farmers; the private developers supervised smallholder operations and also purchased their crops. The large-scale private plantation sector grew most rapidly after 1986, again with government encouragement. Companies were given a range of incentives, including access to credit at concessionary rates for estate development, planting, and processing

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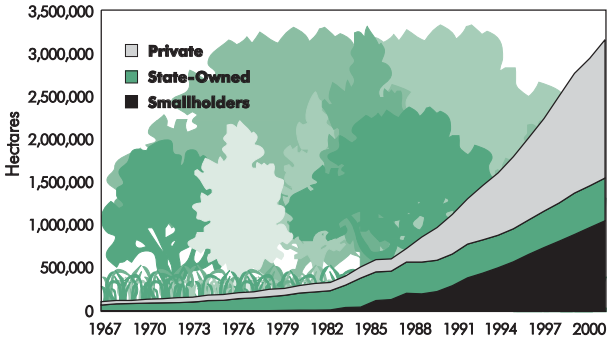
facilities. Between 1967 and 2000, the total area under oil palm plantations grew from less than 200,000 ha to over 3 million ha. (*See Figure 3.9.*)

Private Sector Concentration in the Palm Oil Industry

Indonesia's palm oil industry is dominated by some of the same conglomerates that control the logging, wood processing, and pulp and paper industries, thus tightening the connections among forest clearance, wood supply, and plantation establishment. In 1997, the private estate sector was dominated by 10 groups that, together, owned about 64 percent of the total planted area owned by private firms. In addition, these 10 groups owned "land banks" (land that has been approved for development as plantations) totaling nearly 3 million ha (Casson, 2000:5). Of these 10, 4 also held major logging concessions in 1997. (*See Table 3.9.*)

Foreign investment is also considerable: at the end of 1998, 50 foreign firms were involved in the oil

Figure 3.9 Growth in Area of Oil Palm Plantations, 1967–2000



Source: *Ministry of Forestry, Directorate-General of Plantations.*

palm sector, with total investments valued at US$3 billion (Kartodihardjo and Supriono, 2000:4). Indonesia's state-owned forestry companies are also increasingly involved in the plantation business. In 1998, the Ministry of Forestry officially permitted the Inhutani Groups I-V to convert 30 percent of their concession areas to estate crops, including oil palm (Casson, 2000:18). A prime reason is that tree crops, unlike timber, are a short-term investment and can be expected to improve cash flow quickly.

Table 3.9 Land Holdings of Top Oil Palm Conglomerates, 1997

Group	Total Land Bank Area (Ha)	Total Area Planted (Ha)	Major Logging Concession Holder
Salim	1,155,745	95,310	✓
Sinar Mas	320,463	113,562	✓
Texmaco	168,000	35,500	
Raja Garuda	259,075	96,330	✓
Astra	192,375	125,461	
Hashim	244,235	105,282	
Surya Dumai	154,133	23,975	✓
Napan	245,629	78,944	
Duta Palma	65,800	25,450	
Bakrie	49,283	23,392	
Total 10 Groups	**2,854,738**	**723,206**	

Source: A. Casson. 2000. "The Hesitant Boom: Indonesia's Oil Palm Sub-Sector in an Era of Economic Crisis and Political Change." Center for International Forestry Research (CIFOR). Occasional Paper No. 29. ISSN 0854-9818. June 20.
Note: Total land bank area held by the top 10 companies is *in addition* to the total area planted.

Forest Clearance for Estate Crop Production

The development of estate crop plantations over the past 30 years has clearly been a major factor in deforestation, but it is difficult to present definitive data on the amount of forest that has been converted to estate crops. Official data sources vary widely and are inconsistent from year to year. According to one recent analysis, the total area of forest land converted to all forms of plantation between 1982 and 1999 was 4.1 million ha (Casson, 2000:48). Of this total, according to another study, 1.8 million ha of forest were converted to oil palm plantations between 1990 and 2000 (Wakker, 2000:6).

By law, plantations are required to be established only on forest land that has been officially designated for conversion to other uses. (*See "Conversion Forest" in Glossary.*) In practice, two powerful factors undermine the law. First, most conversion forest in Indonesia is available in the relatively undeveloped eastern part of the country, but most companies prefer to be in the west, closer to a labor force, processing infrastructure, and markets. Second, establishing plantations in forest land is doubly attractive because, having acquired a land-clearing licence (IPK), a company can clear-cut the area and sell the timber to wood-processing indus-

Box 3.5 Illegal Use of Logging Concession Land for Oil Palm in Northern Sumatra

The Leuser Conservation Foundation (Yayasan Leuser Lestari), an NGO based in Medan, North Sumatra, carried out field investigations of the practices in 13 logging concessions (HPHs) located in northern Sumatra. The investigations found that logging concessions were actively being converted to the cultivation of oil palm in 8 of the HPHs. Such clearing is illegal under both Indonesia's forestry laws and the terms of the contracts under which HPHs are granted.

The NGO investigators documented the location of the illegal oil palm plantings using GPS technology. They also documented the process of illegal conversion and planting through tape-recorded interviews with HPH workers, local day laborers, and villagers living nearby. Observations were also made directly in the field and documented with still and video cameras.

Forest clearance was carried out by both local people and concession workers at the request of the companies and under their supervision. The companies then provided the necessary equipment and seedlings to establish oil palm plantations. In some cases, an oil palm unit of the concession company would then request an official permit for oil palm cultivation in the area; in other cases, the request was put forward by a local village cooperative unit. Sometimes a local bureaucrat with the power to grant an oil palm concession was in fact found to be an owner of the involved oil palm company.

Companies tend to justify the apparently widespread practice of converting permanent production forest to oil palm by pointing to the poor condition of the forest in the area being converted and to the ostensible greater benefits to the local community that would follow conversion to oil palm. Thus forest degradation and illegal conversion to oil palm, rather than being punished, provide the justification for granting the company or its partner company a further concession on public land.

Source: Leuser Conservation Foundation, 2000.

tries. This arrangement may represent a windfall profit, over and above the profits expected from future palm oil harvests. In many instances, plantation owners are also concession operators, so the "sale" of such cleared wood represents a simple transfer from one company to another within the same group, at rock bottom prices. As described in Section 3.2, timber from forest clearance provided approximately 30 percent of (legal) wood in the second half of the 1990s, and it has become an indispensable source of supply, especially to the pulp industry. Companies therefore are vigorously pursuing applications for the release of forest land for conversion, even where the forest has previously been designated as production, protection, or even conservation forest. (*See Box 3.5.*)

It appears that some companies have no intention of establishing plantations but instead pursue conversion licenses solely for the timber profits that can be realized through forest clearance. In West Kalimantan, for example, the head of the Plantation Service threatened to revoke the licenses of 21 companies and warned 29 others because of their failure to establish plantations as agreed (Sunderlin, 1999:564). Map 11 shows the extent of plantations established in former logging concessions; the data are from the early to mid-1990s and do not reflect the nearly 50 percent increase in oil palm area that occurred between 1995 and 2000, some of it in former concessions.

Competition for Forest Land

The area actually planted and in production is reasonably well known for the major commercial crops, but much confusion surrounds the status of estate concessions – areas that are *under application* by companies for development, areas that have been *allocated* (agreed in principle) by government officials for development, and areas that have been *released* to companies for development. Vast tracts of forest land are under application for conversion to estate crops but have not yet been developed. Some have been cleared but not planted. Applications, and indeed allocations, for estate crop development frequently overlap with competing claims for development as industrial timber plantations or with forest that is not designated for conversion at all. If all applications currently outstanding were granted, they would greatly exceed the area of conversion forest that is legally available for development.

Two recent studies have produced conflicting but illustrative evidence of the situation. Table 3.10,

based on Kartodihardjo and Supriono, indicates that by the end of 1997, nearly 7 million ha of forest had been approved in principle for conversion to estate crop plantations. All data should be regarded as approximate.

In addition to the 6.8 million ha approved for plantation development, a further 9 million ha are the subject of applications for development, according to Kartodihardjo and Supriono. Even without taking into account these 9 million ha, if the 6.8 million ha already approved for conversion are in fact all converted to plantations, Sumatra and Kalimantan face serious shortfalls in available forest land. A study by Casson came to somewhat different conclusions, finding that applications for the release of some 4.5 million ha of forest for conversion were outstanding as of February 1999. About 840,000 ha were already approved, 70 percent of them for oil palm. Nearly all the applications applied to forest land in Sumatra and Kalimantan.

Whether the higher or lower numbers are more accurate, approval of the existing applications for conversion would lead to deficits in the availability of conversion forest in Sumatra and Kalimantan. This situation results in part from the declining availability of conversion forest area. In 1981, more than 33 million ha of forest were allocated for conversion; by 1990, the number had fallen to 19 million ha and by 1997, to between 8 and 9 million ha. The squeeze on conversion forest in the west stems also from the industry's reluctance to establish plantations in the east. However, the situation is beginning to change. Some oil palm companies are waking up to the possibilities of the timber that can be harvested from the rich forests of East Kalimantan and Irian Jaya. The majority of companies that have begun operations in these regions have strong ties to logging companies (Casson, 2000:23). Meanwhile, the shortage of conversion forest in Sumatra and Kalimantan has encouraged the government to release production forest in these islands for conversion to estate crops and to allocate broad swaths of forest in more remote locations. (*See Box 3.6.*)

The obvious solution would appear to be policy reforms that require companies to establish new plantations not in conversion forest, as at present, but on the millions of hectares of land already cleared (for estate crops or industrial timber plantations) but never planted, and on land already degraded by severe fires. This change does not appear likely in the short term. According to recent unpublished Ministry of Forestry data, the latest revisions of Permanent Forest Status have *increased* allocated conversion forest area to nearly 14 million ha. All the new conversion forest is located in Maluku and Irian Jaya, where Indonesia's most extensive remaining intact forests are found.

Table 3.10 The Balance Between Designated Conversion Forest Area and Applications for Conversion of Forest to Plantation Crops

Province/Region	Permanent Forest Status (Ha)	Actual Forest Cover (Ha)	Conversion Forest (Ha)	Applications Approved (Ha)	Surplus/Deficit of Applications Approved and Conversion Forest Available (Ha)
Sumatra	22,451,907	16,632,143	1,559,583	4,080,530	-2,520,947
Kalimantan	35,342,638	31,512,208	847,958	2,056,300	-1,208,342
Sulawesi	11,792,212	9,000,000	618,419	366,890	251,529
Java, Bali, and Nusa Tenggara	6,691,298	2,406,675	352,667	—	352,667
Maluku	4,959,775	5,543,506	2,034,932	—	2,034,932
Irian Jaya	32,737,449	33,160,231	2,671,275	292,780	2,378,495
TOTAL INDONESIA	**113,975,279**	**98,254,763**	**8,084,834**	**6,796,500**	**1,288,334**

Sources: Columns 1-4: D. Holmes, 2000, "Deforestation in Indonesia: A Review of the Situation in 1999." (Jakarta, Indonesia: World Bank, July 3 draft), Table 2. Note that Actual Forest Cover in Java, Bali, and Nusa Tenggara was calculated by GFW. Column 5: H. Kartodihardjo and A. Supriono, 2000. "The Impact of Sectoral Development on Natural Forest Conversion and Degradation: The Case of Timber and Tree Crop Plantations in Indonesia." (Bogor, Indonesia: Center for International Forestry Research). Occasional Paper No. 26(E). ISSN 0854-9818, Table 3. Column 6: author's calculation.
Notes: The area of conversion forest given in Holmes (8,084,834) differs slightly from that given in Kartodihardjo and Supriono (8,418,000 ha). The areas of conversion forest surplus or deficit calculated in column 6 therefore differ slightly from those given in Kartodihardjo and Supriono. Note that recent, unpublished revisions to Permanent Forest Status appear to have increased allocated conversion forest area, to nearly 14 million ha. Numbers may not add due to rounding.

Box 3.6 Clearing Natural Forests for Plantation Development on Small Islands: The Case of Wawonii Island in Southeast Sulawesi Province

Land clearing for plantation purposes does not occur only in former logging concession areas. In some places, plantations are replacing relatively intact natural forests. This trend is particularly damaging for small islands, where levels of species endemism are high and local people depend heavily on natural forests for watershed protection and livelihood needs. Wawonii Island (40,480 ha) in Kendari regency, Southeast Sulawesi province, is one example. As of 1995 (the most recent data available), 45 percent of the island was forested, with some 9,275 ha zoned as state forests and an additional 8,758 ha held as community forests. Twelve rivers originate in the island's forests and, while the forest was maintained, Wawonii did not face the water supply problems of Buton and other islands in the area.

The situation changed when the provincial government granted a license to two companies, Hoga Prima Perkasa (HPP) and Hasil Human Utama (HHU), to convert some 5,500 ha of the island's natural forest area – about 30 percent of the total – into a cocoa plantation. Political connections played a prominent role in this deal because one of the owners of HPP is the son of the then-governor of the province.

Although the cocoa project was steadfastly opposed by several parties, including the affected local Wawonii communities, it went ahead as planned. Indeed, the two companies did not even wait for the government's official issuance of their concession to begin cutting and clearing the forest with heavy equipment; they cleared a 7 km access road 6 meters wide during their first 3 months of operation. Timber from this 42,000 ha swath was removed from the island by the firms, so it was not even available for local use. Local people are already reporting major changes in river flows, with previously clear waters becoming muddy and silt-choked.

A consortium of local NGOs and community groups have vocally opposed the project, pointing out that the companies began operation before receiving an official license to do so from the government, and that they never carried out the required environmental impact assessment procedure. The latest information received by Forest Watch Indonesia from Wawonii indicates that the two companies, having cut and removed a great deal of timber, are no longer operating on the island. This situation has heightened suspicions that the "cocoa plantation" scheme was merely a ruse to gain access to the timber available from land clearing for the project. As has been true on many similar small islands in Indonesia, grievous harm has been done to the local ecosystem and local livelihoods for the financial benefit of a few unscrupulous and politically connected businessmen.

Sources:

Kendari Central Bureau of Statistics, 1995. *Kendari dalam Angka* [Kendari in Numbers], 1995.

Interview with M. Yakub Azis, Head of The Group of Twelve (a local NGO coalition), 2000.

Kendari Express, February 21, 2000.

Field Investigations by Yayasan Suluh Indonesia and Yayasan Cinta Alam (local NGOs), 2000.

More Expansion May Be on the Way

Oil palm planting rates and production, which slowed abruptly following the 1997 economic crisis and the political confusion that followed, appeared set for renewed growth by 2000. The industry was encouraged by lower interest rates, a reduction in the export tax on crude palm oil, new government regulations that facilitate oil palm plantation establishment, and a surge in the availability of land for planting because of the great fires of 1997-1998. More recently, continued political uncertainty and economic crisis seem to have dampened recovery prospects. However, the global outlook for the industry is robust. World demand for palm oil is forecast to rise 40.5 million tons by 2020, nearly twice the output in 2000 (Oil World, 2001). One industry analyst has estimated that if world production is to increase by 20 million tons by 2020, an additional 300,000 ha of new plantations will have to be established every year for the next 20 years. The study predicts that most of this expansion would occur in Indonesia, "where labor and land remain plentiful" (Sargeant, 2001:vi).

Although oil palm development has so far occurred primarily in Sumatra, and South and West Kalimantan, the next phase of expansion seems likely to be in East Kalimantan and Irian Jaya. Large tracts of forest in these regions are already allocated as logging concessions or conversion forest. Recent government policy changes have paved the way for oil palm expansion into these same forests. In addition to increasing the area of allocated conversion forest in Irian Jaya and Maluku, the government has increased the incentive for companies to establish new plantations in production forest. Regulation No. 614/Kpts-II/1999 about Directives on the Development of Mixed Forest Plantings allows companies to establish timber plantations or estate crops in "nonproductive production forests." These are defined as logging concession forests containing less than 20 m^3 of timber per hectare. Sixty percent of the nonproductive area must be converted to timber plantations, and the rest may be used for estate crop plantations. The new Regulation clearly risks encouraging companies to overharvest their logging concessions, reduce them below the productivity threshold, and apply for conversion licenses that will allow them to clearcut the entire area (Wakker, 2000:27). The area of forest that will be cleared in these regions is likely to exceed what is actually planted, unless industry performance improves markedly.

3.6 Small-scale Farming

Indonesia's population now exceeds 212 million. The country is urbanizing rapidly, but 64 percent of the people (136 million) still live in rural areas, where the majority of the workforce is engaged in the agriculture and forestry sectors. Without doubt, the increasing population density in rural Indonesia has had a role in forest clearance, but the importance of small-scale farming relative to other causes of deforestation has been the subject of great controversy. Small farmers clear land to grow food for their families, plant tree crops to supplement their income, or establish small-scale plantations of cash crops like oil palm and rubber. The clearance rate fluctuates with government development policy, the cost of living, commodity prices, available technologies, weather patterns, the availability of alternative work, and other factors.

Shifting Cultivation

During the 1980s and 1990s, shifting cultivation was widely blamed as a significant, perhaps even the dominant, cause of deforestation in Indonesia. Prominent reports by the FAO and the World Bank claimed that the "slash and burn" practices of traditional farmers, combined with high rates of rural population growth, were placing unsustainable pressure on forest resources. Subsequent analysis has shown that the assumptions behind this claim were oversimplistic, stemming from a failure to distinguish among different types of small-scale farming (Sunderlin, 1997). Traditional shifting cultivation involves mainly subsistence crops grown in a rotational system that includes a long fallow period. Land is used for only 1-3 years, then fallowed for up to 20 years, allowing regrowth of vegetation and restoration of soil fertility. At the opposite end of what has been dubbed the "forest farming continuum" are pioneer farmers, who clear forest land for the long-term production of cash crops, typically coffee, cocoa, rubber, and other tree crops.

Traditional farmers have responded to land pressure by shortening their fallow periods and turning to cash crop cultivation to supplement their incomes. While it would be naive to ignore this source of pressure on Indonesia's natural forests, recent commentators have downplayed the role of shifting cultivators in deforestation. One influential study estimated that traditional farmers may be responsible for no more than 21 percent of total forest loss (Dick, 1991). Given the scale of forest clearance for timber and estate crop plantations since that study, and the acceleration of logging operations since 1997, even this estimate may exaggerate the role of shifting cultivation in deforestation today.

Forest Pioneers

Forest pioneers, as the name implies, are farmers who open up new land for agricultural production. They may grow subsistence food crops, but their primary business is cultivating cash crops for sale both domestically and in international markets. Many forest pioneers are "spontaneous transmigrants" who voluntarily relocate to take advantage of abundant land in more sparsely populated parts of the country or to escape from civil unrest and conflict at home. Logging roads, plantation development, and the infrastructure associated with government-sponsored transmigration sites all provide opportunities for small farmers to follow with land clearance of their own. In the absence of comprehensive surveys, it is impossible to estimate the amount of forest land cleared by pioneer farmers. Not all newly cleared land was formerly forest, and anecdotal evidence suggests that the impact of newcomers is sometimes exaggerated by local farmers who see their lands and traditional practices threatened.[28] Nevertheless,

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pioneer farmers are known to be encroaching on natural forests, including those in national parks and other protected areas. Such encroachment has increased with the breakdown of political authority and law enforcement since 1998.

Small-scale Tree Crop Cultivation and Smallholder Plantations

Indonesia is a world giant when it comes to tree crop production. The country is the second largest producer of palm oil and natural rubber, the third largest producer of cocoa, and the fourth largest producer of coffee.[29] With the exception of oil palms, the great majority of these crops are grown by small-scale farmers. Large-scale oil palm plantations have attracted the ire of environmental organizations because they have so visibly affected forest cover, but the extent of smallholder tree crops and their role in forest clearance have probably been understated.

Box 3.7 Transmigration and Forest Clearance

Transmigration, the government's long-running program to resettle people from densely populated Java and Bali to Sumatra, Kalimantan, and the other "outer islands," opened up 1.7 million hectares of agricultural land and transported some 8 million people between 1969 and 1993 (GOI, 1993).

Transmigration sites were commonly established in one of three patterns. Between the 1960s and 1980s, transmigration focused on developing subsistence agriculture. The Food Crop Pattern allotted each transmigrant household 2 ha of farmland, of which half was cleared and ready for use and half was still forested and awaiting clearance. During the 1990s, until the formal end of the Transmigration Program in 1999, the emphasis shifted away from subsistence agriculture and toward providing wage labor on industrial timber estates and oil palm plantations. The People's Nucleus Plantation Pattern involved associations between private oil palm companies (the nucleus or *Inti*) and transmigrant families (the *Plasma*). Each household received 3 ha of land, of which 2 ha were to be developed for oil palm. The Industrial Timber Estate Pattern involved transmigrant families receiving land in exchange for their labor on privately owned timber plantations. In addition, families received land on which to establish their own crops.

Almost 39 percent of timber estate areas that have actually been planted lie in transmigration sites (Potter and Lee, 1998), and nearly 1 million ha of oil palm plantations with a formal link to transmigration sites had been established by the end of 1995.

The actual impacts of transmigration projects on forests have probably been greater than these numbers imply, given the often poor site choices and the land-clearing practices employed. Transmigrant families who were (and are still) unable to support themselves from their allotted site typically strayed into neighboring unallocated forest. In addition, their presence often increased the land pressure felt by indigenous inhabitants, leading to further forest clearance.

Transmigration projects have sometimes encroached on national parks, as in the case of Wasur National Park in Irian Jaya. Wasur covers 413,810 ha of seasonally inundated grasslands, mangrove forests, monsoon forests, and savanna in Irian Jaya's far southeast corner, bordering New Guinea and the Arafura Sea. Although gazetted as a national park, the government nevertheless gazetted a transmigration area covering 3,000 ha around the traditional village of Sota within the park in 1994, legally backed up by the issuance of various government decrees (Decree, 1994;

Box 3.7 *(continued)*

Site Allocation Letter, 1994; Decree, 1995). The main rationale for creation of this enclave was to bolster "security" in an area where the government was fighting separatist rebels, supplemented by the local government's desire to develop the area economically. A second transmigration area of 3,000 ha (Sota II) was designated for development soon thereafter, but it was postponed because of criticism from NGOs and donor agencies after the clearing of some 200 ha. Wasur is only one of the numerous transmigration sites developed in protected forest areas across Indonesia.

A 1994 World Bank evaluation of the US$560 million in loans it made to Indonesia for the program during the 1970s and 1980s concluded that land clearing was not carried out according to agreed legal and contractual guidelines. Slopes over 8 percent had been cleared, trees were bulldozed into waterways, erosion measures along contours were not taken, and no attempt was made to harvest the commercial timber left partly burned in the field after clearance. Impacts on local communities, particularly traditional indigenous groups, have been extremely negative. In the case of the forest-dwelling Kubu of Sumatra, for example, the report concluded that "there has been a major negative and probably irreversible impact" (World Bank, 1994).

Official data on the number of families moved under the Transmigration Program and the total area of land cleared are often widely divergent. Table 3.11 presents two Ministry estimates of forestland cleared under the program.

Sources:

Decree of the Regional Forestry Office No. 848/KWL-6.C/1994 Regarding Relinquishment of Wasur Wildlife Management Forest Area for a Settlement for Retired Army Officers in Sota Village; Site Allocation Letter of the Merauke Regent No. 95/1994, June 12, 1994; and Decree of the Minister of Forestry No. 1639/Menhut-VI/1995, November 14, 1995.

Government of Indonesia, 1993. *Sixth Five Year Development Plan*. Jakarta: National Development Planning Agency.

Potter, L. and J. Lee. 1998. *Tree Planting in Indonesia: Trends, Impacts, and Directions*. Occasional Paper No. 18. Center for International Forestry Research (CIFOR), Bogor, Indonesia.

World Bank. 1994. *Indonesia Transmigration Program: A Review of Five Bank-Supported Projects.* Report No. 12988, Washington, DC.

In recent years, small-scale tree crop production has expanded rapidly from an already large base as farmers sought to increase their income and establish a hedge against volatile crop prices. Tree crops are often established in forest clearings near agricultural fields, so they are implicated in deforestation. Although many families plant trees independent of government help, many others participate in smallholder development schemes that provide farmers with money and access to land (in the form of forest conversion rights). Farmers typically manage tree crop plantations of 1-5 hectares. A study of 8 villages in Riau province, Sumatra, found that 80 percent of households had traditional (low-yield) rubber gardens of 2.5-3.5 ha, and just over 10 percent had high-yielding rubber plantations established through the Smallholder Rubber Development Program (Angelsen, 1995:1721-22). The total area of rubber managed by the villagers (excluding transmigrant families) was about 12,000 ha, the equivalent of one quarter of the secondary forest in the study area.

Given the fuzzy boundary between small-scale tree crop cultivation and smallholder plantations, the numbers that follow do not attempt to distinguish between them. Small farmers today manage about one third of the total area under oil palm plantations in Indonesia, just over 1 million ha, according to the latest Ministry of Forestry data. Small farmers are far more dominant in the rubber subsector, managing about 3 million ha in 1997, more than 80 percent of the total rubber plantation area in that year (Kartodihardjo and Supriono, 2000:3). The number of hectares is surely higher today.[30] Mature coconut plantations producing copra covered about 2.7 million ha in 2000, but this figure does not

include immature coconut trees or trees not used for copra production (Oil World, 2001). Coffee plantations covered an estimated 1.1 million ha in 2000.[31]

From the mid-1980s, the government actively encouraged smallholders to establish plantations, especially of oil palm. Some farmers already lived around the boundaries of existing large oil palm estates; others arrived as part of transmigration settlement schemes. (*See Box 3.7.*) Smallholder oil palm plantations grew by nearly 1 million ha between 1986 and 1996. Small-scale rubber, coffee, and coconut plantations cover significantly more land in total, but they experienced much lower growth rates than oil palm during the decade. Their impact on deforestation over this period was therefore relatively minor. However, small-scale rubber planting appears to have grown significantly since 1997, despite low prices for rubber (Sunderlin et al., 2000:23-24).

Smallholders who establish plantations generally do not clear primary forest because they lack the necessary equipment. Rather, they tend to use secondary forest, degraded land, or plantations abandoned by conglomerates. Smallholders, however, do contribute to forest clearance associated with larger-scale private development because they continue to benefit from government-sponsored clearance programs. Of the nearly 7 million ha of conversion forest officially approved for estate crop development by 1997, nearly 1 million ha were designated for development under the smallholder plantation program (Kartodihardjo and Supriono, 2000:7).

Table 3.11 Forest Area Released for Transmigration Site Development, to 1998

	Ministry of Forestry Data (1998)		National Forest Inventory Data (1998)
Province	**Number of Sites**	**Area** (Ha)	**Area** (Ha)
Aceh	12	39,376.65	39,594.67
North Sumatra	12	28,530.44	22,549.85
West Sumatra	12	26,992.25	13,472.80
Riau	17	75,448.78	64,575.19
Jambi	12	76,489.53	256,657.33
Bengkulu	9	26,809.45	12,032.95
South Sumatra	30	123,195.28	104,221.82
Lampung	17	138,401.20	10,918.23
Sumatra	**121**	**535,243.58**	**524,022.84**
West Kalimantan	17	49,199.16	43,434.35
Central Kalimantan	27	66,135.77	133,500.79
South Kalimantan	10	47,711.50	40,928.63
East Kalimantan	9	39,891.09	74,711.38

Small Farmers and the Economic Crisis

Palm oil, rubber, coffee, cocoa, copra, black and white pepper, cinnamon, and other smallholder products are primarily export crops. Small farmers are therefore exposed to fluctuations in international commodity prices and to shifts in the value of the Indonesian rupiah against the U.S. dollar. The central impact of the economic crisis that began in 1997 has been the precipitous depreciation of the rupiah. Beginning in July of that year, the rupiah prices of black pepper, white pepper, coffee, and cocoa rose by as much as 450 percent, only to fall again in mid-1998. The prices of palm oil, rubber, and cinnamon,

Table 3.11 (cont.) Forest Area Released for Transmigration Site Development, to 1998

	Ministry of Forestry Data (1998)		National Forest Inventory Data (1998)
Province	**Number of Sites**	**Area** (Ha)	**Area** (Ha)
Kalimantan	**63**	**202,937.52**	**292,575.15**
South Sulawesi	8	11,622.65	7,696.96
Central Sulawesi	18	39,464.23	32,858.56
North Sulawesi	6	21,257.56	5,506.46
Southeast Sulawesi	26	56,161.21	56,126.63
Sulawesi	**58**	**128,505.65**	**102,188.61**
West Nusa Tenggara	2	2,950.00	3,737.25
East Nusa Tenggara	no information	no information	no information
Nusa Tenggara	**2**	**2,950.00**	**3,737.25**
Maluku	**11**	**23,776.58**	**28,388.33**
Irian Jaya	**22**	**117,194.48**	**128,028.00**
TOTAL	**521**	**1,880,244.56**	**2,001,464.03**

however, rose only modestly before dipping below their 1997 levels, reflecting weak world prices. Small-scale producers experienced marked effects on their incomes, both positive and negative.

Evidence suggests that the uncertainty and volatility experienced by small farmers since 1997 led to an increase in rates of forest clearance. A recent study of more than 1,000 small farmer households in Sumatra, Kalimantan, and Sulawesi examined the effects of the crisis in terms of farmers' perceptions of their standard of living and their adaptive responses (Sunderlin et al., 2000). Despite marked regional differences, the study revealed that farmers did not benefit from windfall export profits as much as might be expected because the costs of living and agricultural production rose faster than gross income. As a result, farmers turned to the forests to compensate for lost earnings. Nearly 70 percent of the farmers said they had cleared new land between 1996 and 1999, with the amount of land cleared each year rising sharply after the economic crisis (1998-1999). Forest clearance yielded income from timber, and the land could then be planted to food crops or, increasingly, export-oriented tree crops. The study concluded that forest clearance was strongly linked to price changes and also to the decreased policing of forest boundaries that followed Suharto's fall in 1998.

FWI Sumatra

CHAPTER 4
FOREST AND LAND FIRES

4.1 From Normal to Abnormal Fires

One of the most visible results of the 30-year spiral of forest mismanagement discussed in Chapter 3 has been the increasing frequency and intensity of forest and land fires, particularly on Kalimantan and Sumatra. Undisturbed tropical moist forests, which are normally quite fire-resistant, will burn only after periods of extended drought. Logged-over forests, degraded forests, and scrub on deforested lands are much more fire-prone (Schindler et al., 1989).

Scientific evidence based on radiocarbon dating of charcoal deposits in East Kalimantan indicates that lowland forest areas have repeatedly burned since at least 17,500 years ago, during periods of extended drought that appear to have characterized Quaternary glacial periods (Goldammer, 1990). The earliest fires are thought to have had natural causes, but humans probably had a role in starting fires in recent millennia, first to improve hunting opportunities and later to clear agricultural plots. But although fire has been a feature of Indonesia's forests for thousands of years, earlier fires were undoubtedly smaller and more spread out over time than those of the past 2 decades. As a result, these earlier fires did not cause significant deforestation, illustrated, for example, by the fact that most of Kalimantan was forested until relatively recently (Barber and Schweithelm, 2000).

The processes of forest degradation and deforestation discussed in Chapter 3 have transformed vast areas of Indonesia's forest estate from a fire-resistant to a fire-prone ecosystem. This fundamental change, combined with the periodic occurrence of the El Niño climatic phenomenon,[32] has set the stage for the massive outbreaks of fire over the past 20 years.

4.2 The Fires of 1982–1983 and 1994

The first great fire to result from the convergence of Suharto-era forest management and an El Niño event engulfed 210,000 km^2 of East Kalimantan province during 1982-1983. East Kalimantan was the first focus of Indonesia's timber boom and had been almost wholly divided into logging concessions during the 1970s. Logging practices were generally poor, leaving a vast accumulation of logging waste in the forest. Pioneer and secondary species grew rapidly in logged-over areas, forming a dense and fire-prone ground vegetation layer in place of the sparse ground cover characteristic of primary rainforests.

A severe El Niño-induced drought struck the area between June 1982 and May 1983, and fires started almost simultaneously across wide areas of the province at the end of 1982. They burned out of

control until the rains finally returned the following May. By that time, some 3.2 million ha had burned; of this area, 2.7 million ha were tropical rainforest. Damage varied from creeping ground fires in primary forests to complete destruction of newly logged areas and peat-swamp forests. Some 73,000 ha of commercially valuable lowland dipterocarp forests were badly damaged and another 2.1 million ha lightly or moderately damaged. The degree of fire damage was directly correlated with the level of forest degradation: only 11 percent of undisturbed primary forests in the areas affected by the drought and fires actually burned, damage was limited to ground vegetation and the forest had completely recovered by 1988. By contrast, in an area of nearly 1 million ha of "moderately disturbed" forest (80 percent of which had been logged prior to the fires), 84 percent of the forest burned and the damage was much more severe (Schindler et al., 1989).[33] One estimate put the costs of the 1982-1983 fire at some US$9 billion, of which nearly US$8.3 billion was accounted for by the loss of standing timber (Hess, 1994).

Widespread fires reoccurred several times in the decade following the East Kalimantan fire, burning an estimated 500,000 ha in 1991 and nearly 5 million ha in 1994 (BAPPENAS, 1999). Haze from these fires affected Singapore and Malaysia as well as Indonesia, disrupting air and sea transportation and sharply elevating air pollution levels. In the aftermath of the fires, the government began developing new policies, international aid agencies increased their support for fire-related programs, and for the first time the Association of Southeast Asian Nations (ASEAN) began to discuss Indonesia's fires as a regional problem (State Ministry for Environment and UNDP, 1998). Yet forest degradation and deforestation in Indonesia continued to intensify during the 1990s, with increasing pressure on forest lands from developers of oil palm and timber plantations.

4.3 The Fires of 1997–1998

When the next severe El Niño-induced drought struck Indonesia in 1997-1998, the results were catastrophic. By early 1998, nearly 10 million ha had been affected by fire (*see Table 4.1*) with damages estimated at nearly US$10 billion. (*See Table 4.2*.) Smoke from these fires shrouded much of Southeast Asia in haze for months.[34]

It was clear by early1997 that it would be an El Niño year in Indonesia but, despite warnings from the Environment Ministry, burning continued across vast areas of Sumatra and Kalimantan, primarily to clear degraded forest land and scrub for plantations. The use of fire for land clearance is not restricted to

Table 4.1 Estimated Area Damaged by Fire in 1997-98 (ha)

ISLAND	Montane Forest	Lowland Forest	Peat and Swamp Forest	Dry Scrub and Grass	Timber Plantation	Agriculture	Estate Crops	TOTAL
Kalimantan		2,375,000	750,000	375,000	116,000	2,829,000	55,000	6,500,000
Sumatra		383,000	308,000	263,000	72,000	669,000	60,000	1,756,000
Java		25,000		25,000		50,000		100,000
Sulawesi		200,000				199,000	1,000	400,000
Irian Jaya	100,000	300,000	400,000	100,000		97,000	3,000	1,000,000
TOTAL	**100,000**	**3,100,000**	**1,450,000**	**700,000**	**188,000**	**3,843,000**	**119,000**	**9,756,000**

Source: National Development Planning Agency (BAPPENAS), 1999. "Final Report, Annex I: Causes, Extent, Impact and Costs of 1997/98 Fires and Drought." Asian Development Bank Technical Assistance Grant TA 2999-INO, Planning for Fire Prevention and Drought Management Project.

Table 4.2 Summary of the Economic Cost of the 1997-98 Fires and Haze

Sector	Estimated Economic Losses (US$ millions)		
	Minimum	Maximum	Mean
Agriculture			
Farm Crops	2,431	2,431	2,431
Plantation Crops	319	319	319
Forestry			
Timber from Natural Forests (logged and unlogged)	1,461	2,165	1,813
Lost Growth in Natural Forest	256	377	316
Timber from Plantations	94	94	94
Non-Timber Forest Products	586	586	586
Flood Protection	404	404	404
Erosion and Siltation	1,586	1,586	1,586
Carbon Sink	1,446	1,446	1,446
Health	145	145	145
Transmigration and Buildings and Property	1	1	1
Transportation	18	49	33
Tourism	111	111	111
Fire Fighting Costs	12	11	12
TOTAL	**8,870**	**9,726**	**9,298**

Source: National Development Planning Agency (BAPPENAS), 1999. "Final Report, Annex I: Causes, Extent, Impact and Costs of 1997/98 Fires and Drought." Asian Development Bank Technical Assistance Grant TA 2999-INO, Planning for Fire Prevention and Drought Management Project.

Kalimantan and Sumatra: fires were reported from 23 of Indonesia's 27 provinces in 1997-1998. But plantation firms and government projects set an unusually large number of fires on the islands, clearing tens of thousands of hectares at a time. (*See Box 4.1.*) By July, the fires had created a blanket of haze that spread hundreds of kilometers in all directions. Deliberately set fires in grasslands and scrub lands escaped into adjacent logged forests that burned with greater intensity. The fires eventually reached drained peat swamps and burned beneath the surface long after above-ground fires exhausted their fuel supplies. Map 12 shows burned areas of forest under different kinds of land use in East Kalimantan.

Large-scale burning has produced persistent haze over large areas of Sumatra and Kalimantan during every dry season but the haze normally dissipates in September, when heavy rains extinguish the fires. This was not the case in 1997, however, when the rains failed, the fires intensified, and the haze thickened and spread to neighboring countries. Haze reached Malaysia and Singapore in July, and air quality deteriorated steeply in September, triggering an outburst of complaints that drew global media attention. By late September, approximately 1 million km^2 were haze-covered, affecting about 70 million people. Land, air, and sea transport accidents were linked to the poor visibility caused by the haze, including a ship collision in the Straits of Malacca that killed 29 people. Hospitals and clinics were filled with people seeking treatment for respiratory, eye, and skin ailments. Schools, businesses, and airports closed, and tourists stayed away, inflicting economic hardship on the region.

Box 4.1 The Oil Palm-Forest Fire Connection: Why Do People Set Fires?

The uncontrolled and destructive use of fire is closely associated with the development of oil palm in Indonesia for four principal reasons:

- Fire degrades the quality of forest lands and thus supports efforts to have areas of permanent forest estate (such as production forest) legally reclassified as forest areas available for conversion to plantation agriculture. With the availability of lands not classified as forest and suitable for oil palm plantation development declining, fire becomes a useful tool for increasing the stock of available land.
- In areas already allocated for oil palm development, fire is a cost-effective way of clearing the land. According to one firm operating in Central Kalimantan (Agro Indomas), land clearing by mechanical means is more than twice as expensive as setting fires.
- Oil palm fruits must be processed within 24 hours of harvest, so firms prefer to locate their processing facilities and transportation routes as near as possible to their plantations. But these accessible areas are usually already populated and farmed by local residents. To drive them out, oil palm firms hire outsiders to set fire to the lands of local people whose lands they want to take over. The fires reduce the value of the land by degrading it, then the companies can more easily take over, paying only token compensation to the original inhabitants.
- In some cases, local inhabitants also set fires to protest the takeover of their lands by oil palm firms.

Sources

Barber, C.V. and J. Schweithelm, 2000. *Trial By Fire: Forest Fires and Forestry Policy in Indonesia's Era of Crisis and Reform*. Washington DC: World Resources Institute.

Potter, L. and J. Lee. 1998. *Oil Palm in Indonesia: its Role in Forest Conversion and the Fires of 1997/98*. A report for WWF, Indonesia Programme. Jakarta, Indonesia.

Wakker, E. 2000. *Funding Forest Destruction: The Involvement of Dutch Banks in the Financing of Oil Palm Plantations in Indonesia*. Amsterdam, The Netherlands and Bogor, Indonesia: AIDEnvironment, in co-operation with Jan Willem van Gelder Contrast Advies and the Telapak Sawit Research Team. Commissioned by Greenpeace Netherlands.

After comparing satellite images of fire "hotspots" with land use maps, the government determined that most fires were occurring in timber and oil palm plantation areas, although small farmers were also implicated. It then announced a total ban on burning, accompanied by threats to punish offending firms. Yet even as fires burned out of control into surrounding forests, peat swamps, and agricultural lands, plantation owners and farmers started new fires to take advantage of the extremely dry conditions. These fires intensified the haze, which spread farther, resulting in health alerts and transportation disruptions across the region.

Efforts to put out the fires were largely ineffective, even with assistance from Malaysian volunteers and fire suppression aircraft from Australia and the United States. Poor coordination (especially between air and ground operations), insufficient training, lack of equipment, funds, and water, and the remote location of many of the fires, were often cited as the reasons for failure. Aerial suppression by water bombers was also hindered by the lack of accurate land cover maps and infrastructure support, and land-based efforts were impeded by the reluctance of many rural people to fight fires on land that was not theirs. The number of fires began to decline during October and November, partly because of mounting pressure exerted by the government on plantation owners but also because by then they had burned as much land as they needed. Peat swamps were still burning in late November but were partially extinguished when rain finally began to fall in December.

The rainy season, which usually lasts at least 6 months in western Indonesia, began to taper off in less than 2 months. By the end of January 1998, hundreds of hot spots again appeared on NOAA satellite images as the drought carried over into a second calendar year. The pattern of 1997 was repeated in the swamps on Sumatra's east coast from January through April; in Kalimantan, the fires were concentrated in East Kalimantan, a province that had escaped extensive burning in 1997. The drought also began to cause food shortages because of below-normal harvests and a total failure of the rice crop in some areas. The plight of rural communities already reeling from the effects of the fires, haze, and drought was worsened by the growing economic crisis. The value of the Indonesian rupiah plunged throughout the second half of 1997.[35] Many farmers began to burn still more land in the hope that they could increase the next harvest to compensate for 1997 drought losses. Fears also arose that forest exploitation and related burning would increase as plantation owners tried to offset the effects of the economic crisis.

Fires continued to spread during the month of March. Efforts to fight them were hampered by the increasing scarcity of water because surface water dried up during the drought and the ground water level sank beyond the reach of wells. Haze once again blanketed Singapore and parts of Malaysia, and the fires did not end until heavy rains finally arrived in mid-May.

Analysts have encountered considerable technical difficulties in determining precisely the total area burned during the 1997-1998 fires and in estimating what kinds of vegetation types burned in which areas. Based on the most recent analyses, however, it seems certain that at least 9.8 million ha burned. (*See Table 4.1.*)

The extent of the area affected by air pollution from the fires has been easier to determine. Indeed, the international news media were initially attracted to the 1997 fires by the spectacle of a "thousand mile shroud" spreading over an area of 1 million km^2 where hundreds of millions of people live. The impacts on human health could be considerable. The high levels of particulates inhaled and ingested by millions of people are likely to cause chronic, long-term respiratory diseases (Heil, 1998). Comprehensive monitoring of health impacts is difficult because rural Indonesians are unlikely to visit a hospital unless they are suffering from acute symptoms of illness. In many areas, they depend on traditional healers and herbal medicines for much of their health care. The results of one study that attempted to quantify health impacts of fire-related pollution exposure in eight provinces are presented in Table 4.3.

Table 4.3 Health Effects from Fire-Related Haze Exposure in 8 Indonesian Provinces, September-November 1997

Health Effects	Number of Cases
Deaths	527
Asthma	298,125
Bronchitis	58,095
Acute Respiratory Infection	1,446,120
Daily Activity Constraint	4,758,600
Increase in Outpatient Treatments	36,462
Increase in Hospitalizations	15,822
Lost Work Days	2,446,352

Source: State Ministry for Environment and United Nations Development Programme (UNDP), "Forest and Land Fires in Indonesia, Vol. I: Impacts, Factors and Evaluation." (Jakarta, Indonesia, 1998.)
Note: The provinces studied were Central Kalimantan, East Kalimantan, Jambi, Riau, South Kalimantan, South Sumatra, West Kalimantan, and West Sumatra.

4.4 Government Response to Forest and Land Fires

Several government agencies have fire prevention and control policies, but they are not well coordinated and are generally not enforced. A 1998 review by the State Ministry for Environment and the United Nations Development Programme (State Ministry for Environment and UNDP, 1998) concluded that the existing regulations "are apparently not effective to control fires." Prior to 1997, numerous Ministry decrees dealt with fire prevention in forest areas, but intentional burning was not strictly prohibited. In fact, an April 1997 decree legalized the practice of "controlled burning" and set out technical guidelines. This decree was revoked in October 1997 as a result of that year's disastrous fires, and a new decree prohibited all use of fire for land clearance on state forest lands. The Ministry of Agriculture had established a "zero burning" policy for land clearance by decree in 1995, and the Ministry of Transmigration and

Telapak Indonesia

Settlement of Forest Dwellers established a similar policy for the preparation of transmigration areas in April 1997.

More generally, Indonesia has a variety of environmental and other laws that criminalize intentional burning, both nationally and at the provincial level. But these laws are rarely enforced. Even in the aftermath of the 1997-1998 fires, almost no legal action has been taken against companies implicated in setting fires and, at the time of writing, no substantial legal penalties have been handed down.

Institutionally, the Environment Ministry/UNDP report concluded that "Indonesia does not have a professional fire management organization. Fire suppression efforts are conducted on the basis of coordination amongst several related agencies. . . . Agencies involved in fire management do not have adequate mandates, level of competence and equipment to carry out their tasks." The Ministry of Forestry was the only government agency with a specialized body for fire prevention and control, the Directorate for forest fires under the Directorate General for the Conservation and Protection of Nature (KPA), (subsequently renamed the Directorate General for Forest Protection and Nature Conservation).

Some of the key weaknesses in Indonesia's fire suppression and control apparatus identified by the Environment Ministry/UNDP review are duplication of functions across agencies, unclear institutional authority and responsibility, inadequate mandates, and weak local institutional capacities.

The failure to implement existing laws, according to the review, is the result of many factors: a lack of political will on the part of law enforcement agencies; lack of access by enforcement authorities to data on fires; lack of facilities and equipment to support field investigations; differing perceptions by various agencies on what constitutes adequate legal proof of intentional burning; lack of an understanding of legal provisions on corporate crime that would allow for companies, rather than individual employees, to be prosecuted; a "lack of integrity" on the part of law enforcement authorities; and "conflicts of interest" among agencies, some of which are charged with conservation and fire suppression, others with promotion of plantation and other agricultural products.

In April 2000, Indonesia's Minister of Environment promised his counterparts from neighboring countries a "haze-free year."[36] By July 2000, however, fires were burning again in Sumatra, the haze had crept over the Malacca Strait to Singapore and Malaysia,[37] and thick smog temporarily closed the airport at Medan (Sumatra's largest city).[38] The Indonesian government reportedly had "no plan" to fight the fires,[39] and indeed no fire suppression activities were being undertaken or suspects arrested.[40] With a "haze-free year" apparently not on the horizon, the State Minister of Environment told the press that he was "really ashamed every time my counterparts from Malaysia and Singapore call me to complain about the haze coming from Sumatra." Further, he blamed the burning on plantation companies engaged in "organized crime which often involves government officials and military officers. . . . Many companies feel free to burn because government officials or military officers back their activities."[41]

In February 2001, the government issued a new regulation on forest fires (Government Regulation No. 4 of 2001), which covers pollution and damage to the environment caused by forest and land fires. The new regulation sets out the respective responsibilities of central, provincial, and district governments in handling fires in an effort to stop the buck-passing among various branches of government that hobbled fire prevention and firefighting efforts in past years.[42] But by mid-2001, the situation had not improved. Extensive fires were already burning in parts of Sumatra and Kalimantan in July, spreading haze as far as Malaysia and southern Thailand.[43] The Minister of Forestry's response to this newest round of fires was to tell the press: "So far, we don't have a clear blueprint of how to cope with the problem. We will start to prepare it."[44] Prospects for an effective policy to counter the perennial fire problem thus appear dim.

E.G. Togu Manurung

CHAPTER 5
THE PROSPECTS FOR FOREST POLICY REFORM

Indonesia's forests have experienced a precipitous decline over the past several decades. If the pressures on forests are not checked, Indonesia will enjoy the dubious distinction of having presided over the disappearance of Southeast Asia's last remaining expanses of rainforest. Sulawesi has already lost all its lowland rainforest, Sumatra's will be gone by 2005, and Kalimantan's will have disappeared by 2010. *(See Chapter 2.)* Patches of montane and swamp forests on these islands may last a little longer, but not much. By 2010, Irian Jaya is likely to be the only part of Indonesia with any significant areas of undisturbed natural forest.

This study is primarily a report on the state of the forest, and it does not offer detailed prescriptions for policy reform and institutional change. Nevertheless, a complete accounting of the state of Indonesia's forests should offer an informed prognostication on what the near future may hold, one that goes beyond "if present trends continue. . . ." This chapter, therefore, briefly summarizes the current policy and institutional environment in which decisions must be made and action taken within the next few years if Indonesia is to preserve any significant part of its natural forest ecosystems. It also reviews the current national agenda for forest policy reform and assesses the prospects for its implementation.

5.1 The Forest Policy Context: A Country in Crisis

Forest policy reform and the strengthening of forest management institutions in Indonesia largely depend on factors unrelated to forests. Although this report does not aim to analyze Indonesia's multiple economic, political, and social crises fully, it is important to review the contextual challenges facing efforts to slow deforestation, reform forest policy, and strengthen forestry institutions.

Continuing Economic Malaise

Indonesia's economy is in tatters, partly as a lingering result of the East Asian financial crisis that began in late 1997, but more fully explained by the tangled web of Suharto-era economic mismanagement, cronyism, and corruption that was revealed by the economic crash. Most of the country's banks and many other key economic players are bankrupt, the value of the Indonesian rupiah remains low, and unemployment and inflation are high. At present, the national economy is being kept afloat largely on the basis of an IMF-led international bailout package and oil revenues.[45]

The major impacts of the economic crisis on Indonesia's forests are a result of the depreciation of the rupiah and the more competitive position of Indonesian commodities on the international market, the lure of boosting agricultural and natural resources exports to ameliorate the economic downturn, and increased income insecurity in the rural population. The relatively low price of Indonesian plywood, combined with rising demand (especially from China, which reduced domestic logging 60 percent in 1998), and the restricted supply of timber owing to the 1997-1998 forest fires "means that producers will search for stems in ever more remote and inappropriate places." (Sunderlin, 1999: 562).

Producer prices for some agricultural export commodities increased steeply from 1997 to 1998 and therefore tended to increase pressures for clearing forest. (*See Section 3.6.*) A similar dynamic has boosted expansion of mining, often in forest areas. Meanwhile, some unemployed people in the urban sector have evidently migrated to the countryside in search of employment while labor market entrants who might have sought work in the city remain in rural areas. This trend, combined with high rupiah prices for agricultural export commodities and the incentive to produce food domestically (because of high import prices), appears to be increasing pressure for forest clearance.

A 1999 study of areas in parts of Sumatra, Kalimantan, and Sulawesi concluded that in general, better-off farmers, immigrants, and urban dwellers with capital are more likely to take advantage of the opportunities created by the monetary crisis by converting forest areas for high-value export crops. In some cases, these new investors are putting upward pressure on land prices, tempting local subsistence farmers to sell their holdings and open new lands in the forest (Angelsen and Resosudarmo, 1999).

5.2 Political Paralysis at the Center

Following more than three decades (1966-1998) of relatively stable rule and rapid economic growth under the "New Order" regime of President Suharto,[46] Indonesia entered a period of chaotic political transition that degenerated into almost complete political paralysis by mid-2001. Suharto was hounded from office in mid-1998 following the crash of the economy in late 1997 and an accompanying crescendo of popular protest against the widespread corruption and pervasive human rights violations of the New Order regime.[47] Following an interregnum under Suharto Vice-President B.J. Habibie,[48] Abdurrahman Wahid, a Muslim cleric, came to power in October 1999 after the country's first democratic election in more than 4 decades.[49] Initially praised as a sincere democrat and masterful politician, Wahid led a fractious coalition government that was unable to address the country's economic and social crises effectively. This failure, combined with his mercurial and frequently baffling personal style, his alienation of the newly vocal parliament and the armed forces, and several corruption scandals, led to widespread calls for his removal from office by the beginning of 2001.[50] He was ousted by the Parliament in July 2001, handing over the government to Megawati Sukarnoputri, the Vice-President and daughter of Sukarno, Indonesia's first President.

This drawn-out political drama has had a debilitating effect on efforts to reform and implement forest policies. Engrossed in round-the-clock political machinations, senior government officials paid little attention to forest policy matters. Frequent cabinet shake-ups and widespread expectations of the imminent fall of the Wahid government created the perception that senior forestry officials, and their policies, were transient phenomena that would not be on the scene for long. Megawati's new government has just been installed at the time of writing; its forestry policies, and the priority that it will accord to forest policy issues, are largely unknown.

5.3 Separatism and Demands for Decentralization in the Provinces

The centrifugal tendencies inherent in a large multiethnic, archipelagic nation like Indonesia have been unleashed since the demise of the New Order. East Timor, invaded and occupied by Indonesia in 1975, was finally given its independence after a bloody UN-supervised referendum process in mid-1999.[51] Long-simmering separatist movements in the forest-rich provinces of Aceh and Irian Jaya have been reinvigorated,[52] and other provinces (oil-rich Riau, in Sumatra, for example) have begun to talk about independence as well.[53] Separatism is motivated in large part by the long-standing practice of channeling natural resource rents to Jakarta, with only a small fraction remaining in the provinces.

Partly in reaction to these separatist movements but also in response to a more widespread antipathy outside Java to the centralized governance of the Suharto era, Indonesia is moving rapidly toward a

new system of "regional autonomy." But, for the most part, the provincial and district governments who will benefit from this sweeping decentralization completely lack the capacities needed to govern effectively. Indeed, many are still run by entrenched and corrupt holdovers from the Suharto era.[54]

Growing lawlessness has been a major factor in increased logging and forest clearing.

This quite rapid devolution of governmental powers calls into question the very notion of a uniform national "forest policy." The more likely scenario for the next few years is one in which different local government units each make and implement their own forest policies within vague national guidelines under nominal oversight by a greatly weakened central Forestry Ministry. Raising revenue is foremost on the minds of provincial and district officials, who are being handed vast responsibilities without the necessary funds to carry them out. Intensified exploitation of forest resources through logging and conversion of forest lands for plantations is therefore likely in many regions. (*See Box 5.1.*)

5.4 Spreading Civil Violence and the Breakdown of Law and Order

Ethnic and religious killing, looting, violent street crime, and savage vigilantism have exploded in many parts of Indonesia since 1998. Moslem-Christian violence in the eastern province of Maluku has taken thousands of lives,[55] and similar savagery has appeared in parts of Kalimantan and Sulawesi.[56] As of mid-2001, the Indonesian Red Cross estimated that more than 1.25 million "internal refugees" were displaced by these various conflicts, half of them school children.[57] Crime rates have soared in the cities, along with brutal "street justice" in which hundreds of suspected street criminals have been beaten and burned to death in the streets.[58]

The Indonesian military, reeling from revelations about its past human rights atrocities in East Timor, Aceh, and elsewhere, and what it sees as its humiliation in "losing" East Timor, appears unable to contain the growing violence.[59] Indeed, in Maluku, Christian and Moslem troops sent to quell the fighting ended up fighting with the respective factions.[60] Similarly, the police, long reviled by most Indonesians as corrupt, brutal, and ineffective, are unable or unwilling to stem either the growing crime rate or the vigilantism that has mushroomed in response.[61]

This growing lawlessness has been a major factor in increased logging and forest clearing. Enforcement of forestry law, never strong, is almost nonexistent in national parks and many other areas, allowing new encroachment by small farmers and large-scale operators alike.

5.5 Conflicts Over Forest Lands and Resources

Exploitation of forest resources has been a significant factor in fueling Indonesia's rapid economic development since the early 1970s, as discussed in Chapter 3. Benefits from logging and other forest industries, however, flowed largely to a small coterie of elite Suharto family cronies and their patrons in the government while local and indigenous communities bore the costs. Centuries-old systems of customary rights over forests and traditional resource management systems were swept aside in the name of development and under the authority of national laws declaring that the central government "owned" the 75 percent of the nation's land area legally designated as forest land. Local communities were barred from forest resources on which they had long depended, and the forests themselves were recklessly logged, burned, and cleared for plantations, often causing erosion, flooding, and drought and wiping out many species of plants and animals that local people had been utilizing. The transmigration program also commandeered millions of hectares of land in forest areas and brought millions of new migrants into previously forested and sparsely populated areas.

It is not surprising, then, that conflicts between forest-dependent communities on the one hand and government and private sector forest resource exploitation projects on the other have been a perennial and growing problem in Indonesia since at least the 1970s. Abused local communities had little recourse during the authoritarian Suharto era except to nurse their grievances and develop a strong mistrust of the government. Since Suharto's fall, conflicts have multiplied in both number and intensity. (*See Map 13.*)

As is the case for many social tensions in Indonesia over the past few years, conflicts over forest lands

Box 5.1 Regional Autonomy and Forest Management

Indonesia is currently in the early stages of implementing a wide-ranging "regional autonomy" policy that decentralizes many functions of government, including numerous aspects of forest regulation and management, to the provincial and district governments. At present, however, the basic division of authority and responsibility over forests among central, provincial, and district governments is unclear and is being contested.

With regard to the authority to decide what is forest land and how it may be used, a 1992 spatial planning law (Spatial Use Management Law, 1992) gave provinces the right to make these fundamental land use planning decisions although it contradicted the 1967 Basic Forestry Law. The revised Basic Forestry Law of 1999, however, specifies that the central government retains the right to "determine the forest estate" and "plan the use of the forest" and need only "pay attention" to the local land use plans made under the 1992 law. On the other hand, two 1999 laws on regional autonomy seem to shift significant power over natural resources to the regions, specifying, for example, that 80 percent of state income from resources (including forests) shall go to the regions. Both laws still lack implementing regulations, however, and many lawyers and government officials regard these laws as essentially inoperable (Basic Law on Regional Government, 1999, and Basic Law on Financial Balance, 1999).

The 1999 revised forestry law gave district heads the right to hand out 100 ha logging licenses, and they have given out hundreds in some areas, according to an investigative report by the newsmagazine *Tempo*, despite an October 2000 order from the Minister of Forestry to stop the practice. These concessions are profitable for the districts (sometimes called regencies) because "It's common knowledge that every time such a license is issued, between Rp 50 million and Rp 100 million (approximately US$5,000–10,000) finds its way into regency coffers. And one regent alone can issue hundreds of these licenses." (*Tempo*, July 24–30, 2001.) The *Tempo* report goes on to note, however, that the local governments' take from this practice is small compared to the profits being taken by the businessmen who are issued the licenses, sometimes as many as 10 licenses each. According to one observer in West Kalimantan, the people receiving the new small-scale licenses are in fact old players whose HPH concessions have run out or who cannot get their old concessions renewed. To keep their sawmills running, they manipulate small groups of people to set up cooperatives, which then apply for the new small-scale licenses. The system is also often used to legalize illegal logging: "The timber brokers, who up to now have been receivers of timber from illegally felled trees…no longer need to hide what they are doing because they officially 'own' cooperatives that supply them with the timber they require."

The regional autonomy policy has also fanned disputes about which level of government has the authority to change the status of forest lands. In

and resources have become increasingly violent. Logging concessions have long been a source of tension and occasional conflict between logging firms and the state on the one hand and local communities on the other. In March 2000, the Association of Indonesian Forest Concessionaires (APHI) reported that 50 timber companies, controlling about 10 million ha of logging concessions in Irian Jaya, Kalimantan, and Sulawesi, had stopped logging because of growing trouble with local residents, who not only claimed ownership of the concessions but also often threatened the workers.[62]

In the Suharto era, such local impertinence was usually dealt with rapidly and violently by police or military personnel "rented" to logging firms. Currently, however, the companies find themselves increasingly on their own: the thinly-stretched military, dealing with large-scale violent conflict in numerous parts of the country, lacks the resources to respond to concession-related disputes. The Ministry of Forestry has softened its tone on such local protests, even admitting that logging firms may be to blame. The fact that most of the concessions where clashes are occurring have been linked to members of the Suharto family and inner circle, and hence are said to have been obtained through corruption, means that few officials are eager to spring to their defense.[63] But despite this change in attitude, the government seems to have no plan for

Box 5.1 *(continued)*

South Kalimantan, for example, a dispute has broken out between the Governor and the heads of two districts in the Meratus Mountains over the issuing of logging licenses to two logging firms covering a total of 83,000 ha. The proposed concessions are in an area long designated as protected forest, but in 1999 the then-Minister of Forestry changed the status of 46,000 ha from protection to production forest to accommodate one of the two companies. Local Dayak communities opposed the logging and organized a campaign against the concession. The district heads are also reported to be opposed to the concessions, but the provincial government has argued that it is the Governor's prerogative to issue concessions without the district heads' approval, as long as they lie in more than one district. In short, three levels of government are arguing over who has the right to change the status of forest areas, and the interpretation of regional autonomy with respect to forest land use and exploitation is unclear and is being disputed (*Down to Earth*, August 2001).

Despite widespread confusion and apparent abuses, the then-Forestry Minister told the press in May 2001 that a Presidential decree would soon be issued allowing district heads to award full-scale HPH logging concessions and handing them significant power to manage and supervise national parks and protected forests (*Jakarta Post*, May 28, 2001). The new administration of Megawati Sukarnoputri is likely to slow down the implementation of regional autonomy policies, however, and has signaled an intention to revise the relevant laws to decrease district heads' powers over both natural resources and financial matters (*Jakarta Post*, August 11, 2001). Megawati herself expressed dissatisfaction with the law in May 2001 and said "I expect there to be a conceptual revision of the law as soon as possible." (*Jakarta Post*, May 16, 2001). But with local officials already having tasted the power – and the profits – of local control over forest and other natural resources, it may be difficult to take that power away from them.

Sources:

The Spatial Use Management Law (No. 24/1992).

The Basic Law on Regional Government (No. 22/1999) and The Basic Law on Financial Balance Between Central and Regional Government (No. 25/1999). (For a detailed analysis of the provisions in these two laws, see H. Haeruman, "Law No. 22/1999: Regional Autonomy Over Natural Resources," and H. Haeruman, "Law No. 25/1999: Natural Resource Revenue Sharing,"both in *NRM News,* Vol. 1 No. 1, February 2000. Jakarta, Indonesia: Natural Resources Management Program.

"Forests and regional autonomy: all in the hands of the regents." *Tempo*, July 24-30, 2001.

"The fight against illegal logging." *Down to Earth* No. 50, August 2001. Online at http://www.gn.apc.prg.dte.

"Regents to issue forestry licenses." *Jakarta Post*, May 28, 2001.

"Government revising law on regional autonomy." *Jakarta Post*, August 11, 2001.

resolving conflicts over forest resources. The Ministry of Forestry's 2001–2005 Strategic Plan does not specifically mention them, for example, although it does acknowledge the general problem of local grievances.

In addition to conflicts related to logging concessions, illegal logging is both a cause and a result of tension over resources. It generates anger in local communities when timber is stolen from their land. But it also gives rise to conflicts within communities, where some are employed by illegal logging operations, and thus benefit, while others suffer the effects. These include diminution of local water supplies, increased erosion, and more frequent forest fires that are either set deliberately to hide evidence of illegal cutting or are caused by increased fuel loads of harvest waste material. Illegal logging is also a result of forest-related disputes. When the status of a particular area is contested or unclear (for example, a logging concession where local protests have stopped operations), it becomes an easy target for illegal cutting. And where local communities feel unjustly deprived of access to forest resources, they may often retaliate by "stealing" timber that they feel is theirs.

The rapid development of oil palm and industrial timber plantations on forest lands has sometimes led to hostile relations with local communities, particu-

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larly in Sumatra and Kalimantan. Reports follow a similar pattern. First, land on which local communities have longstanding claims and are often growing tree crops or harvesting nontimber forest products are allocated to a company without consultation with the community. People then protest to the company and local officials, and the company often promises compensation, participation in the plantation scheme, or other enticements. But when the company does not honor its promises, the community protests to local government and company officials again. Still nothing is done to meet their demands, and local people destroy or confiscate equipment and vehicles, occupy base camps, and prevent plantation staff from working. Then the company hires local police or military (sometimes dressed in the "black ninja" outfits that are popular with hired thugs and assassins on Java) to retaliate, and more violence ensues.

Other frequent arenas for conflict are the national parks and protected areas. Small farmers, poachers, and illegal loggers have long encroached upon protected areas, some of which have been illegally converted to plantation agriculture.[64] Since 1998, however, encroachment has increased dramatically, as in Central Sulawesi's Lore Lindu National Park, where locals have taken over thousands of hectares to plant cash crops and cut timber.[65] Similar takeovers have been reported at Kutai National Park in East Kalimantan.[66] Organized illegal logging has been well documented in Aceh's Leuser National Park and Central Kalimantan's Tanjung Puting National Park (Newman et al., 1999), and is generally thought to be widespread in many other parks. It is sadly ironic that conservation efforts have at times been responsible for the abuse of local people. Gazetting of national parks and other protected areas has sometimes occurred without reference to indigenous peoples' views or rights. Two examples, provided in Box 5.2, contrast aggressive government action with more enlightened approaches that were simultaneously pursued over the past decade.

Encroachment, illegal logging, and poaching in protected areas have not given rise to much violent conflict, however, for the simple reason that such activities are mostly unopposed by park management officials or other government agencies. One striking exception is the Leuser Development Programme, a large European Union-funded project to conserve Leuser National Park and its surrounding ecosystem in Aceh province. The program has actively opposed (and in some cases, triumphed over) illegal park conversions to oil palm plantations and encroachments by logging concessions, illegal loggers, local government plans to build roads through the park, and planned transmigration sites on its boundary. Its efforts have created heated local opposition and protest from some quarters.

Should Indonesia decide to take protection of its national parks more seriously, and should the international community decide to provide major funding for such an effort, these kinds of tensions would probably explode into violent confrontations in many protected areas.

Illegal logging is both a cause and a result of tension over resources.

Rhetoric about the need to manage forests in the interests of traditional law (*adat*) and local communities has been pervasive for several years, but from a legal and policy perspective, little has changed since the Suharto era. Numerous analyses have searched for signs of a more local community-oriented forest policy in the spate of new laws and regulations, and there are some encouraging changes around the edges. But the basic structure of power over forest lands remains as it has always been: the state controls the forest and all who would use it may do so legally only by leave of the state.

The 1999 Forestry Law does establish a category of customary forest (*hutan adat*) but defines it as state forest that happens to lie within the territory of a "customary law community," whose definition the government will elaborate in future regulations. Under the Law, the government is obliged to respect the rights of communities that have received its blessing as truly "customary" but "only as long as those rights do not conflict with national interests." In short, the government unilaterally determines which communities qualify as "customary" and

Box 5.2 National Parks and Indigenous People: Cooperation or Conflict? Two Cases From Sulawesi

As Indonesia's system of protected areas has expanded over the past several decades, the designation of forest areas has frequently conflicted with the prior claims and present livelihood needs of numerous indigenous forest-dwelling communities. Two cases from Sulawesi contrast the widely differing approaches that the government has taken to such conflicts.

Rawa Aopa Watumohai National Park comprises an area of 105,000 ha in Southeast Sulawesi province. It was officially gazetted in 1990. The Moronene people have occupied lands lying within the park for generations, but the decision to create the park was made without consultation with the Moronene or reference to their long-standing customary occupation of their areas. From 1997 to late 2000, the Moronene have been the victims of forcible evictions ordered by the provincial governor in the name of nature conservation. In 1997, security forces burned down 175 homes and destroyed crops. In 1998, a further 88 houses were burned and 12 villagers were given year-long jail sentences. Most recently, in November 2000, another 100 homes were destroyed in three Moronene villages on the instruction of the Governor, Laode Kaimuddin, despite widespread protests from not only NGOs but also central government forestry and environment officials.

A more enlightened solution has been worked out between the Lore Lindu National Park and the Katu people in Central Sulawesi. Lore Lindu National Park covers some 568,000 ha of varied ecosystems ranging from lowland rainforest and dense montane forest to grassy plains and swampy upland valleys. Katu is a small village occupied by 227 people whose customary lands were included in the park when it was formally established in the mid-1990s.

The Katu have repeatedly been moved around by outsiders over the past century. In 1918, the Dutch colonial authorities forced them to move to the town of Bangkeluho to facilitate tax collection, but the people moved back to Katu in 1925. In 1949, they were again forced to relocate to Bangkeluho, this time by the newly independent Indonesian government. When disease epidemics ravaged Bangkeluho in the late 1950s, they once again returned to their ancestral lands in Katu. They were not disturbed again until the 1970s, when the government declared their lands to be the "Lore Kalamanta Wildlife Management Conservation Area" and once again began pressuring them to leave. Pressure was stepped up in 1985 when plans were announced to incorporate their area into the planned Lore Lindu National Park. It intensified further when the Central Sulawesi Integrated Conservation and Development Project was launched by the government in the mid-1990s, supported by a loan from the Asian Development Bank.

The Katu resisted these mounting pressures to move, and, with the help of environmental NGOs in 1998, they conducted a natural resource inventory survey of their area and documented their natural resource management practices. The survey revealed a complex system of traditional agriculture using dozens of local crop varieties and sustainable forest product harvest systems that had been in place for centuries without damaging the forest.

In April 1999, the Katu finally won their long battle when the park authorities issued a formal letter awarding the Katu the right to remain on their ancestral lands (1,178 ha) and to continue to use their traditional systems of tenure and resource management. The two factors that ultimately drove this decision were the considerable body of empirical scientific evidence showing that Katu resource management practices were environmentally sustainable, and the Katu's ability to produce detailed maps documenting their customary land claims and detailed documentation of their land use systems. Armed with legal recognition of their rights, the Katu have become more vocal and aggressive in opposing and reporting illegal logging and other encroachments by outsiders into the park, a growing problem at Lore Lindu.

Sources:

Down to Earth. No. 48, February 2001. "Moronene people forced out of national park." http://www.gn.apc.org/dte/48Ind.htm

Biodiversity Support Program-Kemala, Jakarta, Indonesia. "The End of a Dream, The Beginning of Hope: After more than 70 years of resistance, finally the Katu people gain legal recognition of their rights to live and manage their Adat lands." http://www.bsp-kemala.or.id/stories/stories8.htm

Jakarta Post, June 29, 2001. "NGOs protest forest looting in Lore Lindu National Park."

then unilaterally decides which community rights to respect. It is not surprising, therefore, that the 1999 Forestry Law has been denounced by indigenous peoples' organizations and NGOs as a sham with respect to protecting the rights of traditional forest-dwelling peoples.[67]

5.6 The Agenda and Prospects For Forest Policy Reform

In the *reformasi* euphoria following Suharto's resignation in 1998, many believed that at last a real opportunity existed to make fundamental changes in the way Indonesia's forests were managed, thereby slowing deforestation and recognizing the long-slighted claims and interests of forest-dependent rural communities.[68] Various government committees, NGOs, donor agencies, and academics put forward reform agendas, and a flurry of new laws and regulations was issued. But, as noted above, forest policy reform has not been the highest priority for politicians and policymakers, or for ordinary citizens, in the crisis-ridden years since Suharto's fall. What commitment to reform exists in the government is driven largely by the fact that Indonesia's aid donors have made future financial assistance conditional on specific reforms in the forestry sector, among other actions.

Indonesia's aid donors coordinate their assistance through a consortium called the Consultative Group on Indonesia (CGI), chaired by the World Bank. Through CGI, the donors meet periodically with senior Indonesian government officials to discuss and decide on levels of assistance, set targets for policy reform, and assess progress toward those targets. The state of Indonesia's forests was first raised in the CGI process at a meeting in July 1999. At the subsequent February 2000 CGI meeting, Indonesia committed to a set of 8 urgent forest policy reform actions and, in parallel, to begin the process of formulating a new National Forest Program (NFP) and establishing an Interdepartmental Committee on Forestry (IDCF). At the October 2000 CGI meeting, the government reported little progress, but it renewed its commitments and promised to prepare an Action Plan to implement them. The Action Plan was made public in December 2000. It covered the original 8 commitments, plus 4 new ones. These 12 now constitute the core of Indonesia's forest policy reform agenda. (*See Box 5.3*.)

In early 2001, however, Indonesia's Coordinating Minister for Economic Affairs argued to the donors that the government would not succeed if it attempted to devote equal effort to all 12 commitments at the same time. Rather, he resolved to work on 4 of the most urgent issues: illegal logging, forest fires, restructuring indebted wood-based industries, and forest inventory and mapping. But in early April 2001, the newly installed Forestry Minister Marzuki Usman (since replaced) admitted that Indonesia had failed to meet its forestry commitments, saying "It's our own fault. How could we have set such unrealistic targets?"[69] At the CGI meeting later that month, the donor position paper on forests confirmed the Minister's assessment, saying:

> *In terms of results in the forests, which is the ultimate measure of achievements, there have been no tangible improvements. The rate of forest loss has not abated. The situation in the forests remains grave by any measure, and the donors remain seriously concerned…. There are major problems of overall governance that affect the forestry sector particularly severely, including official corruption, weak law enforcement, and a judiciary system needing reform… Decentralization brings in the short term a general weakening of authority for forest management, with the risk that the [regional and district governments] will emphasize short-term revenue enhancement at the expense of sustainability. Unequal resource access rights and issues of land tenure in the forest are fundamental problems, difficult to solve. The legacy of alienation of forest communities and resulting mistrust of government caused by the resource allocation policies and procedures of the past must be cleared away, but [this] will not be [achieved] without extraordinary creativity, sensitivity and hard work.*[70]

In measuring success, the donors' position paper could point to little more than the issuance of a presidential instruction ordering an intensive effort to halt illegal logging in national parks, the steps taken to cut off trade in *ramin* wood, Indonesia's agreement to host a September 2001 ministerial conference on forest law enforcement, and the issuance of a regulation on combatting forest fires (discussed in Chapter 4). The donors concluded their analysis with the statement that "very few

Box 5.3 Indonesia's 12 Commitments to the Consultative Group on Indonesia (CGI) Concerning Forests and Forest Policy

In the course of 2000, the Ministry of Forestry made three groups of commitments: to establish an Interdepartmental Committee on Forestry, to proceed with formulation of the National Forest Program, and to take immediate action to address pressing issues raised by the CGI process. The action commitments are listed below.

- Invite cooperation and coordination of other Ministries to impose strong measures against illegal loggers, especially those operating within national parks, and to close illegal sawmills.
- Speed up forest resource assessment as a basis for National Forest Program (NFP) formulation.
- Evaluate the policy in conversion forest and place a moratorium on all natural forest conversion until the NFP is agreed upon.
- Downsize and restructure the wood-based industry to balance supply and demand of raw material and increase its competitiveness.
- Close heavily indebted wood industries under control of the Indonesia Bank Restructuring Agency (IBRA) and link proposed debt write-offs to capacity reduction.
- Connect the reforestation program with the existing forest industries and those under construction.
- Recalculate the real value of timber.
- Use decentralization processes as a tool to enhance sustainable forest management.
- Prevent and control forest fires.
- Formulate the National Forest Program.
- Resolve tenurial issues on forest lands.
- Improve the forest management system.

Sources:

Commitments 1-8: "Indonesia: Environment and Natural Resource Management in a Time of Transition." (Washington D.C. World Bank, 2001). Commitments 9-12: "Rencana Aksi Komitmen Pemerintah Bidang Kehutanan" [Action Plans for Government Commitments in the Forestry Sector]. Jakarta, Indonesia: Ministry of Forestry, November 2000.

tangible results have been achieved" and warning that the forestry situation is "rapidly deteriorating." They singled out the illegal logging issue, noting that "persons that manage illegal logging operations continue to do so with impunity."[71]

The CGI 12-point plan for reform is not the only reform agenda that has been put forward. One of Indonesia's largest environmental NGOs, the Indonesian Forum for Environment (WALHI), for example, has called for a complete moratorium on all industrial logging in natural forest areas, to be phased in over 2-3 years.[72] We focus here on the CGI-mandated actions because they are the only ones that have captured the serious attention of the government – because they are ostensibly linked to continued donor aid. To the extent that meaningful action will be taken to reform forest policies and remedy the deteriorating forest situation in Indonesia, it appears at present writing that such action will closely follow the steps laid out in the CGI-mandated Action Plan. However, recent experience suggests that the ability of donors to influence implementation of forest policy reforms is limited (Seymour and Dubash, 2000:83-105). Given the overwhelming political, social, and economic problems that Indonesia faces and the near-complete absence of action on *any* forest policy reform agenda item over the past few years, the prognosis for Indonesia's forests remains grim.

NOTES

1. Until 1998, the Ministry was called the Ministry of Forestry. From 1998 to 2000, it was known as the Ministry of Forestry and Estate Crops (MOFEC). In August 2000, a new Cabinet was formed and MOFEC was merged with the Ministry of Agriculture and renamed the Ministry of Agriculture and Forestry. This lasted just 3 months, when the name reverted to the Ministry of Forestry. For the sake of simplicity, this report uses "Ministry of Forestry" throughout.
2. Biomass quantities reported by the FAO refer to above-ground live and dead vegetation. They do not include below-ground biomass, such as root structures, or organic carbon present in soils. The carbon storage estimate presented here is based on the assumption that approximately half the weight of wet biomass is water and approximately half the weight of (dry) biomass is carbon.
3. Some of the common flaws and potential pitfalls of ecological valuation studies are usefully summarized in Doug Sheil and Sven Wunder. "The value of tropical forest to local communities: complications, caveats and cautions." Forthcoming in *Ecological Economics*.
4. The figure of 6.6 million ha corresponds to the areas identified in the GOI/World Bank dataset as forest but classified by the National Forest Inventory, 1996 as industrial timber plantations or estate crop plantations.
5. The six IUCN protected area categories are: Ia Strict Nature Reserve: Protected Area managed mainly for science; Ib Wilderness Area: Protected Area managed mainly for wilderness protection; II National Park: Protected Area managed mainly for ecosystem conservation and recreation; III Natural Monument: Protected Area managed for conservation of specific natural features; IV Habitat/Species Management Area: Protected Area managed mainly for conservation through management intervention; V Protected Landscape/Seascape: Protected Area managed mainly for landscape/seascape conservation and recreation; VI Managed Resource Protected Areas: Protected Area managed mainly for the sustainable use of natural ecosystems.
6. "Illegal loggers steal Indonesia's market share in China." *Asia Pulse/Antara.* June 22, 2001.
7. "Watchdog eyes forestry scams." *Indonesian Observer*, January 5, 2000.
8. "Indonesia stops issuing fresh forestry concession licenses." *Asia Pulse/Antara*, April 18, 2000.
9. Information made available to Forest Watch Indonesia by the Ministry of Forestry.
10. "Indonesia stops issuing fresh forestry concession licenses." *Asia Pulse/Antara*, April 18, 2000.
11. Investigation Report. Leuser Lestari Foundation. 1998-1999.
12. "Environmentalists challenge "eco-timber" go-ahead for logging in endangered tiger habitat. Important test case for Forest Stewardship Council; consumers could be misled by 'green' scheme." Rain Forest Foundation and Walhi. Press Release, July 11, 2001.
13. "Analysis and Discussion Paper by the Director General for Protection and Conservation of Nature," National Working Meeting of the Ministry of Forestry and Estate Crops, June 26-29, 2000, 13-14. (Translation from original by C.V. Barber.)
14. "Timber fencing and smuggling still rampant." *Jakarta Post*, July 3, 1996; "Legislators urge government to stop timber brokers." *Jakarta Post*, July 3, 1996.
15. "Security personnel aid timber thieves." *Jakarta Post*, May 15, 2000.
16. "Military, judiciary urged not to support illegal logging." *Indonesian Observer*, June 20, 2000.
17. "Illegal loggers steal Indonesia's market share in China." *Asia Pulse/Antara*, June 22, 2000.
18. Plywood production data from the FAO, ITTO, and GOI are broadly comparable until 1996 (reporting 1996 production of 9.5, 9.1, and 9.1 million tons, respectively). From that year, the FAO shows a slight increase in 1997, then a precipitous decline from 9.6 million to 4.4 million tons in 1999. ITTO has a small overall decline to 8.5 million tons in 1999. The Indonesian Ministry of Forestry reports a sharp increase to 10.9 million tons in 1997, followed by a fall to 7.2 million tons in 1999. These data are all the more mysterious given that both FAO and ITTO base their reports on official Indonesian statistics.
19. "Indonesia faces forest dilemma: donors seek curbs on logging but powerful interests are involved." *International Herald Tribune*, February 1, 2000.
20. "Indonesia – wood cuts: illegal logging could stem the flow of aid to Indonesia." *Far Eastern Economic Review*, January 27, 2000.
21. Government Regulation No. 7 of 1990 Regarding Industrial Timber Plantations.
22. The 1991 Indonesian Forestry Action Programme stated that "the role of plantation forests in supple-

menting natural forest resources will also be very important to conservation objectives in the country." (Government of Indonesia, 1991. *Indonesia Forestry Action Programme.* Vol. 2, p. 60. Jakarta, Indonesia.)

23. Private firms developing HTIs are eligible for capital participation by the government in the amount of 14 percent and zero-interest loans of up to 32.5 percent, both drawn from the Reforestation Fund. State corporations are eligible for 35 percent government capital participation and can access interest-free loans of up to 32.5 percent.

24. "World Bank Involvement in Sector Adjustment for Forests in Indonesia: The Issues." Jakarta, Indonesia, 1998. Memorandum.

25. Both APP and APRIL were listed on the New York Stock Exchange in 1995, but the exchange announced plans to delist them in July (APP) and September (APRIL) 2001 because the groups had traded at below $1 per share for more than 30 days, breaking an exchange rule. "New York Stock Exchange intends to delist Asia Pacific resources." *The Wall Street Journal,* September 3, 2001.

26. "Indonesia APRIL units $1.3B debt deal draws creditor ire." *Dow Jones Newswires*, November 8, 2000; "Indonesia's APRIL cannot meet all interest payments." *Asian Wall Street Journal,* June 7, 2001.

27. Note that *Oil World's* estimate of 7 million tons is higher than the figure of 6.2 million tons provided by the Indonesian Ministry of Forestry.

28. Local farmers in Lore Lindu National Park, Central Sulawesi, told one of this report's authors that extensive forest clearance around their village was caused entirely by transmigrants from Southeastern Sulawesi. It transpired that the newcomers numbered less than one dozen families and that many of the locals had recently cleared land for new cocoa trees.

29. Production data on cocoa: online at http://www.oardc.ohio-state.edu/cocoa/regions.htm; coffee: online at http://www.ico.org/statist/po2.htm; rubber: online at http://www.sbindo.co.id/products/Agriculture/Natural_Rubber.htm; palm oil: *Oil World Annual, 2001.*

30. A somewhat more recent estimate (Casson, 2000) puts the total area under rubber (including large-scale plantations) at 6.1 million ha in 1998. This is hard to reconcile with the Ministry of Forestry estimate of 3.5 million ha in 1997.

31. "Indonesian farmers have abandoned coffee plantations in Sumatra because of low international prices." *Commodity News*. July 23, 2001.

32. El Niño is a periodic climatic phenomenon caused by interaction between the atmosphere and abnormally warm surface water in the eastern Pacific Ocean off the coast of South America. Occurring about every 2-7 years, El Niño events usually last about one year and often bring extended periods of drought to Indonesia and other parts of the western Pacific.

33. See Barber and Schweithelm, 2000 for a detailed account of the 1982-1983 East Kalimantan fire and citations to the numerous field studies that were carried out in the aftermath of the fire.

34. This account of the 1997–1998 fires is adapted from Barber and Schweithelm 2000, with permission of the authors.

35. Rural impacts of the 1997 currency devaluation have varied a great deal among areas, however. Where export commodities constituted a significant proportion of the local economy, farmers received a windfall from the devaluation. But, where they did not, the rising prices had severe negative economic impacts. See: J. Poppele, S. Sumarto, and L. Pritchett, 1999. "Social Impacts of the Crisis: New Data and Policy Implications." Jakarta, Indonesia: Paper prepared for the World Bank. Draft.

36. "Jakarta promises a haze-free year." *Straits Times*, April 5, 2000.

37. "Indonesia fires spread, smog reaches Thailand." Reuters, July 19, 2000.

38. "Thick smog shuts Indonesia's Medan Airport." Reuters, July 20, 2000.

39. "Jakarta has no plan to combat forest fires." *Straits Times*, July 18, 2000.

40. "Where in the world are the firefighters? Hundreds of fires are burning across Riau province, but no one is fighting them nor are police arresting suspects." *Straits Times*, July 28, 2000.

41. "Sony 'powerless' to cope with forest fires." *Jakarta Post*, July 31, 2000. In the same interview, the Minister (Sony Keraf) recounted how he had confronted the Governor of West Kalimantan with clear satellite data implicating two companies in the ongoing fires in that province. Despite the evidence, the Governor bluntly denied the charge.

42. "Who's playing with fire again?" *Tempo*, July 17–23, 2001.

43. "Peat fires blamed as smoke haze thickens in Indonesia." Agence France-Presse, July 12, 2001.

44. "Still no plan by Jakarta to fight fires feeding haze." *Straits Times*, July 12, 2001.

45. For analysis of the economic crisis of 1997-1998 and its lingering aftereffects, see World Bank. *Indonesia in Crisis: A Macroeconomic Update*. Washington DC: World Bank, 1998; H.W. Arndt and H. Hill. *Southeast Asia's Economic Crisis: Origins, Lessons, and the Way Forward*. Singapore: Institute of Southeast Asian Studies, 1999; A.L. Smith. *Gus Dur and the Indonesian Economy*. Singapore: Institute of Southeast Asian Studies, 2001; E. Salim, "Indonesia's Future Economic Challenges." *Jakarta Post*, April 9-10, 2001 (in two parts).

46. For accounts of the politics and economics of the Suharto era, see A. Schwarz, *A Nation in Waiting: Indonesia in the 1990s.* St. Leonards, Australia: Allen and Unwin, 1994; H. Hill, ed., *Indonesia's New Order: The Dynamics of Socio-Economic Transformation*. St. Leonard's, Australia: Allen and Unwin, 1994.

47. For accounts and analysis of the fall of Suharto see G. Forrester & R.J. May, eds., *The Fall of Soeharto*. Singapore: Select Books, Ltd., 1999. Many analyses of the East Asian economic crisis and its impacts on Indonesia have been published since 1998. See, for example H.W. Arndt and H. Hill, eds., *Southeast Asia's Economic Crisis: Origins, Lessons, and the Way Forward*. Singapore: Institute of Southeast Asian Studies, 1999.

48. On Habibie's presidency, see D.F. Anwar, "The Habibie Presidency" and other articles in G. Forrester, ed., *Post-Soeharto Indonesia: Renewal or Chaos?* Singapore: Institute of Southeast Asian Studies.

49. On the complex process and politics by which Wahid became president in October 1999, see "Dark before dawn: how elite made a deal before Indonesia woke up." *The Wall Street Journal*, November 2, 1999.

50. For an analysis of Wahid's first years in office and his tenuous hold on power as of early 2001, see International Crisis Group, "Indonesia's Presidential Crisis." Briefing Paper, February 21, 2001. Online at www.intl_crisis_group.org.

51. On East Timor's violent independence referendum, see United Nations Office of the High Commissioner for Human Rights, *Report of the International Commission of Inquiry on East Timor to the Secretary-General.* Geneva. January, 2000.

52. On Aceh's separatist struggle, see G. van Klinken, "Whither Aceh? An update on events in 1999." *Inside Indonesia* No. 62, April-June, 2000. Online at http://www.insideindonesia.org and "Indonesia's Aceh conflict smoulders on." *Asian Wall Street Journal*, April 26, 2000. On separatism in Irian Jaya, see "Irian Jaya wants to shake off Indonesian rule." Agence France-Presse, December 1, 1999; J. Rumbiak, "Statement of Irian Jaya at the 56th Commission on Human Rights." United Nations Commission on Human Rights, 56th Session, Agenda Item 11: Civil and Political Rights. Geneva, April 6, 2000.

53. "Rich regions reject Jakarta hand." *Jakarta Post*, November 22, 1999.

54. "Workshop questions Indonesia's autonomy laws… and expert urges 'some form of federalism.'" *Jakarta Post*, July 18, 2000; "Logical flaws in regional autonomy." *Jakarta Post*, May 2, 2000.

55. International Crisis Group, *Indonesia: Overcoming Murder and Chaos in Maluku*, December 19, 2000. Online at www.intl_crisis_group.org; "Bloodbath grips Indonesia." *Far Eastern Economic Review*, July 6, 2000 (cover story).

56. "Savage attacks terrorize migrants on Borneo." *Washington Post*, February 24, 2001; "211 confirmed dead in Poso [Central Sulawesi] clashes." *Jakarta Post*, July 7, 2000; "Communal violence hits Kumai in Central Kalimantan." *Jakarta Post*, July 7, 2000; "West Kalimantan: Tension between ethnic groups obscures future." *Jakarta Post*, February 15, 2000; "Communal violence leaves over 765,000 refugees across Indonesia." Agence France-Presse, June 20, 2000.

57. "1.25 million people displaced by violence, armed conflicts." *Jakarta Post*, July 12, 2001. For an earlier report on internal refugees, see "Communal violence leaves over 765,000 refugees across Indonesia." Agence France-Presse, June 20, 2000.

58. "The new face of Indonesian justice: the legacy of police violence in the Suharto era lives on in an upsurge of brutal vigilante attacks." *Far Eastern Economic Review*, July 13, 2000 (cover story).

59. On the Indonesian military since the fall of Suharto, see: "Skeletons, vigilantes and the Armed Forces' fall from grace." In *Reformasi: Crisis and Change in Indonesia*. A. Budiman, B. Hatley, and D. Kingsbury, eds. Clayton, Australia: Monash Asia Institute, 1999.

60. J. Saunders, "Indonesian forces are part of the problem in the Moluccas." *International Herald Tribune*, July 4, 2000.

61. In July 2000, the Minister of Defense admitted that the government's police and military were unable to maintain security in the country and that it would take "between 10 and 15 years" to build a well-functioning police force. "Indonesian government cannot guarantee internal security: minister." Agence France-Presse, July 12, 2000.

62. "Plywood investors back off," *Jakarta Post*, March 18, 2000. Results of the APHI survey of concession-related conflicts, including names of companies and the specific demands of local communities, were published in "Darurat: Konflik Sosial" ["Emergency: Social Conflict"], *Hutan Indonesia* [Indonesian Forests, APHI's newsletter] No. 7, March 2000.

63. "Conflicts between locals and timber companies to grow." *Jakarta Post*, March 9, 2000. The article quoted the Director General of Forest Production as saying that "social jealousy" was probably behind the conflicts and that concession areas were probably disregarding local concerns and taking their lands without compensation.

64. For a detailed assessment of the situation in 20 of Indonesia's protected areas, see M. Wells et al., *Investing in Biodiversity: A Review of Indonesia's Integrated Conservation and Development Projects*. Washington DC: World Bank, 1999.

65. "Locals take over most of Lore Lindu National Park," *Indonesian Observer*, January 12, 2000.

66. "Foreign NGO blasts destruction of national park." *Indonesian Observer*, January 20, 2000.

67. See, for example, "Indonesia's indigenous peoples' demands for change." *Down to Earth* (43), November 1999. Newsletter.

68. For analysis of forest policy reform efforts in the year following Suharto's downfall, see: Haryanto, ed., 1998. *Kehutanan Indonesia Pasca Soeharto: Reformasi Tanpa Perubahan.* [Indonesian Forestry After Soeharto: Reform Without Change.] Bogor: Pustaka Latin; F.J. Seymour and N.K. Dubash, *The Right Conditions: The World Bank, Structural Adjustment, and Forest Policy Reform.* Washington, DC: World Resources Institute, 2000.

69. "Forestry commitments to CGI donors won't be met: minister." Agence France-Presse, April 3, 2001.

70. "Policy Dialogue for Creation of a Conducive Environment for Sustainable Management of All Types of Forests in Indonesia." Position paper presented on behalf of the Donors by the European Commission, 11th Consultative Group Meeting on Indonesia, Jakarta, Indonesia. April 23-24, 2001.

71. "Policy Dialogue for Creation of a Conducive Environment for Sustainable Management of All Types of Forests in Indonesia." Position paper presented on behalf of the Donors by the European Commission, 11th Consultative Group Meeting on Indonesia, Jakarta, Indonesia. April 23-24, 2001.

72. "Call for a Moratorium on Industrial Logging: Supporting Implementation of the Government of Indonesia's Commitments to Forestry Sector Reform." Prepared for the 11th CGI Meeting, Jakarta, April 23-24, 2001. WALHI-The Indonesian Forum for Environment. Online at http://www.walhi.or.id/KAMPANYE/Moratorium.htm

GLOSSARY

Accessed Forest: A term used in this report to describe forest that has been disturbed by human activity. Accessed forests are defined not according to a measure of biological disturbance but by the proximity of the forest to roads, navigable rivers (in the case of Kalimantan), human settlements, agriculture, mines, and other developments. Forests are considered accessed if they are within 0.5 km of rivers or 1 km of roads and other features. (See also Low Access Forest.)

Afforestation: The establishment by human action of forest cover on land that was not previously forested or was not forested within living memory.

BAPPENAS (*Badan Perencanaan Pembangunan Nasional*): National Development Planning Agency

BPS (*Baden Pusat Statistik*): Central Statistics Board

CIFOR: Center for International Forestry Research

Clear-cutting: The complete removal of all tree cover for wood harvesting and/or land clearance.

Concession: An area of natural forest designated for selective harvest under an HPH license. (See also Production Forest.)

Conservation Forest: Forest that is designated for wildlife or habitat protection, usually found within national parks and other protected areas.

Conversion Forest: Forest that is designated (under an IPK license) for clearance and permanent conversion to another form of land use, typically a timber or estate crop plantation.

Deforestation: The permanent removal of forest cover and conversion of the land to other uses. According to the *land use* definition used by FAO and accepted by most governments, forest land that has been harvested, even clear-cut, is not regarded as deforested because, in principle, trees may regrow or be replanted. Deforestation is recorded only when the land is permanently converted to nonforest use. However, the remote sensing imagery used in this report to determine *land cover* (the presence or absence of forest) over time does not make such a distinction and clear-cut land has been recorded as nonforest or deforested land.

DFID: Department for International Development, United Kingdom

EPIQ/NRM: Environmental Policy and Institutional Strengthening Indefinite Quantity Contract/Natural Resources Management Program. A program of the United States Agency for International Development (USAID).

Estate Crops: Agricultural crops grown on plantations. The most widely grown estate crops include rubber, oil palm, coconut, cocoa, and tea.

FAO: Food and Agriculture Organization of the United Nations

Forest Degradation: May be generally defined as a reduction in tree density and/or increased disturbance to the forest that results in the loss of forest products and forest-derived ecological services. The FAO defines degradation as changes within the forest class (for example, from closed to open forest) that negatively affect the stand or site and, in particular, lower production capacity. Common causes of forest degradation include selective felling, fuelwood collection, road building, and shifting cultivation.

Forest/Forest Cover: Land on which trees form the dominant vegetation type. The FAO defines forest as land with tree crown cover of more than 10 percent of the ground and land area of more than 0.5 ha. In addition, the trees should characteristically reach a minimum height of 5 m at maturity. It should be noted that a canopy cover threshold of 10 percent represents quite sparse tree cover; most natural forest in Indonesia is closed canopy forest. The Indonesian government uses a land use definition of forest in the various land use classes that comprise "Permanent Forest Status" (*see below*). However, up to 20 percent of Permanent Forest Status land has been deforested.

HPH *(Hak Pengusahaan Hutan)*: A license that is granted for the selective harvest of natural forests over a given period, typically 20 years, and is renewable for a further period, typically another 20 years. The licenses are intended to maintain the forest as permanent production forest.

HTI *(Hutan Tanaman Industri)*: A license to grow an industrial forest to supply industrial fiber, usually pulpwood, for 35 years plus 1 rotation period (typically 8 years for pulpwood.) The license may be renewed for a further 35 years. Licensees are allowed to clear 100 percent of the land area but are required to plant only 25 percent. This limited planting requirement is not always met. Industrial forests are supposed to be established on degraded land, but in practice they are sometimes established after clear-cutting natural forest.

ICRAF: International Centre for Research in Agroforestry

IPK *(Ijin Pemanfaatan Kayu)*: A license to clear land for the purposes of establishing industrial timber plantations, agricultural plantations (for example, oil palm), transmigration sites, or other development schemes. Although the ostensible purpose of IPKs is to establish plantations, they are sometimes more highly valued for the roundwood yielded by land clearance. Wood harvested from IPKs provides a major share of total roundwood supplies in Indonesia.

IUCN: World Conservation Union

Limited Production Forest: Forest that is allocated for low-intensity timber production. Typically, limited production forest is found in mountainous areas where steep slopes make logging difficult.

Low Access Forest: A term used in this report to describe primary or mature secondary-growth forests that are relatively undisturbed by human activity. Low access forests are defined according to their area and distance from roads, navigable rivers (in the case of Kalimantan), human settlements, agriculture, mines, and other development. The minimum distance from these features is 0.5-1 km. Low Access Forests allocated for use under an HPH, HTI, or IPK license are defined as potentially low access forests. (See also Accessed Forest.)

MOF: Ministry of Forestry. See also Note 1 of this report.

Natural Forest: Forests composed primarily of indigenous trees that have not been planted by humans. Natural forests exclude plantations.

NFI (National Forest Inventory): The NFI, published in 1996, was undertaken by the Indonesian government (Ministry of Forestry) with financial support from the World Bank and technical assistance from the Food and Agriculture Organization of the United Nations (FAO).

Nonforest: Any land use or land cover category other than forest.

Permanent Forest Status: Land that is legally allocated as part of the national forest estate and falls under the control of the Ministry of Forestry. The term refers to land *use* (land intended for the purposes of forestry) not to land *cover* (land covered with trees). Land under permanent forest status is not necessarily forested and is not therefore the equivalent of forest cover (*see above*).

Plantations: Forest stands established by planting and/or seeding in the process of afforestation or reforestation. They comprise either introduced species (all planted stands) or intensively managed stands of indigenous species. Plantations may be established to provide wood products (timber, pulp) or such agricultural crops as oil palm and coconut.

Production Forest: Forest that falls within the boundaries of a timber concession (under an HPH license) and is managed for timber production. Under good management, harvesting levels are balanced by planting and regrowth so that the forest will continue to produce wood indefinitely. In practice, forests within timber concessions are often heavily logged and sometimes clear-cut.

Protection Forest: Forest that is intended to serve environmental functions, typically to maintain vegetation cover and soil stability on steep slopes and to protect watersheds.

Reforestation: The establishment by humans of forest cover on land that was formerly forested.

Regrowth: The reappearance of forest on cleared or selectively logged land through natural regeneration.

RePPProT (The Regional Physical Planning Programme for Transmigration): A national survey, published in 1990, that included a mapping exercise, carried out by the Indonesian government (Ministry of Transmigration) with funds and technical assistance provided by the British government.

Roundwood: All wood in its natural state obtained from felling or other forms of harvesting. Commodities produced from roundwood include sawlogs and veneer logs, pulpwood, wood-based panels, other processed wood products, other industrial roundwood (including mining pitprops), and fuelwood.

Selective Logging/Selective Harvesting: The selective removal of specific tree species or trees of a specific size or other quality. Selective logging, depending on its intensity, may or may not result in partial opening of the canopy cover. Even very low-intensity selective logging may lead to forest degradation if trees are felled carelessly or are removed roughly from the surrounding forest.

UNEP-WCMC: United Nations Environment Programme-World Conservation Monitoring Centre.

REFERENCES

Angelsen, A. 1995. "Shifting Cultivation and 'Deforestation': A Study from Indonesia." *World Development*. Vol. 23 (10):1713-1729.

Angelsen, A. and 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." Bogor, Indonesia: CIFOR.

APKI (Indonesian Pulp and Paper Association). 2001. *Statistics of the Pulp and Paper Industry 2000.*

BAPPENAS (National Development Planning Agency). 1993. *Biodiversity Action Plan for Indonesia.*

BAPPENAS (National Development Planning Agency). 1999. *Final Report, Annex I: Causes, Extent, Impact and Costs of 1997/98 Fires and Drought*. Asian Development Bank Technical Assistance Grant TA-2999-INO, Planning for Fire Prevention and Drought Management Project.

Barber, C.V. and A. Nababan. 1997. *Eye of the Tiger: Conservation Policy and Politics on Sumatra's Rainforest Frontier*. Washington DC and Bogor, Indonesia: World Resources Institute and Telapak Indonesia. (Unpublished research report.)

Barber, C.V. and J. Schweithelm. 2000. *Trial By Fire: Forest Fires and Forestry Policy in Indonesia's Era of Crisis and Reform*. Washington DC: World Resources Institute.

Barr, C. 2000. "Profits on Paper: The Political-Economy of Fiber, Finance, and Debt in Indonesia's Pulp and Paper Industries." In Christopher Barr, *Banking on Sustainability: A Critical Assessment of Structural Adjustment in Indonesia's Forest and Estate Crop Industries*. Bogor, Indonesia: CIFOR and WWF, forthcoming.

Bierregaard, R.O., T.E. Lovejoy, V. Kapos, A. Augusto dos Santos, and R.W. Hutchings. 1992. "The Biological Dynamics of Tropical Rainforest Fragments." *BioScience* 4211: 859-866.

Bogor Agricultural Institute (Institut Pertanian Bogor). 1999. "Kajian Sistem Nilai Hutan Produksi." [Production Forest Value Research System.] Bogor, Indonesia: Forestry Faculty, IPB. Unpublished, in Indonesian.

Booth, A. 1988. *Agricultural Development in Indonesia*. Sydney: Allen & Unwin Ltd.

Brown, D.W. 1999. *Addicted to Rent: Corporate and Spatial Distribution of Forest Resources in Indonesia; Implications for Forest Sustainability and Government Policy*. Jakarta: Indonesia-UK Tropical Forest Management Programme.

Casson, A. 2000. *The Hesitant Boom: Indonesia's Oil Palm Sub-sector in an Era of Economic Crisis and Political Change*. Bogor, Indonesia: CIFOR. Occasional Paper 29. ISSN 0854-9818.

Central Statistics Board (BPS). Cited in N. Scotland. 2000. "Indonesia Country Paper on Illegal Logging." Paper prepared for the World Bank-WWF Workshop on Control of Illegal Logging in East Asia. Jakarta, Indonesia. August 28, 2000.

De Beer, J.H. and M.J. McDermott, 1996. *The Economic Value of Non-Timber Forest Products in Southeast Asia*. Amsterdam: Netherlands Committee for IUCN. Second Revised Edition: 74.

Dick, J. 1991. "Forest Land Use, Forest Use Zonation, and Deforestation in Indonesia: A Summary and Interpretation of Existing Information." Background paper to United Nations Conference on Environment and Development (UNCED) for the State Ministry for Population and Environment (KLH) and the Environmental Impact Management Agency (BAPEDAL). Cited in Sunderlin, 1997.

FAOSTAT. 2001. Electronic database of the Food and Agriculture Organization of the United Nations. Available online at: http://apps.fao.org/subscriber/page/collections?subset=forestry Accessed July 18.

FAO (Food and Agriculture Organization of the United Nations). 2001. *Unasylva:* Vol. 52 (205).

Fox, J., M. Wasson and G. Applegate. 2000. "Forest Use Policies and Strategies in Indonesia: A Need for Change." May. Jakarta, Indonesia. Paper prepared for the World Bank.

Gellert, P.K. 1998. "The Limits of Capacity: The Political Economy and Ecology of the Indonesian Timber Industry, 1967-1985." Unpublished Ph.D dissertation., University of Wisconsin-Madison.

Gillis, M. 1988. "Indonesia: Public Policies, Resource Management, and the Tropical Forest." In *Public Policies and the Misuse of Forest Resources*. R. Repetto and M. Gillis, eds. Cambridge, UK: Cambridge University Press.

GOI (Government of Indonesia) and IIED (International Institute for Environment and Development). 1985. *Forest Policies in Indonesia: The Sustainable Development of Forest Lands*. Jakarta, Indonesia. In three volumes.

Goldammer, J.G. ed. 1990. "Fire in the Tropical Biota: Ecosystem Processes and Global Challenges." *Ecological Studies* 84. Berlin-Heidelberg: Springer-Verlag.

Hannibal, L.W. 1950. Vegetation Map of Indonesia. Planning Department, Forest Service, Jakarta. In: *Forest Policies in Indonesia: The Sustainable Development of Forest Lands*. Jakarta, Indonesia: International Institute for Environment and Development and Government of Indonesia. 1985. Volume 3, Ch. 4.

Heil, A. 1998. "Air Pollution Caused by Large Scale Forest Fires in Indonesia, 1997." Report for the German Agency for Technical Cooperation (GTZ) Project on Strengthening the Management of the Indonesian Forestry Ministry (SCMP) and the Integrated Forest Fire Management Project (IFFM), Jakarta, Indonesia. Unpublished.

Hess, P. 1994. "Forest Fire in East Kalimantan 1982/1983: effects, damages and technical solutions." Paper presented at the Workshop on Forest Rehabilitation and Forest Protection from Fire. Samarinda, East Kalimantan, Indonesia. January 31-February 2, 1994.

Hoffmann, A.A., A. Hinrichs, and F. Siegert. 1999. *Fire Damage in East Kalimantan in 1997/1998 Related to Land Use and Vegetation: Satellite Radar Inventory Results and Proposals for Futher Actions*. IFFM-SFMP Report 1a. ISBN 979-606-044-2.

Holmes, D. 2000. *Deforestation in Indonesia: A View of the Situation in 1999*. Jakarta, Indonesia: World Bank. Draft Report of July 3.

ITTO (International Tropical Timber Organization). 2001. *Annual Review and Assessment of the World Timber Situation, 2000.* Yokohama, Japan: ITTO.

Kartodihardjo, H. and A. Supriono. 2000. *The Impact of Sectoral Development on Natural Forest Conversion and Degradation: The Case of Timber and Tree Crop Plantations in Indonesia.* Bogor, Indonesia: CIFOR. Occasional Paper 26(E). ISSN 0854-9818.

Mackie, C. 1984. "The Lessons Behind East Kalimantan's Forest Fires." *Borneo Research Bulletin*. 16:63-74.

Mackinnon, J., ed. 1997. *Protected Areas Systems Review of the Indo-Malayan Realm*. Canterbury, UK: Asian Bureau for Conservation.

MOF (Ministry of Forestry). 2000. *Rencana Stratejik 2001-2005* [Strategic Plan 2001-2005]. Jakarta, Indonesia: Ministry of Forestry.

MOF (Ministry of Forestry). 2000. "Analysis and Discussion Paper by the Director General for Protection and Conservation of Nature," National Working Meeting of the Ministry of Forestry and Estate Crops, June 26-29. Translation from original by C.V. Barber.

Newman, J., A Ruwindrijarto, D. Currey, and Hapsoro. 1999. *The Final Cut: Illegal Logging in Indonesia's Orangutan Parks.* Jakarta and London: Environmental Investigation Agency and Telapak Indonesia.

Nicholls, N. 1993. "ENSO, Drought and Flooding in Southeast Asia." In *Southeast Asia's Environmental Future: The Search for Sustainability.* H. Brookfield and Y. Byron, eds. Tokyo, Japan: United Nations University Press; Oxford, UK: Oxford University Press.

Oil World. 2001. *Oil World Annual 2000*. Hamburg, Germany: ISTA Mielke GmbH.

Peluso, N.L. 1992. *Rich Forests, Poor People: Forest Control and Resistance in Java*. Berkeley CA: University of California Press.

RePPProT (Regional Physical Planning Programme for Transmigration). 1990. *The Land Resources of Indonesia: A National Overview*. Final report. Land Resources Department of the Overseas Development Administration, London (Government of UK), and Ministry of Transmigration (Government of Indonesia), Jakarta, Indonesia.

Romm, J. 1980. "Forest Development in Indonesia and the Productive Transformation of Capital." Paper presented at the Ninth Annual Conference on Indonesian Studies, July 31-August 3. Berkeley CA.

Sargeant, H. 2001. *Vegetation Fires in Sumatra, Indonesia. Oil Palm Agriculture in the Wetlands of Sumatra: Destruction or Development?* A report of the Forest Fire Prevention and Control Project. Jakarta, Indonesia: GOI, Ministry of Forestry and the European Union.

Schindler, L., W. Thoma, and K. Panzer. 1989. *The Kalimantan Forest Fire of 1982-3 in East Kalimantan. Part 1: The Fire, the Effects ,the Damage and Technical Solutions*. FR Report 5. Jakarta, Indonesia: German Agency for Technical Cooperation (GTZ) and International Tropical Timber Organization (ITTO).

Scotland, N. 2000. "Indonesia Country Paper on Illegal Logging." Paper prepared for the World Bank-WWF Workshop on Control of Illegal Logging in East Asia. Jakarta, Indonesia, August 28. Draft.

Seymour, F. and N. Dubash. 2000. *The Right Conditions: The World Bank, Structural Adjustment, and Forest Policy Reform*. Washington DC: World Resources Institute.

Spalding, M., F. Blasco, and C. Field. 1997. *World Mangrove Atlas*. Okinawa, Japan: International Society for Mangrove Ecosystems.

State Ministry for Environment and United Nations Development Programme (UNDP). 1998. *Forest and Land Fires in Indonesia. Vol. I, Impacts, Factors and Evaluation*. Jakarta, Indonesia.

Sunderlin, W.D. 1997. *Shifting Cultivation and Deforestation in Indonesia: Steps Toward Overcoming Confusion in the Debate*. Network Paper 21b. London: Overseas Development Institute (ODI).

Sunderlin, W.D. 1999. "Between Danger and Opportunity: Indonesia and Forests in an Era of Economic Crisis and Political Change." *Society & Natural Resources* 12:559-570.

Sunderlin, W.D. and I.A.P. Resosudarmo. 1996. *Rates and Causes of Deforestation in Indonesia: Towards a Resolution of the Ambiguities*. Bogor, Indonesia: CIFOR. Occasional Paper 9. ISSN 0854-9818.

Sunderlin, W.D., I.A.P. Resosudarmo, E. Rianto, and A. Angelsen. 2000. *The Effect of Indonesia's Economic Crisis on Small Farmers and Natural Forest Cover in the Outer Islands.* Bogor, Indonesia: CIFOR. Occasional Paper 28(E). ISSN 0854-9818.

Thiollay, J.M. 1989. "Area Requirements for the Conservation of Rainforest Raptors and Game Birds in French Guiana." *Conservation Biology* 3 (2):128-137.

Wakker, E. 2000. *Funding Forest Destruction: The Involvement of Dutch Banks in the Financing of Oil Palm Plantations in Indonesia*. Amsterdam and Bogor, Indonesia: AIDEnvironment, in co-operation with Jan Willem van Gelder Contrast Advies and the Telapak Sawit Research Team. Commissioned by Greenpeace Netherlands.

World Bank, 1994. *Indonesia Transmigration Program: A Review of Five Bank-Supported Projects*. Report 12988. Washington, DC.

World Bank. 1998. "Involvement in Sector Adjustment for Forests in Indonesia: The Issues." Jakarta, Indonesia. Memorandum.

World Bank. 2001. *Indonesia: Environment and Natural Resource Management in a Time of Transition*. Washington, DC: World Bank.

World Conservation Monitoring Centre (UNEP-WCMC). 1996. *Tropical Moist Forests and Protected Areas: The Digital Files. Version 1.* Cambridge, UK: World Conservation Monitoring Centre, Centre for International Forestry Research, and Overseas Development Adminstration of the United Kingdom.

World Conservation Monitoring Centre (UNEP-WCMC). 2000. Subset of V 4.0 UNEP-WCMC Protected Areas Global GIS dataset. March.

Zerner, C. 1992. *Indigenous Forest-Dwelling Communities in Indonesia's Outer Islands: Livelihood, Rights, and Environmental Management Institutions in the Era of Industrial Forest Exploitation*. Consultancy report prepared for the World Bank Indonesia Forestry Sector Policy Review. Washington, DC: Resource Planning Corporation.

Annex 1 Guest Commentaries on Data Difficulties

The following contributions were solicited by Global Forest Watch from two experienced researchers in the field of Indonesian forestry. Both are based on personal experiences and offer some frank insights into the obstacles that can block the path of those who wish to compile and analyze credible forestry statistics for Indonesia. The stories are backward-looking in that they generally describe conditions prevailing under the Suharto regime. They do not reflect the genuine efforts among at least some members of more recent administrations to improve both the quality of and access to forestry data. Nevertheless, Tim Brown's observation that "official data from the Ministry of Forestry sometimes seem surreal" is as valid today as it was in the 1970s, 1980s, and 1990s.

Whose "Official" Data Should We Believe?

By Tim Brown

Central Statistics Board (BPS) Data on Indonesia's Forestry Sector[1]

One current focus of policy debate in Indonesia is on the sources and trends in forest use and timber harvesting as well as on the industry restructuring needed to face the future. Estimates of wood use and industrial capacity vary all over the map (25-90 million m^3 of wood per year), depending on the assumptions – and you have to use assumptions because the official data from the Ministry of Forestry are notoriously "weak."

The Natural Resources Management (NRM) Program of USAID was excited by the prospect of analyzing data on the wood processing industry from the annual *Survey of Large & Medium Manufacturers* conducted by the Central Statistics Board (*Badan Pusat Statistik, BPS*), which sets the standard for quality official data in Indonesia. This survey attempts complete enumeration of all industrial sectors based on a standard questionnaire with a response rate of over 85 percent. It provides detailed information about the structure of Indonesia's wood processing sector so that wood use, efficiency, productivity, and trends can be examined. The dataset offers great advantages: it is collected independently using a consistent approach every year. The large sample allows a reasonable projection to the entire population. Best of all, compared to Ministry of Forestry sources, it provides disaggregated firm level data – no names, though – that can be analyzed by region or subsector.

Excitement turned to exhaustion after the fourth or fifth month of waiting – after we had paid – to get the electronic data from our BPS contact. Exhaustion nearly reached exasperation as we found that all this detail had to be cleaned and organized before the data could be sorted or analyzed. Because BPS works with all sectors, firms must specify their own line of products (with no codes or guidelines), which can be general or specific (e.g., plywood or teak plywood) and can use Indonesian (e.g., *kayu lapis*) or English. Self-reporting also means potential for bias, gaps, mismatched units, or such incredible results as output volumes that exceed input volumes. Also note that the general questionnaire may not offer specifics that some analysts would want (e.g., timber from "concession," "conversion," or "purchased"). Foremost among the disadvantages, though, is the delay of up to 2 years for BPS to get the data into a processed form: data from 1998 are not yet available (in 2001).

1. Based on: "Overview Of Commercial Forestry Sector: Analysis of BPS Survey of Manufacturing," Presentation by Natural Resources Management (NRM) Program Policy, and Planning Group and Protected Areas and Forest Management Group. Jakarta, Indonesia, June 2000.

Still, through much effort by a team of analysts, we were able to calculate that Indonesia's solid wood-processing industry was using at least 33.1 million cubic meters of wood per year in the mid-1990s (sawmills: 9.4 million m^3; plymills: 23.7 million m^3). These figures are for a period (1994-1997) when the Ministry of Forestry was reporting official log production of about 25 million m^3 per year. The estimate is a lower bound because it does not include all small sawmills (potentially another 5-6 million m^3 per year) or the pulp and paper sector, which was then using as much as 15 million m^3 per year.

Though this is just one in a sea of estimates, it carries the credibility of BPS and establishes a realistic lower bound backed by firm level data. This "minimum estimate" represents a prodigious volume of wood and a major pressure on Indonesia's forests. Further, it is about 40 percent higher than the Ministry of Forestry reports. The enormous potential of this database remains untapped, mainly owing to constraints of time, money, and demand from counterparts.

A Series of Troubles with Time Series [2]

Indonesia's financial (and political) crisis is not over. In addition to profound human effects, most people believe that the crisis has important impacts on natural resources. Discussions of this topic usually rely on anecdotal evidence, however, rather than on rigorous analysis. Consistent time series data are the key to tracing the effects of the crisis on forests.

Two sources come to mind for an economist who is reaching for the closest, easiest secondary data. The Ministry of Forestry, Directorate General for Forest Utilization publishes a *Forest Utilization Statistical Yearbook* annually. It reports monthly production of roundwood (harvests from concessions, conversion, woodlots, plantations, etc.) and processed wood (in the form of plywood, sawnwood, and other types of wood products). These statistics are based on the real world (volumes harvested, hectares converted), although, admittedly, official data from the Ministry of Forestry sometimes seem surreal.

Indonesia's Central Statistics Board, which sets the standard for official data, publishes such key economic indicators as Gross Domestic Product and value of exports every quarter. It tracks economic subsectors including forestry (as part of the agriculture and natural resources sector) and forest products (as part of the manufacturing sector). Much of this information is financial, however, at least in the easily obtained *Monthly Indicators* document.

Data quality aside, it seems that these two sources should be combined and compared to analyze crisis impacts from both a financial (earnings) and real (volumes) perspective. Even without the crisis, comparing the volume data from one source with the earnings data from another source would be interesting. Easy, except for the devilish details.

Until the end of 1998, BPS's *Monthly Indicators* booklet included all the subsectors of "general manufacturing" (including wood processing and paper) in a quarterly time series that can be traced backwards relatively easily. Starting in January 1999, though, BPS stopped including all the detailed subsector data in the booklet. These data can be obtained, but not conveniently, through monthly periodicals available through the BPS bookstore.

The Ministry of Forestry's *Statistical Yearbook* is considerably more difficult to work with. The publication is structured differently in different years. Although many of the tables are the same, content or definitions change with little warning or documentation. And because these documents have never been widely disseminated, it can become almost a word-of-mouth process to find a copy for a particular year. Most of mine are copies of copies.

Most years, the log and processed wood production data are published by month and by province. . .but not every year. For 1994 and 1995 (important precrisis years for the time series), log production is available by month, but volume of processed wood products is not. Even the log production, or harvest data, are not consistent. Some years "wood chips" are reported monthly by province but are not included under "total harvest." Is that because "wood chips" aren't "roundwood" or because they are lumped with something else? For the early 1990s, these consistency and continuity problems were even greater.

Even when monthly data on processed wood products are reported, great detail is sometimes provided

2. "Natural Resource Impacts Of Indonesia's Financial Crisis." NRM Program, Policy and Planning Group. Presentation for BAPPENAS. Jakarta, Indonesia. August 2000. Updated semi-annually.

for all minor products, such as block board, veneer, particle board, chips, pulp, moulding, dowels, and paper. Other years these details are not provided. Is that because there was no production that year? Or because the aggregation scheme was different? Watch out for the units, too: older issues report pulp in cubic meters, instead of tons, as is more usual. Seems wrong, but how can you be sure?

More recently, it has become easier to track down the people responsible for these reports and get the data on a disk. The quality and consistency of the reports are improving, as is the Ministry of Forestry website (www.mofrinet.cbn.net.id).

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Secrecy in the Indonesian Forest Products Sector: A Researcher's Experience

By David W. Brown

How difficult is it to obtain information on the Indonesian forest products industry? It is possible to get this type of information, but researchers must be tenacious and willing to live with setbacks of years at a time.

In 1993, I was awarded a grant from the U.S. Social Science Research Council and the Ford Foundation to study the Indonesian forest products industry. I was to have initiated my work that very summer, but I had to wait 2 years for approval from Indonesian authorities to begin my research. I managed to use the first year in the United States productively, but the second year was almost totally wasted. In experiencing such delays, I was not alone. In the first half of the 1990s, many researchers were denied permission to study even innocuous topics in Indonesia. However, because I was never actually denied permission to enter the country, I do not have evidence that anyone in the government objected to my topic.

I never did get formal approval from the Indonesian government to conduct research. Instead, I contacted a tropical forestry expert with the World Bank in Indonesia and asked him to sponsor my work. He agreed and arranged for a 1-year appointment in the Bank as an unpaid natural resource specialist. The visa that accompanied that appointment was indispensable to my being able to start my research.

But problems quickly emerged at my sponsoring institution, the World Bank. The forestry expert who arranged for me to enter Indonesia was reassigned to Washington. Some of those who remained in Jakarta were hostile to my research. For example, one staffer withheld a document she had been instructed to pass along to me and told me, in her own words, that she did not "trust" me. The real setback came when the Bank's Chief of Mission barred me from coming into the Bank's offices. I did not insist on the Bank's honoring its commitment to me because this could have resulted in my visa being revoked. I made a decision to lay low and did not return to the Bank until years later.

Fortunately, a forestry aid project sponsored by the United Kingdom's Department for International Development (DFID) saw value in my work. At the end of my formal scholarly research, the DFID hired me for a consultancy, which helped me obtain a wealth of data. Later I went to work there full time. The DFID had built up a great deal of trust and goodwill in the Indonesian Department of Forestry over the course of a decade and, as an employee of their project, I benefited from that trust. When I asked the department for sensitive documents, I would usually receive them, but only because I was affiliated with the project.

Even though I came to enjoy a solid institutional entrée to the Indonesian Department of Forestry, I occasionally ran into resistance. This first happened when I was given obviously fake data on the domestic price of Indonesian roundwood. The department told me that Indonesian mills were buying logs from Indonesian timber concessionaires for US$100 per m^3, when in fact our project knew

that mills were buying legal wood for half that price and illegal wood for one fifth that price. Why would the department deliberately overstate the domestic price of logs? The government wished to obscure the fact that Indonesian plywood factories were making enormous windfall profits from buying Indonesian logs at low prices on the glutted domestic market and then processing those cheap logs into plywood and selling them at full prices on the world market. Meanwhile, Indonesia was taxing timber concessionaires and wood processors at suboptimal rates. Therefore, instead of the majority of potential revenue being officially *collected* by the government to pursue national economic development objectives, the timber industry and their patrons in the government unofficially *appropriated* the majority of revenue. To some extent, the Department of Forestry was able to hide this practice by giving out inflated domestic log price information.

A second instance of obstruction came when an official in the Indonesian Department of Forestry expressed reservations about my borrowing annual work plans for timber concessions in eastern Indonesia. When I left his office with harvesting plans for a dozen concessions, he warned me, "Don't leak these." When I analyzed the work plans, I began to see why he had issued this warning. Maps of one concessionaire, Brata Jaya Utama, owned by the National Police, showed that the company was logging inside a biodiversity hotspot, Manusela National Park, on Seram Island. (I never leaked this information but did report it to the former head of the department's planning body in an official letter.) I also discovered that another timber concession, located in a biologically sensitive buffer zone between two proposed parks on Halmahera island, which had been turned over to one of the state forestry corporations for the purpose of rehabilitation, was not being rehabilitated at all, but instead its virgin forests were being harvested.

Although I did encounter resistance from various institutions, I do not wish to characterize them as nontransparent just because some of their employees went out of their way to withhold information. Rather, it is important to take a broader view of the structural constraints on these institutions. Tropical timber as a commodity embodies high levels of windfall profit, whose very existence creates a strong *disincentive* for the proper management of the resource. Years of rent-seeking at all levels of the Indonesian government, especially at the top, have crippled the ability of institutions, including the Department of Forestry, to regulate industry properly. Meanwhile, multilateral and bilateral donors have their own sets of constraints. On the one hand, donors are compelled to give out loans or grants to economically distressed governments but, on the other hand, are institutionally incapable of ensuring that these funds are not simply appropriated by government leaders.

In summary, agencies that work in and around the tropical timber sector face structural barriers that prevent their employees from doing the right thing. Nevertheless, all these agencies have at least some good employees working in them. These staff are genuinely committed to the survival of the forest and to the people whose lives most directly depend upon it. Researchers must strive to identify these employees, befriend them, not place them in danger, and above all, report the truth.

David W. Brown worked as a political economist for the UK-Indonesia Tropical Forest Management Programme, and as a forest products investment analyst with the global investment bank of Dresdner Kleinwort Benson. In recent years he has also undertaken consultancies for the World Bank, the Indonesian Bank Restructuring Agency, and The Nature Conservancy. Brown was recently awarded a Ph.D. by the Political Science Department of the University of Washington. His dissertation explains how the secret appropriation of timber windfall profits by political leaders undermines timber revenue policy in developing nations.

Annex 2 Tables

Annex Table 1 Permanent Forest Status and Actual Forest Cover, 1997

Province	Total Land Area (Ha)	Conservation Forest (Ha)	Protection Forest (Ha)	Limited Production Forest (Ha)	Production Forest (Ha)	Permanent Forest Status (Ha)	Actual Forest Cover (Ha)	Conversion Forest (Ha)
Aceh	5,674,800	852,421	1,844,500	37,300	601,392	3,335,613	3,611,953	0
Northern Sumatra	7,250,100	253,885	1,924,535	760,958	871,183	3,810,561	1,891,819	37,797
Western Sumatra	4,169,000	846,175	910,533	246,383	407,849	2,410,940	1,944,015	189,346
Riau	9,859,700	560,237	1,323,801	0	2,649,608	4,533,646	5,071,891	334,521
Jambi	4,873,900	676,120	191,130	340,700	971,490	2,179,440	1,603,079	0
Southern Sumatra	10,226,300	822,300	879,390	298,600	2,269,400	4,269,690	1,248,209	774,100
Bengkulu	2,090,400	444,882	252,042	182,210	41,830	920,964	899,858	70,360
Lampung	3,386,700	422,500	331,531	44,120	192,902	991,053	361,319	153,459
Sumatra	**47,530,900**	**4,878,520**	**7,657,462**	**1,910,271**	**8,005,654**	**22,451,907**	**16,632,143**	**1,559,583**
West Kalimantan	14,753,000	1,435,480	2,355,045	2,421,950	2,235,700	8,448,175	6,713,026	582,320
Central Kalimantan	15,360,400	680,580	1,014,130	4,593,003	4,448,222	10,735,935	9,900,000	0
South Kalimantan	3,749,000	176,615	554,139	155,268	687,834	1,573,856	999,182	265,638
East Kalimantan	19,721,000	2,166,212	2,935,478	4,755,494	4,727,488	14,584,672	13,900,000	0
Kalimantan	**53,583,400**	**4,458,887**	**6,858,792**	**11,925,715**	**12,099,244**	**35,342,638**	**31,512,208**	**847,958**
North Sulawesi	2,655,500	429,065	341,447	552,573	168,108	1,491,193	1,300,000	34,812
Central Sulawesi	6,032,900	676,248	1,489,923	1,476,316	483,034	4,125,521	3,400,000	269,411
South Sulawesi	6,245,100	843,966	1,928,597	828,255	186,666	3,787,484	2,300,000	102,073
Southeast Sulawesi	3,681,000	274,069	1,061,270	419,244	633,431	2,388,014	2,000,000	212,123
Sulawesi	**18,614,500**	**2,223,348**	**4,821,237**	**3,276,388**	**1,471,239**	**11,792,212**	**9,000,000**	**618,419**
Subtotal: 3 Islands	**119,728,800**	**11,560,755**	**19,337,491**	**17,112,374**	**21,576,137**	**69,586,757**	**57,144,351**	**3,025,960**
Java and Bali	13,820,400	468,233	728,651	394,316	1,633,383	3,224,583	1,946,375	0
Nusa Tenggara	8,074,000	567,714	1,571,418	651,257	676,326	3,466,715	460,300	352,667
Maluku	7,801,900	443,345	1,809,634	1,653,625	1,053,171	4,959,775	5,543,506	2,034,932
Irian Jaya	41,480,000	7,539,300	11,452,990	3,365,475	10,379,684	32,737,449	33,160,231	2,671,275
TOTAL INDONESIA	**190,905,100**	**20,579,347**	**34,900,184**	**23,177,047**	**35,318,701**	**113,975,279**	**98,254,763**	**8,084,834**

Source: Holmes, 2000.
Note: Actual Forest Cover, 1997 for Java/Bali and Nusa Tenggara are GFW estimates based on GOI/World Bank, 2000.

Annex Table 2 Partial List of Suharto Family Logging and Plantation Companies

Company	Suharto Family Owner	Sector	Area (Ha)	Location
Adindo Hutani Lestari	Siti Hediati Hariyadi	Timber/Pulp Plantation	201,281	West Kalimantan
Arha Putra Internasional	Ari Sigit	Peat Forest Development	4,400	Riau
Buana Estate (I)	Probosutedjo	Plantation: Rubber, Cocoa, Coconut, Oil Palm	1,788	North Sumatra
Buana Estate (II)	Probosutedjo	Plantation: Coconut, Oil Palm, Cocoa	753	North Sumatra
Buana Estate (II)	Probosutedjo	Plantation: Rubber, Cocoa	956	North Sumatra
Buana Estate Hambalang	Probosutedjo	Plantation: Clove, Coconut, Rubber	705	West Java
Bumi Pratama Usaha Jaya	Hutomo Mandala Putra	Logging Concession	56,000	South Sumatra
Citra Lamtorogung Persada	Siti Hardiyanti Rukmana	Plantation: Cocoa	1,585	West Kalimantan
Condong Garut	Hutomo Mandala Putra	Plantation: Rubber, Coconut Oil, Palm	5,021	West Java
Dacridium II	Siti Hediati Hariyadi	Logging Concession	80,000	Central Kalimantan
Duta Rendra Mulya Sejahtera	Bambang Trihatmodjo	Logging Concession	215,000	East Kalimantan
Eucalyptus Tanaman Lestari	Siti Hediati Hariyadi	Timber/Pulp Plantation	298,900	Irian Jaya
Fajar Multi Dharma	Ari Sigit	Plantation: Coconut, Oil Palm	15,975	South Sulawesi
Gowa Manurung Jaya	Dr. Ibnu Hartomo	Plantation: Coconut, Oil Palm	10,000	South Sumatra
Gula Putih Mataram	Bambang Trihatmodjo	Plantation: Sugar Cane	18,000	Lampung
Gunung Madu Plant	Sigit Harjojudanto	Plantation: Sugar Cane	17,209	Lampung
Gunung Sinaji	Hutomo Mandala Putra	Plantation: Coconut, Oil Palm	n.d.	South Sulawesi
Hanurata	Family Foundation	Logging Concession	151,600	East Kalimantan
Hanurata	Family Foundation	Logging Concession	188,500	Irian Jaya
Hanurata	Family Foundation	Logging Concession	471,570	Irian Jaya
Harapan Kita Utama	Bambang Trihatmodjo	Logging Concession	138,500	West Kalimantan
Humpuss Graha Nabari	Hutomo Mandala Putra	Plantation: Coconut, Oil Palm	n.d.	West Sumatra
IFA	Siti Hardiyanti Rukmana	Logging Concession	248,100	Jambi
Indo Lampung Perkasa	Bambang Trihatmodjo	Plantation: Sugar Cane	21,401	Lampung
ITCI	Bambang Trihatmodjo	Logging Concession	262,573	East Kalimantan
Jabontara Ekakarsa	Ratna Hardjojudanto	Plantation: Coconut, Oil Palm	10,086	East Kalimantan
Maharani Puricitra Agung	Siti Hediati Hariyadi	Plantation: Coconut, Oil Palm	n.d.	West Sumatra

Annex Table 2 *(continued)* **Partial List of Suharto Family Logging and Plantation Companies**

Company	Suharto Family Owner	Sector	Area (Ha)	Location
Maharani Rayon Jaya	Siti Hediati Hariyadi	Timber/Pulp Plantation	206,800	Irian Jaya
Mandala Permai	Hutomo Mandala Putra	Plantation: Cocoa	536	West Java
Mantikei	Siti Hediati Hariyadi	Logging Concession	40,000	Central Kalimantan
Melapi Timber	Siti Hardiyanti Rukmana	Logging Concession	150,000	East Kalimantan
Menara Hutan Buana	Probosutedjo	Timber/Pulp Plantation	268,585	South Kalimantan
Menara Tri Buana (IV)	Probosutedjo	Plantation: Coconut, Hibrida, Cocoa	979	South Sulawesi
Menara Tri Buana	Probosutedjo	Plantation: Coconut, Hibrida	38,095	South Sulawesi
Mertju Buana (III)	Probosutedjo	Plantation: Cocoa	4,576	Bengkulu
Multigambut Industri	Siti Hediati Hariyadi	Plantation: Coconut, Oil Palm	23,045	Riau
Musi Hutan Persada	Siti Hardiyanti Rukmana	Timber/Pulp Plantation	296,400	South Sumatra
Musi Rindang Wahana	Siti Hardiyanti Rukmana	Plantation: Coconut, Oil Palm	7,020	South Sumatra
Okaba Rimba Makmur	Siti Hediati Hariyadi	Timber/Pulp Plantation	283,500	Irian Jaya
Panambangan	Yayasan	Logging Concession	44,786	East Kalimantan
Pemuka Sakti Manis Indah	n.d.	Plantation: Sugar Cane	30,000	Lampung
Prakarsa Tani Sejati	Siti Hediati Hariyadi	Plantation: Coconut, Oil Palm	16,079	Riau
Rante Mario	Hutomo Mandala Putra	Logging Concession	114,000	South Sulawesi
Rejosaribumi (III)	n.d.	Plantation: Coconut, Cocoa, Rubber	413	West Java
Rejosaribumi (III)	Siti Hardiyanti Rukmana	Plantation: Teh, Kopi, Rubber, Antan	751	West Java
Rejosaribumi (IV)	Siti Hardiyanti Rukmana	Plantation: Clove, Rubber, Antan, Ternak	123	West Java
Rejosaribumi	Siti Hardiyanti Rukmana	Logging Concession	57,090	East Kalimantan
Saudara Sejati Luhur	Sudwikatmono	Plantation: Oil Palm	2,319	North Sumatra
Sinar Kalbar Raya	Siti Hediati Hariyadi	Timber/Pulp Plantation	72,315	West Kalimantan
Sweet Indo Lampung	Bambang Trihatmodjo	Plantation: Sugar Cane	25,435	Lampung
Tidar Kerinci Kerinci Agung	Siti Hediati Hariyadi	Plantation: Coconut, Oil Palm	18,433	West Sumatra
Tridan Satria Putra Indonesia	Siti Hardiyanti Rukmana	Plantation: Sugar Cane		East Timor
Wahana Sari Sakti	Ratna Hardjojudanto	Logging Concession	100,000	Central Sulawesi
Wonorejo Perdana	Notosuwito	Plantation: Coconut, Oil Palm, Rubber	9,091	North Sumatra

Source: Ministry of Forestry and Estate Crops.1998. Announcement, December 8.

Annex Table 3 Concession Area by Region and Province, 1985–1998

Province	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998
Aceh	1,511,000	14,565,00	1,778,500	1,803,700	2,202,900	1,803,700	1,834,100	1,618,800	1,472,614	1,574,704.00
N. Sumatra	991,000	1,025,400	1,099,680	1,080,600	879,000	1,080,600	1,033,600	950,600	731,990	745,788.00
W. Sumatra	950,000	968,000	980,000	766,200	512,200	766,200	561,900	528,900	412,230	450,610.00
Riau	6,031,000	6,435,000	6,145,000	5,481,030	5,831,120	5,481,028	5,032,858	4,482,843	4,153,399	3,282,489.00
Jambi	2,388,000	2,662,000	2,349,000	2,218,670	2,684,101	2,218,670	2,152,700	2,154,689	1,447,779	1,113,499.00
S. Sumatra	1,986,000	2,261,000	511,000	1,871,550	1,704,300	1,871,550	1,747,850	1,406,850	1,231,850	1,120,280.00
Bengkulu	299,000	411,000	2,505,800	352,900	375,000	352,900	352,900	352,900	352,900	352,900.00
Lampung	177,000	190,000	195,000	40,000	0	40,000	0	0	0	0
Total Sumatra	**14,333,000**	**13,952,400**	**15,563,980**	**13,614,650**	**14,188,621**	**13,614,648**	**12,715,908**	**11,495,582**	**9,802,762**	**8,640,270.00**
W. Kalimantan	5,902,000	5,852,100	5,596,000	5,509,390	6,131,600	5,509,395	5,274,230	4,817,500	5,153,500	4,746,036.00
C. Kalimantan	11,145,000	11,748,000	11,097,000	11,509,750	10,864,252	11,509,750	11,152,564	9,891,509	9,563,775	7,900,494.00
S. Kalimantan	1,479,000	1,123,500	1,233,000	1,255,950	1,042,500	1,255,950	1,217,950	1,149,790	1,102,310	902,870.00
E. Kalimantan	12,009,000	12,426,800	11,356,700	13,201,430	12,286,401	13,201,425	12,770,215	11,209,199	10,624,854	9,497,024.00
Total Kalimantan	**30,535,000**	**31,150,400**	**29,282,700**	**31,476,520**	**30,324,753**	**31,476,520**	**30,414,959**	**27,067,998**	**26,444,439**	**23,046,424.00**
N. Sulawesi	492,000	542,800	755,000	599,100	261,300	559,100	676,650	676,650	676,650	676,650.00
C. Sulawesi	2,126,000	1,669,000	1,908,000	1,967,500	2,232,100	1,967,500	1,751,500	1,654,790	1,640,410	1,531,288.00
S. Sulawesi	2,126,000	279,000	647,000	651,200	587,462	651,197	529,557	437,962	486,602	486,602.00
S.E. Sulawesi	244,000	680,000	398,000	651,000	651,000	651,000	651,000	651,000	651,000	491,500.00
Total Sulawesi	**4,988,000**	**3,170,800**	**3,708,000**	**3,868,800**	**3,731,862**	**3,828,797**	**3,608,707**	**3,420,402**	**3,454,662**	**3,186,040.00**
Nusa Tenggara	**20,000**	**90,500**	**80,500**	**80,500**	**81,100**	**80,500**	**80,500**	**80,500**	**80,500**	**80,500.00**
Maluku	**2,260,000**	**3,327,000**	**3,041,800**	**3,527,930**	**3,745,300**	**3,527,925**	**3,083,123**	**3,083,123**	**3,083,123**	**3,078,209.00**
Irian Jaya	**2,812,000**	**5,734,800**	**7,722,300**	**9,197,500**	**9,664,900**	**9,197,500**	**11,017,570**	**11,017,570**	**11,226,030**	**11,490,773.00**
TOTAL INDONESIA	**54,948,000**	**58,881,400**	**59,399,280**	**57,897,100**	**61,736,536**	**61,725,890**	**60,920,767**	**53,883,056**	**54,268,516**	**49,522,216**

Sources: Forestry Statistics Indonesia, 1998; Concession names and locations from Agriculture Census, 1993, BPS; CIC, Study and Directory of Forest Management Rights (HPH) in Indonesia, 1999. **Note:** Data from 1996 onward are for HPHs believed to be currently active.

Annex 3 Data Sources and Technical Notes

Land Cover Data

Natural Forest Cover in 1985

Source: World Conservation Monitoring Centre (UNEP-WCMC). 1996. *Tropical Moist Forests and Protected Areas: The Digital Files. Version 1.* Cambridge: World Conservation Monitoring Centre, Centre for International Forestry Research, and Overseas Development Administration of the United Kingdom.

Date: Data are from various years in the early 1980s but are generally taken to describe the situation in 1985.

Scale: 1:250,000. The dataset was gridded by GFW at 1:500,000 to enable overlay with the GOI/World Bank, 2000 dataset (see below).

Comments: The WCMC dataset represents a modified version of the RePPProT survey. It harmonizes the 12 forest cover types of RePPProT to 6 classes: mangrove forest, inland swamp forest, montane rainforest, lowland rainforest, montane monsoon forest, and lowland monsoon forest. Total forest area, according to GFW's analysis of the dataset, is 117.2 million ha, compared with 119.7 million ha reported in RePPProT. The difference may be accounted for by our stricter interpretation of "no data" or otherwise unclassified areas. We found 1.1 million ha of "no data" areas and more than 6 million ha of unclassified area, most of which is probably nonforest, but some of which might plausibly be assumed to be forest. *(See also Box 2.1 of this report.)*

Natural Forest Cover, Logging Concessions, Industrial Timber Plantations, and Estate Crop Plantations

Source: Directorate General of Forest Inventory and Land Use Planning, Ministry of Forestry, Government of Indonesia, and Food and Agriculture Organization of the United Nations (GOI-FAO). 1996. *National Forest Inventory of Indonesia (NFI): Final Forest Resources Statistics Report*. Field Document No. 55 and associated digital files. Jakarta, Indonesia: GOI/FAO.

Date: Data are from various years in the early and mid-1990s but are generally taken to describe the situation in the early 1990s.

Scale: 1:250,000

Comment*:* See Box 2.1 of this report.

Natural Forest Cover in 1997

Sources: Ministry of Forestry, Government of Indonesia and World Bank (GOI/World Bank). 2000. Digital dataset on CD-ROM; D. Holmes, 2000. *Deforestation in Indonesia: A Review of the Situation in 1999*. Consultant report to the World Bank. Jakarta, Indonesia. Draft, July 3.

Date: Most data are from 1996 to 1998 but in a few areas are from 1994. An average year of 1997 is assumed.

Scale: 1:500,000

Comments: The dataset classifies forest and nonforest areas; it does not distinguish among different forest vegetation types. In the last draft of the report completed before his untimely death, Holmes did not provide estimates of forest cover in Java, Bali, or Nusa Tenggara. For this report, GFW calculated forest cover in these islands from the GOI/World Bank dataset. We note throughout where our estimates are being used.

For the sake of avoiding confusion, we quote Holmes's findings (supplemented by our own for the islands listed above) throughout this report. However, in our spatial presentations that involve the GOI/World Bank dataset (Maps 1, 2, and 3) we make no assumptions about forest cover in "no data" or "cloud cover" areas, and we depict these areas simply as "no data." This is not the case in the maps that analyze the extent and condition of low access forests (Maps 4, 5, and 6). For these maps, "no data" areas occurring in areas that appear to lie within potentially intact forest areas have been "filled" using land cover data from NFI, 1996. That is, the "no data" areas are classified as forest or nonforest, based on the information for those areas contained in the NFI vegetation cover dataset. (*See also Box 2.1 of this report.*)

Selected Tables: Data Sources and Methodology

Table 2.3 Forest Area and Deforestation, 1985-1997 (GFW Estimate)

Table 2.2 presented in the body of this report utilizes data from the original RePPProT survey for forest cover in 1985 and from the World Bank study for forest cover in 1997. Table 2.3 presents GFW's deforestation estimates utilizing the modified RePPProT dataset developed by UNEP-WCMC and our own analysis of the GOI/World Bank dataset. Our analysis of the UNEP-WCMC dataset finds a somewhat lower estimate of total forest cover in 1985 than that of RePPProT. *(See Comment under Forest Cover in 1985, above*).

Holmes reports a total of 12,786,970 ha as "no data" areas. The largest "no data" area was in Irian Jaya, owing to the heavy cloud cover in that mountainous area. In a limited number of other provinces, listed in Annex Table 4, Holmes estimated the percentage of "no data" areas that were likely to be forested.

In total, Holmes estimated that of 5.3 million ha of "no data" areas, 2.8 million ha (53 percent) should be classified as forest. The area of assumed forest represents 9 percent of the adjusted forest area for the provinces presented in his report.

Our analysis of the GOI/World Bank dataset differs from that of Holmes in that we make no assumptions about possible forest cover in areas obscured by cloud, otherwise classified as "no data" or not classified at all ("unknown"). We categorize all these areas as "no data"; the total forest area is therefore lower (but not necessarily more accurate) than that produced by Holmes for the

Annex Table 4 Measured and Estimated Forest Area in Selected Provinces

Province	Measured Forest (Ha)	"No Data" Area (Ha)	"No Data" Area Assumed to be Forest (Ha)	Adjusted Forest Area (Ha)	"No Data" Area Assumed to be Forest (%)
Central Kalimantan	8,543,384	1,883,359	1,356,616	9,900,000	72
East Kalimantan	13,361,195	716,512	538,805	13,900,000	75
North Sulawesi	1,106,031	635,586	193,969	1,300,000	31
Central Sulawesi	2,892,697	1,152,402	507,303	3,400,000	44
South Sulawesi	2,114,703	534,416	185,297	2,300,000	35
Southeast Sulawesi	1,975,726	329,540	24,274	2,000,000	7
TOTAL	**29,993,736**	**5,251,815**	**2,806,264**	**32,800,000**	**53%**

Source: D. Holmes, "Deforestation in Indonesia: A Review of the Situation in 1999." (Jakarta, Indonesia: World Bank, 2000), Table 1.

three major islands of Sumatra, Kalimantan, and Sulawesi. As mentioned above, Holmes did not complete estimates of forest cover for Java, Bali, or Nusa Tenggara. Our estimates of forest cover in these islands are based only on areas positively identified as forest. After eliminating from consideration all "no data" areas in both the WCMC and GOI/World Bank datasets, we found that deforestation between 1985 and 1997 totaled 21.6 million ha, an area equivalent to 18 percent of forest cover at the beginning of the 12-year period. In addition, we overlaid the World Bank dataset with spatial data on industrial timber and estate crop plantation area from the NFI, 1996. By doing so, we identified 6.6 million ha that may have been wrongly classified as natural forest in the World Bank study. These areas are identified in the relevant maps as areas "reported as plantations: status unknown." However, in the absence of ground truthing, we chose not to remove them from our estimate of natural forest cover.

Table 2.6 Natural Forest, Potentially Degraded Forest, and Deforested Area, Mid-1990s

Source: GOI-FAO, 1996.

Methodology: Using the vegetation cover files of the National Forest Inventory, the following initial forest cover classes were defined: mountain forest, highland forest, lowland forest, mangrove forest, and swamp forest. These classes were aggregated to one category of natural forest. This grid was overlaid successively with the concession grid, industrial timber plantation and estate crop plantation grids, and spatial data on transmigration sites. Natural forest area that coincided with area under logging concession was defined as degraded (*but see the caveat in the text preceding Table 2.6*). Natural forest area that coincided with a plantation or a transmigration site was defined as deforested, on the assumption that natural forest so converted is unlikely to revert to natural forest cover. Where natural forest area coincided with more than one other land use category, the hierarchy chosen was transmigration site > estate crop > timber plantation > logging concession. Thus if a transmigration site coincided with a logging concession, the area was defined as deforested. The rationale for this ordering is that logging concessions can precede the other forms of forest conversion but cannot follow them.

Maps: Data Sources and Methodology

Map 1 Natural Forest Cover Change in Indonesia, 1985-1997

Sources: UNEP-WCMC, 1996, and GOI/World Bank, 2000.

Methodology: The two forest cover grids were overlaid to highlight forest areas lost since 1985. "No data" areas are identified. In addition, some areas classified as "forest" in the World Bank dataset are classified in the NFI dataset as industrial timber plantations or estate crop plantations. We identify these areas as "Reported as plantations: status unknown." Given the lack of ground truthing in the World Bank dataset, the areas are probably plantations.

Map 2 Natural Forest Cover Change in Kalimantan, 1985 –1997

Sources: UNEP-WCMC, 1996, and GOI/World Bank, 2000.

Methodology: As Map 1 above.

Map 3 Loss of Lowland, Submontane and Montane Forest, 1985-1997

Sources: UNEP-WCMC, 1996, and GOI/World Bank, 1999.

Methodology: The deforestation grid was overlaid with a digital elevation model (DEM) to classify deforested areas by elevation. Lowland forests were considered to be below 300m. Submontane forests were classified as being between 300m and 1,000m. Montane forests were categorized as being above 1,000m. The majority of deforestation has occurred in lowland forests.

Map 4 Extent and Distribution of Low Access and Accessed Forest, 1997

Sources: Forest cover from GOI/World Bank, 2000; plantation and concession data from GOI/FAO, 1996; river data from Digital Chart of the World; road data (including major logging roads) from sources in the Indonesian Ministry of Transportation; settlements and transmigration sites from the Ministry of Transmigration, provided by FWI.

Definitions: Low access forests are those believed to be relatively undisturbed by human activity. They are defined as forest areas that are more than 1 km distant from roads, logging concessions, industrial timber plantations, estate crop plantations, or other forest developments. In the case of Kalimantan, forest areas that are more than 0.5 km distant from navigable rivers with no more than one mapped settlement per 30 km were also considered to be low access forests.

Methodology: The GOI/World Bank forest cover dataset was used to map the extent and distribution of low access forests; "no data" areas in this dataset were filled using the National Forest Inventory forest cover dataset (1996). Roads were buffered 1 km on either side and converted to a grid. By overlaying settlement and river data layers, river segments with no more than one mapped settlement per 30 km were selected. Selected rivers were buffered 15 km upstream and downstream of each settlement and 0.5 km on either side. The resulting coverage was converted to a grid. Rivers within swamps and hill forest were considered unaccessed and were excluded from this analysis. The river, road, and forest cover grids were merged. Any forest grid cells outside road and/or river linear features were extracted and overlaid with plantations and estate crops. Forest areas that overlapped with plantations and estate crops were eliminated. The resulting forest lands were classified as low access forest. All excluded forest areas were classified as accessed forest. Low access forests were further characterized based on whether they are located in logging concessions. The low access forest grid was overlaid with the concessions grid. Forest areas were then delineated as either within or outside concession areas. Forest area falling within concessions may be regarded as "contact zones," where the probability of access and disturbance is higher. Note that in the absence of data on the status of concessions (active, inactive, or expired) as well as information on the condition of protected areas, this analysis of the status of Indonesia's potentially intact forest is incomplete.

Map 5 Fragmentation of Low Access and Potentially Low Access Forest

Sources: As for Map 4.

Methodology: Low access forest areas were grouped into contiguous tracts of forest and reclassified based on the following size categories:

200 km^2-500 km^2

501 km^2-10,000 km^2

Over 10,000 km^2

Map 6 Protection Status of Low Access and Potentially Low Access Forest

Sources: Forest cover as for Map 4. Protected area data from UNEP-WCMC: subset of V 4.0 UNEP-WCMC Protected Areas Global GIS dataset. March 2000.

Methodology: The low access forest grid was overlaid with the protected area data. The resulting grid was further overlaid with the concession area grid from the NFI to classify the protected areas further according to whether they are located within or outside logging concessions.

Map 7 Extent and Distribution of Protected Areas, Kalimantan

Sources: Forest Cover as for Map 4. Protected area data from UNEP-WCMC: subset of V 4.0 UNEP-WCMC Protected Areas Global GIS dataset. March 2000.

Methodology: No additional analysis was performed for this map.

Map 8 Extent and Distribution of Logging Concessions

Source: GOI-FAO, 1996.

Methodology: No additional analysis was performed for this map.

Comment: The data in this map are outdated. More recent nonspatial data were made available from the Ministry of Forestry, with attribute data, including location, size, and ownership of concession. Unfortunately, it was not possible to georeference these data, and the information in the NFI remains the most recent spatial data that we were able to access.

Map 9 Limited Survey of Reported Cases of Illegal Logging

Sources: Based on reports of illegal logging published between 1997 and 1998 in the following Indonesian newspapers: *Suara Pembaruan; Kompas; Media Indonesia; Bisnis Indonesia; Rakyat Merdeka; Radar Bogor, Koran Tempo; Business News; The Jakarta Post; Serambi Indonesia; Cendrawasih Post; Kaltim Post; Kontan; Republika; Suara Karya; Harian Terbit; Harian Ekonomi; Forum Keadilan; Kalteng Post; Kendari Post; Merdeka; Pakuan; Pelita Bangsa; Pikiran Rakyat; Riau Pos; Samarinda Pos; Sinar Tani; Sinar Pagi; Terbit; Warta Kota; Banjarmasin Pos; Berita Keadilan; DR; Tempo*. Data were also collected via investigative reports from members of the Forest Watch Indonesia network.

Map 10 Extent and Distribution of Estate Crops in Sumatra

Source: GOI-FAO, 1996

Methodology: No additional analysis was performed for this map.

Map 11 Plantations in Former Logging Concessions, Sumatra and Kalimantan

Source: GOI-FAO, 1996.

Methodology: The logging concession, estate crop plantation, and industrial timber plantation grids were overlaid to identify areas classified as both a logging concession and a plantation. The most likely explanation for such overlaps is that plantations have been established in former concession areas. Such overlaps are not uncommon in the NFI because the survey was developed in part on the basis of land use (land tenure) documents. Not infrequently, applications for a logging concession and for a license to convert forest to a plantation will compete for the same area of forest. Equally, some companies hold licenses to operate forest land as a logging concession and, subsequently, convert their own concession to a plantation.

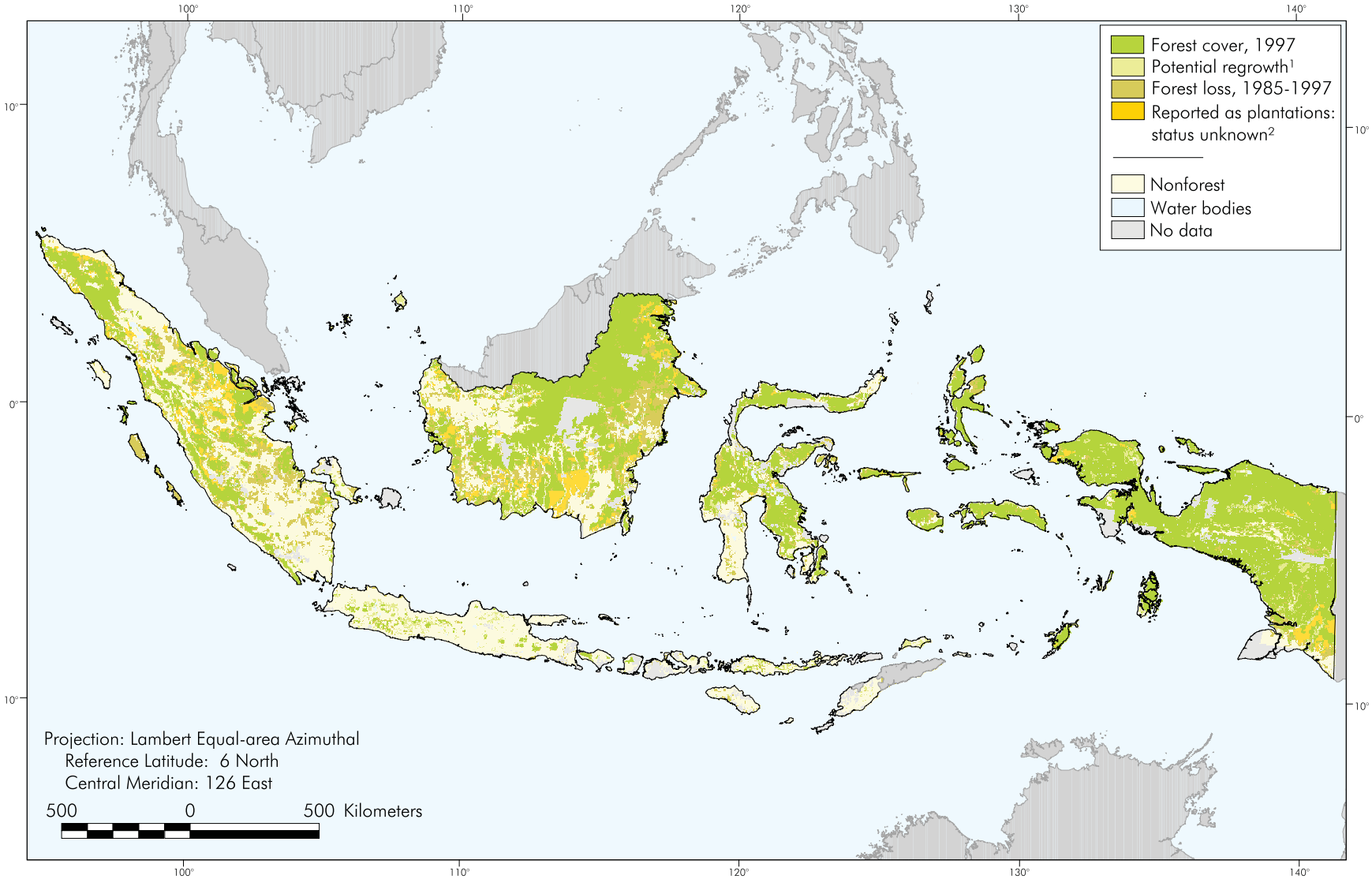
Map 12 Forest Uses and Areas Burned in 1997-1998: East Kalimantan

Source: A.A. Hoffmann, A. Hinrichs, and F. Siegert. 1999. *Fire Damage in East Kalimantan in 1997/1998 Related to Land Use and Vegetation: Satellite Radar Inventory Results and Proposals for Further Actions*. IFFM-SFMP Report 1a. ISBN 979-606-044-2.

Map 13 Limited Survey of Reported Conflicts Over Forest Resources

Source: Government of Indonesia, Ministry of Forestry information, 1997-1999; reports of forest-related conflict published between 1997 and 1998 in the Indonesian newspapers listed for Map 9.

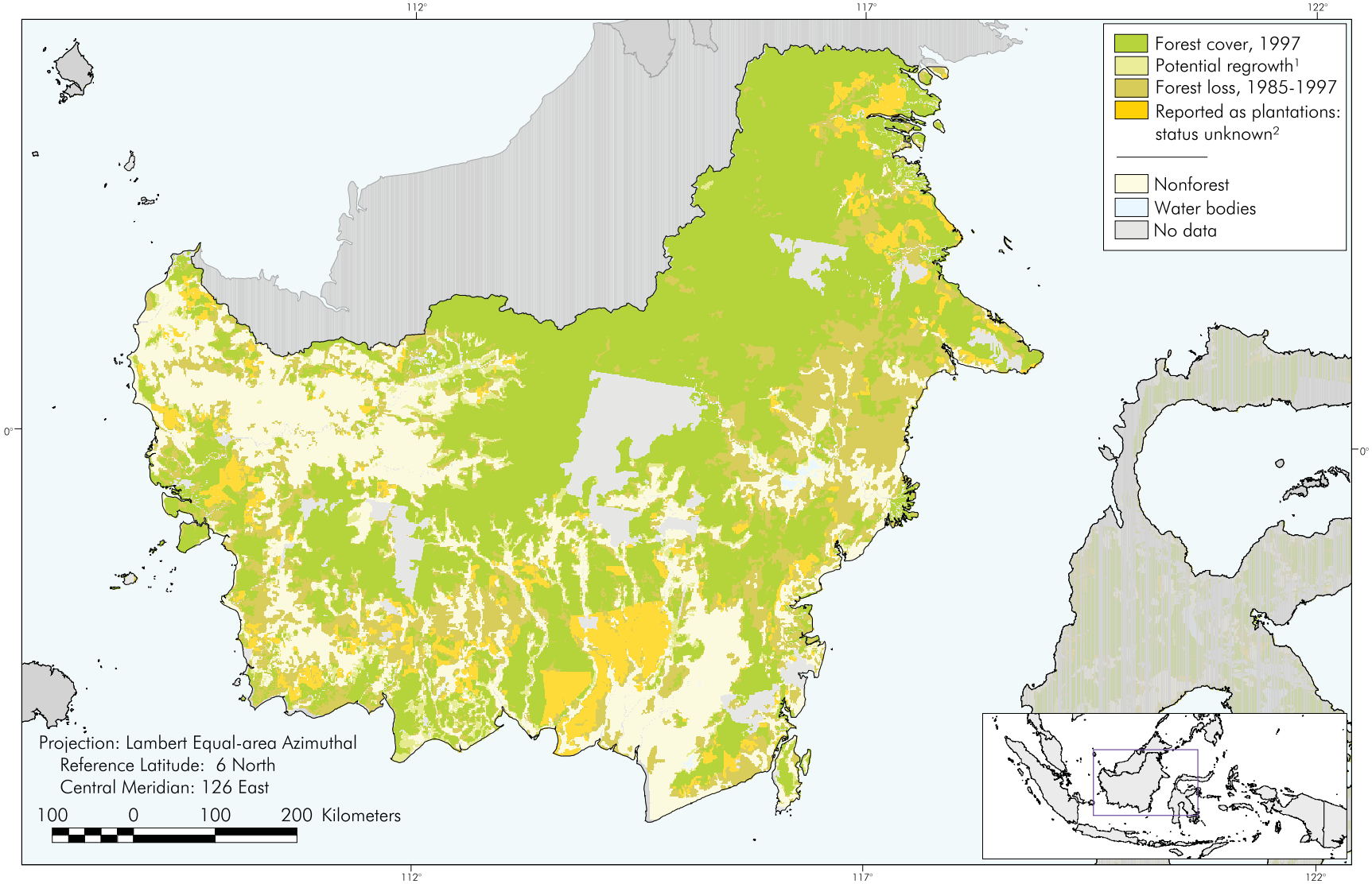
MAP 1 Natural Forest Cover Change in Indonesia, 1985-1997



Sources:
Forest cover for 1997: GOI/World Bank, 2000. Forest cover for 1985: UNEP-WCMC, 2000 based on RePPProT data. Estate crops and plantations: GOI/FAO, 1996. Boundaries: ESRI Digital Chart of the World (DCW), 1993 and FWI, 2001.

Notes:
[1] Potential regrowth areas are classified as forest in GOI/World Bank 2000 but not in UNEP-WCMC, 1996. In some cases, it appears that these areas are an artifact of the overlay process.
[2] These are areas identified as forest in GOI/World Bank, 2000 and as estate crops or plantations in GOI/FAO, 1996.

MAP 2 Natural Forest Cover Change in Kalimantan, 1985-1997



Sources:
Forest cover for 1997: GOI/World Bank, 2000. Forest cover for 1985: UNEP-WCMC, 2000 based on RePPProT data. Estate crops and plantations: GOI/FAO, 1996. Boundaries: ESRI Digital Chart of the World (DCW), 1993 and FWI, 2001.

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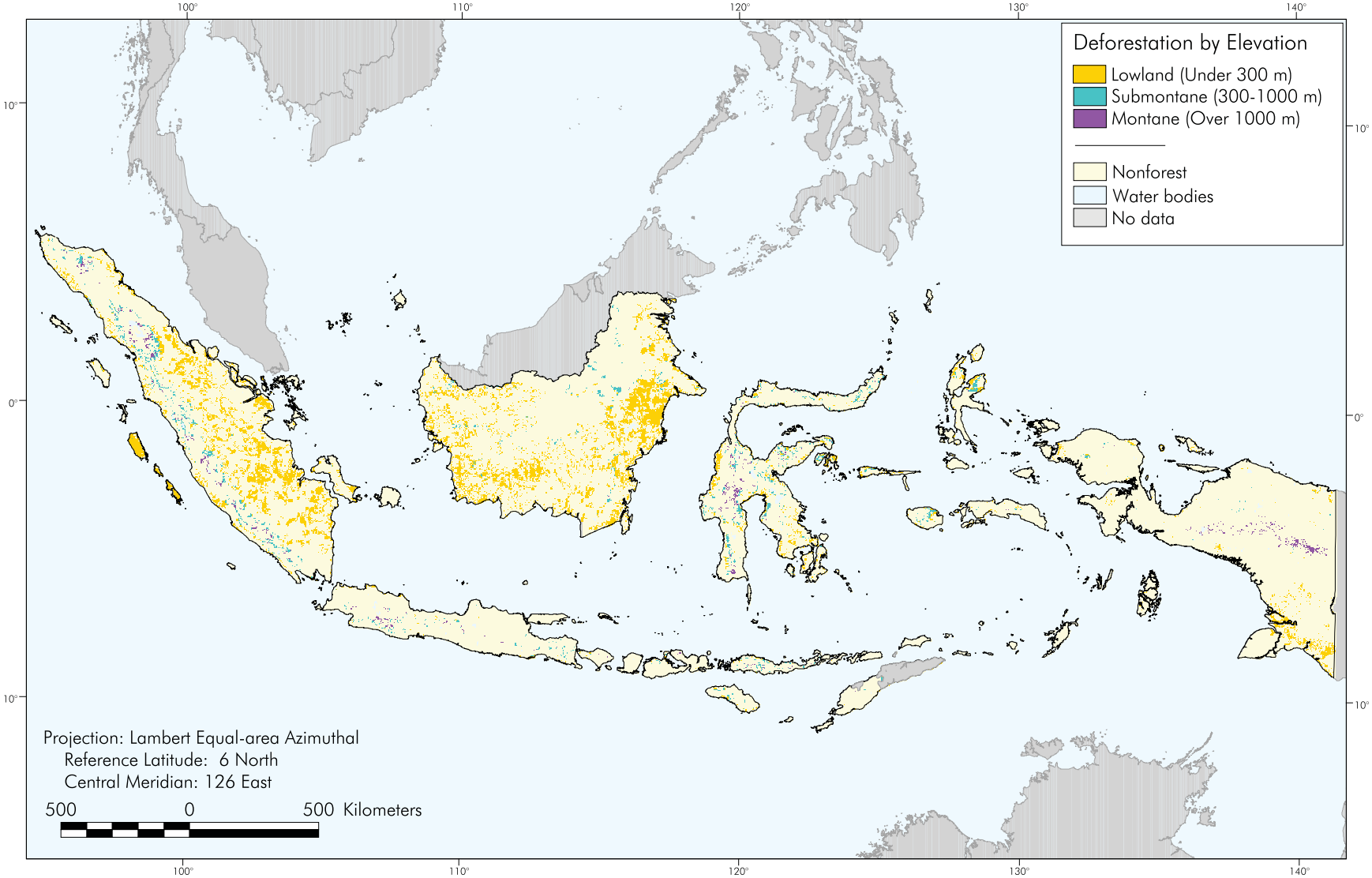
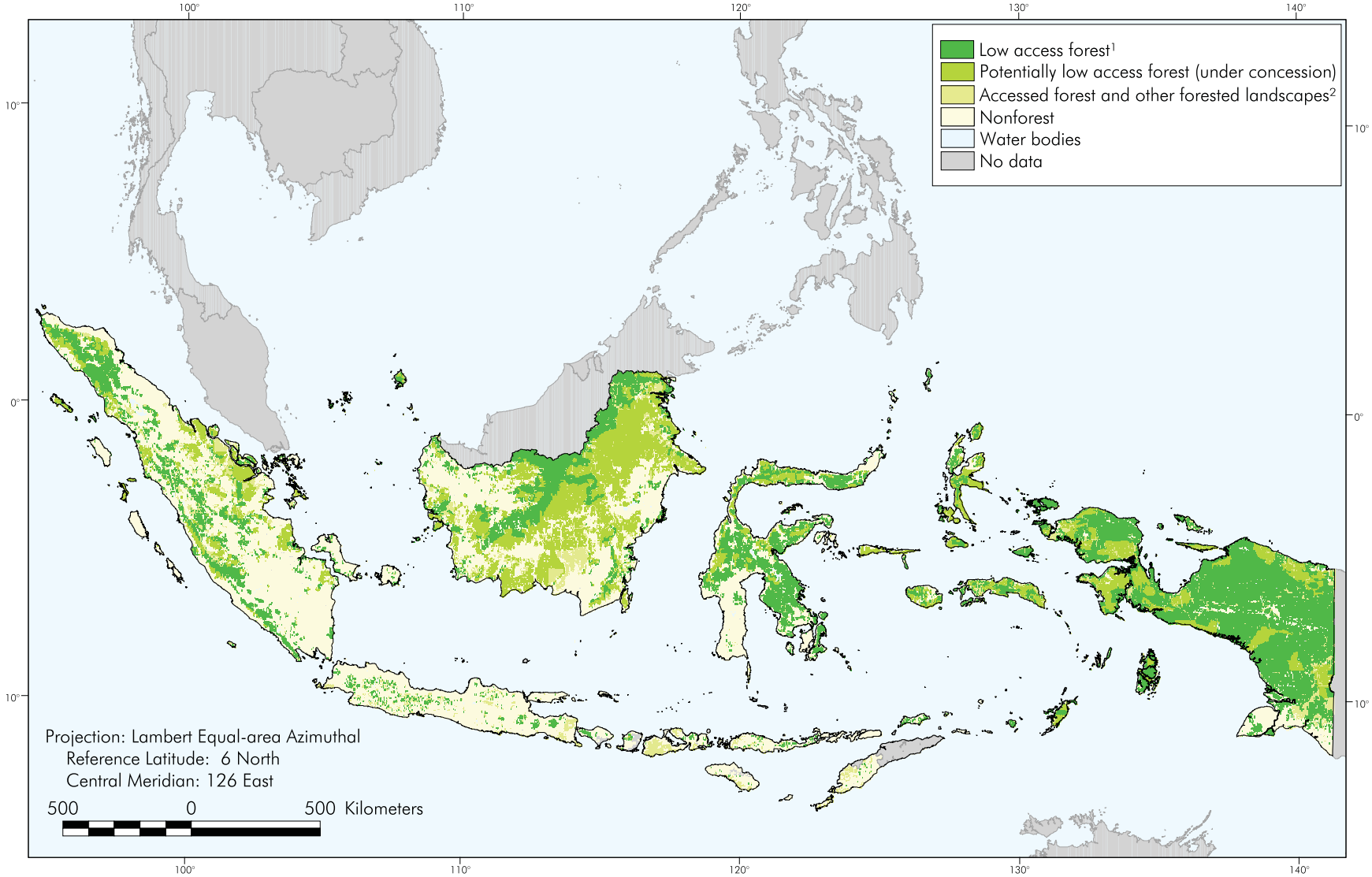
MAP 3 Loss of Lowland, Submontane, and Montane Forest, 1985-1997



Sources:
Forest cover for 1997: GOI/World Bank, 2000. Forest cover for 1985: UNEP-WCMC, 1996 based on RePPProT data.
Elevation: USGS, 2000. Boundaries: ESRI Digital Chart of the World, 1993 and FWI, 2001.

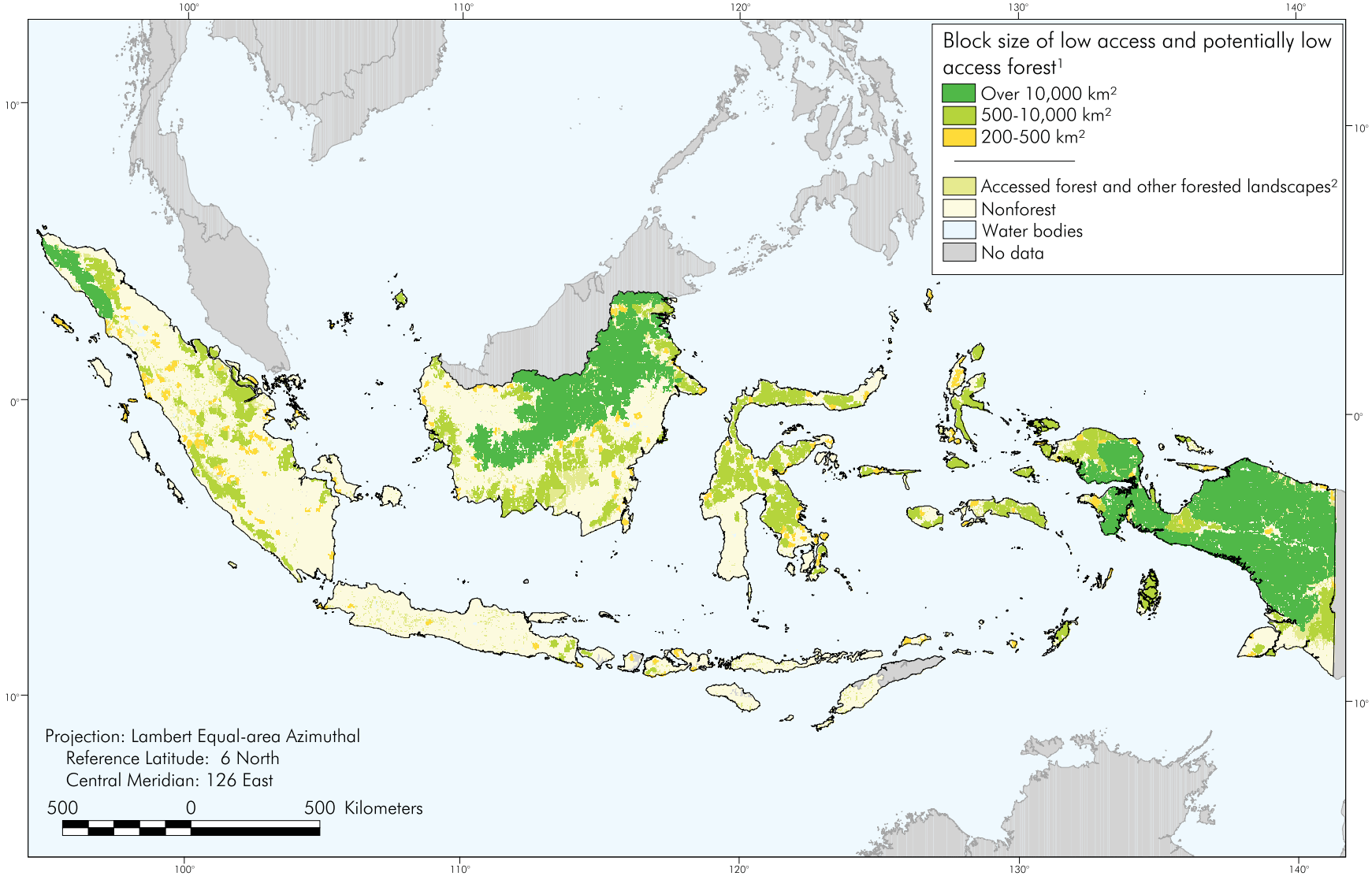
MAP 4 Extent and Distribution of Low Access and Accessed Forest, 1997



Sources:
Base forest cover: GOI/World Bank, 2000, modified with GOI/FAO, 1996. Forest concessions: GOI/FAO, 1996.
Boundaries: ESRI Digital Chart of the World, 1993 and FWI, 2001.

Notes:
[1] Low access forests are presumed natural forests; however, the dataset does not identify forests that have been degraded by fires or other human activities.
[2] Includes areas of forest reported as plantations (see Map 1) and accessed forests within 1km of roads or navigable waterways.

MAP 5 Fragmentation of Low Access and Potentially Low Access Forest



Sources:
Base forest cover: GOI/World Bank, 2000 modified with GOI/FAO, 1996. Forest concessions: GOI/FAO, 1996.
Boundaries: ESRI Digital Chart of the World, 1993 and FWI, 2001.

Notes:
[1] Low access forests are presumed natural forests; however, the dataset does not identify forests that have been degraded by fires or other human activities.
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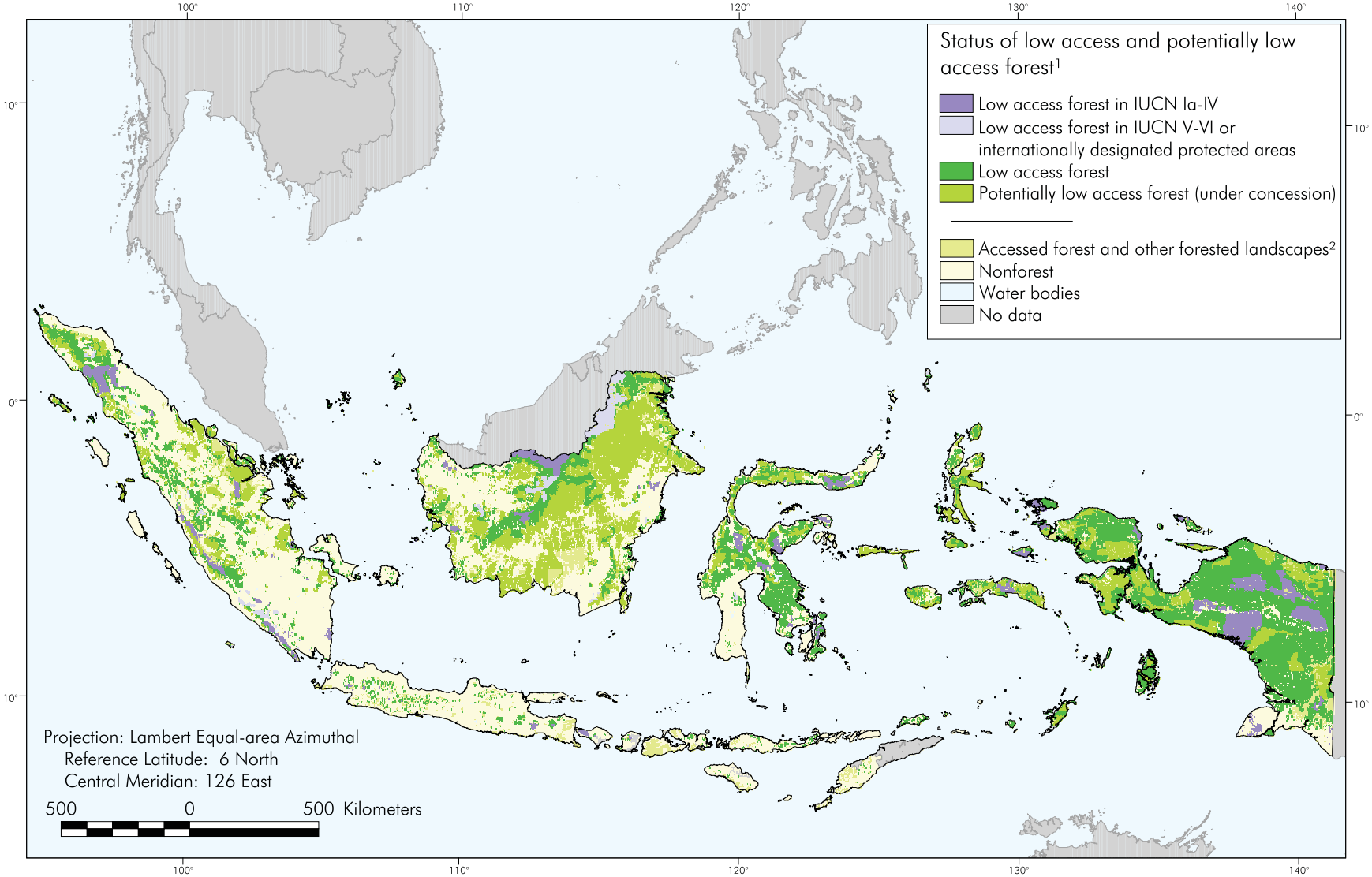
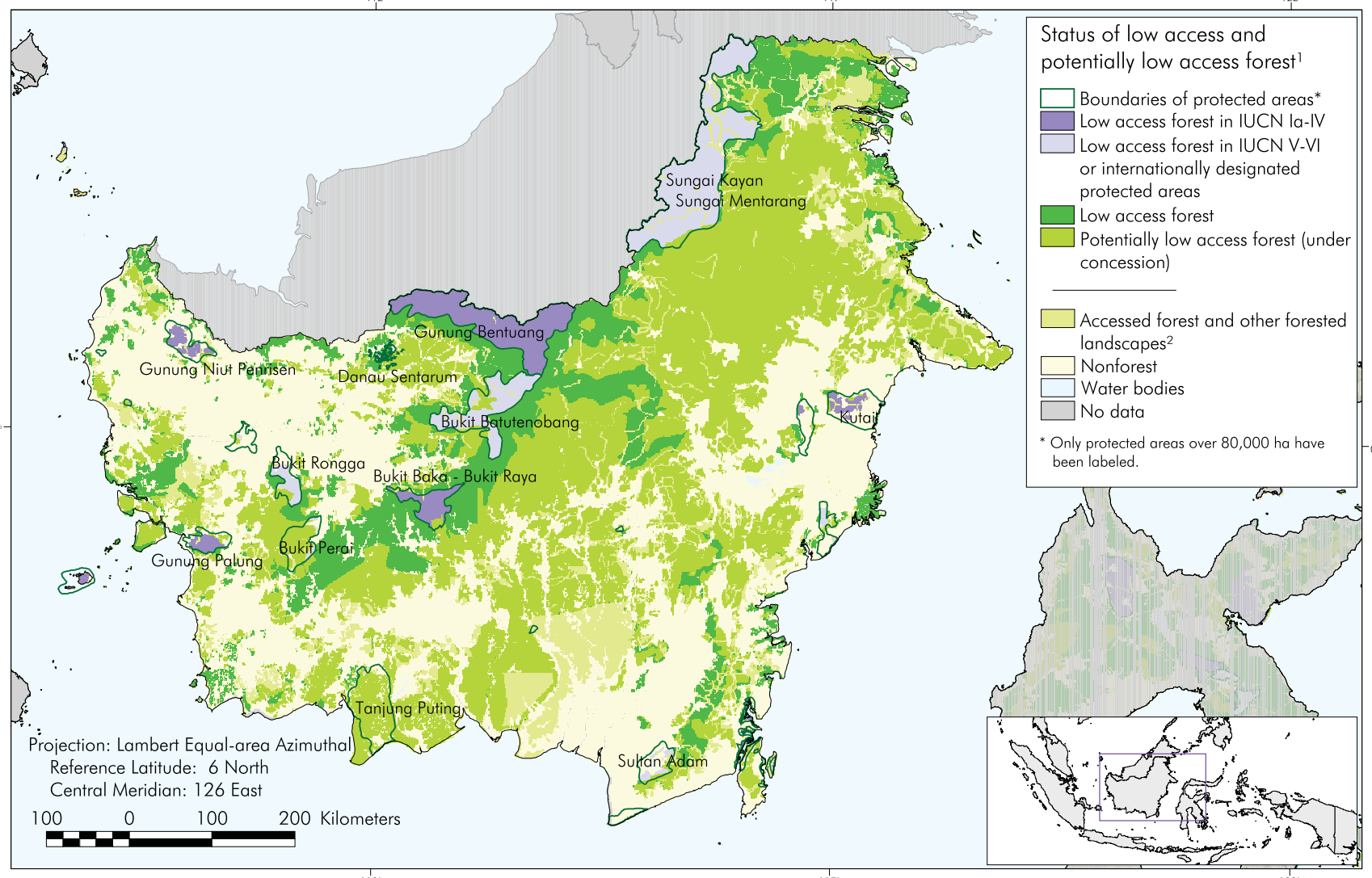
MAP 6 Protection Status of Low Access and Potentially Low Access Forest



Sources:
Base forest cover: GOI/World Bank, 2000 modified with GOI/FAO, 1996. Protected area boundaries: UNEP-WCMC, 2000. Forest concessions: GOI/FAO, 1996. Boundaries: ESRI Digital Chart of the World, 1993 and FWI, 2001.

Notes:
[1] Low access forests are presumed natural forests; however, the dataset does not identify forests that have been degraded by fires or other human activities.
[2] Includes areas of forest reported as plantations (see Map 1) and accessed forests within 1km of roads or navigable waterways.

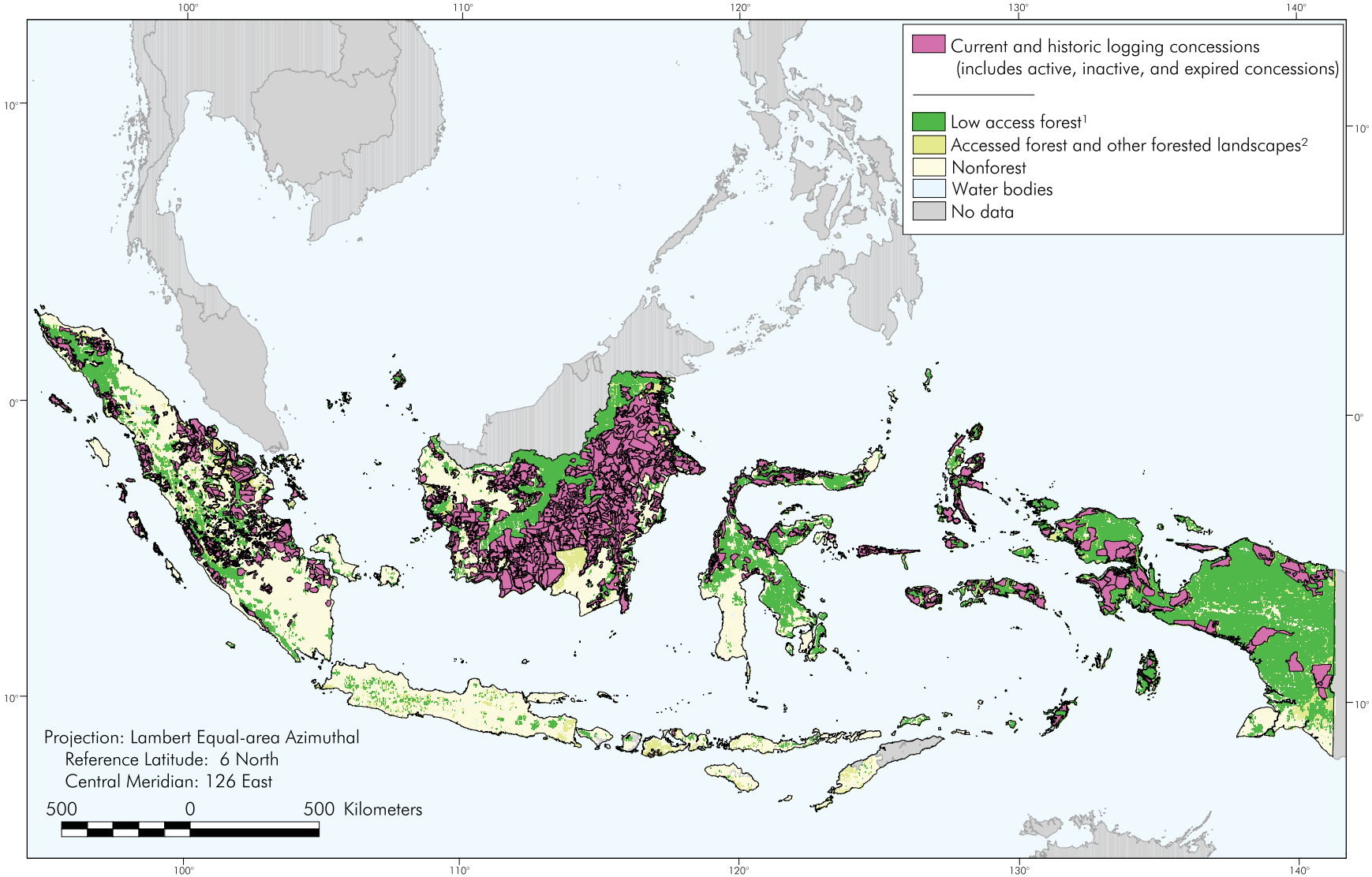
MAP 7 Extent and Distribution of Protected Areas, Kalimantan



Sources:
Base forest cover: GOI/World Bank, 2000 modified with GOI/FAO, 1996. Protected area boundaries: UNEP-WCMC, 2000. Forest concessions: GOI/FAO, 1996. Boundaries: ESRI Digital Chart of the World, 1993 and FWI, 2001.

Notes:
[1] Low access forests are presumed natural forests; however, the dataset does not identify forests that have been degraded by fires or other human activities.
[2] Includes areas of forest reported as plantations (see Map 1) and accessed forests within 1km of roads or navigable waterways.

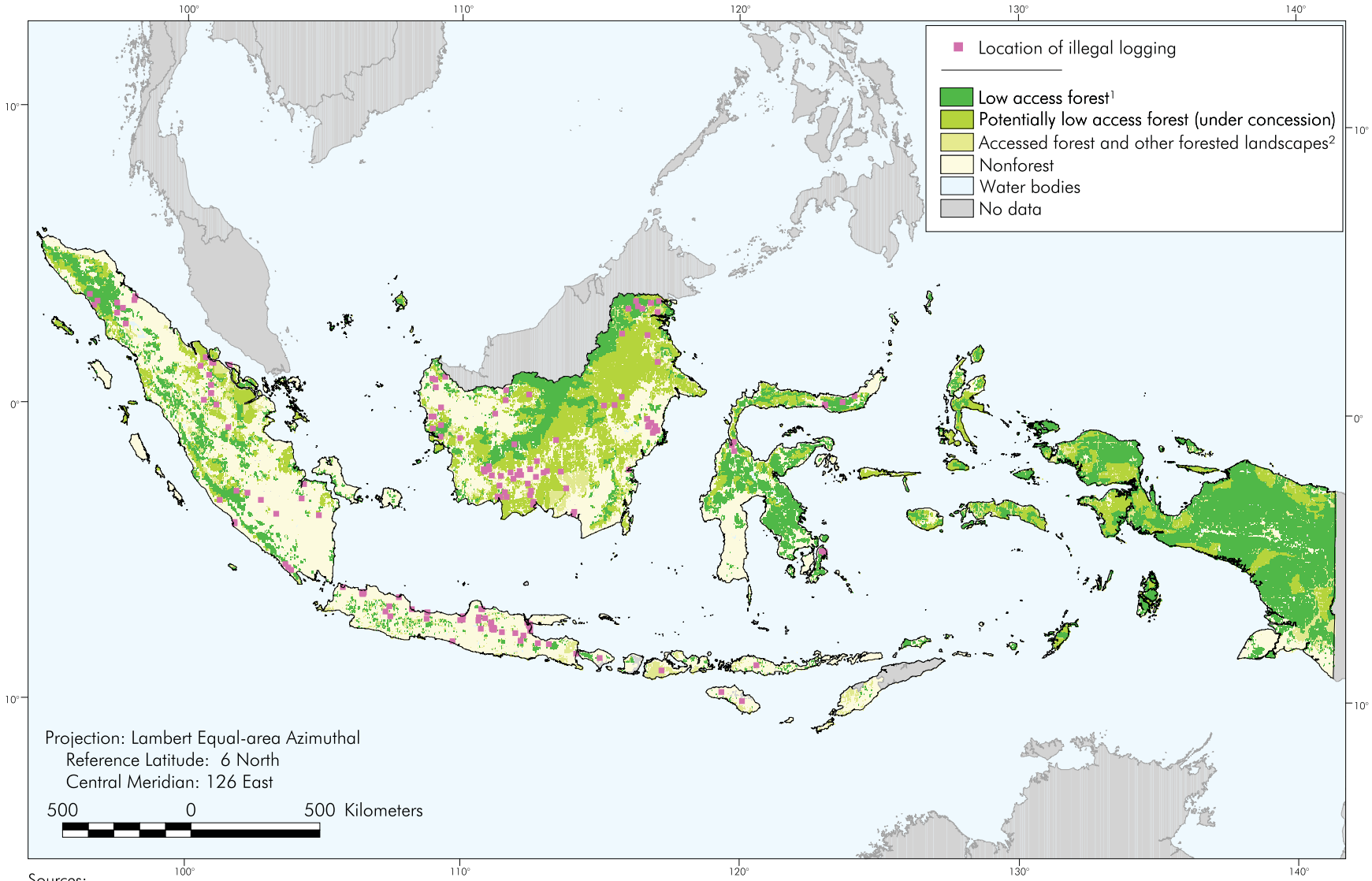
MAP 8 Extent and Distribution of Logging Concessions



Sources:
Base forest cover: GOI/World Bank, 2000 modified with GOI/FAO, 1996. Forest concessions: GOI/FAO, 1996.
Boundaries: ESRI Digital Chart of the World, 1993 and FWI, 2001.

Notes:
[1] Low access forests are presumed natural forests; however, the dataset does not identify forests that have been degraded by fires or other human activities.
[2] Includes areas of forest reported as plantations (see Map 1) and accessed forests within 1km of roads or navigable waterways.

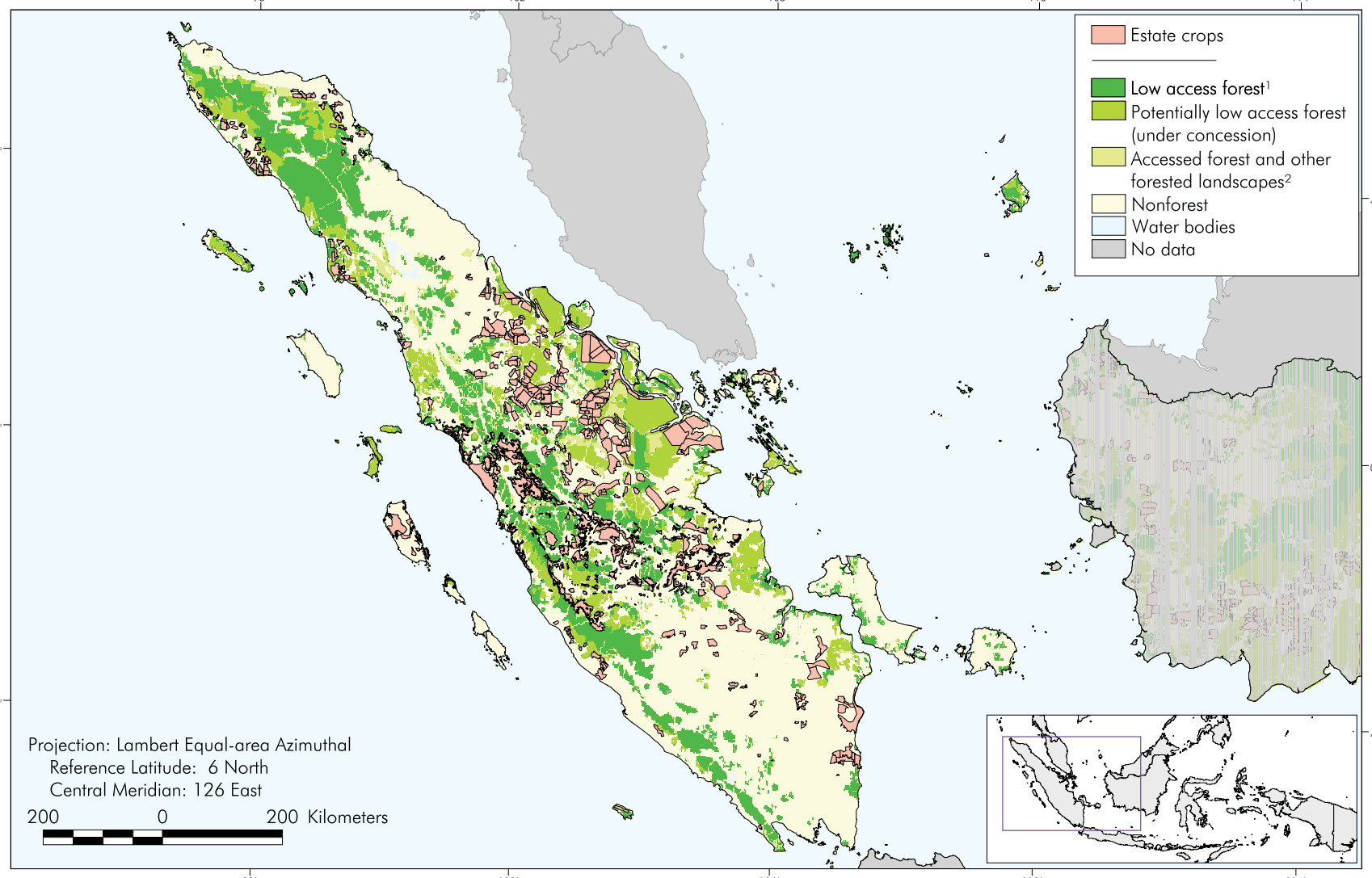
MAP 9 Limited Data Survey of Reported Cases of Illegal Logging, 1997-1998



Sources:
Base forest cover: GOI/World Bank, 2000 modified with GOI/FAO, 1996. Forest concessions: GOI/FAO, 1996. Illegal logging: FWI compilation of information from Indonesian newspapers between 1997 and 1998. Boundaries: ESRI Digital Chart of the World, 1993 and FWI, 2001.

Notes:
[1] Low access forests are presumed natural forests; however, the dataset does not identify forests that have been degraded by fires or other human activities.
[2] Includes areas of forest reported as plantations (see Map 1) and accessed forests within 1km of roads or navigable waterways.

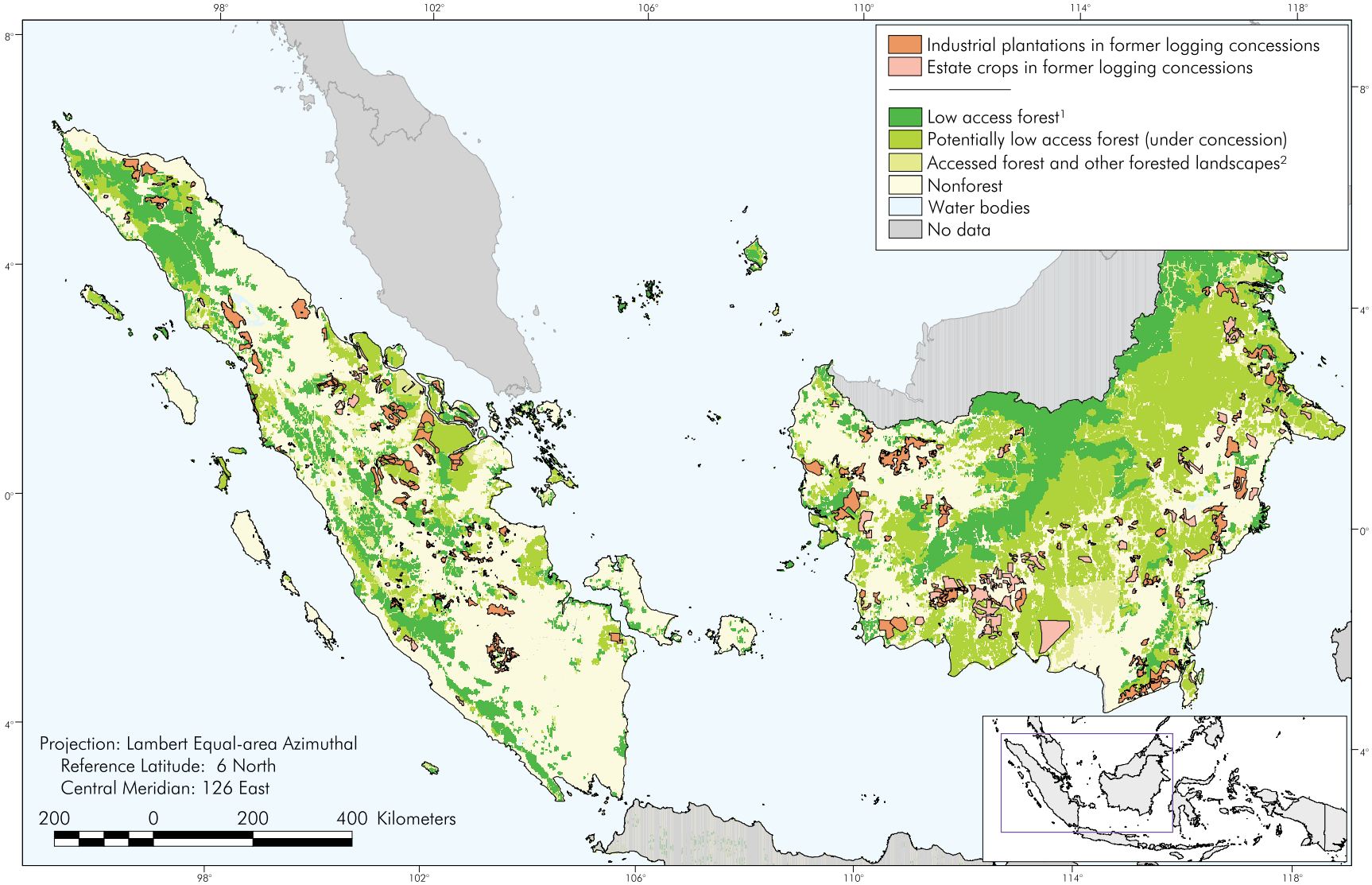
MAP 10 Extent and Distribution of Estate Crops in Sumatra



Sources:
Base forest cover: GOI/World Bank, 2000 modified with GOI/FAO, 1996. Forest concessions: GOI/FAO, 1996.
Estate crops: GOI/FAO, 1996. Boundaries: ESRI Digital Chart of the World, 1993 and FWI, 2001.

Notes:
[1] Low access forests are presumed natural forests; however, the dataset does not identify forests that have been degraded by fires or other human activities.
[2] Includes areas of forest reported as plantations (see Map 1) and accessed forests within 1km of roads or navigable waterways.

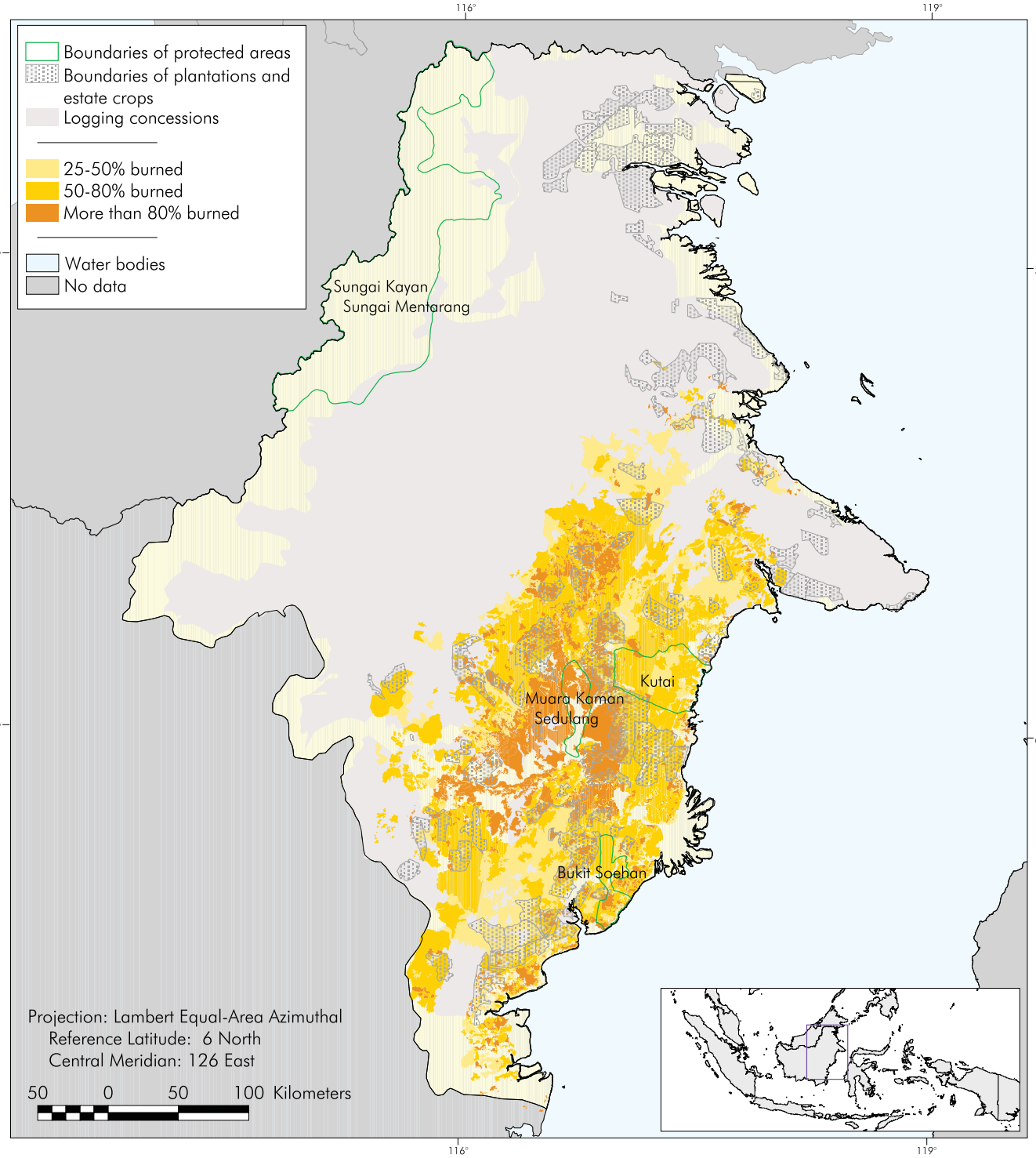
MAP 11 Plantations in Former Logging Concessions, Sumatra and Kalimantan



Sources:
Base forest cover: GOI/World Bank, 2000 modified with GOI/FAO, 1996. Forest concessions: GOI/FAO, 1996.
Estate crops: GOI/FAO, 1996. Boundaries: ESRI Digital Chart of the World, 1993 and FWI, 2001.

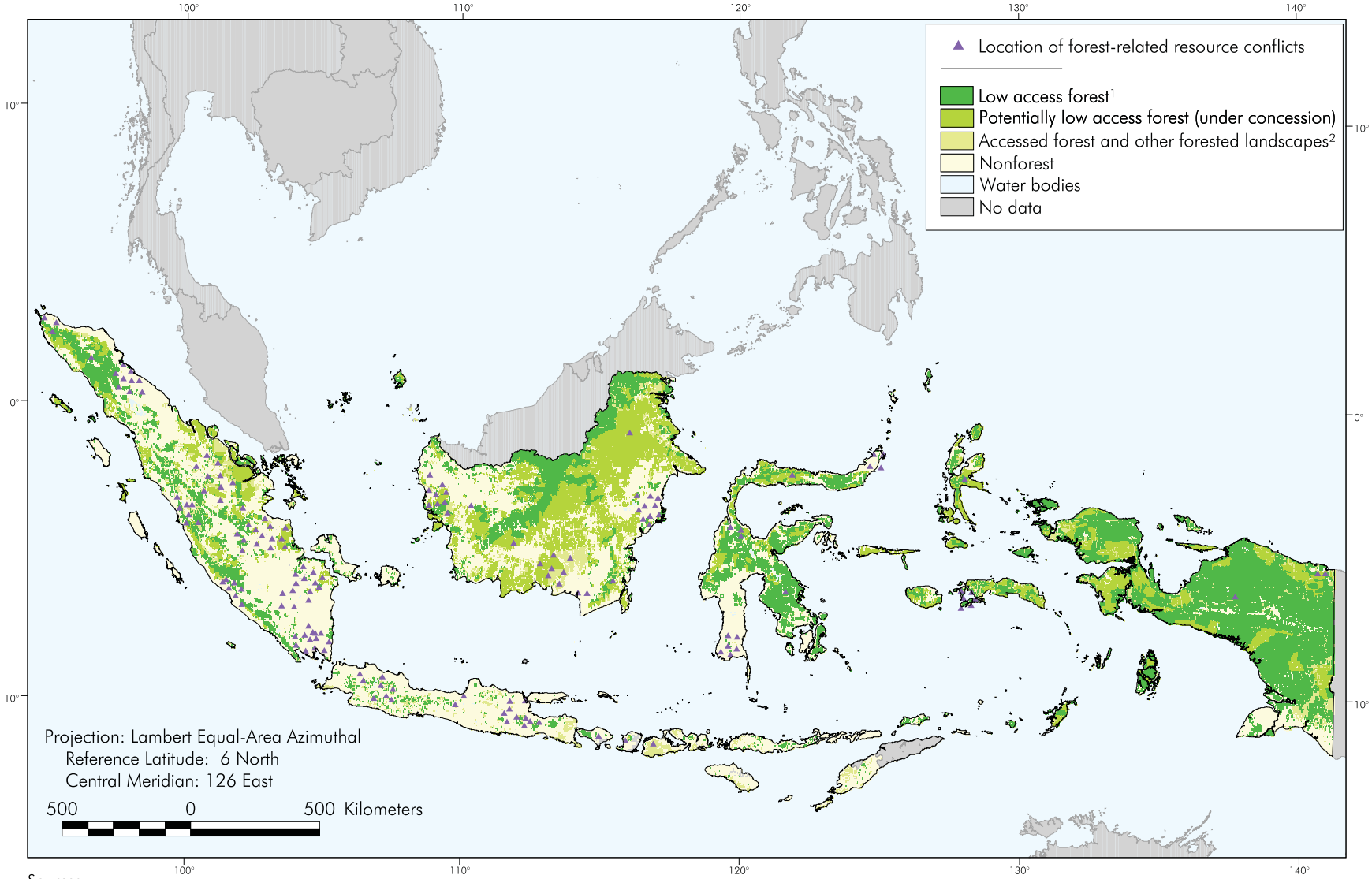
Notes:
[1] Low access forests are presumed natural forests; however, the dataset does not identify forests that have been degraded by fires or other human activities.
[2] Includes areas of forest reported as plantations (see Map 1) and accessed forests within 1km of roads or navigable waterways.

MAP 12 Forest Uses and Areas Burned in 1997-1998: East Kalimantan



Sources:
Protected areas: UNEP-WCMC, 2000. Plantations, estate crops, logging concessions, and fires: A. Hoffmann, A. Hinrichs, and F. Siegart (Deutsche Gesellschaft für Technische Zusammenarbeit), 1999. Boundaries: ESRI Digital Chart of the World, 1993 and FWI, 2001.

MAP 13 Limited Data Survey of Reported Conflicts Over Forest Resources, 1997-1999



Sources:
Base forest cover: GOI/World Bank, 2000 modified with GOI/FAO, 1996. Forest concessions: GOI/FAO, 1996. Forest-related conflicts: FWI compilation of information from Indonesian newspapers between 1997 and 1998. Boundaries: ESRI Digital Chart of the World, 1993 and FWI, 2001.

Notes:
[1] Low access forests are presumed natural forests; however, the dataset does not identify forests that have been degraded by fires or other human activities.
[2] Includes areas of forest reported as plantations (see Map 1) and accessed forests within 1km of roads or navigable waterways.

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