

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. Leonards, 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.
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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.
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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 (Badan 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.

RePPPProT (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.

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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 Sector¹

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 m³ 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 process-

ing 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 "conversion," "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 m³; plymills: 23.7 million m³). These figures are for a period (1994-1997) when the Ministry of Forestry was reporting official log production of about 25 million m³ per year. The estimate is a lower bound because it does not include all small sawmills (potentially another 5-6 million m³ per year) or the pulp and paper sector, which was then using as much as 15 million m³ 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 m³, 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 Intemasional	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 (III)	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 Matararam	Bambang Trihatmodjo	Plantation: Sugar Cane	18,000	Lampung
Gunung Madu Plant	Sigit Harijodanto	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	14,565,000	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 Area (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 km²-500 km²

501 km²-10,000 km²

Over 10,000 km²

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; Republik; 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. Siebert. 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.