Report on Biodiversity and Tropical Forests in Indonesia

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Table of Contents

List of Tables

List of Figures

Acronyms/Glossary

Accessed Forest	A term used 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.)
ADB	Asian Development Bank
Afforestation	The establishment by human action of forest cover on land that was not previously forested or was not forested within living memory.
AMDAL	Environmental Impact Assessment
APKINDO	Indonesia Plywood Association
ASB	Alternatives to Slash and Burn Program
BAPPEDA	Regional Development Planning Board
BAPPENAS	*Badan Perencanaan Pembangunan Nasional*/National Development Planning Agency
Bina Desa	Community assistance requirements under forest concessions
BPN	*Badan Pertanahan Nasional/*National Land Agency
BPS	*Biro Pusat Statistik/*Central Statistics Board
CAS	Country Assistance Strategy
CBD	Convention of Biodiversity
CBFM	Community-based forest management
CDD	Community-driven Development
CDM	Clean Development Mechanism
CGI	Consultative Group on Indonesia
CI	Conservation International
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.
COREMAP	Coral Reef Rehabilitation and Management Program
CGI	Consultative Group on Indonesia. Refers to the group of bilateral and multilateral donors to Indonesia, as well as the meetings between this donor group and the Indonesian government.
dbh	diameter (of tree trunk) at breast height

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 re-grow or be replanted. Deforestation is recorded only when the land is permanently converted to non-forest 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 non-forest or deforested land.
DFF	Donor Forum on Forestry
DfID	Department for International Development, U.K.
DG	Directorate General/*Direktorat Jendral*
Dinas	Provincial or district agency reporting to governor, mayor or *bupati*
Dinas Kehutanan	Forestry Service (regional)
DirJen	Direktorat Jendral/Directorate General, DG
DPR	*Dewan Perwakilan Rakyat*/People's National Assembly
DPRD	*Dewan Perwakilan Rakyat Daerah/* District or Provincial House of Representatives
EIA	Environmental Impact Assessment
EKUIN	Coordinating Ministry for the Economy, Finance and Industry
ENSO	El Niño Southern Oscillation
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).
Era Reformasi	Era of policy reform since the fall of Soeharto, mid-1998
Estate Crops	Agricultural crops grown on plantations. The most widely grown estate crops include rubber, oil palm, coconut, cocoa, and tea.
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FLEG	Forest Law Enforcement and Governance [Initiative]
FKKM	*Forum Kommunikasi Kehutanan Masyarakat* (Communication Forum on People's Forestry)
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.
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.
GDP	Gross Domestic Product
GEF	Global Environment Facility
GoI	Government of Indonesia
GRIP	Governance Reform Initiative Project
GTZ	*Deutsche Gesellscahft fur Technische Zusammenarbeit, GmbH*/German Development Agency
Ha	Hectares
HGU	*Hak Guna Usaha*/Use rights
HKons	*Hutan Konservasi*/Conservation Forest, incl. national parks, nature and wildlife reserves, great forests, etc.
HKonv	*Hutan Konversi*/Conversion Forest
HL	*Hutan Lindung*/Protection Forest [for watershed protection]
HP	*Hutan Produksi*/Production Forest
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.
IBRA	Indonesia Bank Restructuring Agency
IBSAP	Indonesian Biodiversity Strategic Action Plan. Also referred to as BAPI (Biodiversity Action Plan Indonesia).
ICDP	Integrated Conservation and Development Project
ICRAF	International Center for Research on Agroforestry
IDCF	Interdepartmental Committee on Forestry
IMF	International Monetary Fund
IPB	*Institut Pertanian Bogor*/Bogor Agricultural Institute

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
JICA	Japanese International Cooperation Agency
Kab.	*Kabupaten*/Regency or District
Kabupaten	District
Kanwil	*Kantor Wilayah/*Provincial office of a central line agency
Kawasan Hutan Negara	State Forest Area
KDP	Kecamatan Development Project
Kec.	*Kecamatan*/Sub-District
KS-ICDP	Kerinci Seblat - Integrated Conservation Development Project
KSNP	Kerinci Seblat National Park
LEI	*Lembaga Ekolabel Indonesia* (Ecolabeling Institute)
Limited Prod. 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.)
MDG	Millenium Development Goal
MLH	Ministry of Environment
MoF	Ministry of Forestry/*Departemen Kehutanan (DepHut)*
MoFEC	Ministry of Forestry and Estate Crops. Previous name of MoF
MPR	*Majelis Permusyawaratan Rakyat*/People's Consultative Assembly
Nagari	Administrative area under traditional Minangkabau governance
Natural Forest	Forests composed primarily of indigenous trees that have not been planted by humans. Natural forests exclude plantations.
Non-forest	Any land use or land cover category other than forest
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).
NFP	National Forest Program

NGO	Non-Governmental Organization
NRM	Natural Resource Management
PA	Protected areas
PEMDA	*Pemerintah Daerah*/Local Government
PERDA	*Peraturan Daerah*/Local Government Regulation issued by the local parliament, DPRD I or DPRD II
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*).
PKA	*Perlindungan dan Konservasi Alam*/Protection and Nature Conservation, i.e., *DirJen PKA*
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.
PMDH	*Pembinaan Masyarakat Desa Hutan*/Guidance for Forest Village Communities, a government program for implementation by forest concessionaires, that replace the similar *Bina Desa* program
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
PRSL	Policy Reform Support Loan
PRSP	Poverty Reduction Strategy Paper
razia	raid, e.g., by anti-illegal logging team
Reforestation	The establishment by humans of forest cover on land that was formerly forested.
Re-growth	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.
RIL	reduced impact logging

RKT	*Rencana Karya Tahunan*/Annual Cutting Plan
Roundwood	All wood in its natural state obtained 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
SAKB	*Surat Angkutan Kayu Bulat*/Log (round wood) transport license; since2000, *SKSHH*
SAL	Structural Adjustment Loan
SB-BipHut	*Sub Balai Inventorisasi dan Pemetaan Hutan*/Sub-office of [regional] office for Forest Inventory and Mapping, MoF (under the Planology Agency/Badan Planologi)
SB-KSDA	*Sub Balai – Konservasi Sumber Daya Alam*/Sub-office of regional office of Conservation of Natural Resources, MoF (under PKA)
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 lowintensity selective logging may lead to forest degradation if trees are felled carelessly or are removed roughly from the surrounding forest. (including mining pitprops), and fuelwood.
SFA	State Forest Area
SFM	sustainable forest management
SKSHH	*Surat Keterangan Sah Hasil Hutan*/Letter of Official Validity for Forest Products; previously SAKB
SO	Strategic Opportunities 1 to 5, inclusive
sosialisasi	Provision of information on implementation of a program or policy (top-down connotation)
TGHK	*Tata Guna Hutan Kesepakatan*/Forest Land-Use Plan, 1982
TNC	The Nature Conservancy
TNKS	*Taman Nasional Kerinci Seblat/* Kerinci Seblat National Park (KSNP)
TPI	*Tebang Pilih Tanam Indonesia*/Selective logging system
TPTI	*Tebang Pilih dan Tanam Indonesia*/Indonesian Selective Harvest and Planting sylvicultural system for natural production forests
UKL	*Upaya Pengelolaan Lingkungan*
UNEP-WCMC	United Nations Environment Programme-World Conservation Monitoring Centre.
UPL	*Upaya Pemantauan Lingkungan*
UPT	Technical Execution Unit for national park management
USAID	United States Agency for International Development
USEPA	United States Environmental Protection Agency
vegetation	cover and soil stability on steep slopes and to protect watersheds.
WALHI	*Wahana Lingkungan Hidup Indonesia*/The Indonesian Environmental Forum

WATSAL	Water Resources Sectoral Adjustment Loan
WB	World Bank
WWF	World Wildlife Fund
WWF	World Wildlife Fund for Nature
Yayasan Kehati	*Yayasan Keanekaragaman Hayati*/National Biodiversity Foundation

Executive Summary

Purpose of the Report

USAID/Indonesia is required under Sections 118 and 119 of the Foreign Assistance Act (FAA) to carry out a background assessment of the status of forests and biological diversity in Indonesia to ensure that its new strategic plan most effectively improves the conservation of biological diversity and sustainable use of forest resources in Indonesia. This assessment must:

- Provide an analysis of actions necessary in Indonesia to achieve conservation and sustainable management of tropical forests.
- Evaluate the extent to which actions proposed meet identified needs.

Current status of biodiversity and forests

Indonesia with 17,000 islands is a mega biodiversity country that is ranked first in the world for number of mammals, palms, swallowtail butterfly, and parrot species. Further, it is the center of plant species diversity for a number of genera and is one of the world's centers of species diversity of hard corals and many groups of reef-associated flora and fauna.

Because of the multiple threats to its forests and their associated biodiversity, Indonesia has been identified, by all recent international priority-setting exercises, as a global priority for actions to conserve biodiversity. The regional biodiversity analyses in this report demonstrate that these threats to biodiversity and forests have worsened since the political, economic and environmental shocks of 1997-1998.

The fall of Suharto in May 1998, saw the central government's control over regional affairs, including natural resource management, vastly reduced. This has led to worse forestry practices, increased exploitation of biodiversity and increased conflicts over land tenure. The rate of deforestation in Indonesia in 2003 was the highest in the world and reached 2.4 million ha/yr. Overcapacity in the wood-processing industry, which consumes at least six times the officially allowed harvest (6.3 million m^3 for 2003), is a key factor driving over-exploitation of the forests and illegal logging. Conversion of forests for agricultural purposes is also a primary cause of forest loss and a secondary cause of the 1997-98 forest and land fires, which burned nearly 5 million ha and imposed approximately US$8 billion in economic losses on Indonesia's citizens.

The World Bank predicts that all lowland rainforests outside protected areas will be degraded in Sumatra by 2005 and in Kalimantan by 2010. Lowland forests throughout Indonesia are the most biodiverse habitats, but are also under greatest threat from habitat loss, fragmentation and degradation, over-exploitation of resources, and secondary extinctions.

Approximately 40 million Indonesians depend directly on forest resources (timber, rattan, firewood, etc.) and millions of others reap indirect benefits. These forest and non-forest products are exploited at unsustainable rates, which will most affect the forest dependent communities, who will suffer from loss of these environmental services.

On paper, Indonesia has a reasonably representative set of protected areas, but most of these areas are under intense multiple threats. National conservation strategies are also reasonably well defined and the local human capacity, if not availability of resources, to manage protected areas steadily improves. Further, there is a burgeoning and vocal civil society interest in conserving forests and biodiversity. A nascent environmental conservation culture is developing in Indonesia, stimulated in part by environmental catastrophes (e.g., floods, erosion, landslides, loss of potable water and pollution) that are often caused by bad forestry practices. The increasing empowerment of local governments and communities through decentralization laws, also offers hope that governments and local communities will purposively respond to these environmental crises at both the policy and ground levels.

Actions required to conserve biodiversity and forests

Land tenure conflicts need to be resolved by improved governance, especially by allowing more transparent participation of all stakeholders in spatial planning processes and management of forests and biodiversity at all levels of government. The spatial planning process should be much more focused on landscape level approaches and mechanisms to encourage better conservation practice outside as well as inside existing protected areas. Objectives for conservation of forests and biodiversity need to be 'mainstreamed' into these planning processes. While greater participation in decision-making is essential, much greater emphasis is required with outreach to educate

stakeholders of the socio-economic benefits of environmental services. Improved governance is also required to enforce existing laws and regulations that relate to spatial plans, and environmental management practices, especially in timber concessions and protected areas.
Priorities need to be established to determine where conservation actions need to be implemented in Indonesia and the most appropriate mechanisms for that implementation.

Actions to be taken

This report reviews the regional situation for biodiversity and forests, identifying and prioritizing some islands and areas within islands for priority conservation actions. This report also specifies some of these priority conservation actions based on the regional analyses.

This report also makes a number of recommendations that will improve overall governance and assist in the resolution of land use conflicts, improve spatial planning processes and enforcement of laws and regulations relating to the management of biodiversity and forests. Conservation initiatives at a landscape scale are encouraged throughout the report, particularly using an ecosystem approach based on management of catchment areas, rivers and the entire watershed to the sea.

Recommendations are also made for 'mainstreaming' conservation objectives into planning processes through the provision of ecoregional plans, endangered species action plans, improvement of capacity for spatial planning process at provincial and district levels, educational outreach to inform stakeholders of the socio-economic benefits of environmental services and policy reviews and reforms for fishing and timber concession cutting policy.

1. Introduction

Indonesia is renowned for both its biological diversity and the rate of its loss. Indonesia is the world's largest and most densely populated archipelago, comprising of approximately 17,000 islands of which around 990 are permanently inhabited. The nation straddles two of the world's seven major biogeographic regions, the Oriental and Australasian, and includes Wallacea, a unique biotic and geographic area that lies in the broad interface between these two major regions.

Indonesia has been identified by all recent international conservation priority-setting exercises as a global priority for actions to conserve biodiversity. For example, in Conservation International (CI) considers Indonesia to be one of 17 "megadiversity" countries -- with two of the world's 25 "hotspots."[1] It has 18 of the World Wildlife Fund's (WWF) "Global 200" ecoregions[2], and 24 of Bird Life International's 218 "Endemic Bird Areas."[3] It also has 10% of the world's flowering plant species and ranks as one of the world's centers for agrobiodiversity of plant cultivars[4] and domesticated livestock.

Indonesia's unusually high levels of species richness and endemism are explained by the fact that it straddles two biogeographic regions, is located in the wet tropics, has many islands and an extremely complex geological history. The country ranks first in the world for number of mammal, palm, swallowtail butterfly, and parrot species (World Bank 2001; BAPPENAS 2003). Further, it is one of the world's centers of species diversity of hard corals and many groups of reef-associated flora and fauna; indeed, it has the highest coral species richness in the world (Suharsono 1998).

Indonesia's rich biodiversity is being rapidly degraded and increasingly under threat from rapid landscape change, pollution and over harvesting. Indeed, the country is often noted to be in an environmental crisis. This report synthesizes and provides updated

[1] "Megadiversity countries" refers those countries where the highest number of species are found and which account for a high percentage of the world biodiversity. "Hotspots" refer to the richest and most threatened reservoirs of plant and animal life on Earth (www.conservation.org).

[2] The "Global 200 ecoregions" is a "science-based global ranking of the Earth's most biologically outstanding terrestrial, freshwater and marine habitats. It provides a critical blueprint for biodiversity conservation at a global scale" (www.panda.org/about_wwf/where_we_work/ecoregions/global200/pages/home.htm).

[3] "Endemic Bird Areas" refers to those regions in the world where two or more endemic bird species that have restricted ranges, i.e., less than 50,000 km2, overlap (www.birdlife.net/action/science/endemic_bird_areas/).

[4] A cultivar refers to a plant that "has been selected for a particular attribute or combination of attributes, and that is clearly distinct, uniform and stable in its characteristics and that, when propagated by appropriate menas, retains those characteristics" (www.palntcultivar.info/what_is_a_cultivar.htm).

information about the status of these threats to biodiversity and forests and their causes, many of which have been exacerbated by the series of dramatic political, economic and environmental shocks of 1998-1998 (World Bank 2001).

Recent events, however, offer hope that this environmental crisis can be abated. Communities throughout Indonesia are increasingly cognizant of the nature of this crisis through their witnessing and experiencing the considerable loss of life, health and economic hardship, due to devastating land slides, floods, loss of potable water and pollution and degradation of many ecosystems. The increasing empowerment of local governments and communities through decentralization laws also offers some hope that governments and local communities will now purposively respond to this crisis at both the legislative and ground level.

Fig. 1.1: Map of Indonesia

Even with increasing awareness in Indonesia of the need to conserve biological diversity and manage protected areas, loss of biodiversity and forests continues unabated across the country. The most biodiverse habitats, particularly lowland forests, are under the greatest pressure. The World Bank predicts that non-swampy lowland forests outside protected areas will be highly degraded in Sumatra by 2005 and in Kalimantan by 2010

(Holmes 2000)[5]. While timber, rattan, fisheries, swiftlet nests and other biological resources are major contributors to the national economy, they are exploited at unsustainable rates. Approximately 40 million Indonesians directly depend on forest resources with millions of others reaping indirect benefits (World Bank 2001, Bennett and Walton 2003). Many of these people find themselves increasingly impoverished by the economic decline of Indonesia. It is these poor people who are most dependent on biological resources for their livelihoods and who suffer the most from the impacts of the degradation of biodiversity and environmental services.

The four key factors leading to biodiversity loss in Indonesia are summarized in the box below.

Megadiversity Country in Crisis

The main factors affecting biodiversity loss and species extinction in Indonesia and a partial list of their impacts

1. **Habitat loss and fragmentation**
   - Between 1985 and 1997, 20 million ha of forest was lost (about 1.5 million ha per year) most of it lowland forest below 300m where more than 60% of all rainforest species occur.
   - Since 1997, the rate of forest lost is 2.4 million ha per year or more – over 10 years an area as large as Montana or the UK is lost on forest rich islands such as Kalimantan and Sumatra.
2. **Habitat degradation**
   - 5 million ha of forests degraded by fires in 1997-98.
   - 60% of Indonesian coral reefs degraded.
   - Industrial and urban waste pollute fresh and coastal water ecosystems.
3. **Overexploitation**
   - Many species of animals harvested to local extinction to supply medicinal and specialist-food markets in Asia.
   - Rapid development in recent decades fueled and funded by non-sustainable use of natural resources.
   - Millions of increasingly impoverished coastal dwellers, rural villagers, and poor communities contribute to overexploitation of animals, plants, fresh water and marine fisheries in their search for subsistence.
4. **Secondary extinction**
   - Many species dependent on lowland forests are on the verge of extinction. Only a tiny number of species are the focus of monitoring programs

An additional factor likely to have increasing impact in the future is climate change; already the effects of global warming are being reflected in coral reef die-off.

SOURCE: World Bank (2001) with amendments

The most visible and intractable aspect of Indonesia's natural resource crises is forest loss. The escalation in the rate of deforestation is intimately linked not only to degradation of other resources, but also to immense social, economic and political

[5] This oft-cited prediction requires the following contextualization: In that report, Holmes (2000) notes that the reminants of non-swampy lowland forests in Sumatra in 2005 and in Kalimantan in 2010 "will not be viable as timber resources or as habitats for biodiversity" (Holmes 2000: ii). Further, this prediction is based upon the comparison of forest cover maps produced by the Ministry of Forestry and Estate Crops c. 1997 with the c. 1985 forest cover maps produced by the Regional Physical Planning Programme for Transmigration (REPPProT). The c. 1997 maps are satellite images and were produced as part of an attempt to obtain a rapid overview of the change in forest cover. The scale of these maps is 1:500,000. There was no ground truthing. The methods and scale of the c. 1997 mapping exercise were intended to provide information on forest cover only, i.e., "natural forest that could be recognized as such on satellite images" (Holmes 2000: i). Holmes (2000: 1) notes that "the data must be regarded as provisional."

changes, which began in 1997 and continues to the present. The rate of forest loss was already high and accelerating in the mid-1990s, but in 1997-1998 these rates escalated as a consequence of the devastating fires in Kalimantan and Sumatra. These fires were unprecedented in number and geographic scope, and for the first time, international attention was drawn to the massive scale of environmental damage occurring in Indonesia (Barber and Schweithelm 2000). Further, during the economic crisis of 1997-1998, Indonesia saw the loss of 80% of the value of the Rupiah and the flight of working capital that led to the collapse of Java's industrial sector. As a result, Indonesians, including policymakers, looked to their traditional economic base in natural resources to power the country's economic recovery (World Bank 2001, Sunderlin et al. 2000). Moreover, with the fall of the 32-year centralistic Suharto government in May 1998, the call for political reform (*reformasi*) by various segments of society and the enactment of a set of decentralization laws in 1999, the central government's control over regional affairs, including natural resource extraction, was vastly reduced. Regional governments, unable to develop during the New Order[6], are to a large extent ill equipped to cope with these new responsibilities. Also, civil society – greatly suppressed during the New Order -- has yet to fully mobilize to monitor and assist the government in its attempts to be accountable and transparent. Thus, one result of this transition towards decentralization has been the manifestation and expansion in the regions of the system of corruption, collusion and nepotism that characterized the New Order regime.

Indonesia's multi-dimensional economic and political crisis has exacerbated forest degradation and biodiversity loss. The economic crisis, dramatic political transition, unsystematic devolution of authority to provincial and district (*kabupaten)* levels and lack of law enforcement have led to increased pressures on forests throughout the country. Accelerated illegal logging and land encroachment are often sponsored by powerful political figures and institutions, and continues to be encouraged in the name of economic recovery and development. Some local governments, with support from the defense forces, issue permits to remove logs in protected areas (PAs) and areas not gazetted for logging. The practice is so prevalent and out in the open that it is sometimes difficult to determine that these activities are in fact illegal. Forest clearing occurs even in many well-known PAs that have important international donor programs. For example, 30,000 ha of lowland forests in the northern area of Bukit Barisan Selatan National Park

[6] "New Order" or *Orde Baru* is the term coined by Suharto to refer to his regime and to mark a break with the previous Sukarno regime.

(Sumatra) have been lost in the last few years (World Bank 2001). Due to this illegal logging, the risk of fire within national park boundaries has increased (Nepstad et al. 1999). Moreover, with the increasing fragmentation of habitats, some conservationists suggest that many species' populations may not be viable. Conservationists increasingly call for an ecosystem approach that focuses on PAs and surrounding areas, which means that Indonesian production forests must be managed as buffer zones to PAs to maintain both permanent forest cover and biodiversity (World Bank 2001, Curran et al. 2004).

Several factors drive deforestation in Indonesia. Political will is a key one. For example, although previous governments in Indonesia repeatedly expressed commitments to sustainably manage production forests by 2000, Indonesia in 2003-4 has the highest rate of deforestation in the world at 2.4 million ha/year. Oil palm plantations were one of the primary causes of deforestation in the 1990s. Such large-scale land conversion was the largest cause of the 1997-98 fires, which burned nearly 5 million hectares of forest and imposed approximately US$8 billion in economic losses on Indonesia's citizens and businesses (ADB 2002). Further driving illegal logging is overcapacity in the wood-processing industry, which at this point consumes at least six times the amount of the annual allowable cut of 6.3 million m^3 for 2003 (MoF 2003a). Overcapacity is a consequence of more than a decade of government policy incentives to develop local value-added industries, as well as below-market stumpage fees and log prices and a lack of care by banks in their evaluation of new wood-processing investments. Of the US $51.5 billion in private debt owed to the Indonesia Bank Restructuring Agency (IBRA), US$4.1 billion is in loans to the forest industry, of which US$2.7 billion are classified as non-performing (World Bank 2001, Simangunsong and Setiono 2003).

Moreover, years of built-up resentment from forest dependent communities and the political changes in the *reformasi* era have fomented another set of challenges for Indonesia's forests. Specifically, the New Order denied communities access to their customary natural resource base, thereby exacerbating poverty for many rural households. Now, communities that believe they have claims against GoI or logging or plantation companies for compensation or return of land use rights perceive a sense of power and are willing to act. In many places, they have created new local pressures on forests that have exacerbated the strains imposed by large-scale operators (World Bank 2001). Hence the factors driving deforestation are not only multiple, but also are the legacy of the New Order. Resolution of conflicts over land tenure and management rights is a key factor to reducing on-going rates of deforestation and achieving more sustainable natural resources management.

Purpose of Assessment. This assessment reviews the challenges to and opportunities for improving the dynamic relationship between people, forests and biodiversity in Indonesia. In doing so, it provides a topical overview of the current situation. It also recommends approaches and directions that may be pursued to leverage existing opportunities and create new ones to improve the possibilities of biodiversity and forest conservation and management. To help ensure biodiversity and forest conservation and management, the report suggests a focus on improved governance and capacity, particularly with respect to multiple land-use planning and practice through transparent engagement and integration of all levels of government and local communities. Support for this focus will be through creating more awareness that economic gains may be achieved through better land practices that conserve biodiversity. The emphasis on multiple land-use planning is part of a contemporary awareness that biological diversity in Indonesia -- and most countries -- cannot be sustained within protected areas (PAs) alone, but requires management of the entire conservation domain, much of which is outside PAs.

Information Sources and Gaps. Literature consulted for this report includes some of the most recent and trusted overviews as well as detailed analyses of relevant sectors produced by institutions such as National Development Planning Agency (Bappenas), the Center for International Forestry Research (CIFOR), the World Bank, and Forest Watch Indonesia (FWI), as well as USAID's Natural Resource Management project (NRM III) and Coastal Resource Management project (CRMP II). Primary and secondary data were analyzed to provide further detail and crosschecked with the literature. Finally, experts were consulted (please see Appendix III for a list of experts contacted for this report) to fill gaps and contribute a further dimension of veracity and accuracy to the assessment.

There are information gaps and inconsistencies, but they are difficult to overcome. For example, compilation and analysis of credible forest statistics in Indonesia frequently encounter formidable obstacles (FWI/GFW 2002). Data collection and compilation are not consistent over time within an agency or between them, thus combination and comparison of data are extremely difficult tasks (FWI/GFW 2002). The problem of data quality is also not easily resolved. It is important to take a broader view of the structural constraints on the responsible institutions. Years of rent-seeking at all levels of government, especially at the top, have crippled the ability of institutions to regulate industry properly, including collecting, analyzing and providing quality data (FWI/GFW 2002).

With that caveat, we provide a current and accurate compilation of recent assessments of the status of, opportunities for and constraints to biodiversity and forest conservation and management in Indonesia.

2. Legislative and Institutional Structure Affecting Biological Resources

This portion of the report discusses Indonesia's legislative and institutional structures that affect biodiversity conservation and forest management. The section begins with some brief background on the sweeping changes that have recently taken place in the country. Next is a summary of the structure of the government, the legislation, and the key institutions involved in biodiversity conservation and forest resource management. National conservation strategies are summarized, as well as government expenditures on biodiversity conservation and protected area (PA) management. There is a brief discussion of international treaties and agreements related to biodiversity conservation and forest management that the Government of Indonesia (GoI) participates in. This section also describes the conservation efforts of international donor organizations, and national and international non-governmental organizations.

Since the political-economic crisis in 1997-1998 and particularly after the fall of Suharto in May 1998, Indonesia has experienced dramatic changes in governance that strongly affect its rich biodiversity, forests and other natural resources. These governance changes include, among others, new and profound legislation and government restructuring. Additionally, this era of reform and autonomy has meant a loosening of authoritarian rule, and hence civil society institutions have blossomed and experienced attendant growing pains. International organizations must consider and address these changes in governance in their strategies and operations in Indonesia.

Although this is a period of transformation and opening of government, the long legacy of authoritarianism and patronage politics has proved a formidable obstacle to meaningful governance reform. "Corruption, Collusion and Nepotism," the local term for the legacy of the New Order, still influence government decisions, legislation development, and law enforcement at all levels. This tension between prospective reform and the deeply entrenched legacy of the New Order has engendered instability, uncertainty and conflict throughout the country that continue to persist five years into the reform era. These factors have had strong negative impacts on Indonesia's biodiversity and forest conservation efforts. Facilitating meaningful governance reform will be critical to ensuring the conservation and management of biodiversity and forest resources.

2.1 Government of Indonesia

Indonesia is a republic that consists of three branches of government: executive, legislative, and judicial. The President is both the chief of state and head of the government. The president currently presides over 32 cabinet members, who manage the executive branch ministries and departments. It is the president's prerogative to determine the number and responsibilities of Ministries.

The People's Consultative Assembly or *Majelis Permusyawaratan Rakyat* (MPR) is the country's highest legislative body. It consists of the House of Representatives or *Dewan Perwakilan Rakyat* (DPR) plus 195 indirectly selected members. The MPR elects the president and vice-president every five years and approves the broad outlines of national policy, while also meeting annually to consider constitutional and legislative changes. The DPR consists of the 500-seat unicameral House of Representatives. The judiciary is led by the Supreme Court, which is preparing to assume administrative responsibility for the lower court system currently run by the executive. The President appoints Supreme Court justices. Indonesia consists of 30 provinces and 357 districts (*kabupaten*), which since the enactment of decentralization in 1999 have substantially more authority to govern local affairs.

The recent third amendment to Indonesia's constitution (9 November 2001) revised the electoral process and the structure of the legislative branch. Formerly, the president and vice president were chosen by vote of the MPR. Beginning in 2004, the president and vice president will be directly elected by the people. Further, the amendment established a second legislative body, the House of Regional Representatives (*Dewan Perwakilan Daerah* or DPD). Members of this body will be chosen by election with equal numbers for each province. The total number of members in the DPD will be one third of the number of members in the DPR. In contrast, the DPR membership is based on population: larger regions have more representatives.

2.1.1 Legislative Basis for Protection and Management of Biodiversity and Forest Resources

Indonesia's Constitution of 1945 establishes the foundation for state management of natural resources for the good of the people of Indonesia. From this base, a wide range of laws have been developed both to conserve biodiversity, forests, and natural resources and to regulate their exploration, development and exploitation. Some of the more relevant legislation is briefly summarized below. This section is adapted and updated from Sembiring et al. (1999) except where noted below. Appendix (IV) provides additional detail on these laws and the implementing regulations that stem from them.

- **Law 5/1990. Conservation of Biodiversity and Ecosystems.**

Derived from an earlier Law (No. 4/1982) it is based on the conservation of the potential of and use of biodiversity and ecosystems in a balanced and compatible manner to support community prosperity and quality of life. Conservation of biodiversity and ecosystems is considered the responsibility of the Government and community through the following three activities: (1) protection of life support systems, (2) conservation of the diversity of vegetation and wildlife found in ecosystems, and (3) sustainable use of biodiversity and ecosystems. The Law regulates understanding of the protection of life support systems, conservation of biodiversity, sustainable use of biological resources and ecosystems, nature conservation areas, use vegetation and wildlife, role of the community, and activities related to assistance, investigations, and criminal stipulations.

- **Law 41/2000. Basic Forestry Law (replaces Law 5 from 1967).**

Sets the objective of forest management as obtaining maximum, versatile, and sustainable benefits in the interest of the people and defines how the state will regulate and manage forest use. Defines main forest functions and the need for planning. Includes provisions on participatory forestry planning, people's economic empowerment, transfer of partial authority to regional governments, and community-based forest monitoring.

- **Law 23/1997. Management of the Environment.**

States that natural resources are controlled by the State to maximize the prosperity of the community. Provides that the government will (1) regulate and develop policy for environmental management; (2) regulate the availability, allocation, use, management, and returns from natural resources; (3) regulate the creation of Law and the relationship between people and the Law; (4) mitigate activities that have environmental and social impacts; and (5) develop funds for initiatives to conserve the function of the environment. Replaces Law 4/1982 and provides broader definition of the right to participate, the right to a healthy and good environment, the right to information, the right to inform/report, the right to file a class action suit, the right of NGOs to file suits, and strict liability.

- **Law 24/1992. Spatial Use Management.**

Strives to assure the proper the use of space, while safeguarding the nation's territory and national defense. Seeks to implement the arrangement of protected areas and cultivation areas and achieve spatial organization with a certain quality. This Act regulates the rights and responsibilities, planning, use and restraints of spatial planning, including authority and development. Spatial planning, whether at the national level, provincial level, or regency level, is carried out in an integrated fashion.

- **MPR Decree No. IX/2001 on Agrarian Reform and Natural Resources Management**

This decree provides a mandate to the DPR and President of Indonesia to implement policies on agrarian reform and the management of natural resources according to the principles of sustainable development, national integrity, human rights, legal supremacy, justice, democracy, participation and people welfare, taking into consideration the social, economic and cultural conditions of the community and the ecological functions of natural resources. This decree addresses directly the need to conduct a comprehensive inventory of land use, ownership and control and the need to implement reforms on the control, ownership and utilization of land to increase equity. The decree also addresses the need to resolve existing conflicts over agrarian resources and proposes an institutional framework. This decree also clearly recognizes, protects and respects the rights of traditional communities and cultural diversity in the management of natural resources in Indonesia. Bappenas notes in IBSAP (2003) that this initiative "might provide the basis for sustainable management of biodiversity if effectively and appropriately enforced."

- **Draft Law on Natural Resource Management**

As a follow up to the MPR Decree No. IX/1999 (above), the Ministry of Environment with support from various NGOs and universities has proposed a reformed framework for natural resources management, which applies a holistic approach, consistent with sustainable development principles, i.e., natural resources are treated as natural capital or stock, as an integral part of natural ecosystem and the local community. This umbrella legislation has provisions to ensure more integrated and cohesive consideration for the carrying capacity and sustainability of the environment under sectoral regulations, such as for mining, forestry, fisheries and irrigation, which may overlap or contain inconsistencies. The draft law is being developed through an extensive public consultation process that is ongoing. (IBSAP 2003)

Several laws address management of biological and natural resources in the coastal zone and Indonesia's marine environment. This legal framework is under revision now through the efforts of the recently established Ministry of Fisheries and Marine Affairs, together with donor support.

- **Law 5/1983. Indonesia's Exclusive Economic Zone.**

The oceanic area of Indonesia delimits the Exclusive Economic Zone, determined based on the Act regarding Indonesian Waterways, and bounded as far out as 200 miles, measured from the starting point of Indonesia's marine area. Asserts Indonesia's sovereign right not only to explore, use and manage, but also to conserve biological and non-biological natural resources from the ocean floor and the land underneath it.

- **Law 9/1985. Fisheries.**

Strives to implement the "management of fish resources in an integrated fashion with the preservation of fish resources as well as its environment for the prosperity and success of the Indonesian community." Forbids activities that cause pollution and destruction of fishery resources and their environment, except for research and scientific activities. To protect natural fisheries, the government determines the species that are protected and/or the location of the waters as fishery reserves based on the factors that are critical for a species of fish and/or the area.

- **Draft Coastal Zone Management Law**

A new law to develop coastal zone management programs has been drafted and subjected to a public participation process. Framework is based on United States Coastal Zone Management Law of 197x). The law is now being considered by Indonesia's House of Representatives (DPR). (CRMP 2003)

There are several key pieces of legislation that affect biodiversity preservation and natural resource management indirectly through the determination of roles and responsibilities of the various levels of government. These are the primary laws and regulations that define Indonesia's decentralization framework, although this summary is not exhaustive.

- **Law 22/1999. Regional Governance.**

Provides for regional autonomy over all administrative and operational processes of governance, except defense and security, foreign policy, monetary and fiscal policy, judiciary and religious affairs, which are retained at the center. Eliminates the hierarchical relationships between the various levels of government and places them in parallel status. Outlines a system of shared responsibility between the three levels of government with regard to natural resource management and environmental conservation. The central government retains the planning and policy authority that pertain to national economic development, natural resource use, conservation, implementation of international conventions, and environmental management issues related to trans-national and trans-provincial boundaries. The provincial and local governments are both responsible for implementing these national level policies at the local level. Article 10 outlines other significant responsibilities for provincial governments over natural resource management issues related to trans-district boundaries and conservation of coastal zones (12 nautical miles from shore). Article 11 outlines the eleven governance sectors that will fall under the domain of local government: public works, health, education and culture, agriculture, communications, industry and trade, direct investment, environmental management, land use, cooperatives, and labor. Article 7 states that forest conservation policy is the authority of the central government, but it does not provide for any central or regional mechanism.

- **Law 25/1999. Fiscal Balance between Central and Regional Governments.**

Articulates the revenue sharing mechanisms that define how natural resource revenues will be allocated and which levels of government will manage them. Provincial governments receive 80% of the tax revenues from fisheries, forestry, and mining, 15% of the oil revenue, and 30% of the gas revenue. Because this Law bases revenue allocations on natural resources, which are unevenly distributed throughout the country, a General Allocation Fund (Chapter 3, Article 7) will include 25% of national domestic (own source) revenues to be allocated 10% to the provincial level and 90% to the district/municipality level. This general fund will be allocated among the regions according to the needs and development potential of the region. A Special Allocation Fund (Chapter 3, Article 8) will address special development needs, including unpredicted needs, committed needs or national priority needs, at the regional level.

Other laws regulate matters related to development, management, and use of natural resources and land, especially extractible resources. While these laws are not directly related to biodiversity and forest conservation, their implementation and interpretation can have influence the effectiveness of conservation efforts. Some sectoral laws are not fully consistent with the nature conservation and environmental management laws noted above, giving rise to uncertainty in interpretation and application. Some of the more important sectoral laws include Law 5/1960 the Basic Agrarian Law, Law 44/1960 on Oil and Gas Mining, and Law 11/1967, the Basic Mining Law. These and other related sectoral laws are described further in Appendix IV.

Hierarchy of Legal Products. Aside from these national laws, there are a range of other legal products that regulate activities and have the potential to affect conservation initiatives or results. Each national law is implemented through passage of Government Regulations (PP, see below), which further specify and detail the requirements laid out in the law. One law can generate several implementing regulations dealing with different aspects of the law. In the past, presidential decrees were used frequently to create, in effect, new laws or new legal responsibilities and authorities. Ministerial decrees also were frequently used to further specify rules, providing a level of detail beyond the PP. Often, sectoral ministries developed decrees based on sectoral laws, with insufficient attention to other related laws. This led to a complicated system of laws and rules of varying status that sometimes overlapped or conflicted with other ministerial decrees, or even with other national laws.

Since the advent of autonomy, local regulations passed by Provinces, Districts, and Cities play an increasingly important role in the overall legislative framework. Local regulations are also often sectoral in nature, leading to more overlaps or conflicts with national laws or decrees. To clarify this situation, Decree III/2000 of the MPR (highest legislative body) stipulated the hierarchy of legislation in the following order:

1. *Undang-Undang Dasar* 1945 (UUD 1945) or the 1945 Constitution
2. *Ketetapan Majelis Permusyawaratan Rakyat* (TAP MPR) or Decision from the People's Consultative Assembly.
3. *Undang-Undang* (UU) or Law
4. *Peraturan Pemerintah Pengganti Undang-Undang* (Perpu) or Government Regulation on Replacements of existing Laws
5. *Peraturan Pemerintah* (PP) or Government Regulation
6. *Keputusan Presiden* (KEPPRES) or Presidential Decree
7. *Peraturan Daerah* (PERDA) or District Regulation

A fundamental principle of the legislative hierarchy is that a lower legal regulation may not conflict with a higher one. However, this decree does not mention Ministerial Decrees or Governors' Decrees, so their legal status is uncertain, at least in respect to other legal products in the hierarchy (Effendi 2003). Although ministerial decrees are still used frequently, it is not clear whether they take precedence over regional laws or regulations, for example. It is clear, however, that both regional regulations and decrees must be consistent with the higher national laws on which they are based.

This has led to substantial confusion and conflict over legal interpretations in the decentralization process as district governments may choose not to implement Ministerial Decrees. There are also gaps and disconnects across regions as some districts have adopted rules that may be inconsistent with the rules in neighboring areas. The forestry sector has manifested a number of important inconsistencies in laws and legal interpretations that have led to a reduction in the effectiveness of management and protection of forestlands.

Inconsistencies in the Legal Framework. Beyond the hierarchy issue, there are some inconsistencies and ambiguities between various pieces of legislation. Disharmony among laws and regulations contributes to the difficulty of forest resource management and biodiversity conservation.

One area of inconsistency is language. Even within the basic laws dealing with conservation, different terms are used to refer to protected areas, impeding clear implementation of policy. At least three different terms are used to describe conservation or protection objectives: “the Environment” (UU No. 23 1997), “Conservation Area” (UU No. 5/1990) and “Protected Area” (UU No. 24/1992). Some legal products refer to “protection,” while others refer to “preservation,” two words with different connotations (Sembiring et al. 1999). For example, the law on Spatial Use Management uses the term "protected area" management in the same way as the Presidential Decree of 1990 regarding Protected Areas, but does not use the term "conservation area." The term "protected area" is not used in the 1990 Law on Conservation of Biodiversity and Ecosystems, although the word “conservation” appears in the earlier law on which it was based. These differences in terminology are important because they influence the implementation of policy, especially at the regional level.

Beyond the lack of standardized language, there are disconnects among basic laws governing various sectors. Several important illustrative examples of inconsistencies that have been noted by several commentators are discussed below.

- **Mining and Forestry**

Mining in Protection Forests is an issue that created substantial controversy in 2003. Law No. 11/1967, the Basic Mining Law, does not refer to protected areas, but mentions that mining activities cannot be carried out in areas that are closed for "public interest." Bappenas (IBSAP, 2003: p. 65) notes that "Law No. 5/1990 on Nature Conservation clearly prohibits cultivation (production) activities within nature reserves…. Law No.41/1999 on Forestry also has firm provisions on banning open pit mining in protection forest areas. Nevertheless within this same regulation there is a special clause that permits mining activities as long as members of the House approve it…. But according to a joint decree between the Minister of Mining and the Forestry Minister (No. 969 K/08/MPE/1989) … mining activities may be conducted in Nature Reserves."

- **Forestry and Decentralization.**

Many commentators have noted that there are inconsistencies between the Basic Forestry Law (No. 41/1999) and the Law on Decentralized Regional Governance (Law No. 22/1999). As noted above, the Law on Decentralized Regional Governance devolves to local government the responsibility for agriculture, environmental management, and land use. The central government retains the planning and policy authority for natural resource use and conservation. Although passed later in the same year, the forestry law does not take into consideration the law on decentralization. The Basic Forestry Law articulates a centralized decision making structure with respect to forest use and management. The implementing regulation for this law (PP No. 34/2003) goes even further in making explicit centralized regulatory control in forest use and management. This regulation removes the powers of Governors and District Heads to grant small timber exploitation concessions (Effendi 2003).

Even without inconsistencies in interpretation, legal complexity manifested through a system of laws, regulations, national decrees, and local decrees can result in weaknesses in implementation. For example, in the forestry sector hundreds of regulations impact the behavior of forest concessionaires. Sève notes that "one effect of this regulatory pressure is that most forest operators concentrate on the administrative compliance, while essential components of sustainable forest management (such as maintaining forest productivity and ensuring environmental conservation) become secondary concerns, and are often neglected" (Sève 1999: 4).

2.1.2 Government Institutions Concerned with Biodiversity Conservation and Management of Forests and other Natural Resources

A wide array of government institutions have authorities that affect biodiversity and forest conservation and management, as well as natural resource management more generally. This is partly because natural resource management is inherently inter-sectoral. Overlaps and inconsistencies in legislation, noted above, also contribute to lack of clarity in government agencies' roles and responsibilities in biodiversity conservation and forest management. The table below provides a brief overview of the main executive branch agencies that have responsibilities for conservation or have authorities that affect conservation and forest management.

Although this is a long list, the Ministry of Forestry stands out as one of the primary agencies with responsibilities for biodiversity conservation and preservation and management of forest resources. The Ministry of Forestry is responsible for the system of national parks and other protected areas. It is also the implementing agency for the Basic Forestry Law (1999) and for the Law on Conservation of Biodiversity and Ecosystems (1990). The Ministry of Forestry is directly responsible for administration and management of 68% of the land area of Indonesia, as well as substantial areas of marine environment included in the national park system.

Because of the inter-sectoral nature of forestry and biodiversity issues, coordination among regulatory and management agencies is a critical element for proper conservation efforts. However, coordination has often been inadequate to achieve consistent conservation or halt forest degradation. For example, in the forest sector, the inter-sectoral nature of problem have been explicitly recognized through the establishment in 2000 of the Inter Departmental Committee on Forestry (IDCF), which consists of 13 government agencies chaired by the Coordinating Ministry on Economic Affairs. This inter-departmental body was one response toward implementing reform commitments made by the GoI to the Consultative Group on Indonesia, the donor group that provides assistance to Indonesia in its transition from crisis to stability and growth.

Table 2.1: Central Government Agency Function Related to Conservation of Forests and Biodiversity Resources

Central Government Agency	Function Related to Biodiversity and Forest Conservation
1. Min. of Forestry	Jurisdiction over national forest lands (68% of Indonesia's landmass), including protected areas, national parks, nature reserves, etc.
2. Min. of Environment	Responsible for managing environmental impacts, establishing policies, standards, and criteria for environmental programs, and regulating pollution discharges.
3. Min. of Mining and Energy	Regulates oil, mining and other energy industries.
4. Min. of Agriculture	Oversees agriculture sector, as well as plantation crops.
5. Coord. Min. of Economic Affairs	Coordinates work of financial sector agencies, including Ministries of Finance, National Planning, Industry and Trade, State Owned Enterprises, and special institutions like IBRA. Co-chairs the Consultative Group on Indonesia (CGI), the group of donor countries.
6. Min. of Defense	Oversees actions of security forces, which have a role in border protection, law enforcement, military and police operations.
7. Min. of Culture and Tourism	Promotes Indonesia as a tourist destination. Sets standards for hotels and tourist facilities.
8. Min. of Home Affairs	Major responsibility for decentralized governance policies and practices, as well as capacity development for regional governments. Oversees approval of district issued regulations, which includes justification of district issued natural resource extraction permits.
9. Min. of Industry and Trade	Formerly, regulated licensing of wood processing industry, now only pulp and paper. Regulates international trade, export licensing and tariffs.
10. Min. of Finance	Oversees national budget, taxation policies, and the distribution of resource revenue earnings through the decentralization framework. Also, controls general and special allocation funds, which incorporates part of the reforestation fund.
11. Min. of Settlements and Regional Infrastructure	Formerly department of public works. Oversees public infrastructure investments and plays a role in oversight/review of spatial planning process.
12. Min. of Justice and Human Rights	Strengthens national legal system (including national laws and regulations) in the framework of rule of law, as well as human rights.
13. Min. of Research and Technology	Oversees research and technology activities. Conducts research and maintains data systems on the distribution of natural resource wealth in Indonesia. Mapping and GIS capabilities.
14. Armed Forces	Main role in national defense, border protection, and public order. Involved in joint efforts with MoF on illegal logging.
15. Nat'l Police	Important role in law enforcement, public order, and criminal investigation. Involved in joint efforts with MoF on illegal logging.
16. Nat'l Development Planning Board	Plans and coordinates national level development. Formerly powerful in determining budget allocations, now a role of Finance.
17. Nat'l Land Bureau	Regulates and issues permits for land outside the forest estate.
18. Min of Marine Affairs and Fisheries	Authority over the fishing industry and proposed increasing role in management of marine protected areas.
19. Judiciary	Judges determine verdicts. Notably weak in issuing guilty verdicts for those clearly involved in illegal logging.
NB: 1-13 are members of Inter Departmental Committee on Forestry (KepPres 80/2000)	

Though reasonably constituted, this new institutional framework for coordination has faced many obstacles in achieving reform in the forestry sector. Managing the transition from crisis to stability and growth has pre-occupied the agendas of many government agencies. Also, due to frequent political changes, there have been a number of different cabinet line-ups, with some ministries experiencing several overhauls in the senior management teams. Frequent personnel changes do not contribute to smooth communication and cooperation among agencies. Also, the inter-departmental initiative has not been able to overcome the diverse – even competing – interests, directions, and incentives of the sectoral agencies to achieve reform in the forestry sector. Decentralization adds another layer of complexity to the roles and responsibilities of government bodies with respect to conservation and forest protection. This is discussed further in Section 2.1.6.

Effective biodiversity conservation and forest resource management faces both horizontal and vertical obstacles. Interagency coordination and collaboration is lacking at the national level. Even if coordination improved, however, it would not guarantee meaningful implementation on the ground. The vertical conflict in interpretation and application of responsibilities poses a serious challenge particularly to protected areas management. Protected areas such as national parks still fall under the authority of the Ministry of Forestry at the center; their management has not been devolved to district governments. District governments have little if any incentive to manage or conserve National Parks, yet the Ministry of Forestry lacks the financial and human resources (as do the provinces and districts) to manage them properly (please see Protected Areas section for more information).

2.1.3 Environmental Profiles and National Conservation Strategies

Since the mid-1990s, biodiversity has attracted increased attention at the national level as well as among donors. The Indonesian government through Act No. 5/1994 ratified the United Nations Convention on Biological Diversity (CBD). The Ministry of Environment is the national focal point for the implementation of CBD, which has three main objectives: conservation of biodiversity, sustainable utilization of its components, and the equitable distribution of benefits arising from the use of genetic resources, including adequate access to genetic resources and transfer of technology and through the provision of adequate funding. The CBD requires member countries to formulate conservation strategy, action plan and program for sustainable biodiversity utilization or to modify the existing similar documents to meet these requirements. The convention also stipulates that governments integrate sustainable biodiversity conservation and utilization as much as possible into their relevant national sectoral and inter-sectoral plan, program and policy. (IBSAP, 2003: pp. 3-5).

The Biodiversity Action Plan for Indonesia (BAPI) was published in 1993, prior to its ratification of the UN Convention on Biodiversity (CBD). Indeed, Indonesia was one of the first countries to formulate a biodiversity action plan. BAPI 1993 was designed as a reference to set priorities and investment in biodiversity conservation during the Fifth and Sixth Five Year Development Plan (up to 1999) and beyond. BAPI's objectives were to reduce the rate degradation in key habitats, to develop data and information on the richness of national biodiversity to be used by decision makers, and to encourage a more sustainable and environmentally friendly use of natural resources. Although BAPI 1993 was formulated before the reform era, one of its main messages was in fact the need for institutional reform. (IBSAP 2003: pp. 3-5).

Though there was some outside involvement of NGOs, BAPI was seen to be exclusive, top down, and had a limited sense of ownership and commitment by stakeholders. This document also did not clearly lay out institutional responsibilities for implementing activities toward established targets. Also, "BAPI 1993 did not have formal legal basis in the national legislation, so … relevant stakeholders were not legally bound to comply with its contents." Despite these weaknesses, some biodiversity management activities were carried out: biodiversity collection and inventory activities were conducted by LIPI and integrated conservation and development programs (ICDP) were intensified. (IBSAP, 2003: pp. 3-5). According to the World Bank (2001), many of the actions identified as priorities in BAPI 1993 have been implemented (World Bank 2001), including the financing of priority PAs and expansion of the PA system, with creation of several new conservation areas (World Bank 2001).

The Indonesian Biodiversity Strategy and Action Plan (IBSAP 2003) was formulated by BAPPENAS and many stakeholders to answer the challenge of making sustainable management and use biodiversity for the prosperity of the Indonesian people a reality. It covers the period 2003 to 2020. This new biodiversity strategy was formulated through a process that tried to address the weaknesses associated with BAPI 1993. The specific objectives of IBSAP 2003 are to review needs and priority actions, to identify what had been achieved, and what remains to be done; to assess new needs and priorities and revise action plans accordingly; to identify opportunities and constraints for effective biodiversity conservation and sustainable use; and to prepare to prepare new strategies, with detailed action plans. (IBSAP 2003: pp. 3-5).

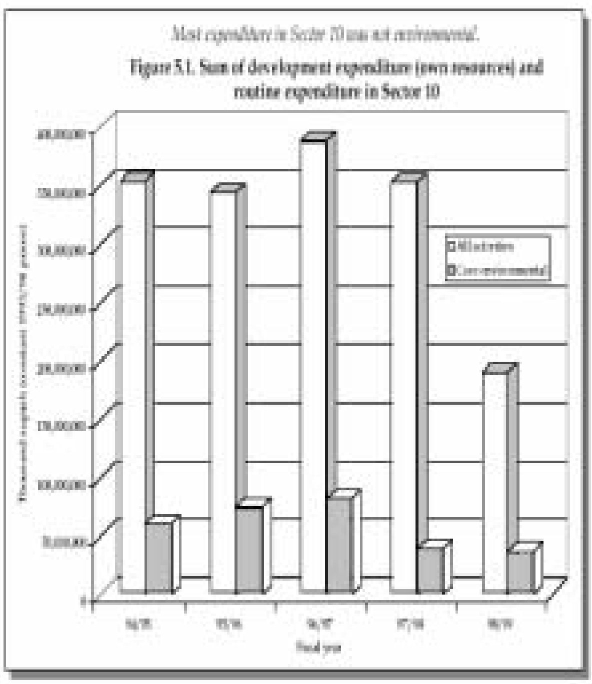
As an outcome of the 2000 Consultative Group on Indonesia (a donor group), the GoI committed to the formulation of the National Forest Program (NFP) through a consultative process, yet progress has been slow. "The NFP is intended to be an Indonesia-specific policy, strategy, and action plan to achieve sustainable use of forest resources, formulated in a transparent manner and in consultation with all stakeholders. Considering the number of issues that are outside the responsibility or authority of MoF, a fully satisfactory process for preparing the NFP requires participation by many other agencies. The Government committed to elevating the NFP process to a higher, inter-ministerial level. It proposed that the NFP would go forward under a temporary statutory body to be established within 60 days by Presidential Decree and that this body would involve representatives of all stakeholders at district, provincial, and national levels" (World Bank 2001). The IDCF was charged with completing the NFP in 2000, but has not. Currently, a Ministry of Forestry working group is trying to develop an NFP with some donor assistance.

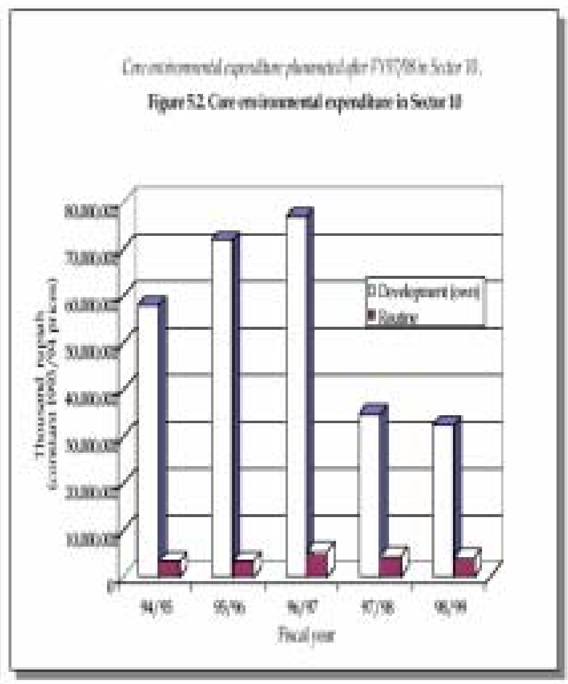
The Ministry of Environment recently released its *Status of the Environment in Indonesia 2002*, an update to the 1992 version. The report underscores Indonesia's initiatives in environmental control and sustainable development. It is expected to be an information source and framework for decision makers in developing environmental policy and also to encourage the broader community to participate in the preservation of the environment. Key issues discussed include the environmental effects of population and poverty; urbanization; improper spatial planning; policy coordination, law enforcement and good governance; and the economic crisis.

2.1.4 GoI Budget Expenditure on Environmental Management, including Biodiversity Conservation, Forestry, and Protected Areas Management

Based on an analysis of public expenditure data for the period FY94/95-FY98/99, the World Bank (2001) noted that "public expenditure on environmental activities is extremely low in Indonesia, in terms of percentage of GDP, percentage of government expenditures and per capita expenditure level" (World Bank 2001: 83). The economic crisis, which began in 1997, significantly affected expenditure on projects with environmental objectives. Spending at the end of the five-year review period (FY98/99) was only about a third of the level at the beginning (FY94/95). Moreover, the post-crisis declines in spending were greater than in other East Asian crisis countries. These environmental expenditure trends reduce resources and capacity to address environmental threats, such as increasing pressure on forests, biodiversity, and land, as well as urban and industrial pollution.

Implementation of the decentralization process implies that more resources would be needed for environmental management at the regional level. However, the World Bank's (2001) expenditure review also noted that environmental spending by regional governments declined steeply after the crisis. The World Bank further notes that, "three types of environmental expenditure that will be needed at district and provincial levels include core expenditures (for example, funding for safeguards capacity building, protection of local conservation areas and enforcement of national minimum standards), mitigation expenditures (such as expenditure on erosion control during road construction and maintenance), and incidental expenditures (such as water supply projects to reduce exposure to contaminants in existing water sources). Whether regional budgets include environmental expenditures commensurate with increasing pressures on regional resource bases will be a critical indicator of political will to support adequate regional safeguards. Central budget support for a substantial share of the environmental and sustainable natural resource management activities conducted at the regional level will be essential."

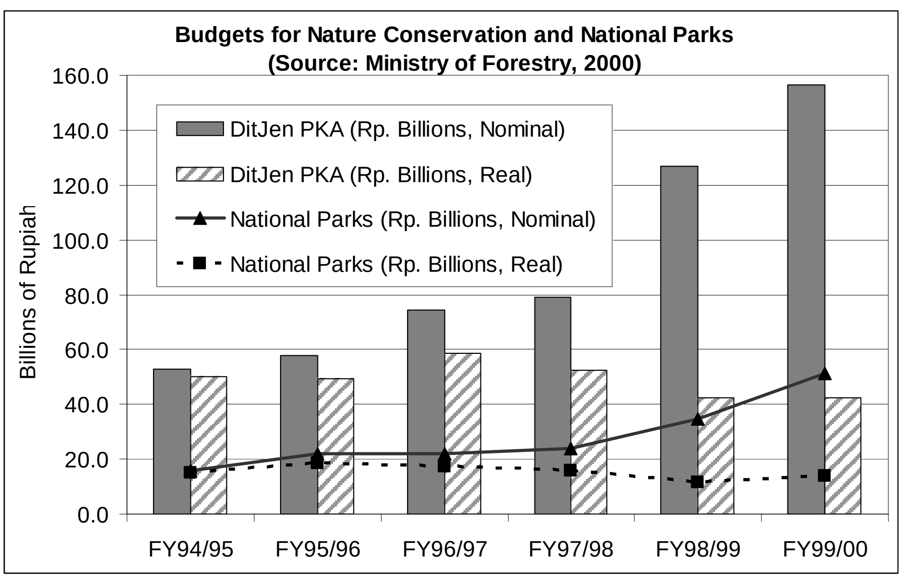




The figure above on the left (World Bank, 2001: 83) "illustrates that core domestic environmental expenditure … was around a fifth of expenditure on all activities in all Sector 10 in most years." "Sector 10" is 'Environment and Spatial Planning,' but not all spending in this category is environmental. "Core environmental expenditure" is defined by the World Bank as "expenditure on activities that pertain solely or primarily to environmental management and appear as discrete entries" in the budget (World Bank 2001: 83). The figure on the right shows that core environmental expenditure is comprised of a large share (over 80%) in development spending (project and special activities) and a small share in routine spending (includes salaries and fixed costs). After the crisis, development spending on environmental activities declined by 60%, while routine spending dropped by only 25%.

Domestic financial resources available for nature conservation and national park management can be found in the Ministry of Forestry's Financial Database for National Parks (Ditjen PKA 2000). This does not include financial resources contributed by donor projects or international environmental NGOs. These data are available for a six-year period up to FY99/00. After that, national level data sources are incomplete because forest conservation management units in the provinces and regions do not place a priority on reporting data to the central ministry in a complete and consistent form.

Analysis of data in the Financial Database for National Parks (Ditjen PKA 2000) yielded the figure below. The figure shows spending on the entire Directorate General for Nature Conservation and spending on National Parks as a subset of that. Both nominal and real (deflated) Rupiah values are shown to indicate the effects of the strong currency devaluation during the monetary crisis of 1997-9. The figure shows that while nominal spending appeared to increase over the six year period examined, the real purchasing power associated with that spending declined, so that real expenditure at the end of the period was less than at the beginning. The figure also shows that National Parks represent about a third of the Ministry's overall spending on nature conservation.



2.1.5 International Treaties and Agreements Involving GoI

GoI has engaged the international community concerned with biodiversity and forest conservation through a number of mechanisms, including formal bilateral and multilateral agreements. As the table below illustrates, the Government of Indonesia has ratified or been party to most international conservation treaties. However, making these agreements and conventions operational and effective in the context of the political transformation and transition to decentralization has proven difficult.

Table 2.2: Indonesia's Membership in International Conservation Treaties

TREATY	DATE (m/d/yr)
Signatory to CITES[1]	12/28/1978
Signatory to Ramsar Wetlands Convention[2]	8/8/1992
Signatory to Convention on Biological Diversity[3]	8/23/1994
Signatory to Migratory Bird Treaty	did not sign
Member of International Whaling Commission	currently not a member
Signatory to other international treaties designed to protect or manage biological resources	Party to: Biodiversity, Climate Change, Endangered Species, Hazardous Wastes, Law of the Sea, Nuclear Test Ban, Ozone Layer Protection, Ship Pollution, Tropical Timber 83, Tropical Timber 94, Wetlands signed, but not ratified: Desertification, Marine Life Conservation

Source: http://darwin.bio.uci.edu/~sustain/h90/Indonesia.htm

Beyond these conventions and treaties, the GoI has engaged in a number of multi-lateral and bi-lateral agreements in attempts to curb illegal logging, which is a serious threat to remaining forest resources and a major priority of the Ministry of Forestry.

[1] CITES: Formulated in 1973, the Convention on International Trade in Endangered Species of Wild Fauna and Flora is an international agreement between governments that aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival. Today, CITES accords varying degrees of protection to more than 30,000 species of animals and plants, whether they are traded as live specimens, fur coats, or dried herbs. For more information see www.cites.org.

[2] Ramsar Convention on Wetlands: Formulated in Ramsar, Iran in 1971, this convention is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. For more information see www.ramsar.org

[3] The Convention on Biological Diversity was agreed to in 1992 in Rio by the vast majority of the world's governments and sets out commitments for maintaining the world's ecological underpinnings as economic development continues. The CBD establishes three main goals: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources. For more information see www.biodiv.org.

Table 2.3: Indonesia's MOUs/Agreements to Curb Illegal Logging

Agreement	Description
East Asian Forest Law Enforcement and Governance (FLEG). 9/1/01	Ministerial Declaration agreed at the end of East Asian FLEG conference in Bali. Includes indicative list of actions for the implementation of the declaration. www.worldbank.or.id/fleg-eap
Forest Law Enforcement, Governance and Trade (FLEGT). 5/1/03	EC measures set out in this plan include support for improved governance in wood-producing countries, voluntary partnerships with producing countries to ensure only legally harvested timber enters the EU market, and efforts to develop international collaboration to combat the trade in illegally harvested timber. http://europa.eu.int/comm/external_relations/flegt/workshop/forest.htm
Asia Forest Partnership (AFP). 2002	Asia Pacific forest partnership (AFP) promotes sustainable forest management in Asia through addressing the following 5 urgent issues: Good governance and forest law enforcement; Developing capacity for effective forest management; Control of illegal logging; and Control of forest fires. http://www.asiaforests.org/
Indonesia-UK. 4/1/02	MOU on co-operation to improve forest law enforcement and governance and to combat illegal logging and the international trade in illegally logged timber and wood products. It aims to establish a system of legality identification and verification in Indonesia (with capacity-building assistance from the UK), and to move towards excluding products not so identified from the UK/EU market. http://illegal-logging.info/dfid/DFID%20FLEG%20web%20output1.htm
Indonesia-EU. End 2003 (expected)	MOU would see the EU ban the entry of illegal logs from Indonesia into their countries. To aid this, Indonesia will supply both governments with a list of companies that are licensed to export logs, and will audit local timber companies to ensure that their logs come from sustainable sources. http://www.ran.org/news/newsitem.php?id=837&area=home
Indonesia-Norway. 8/30/02	LoI to cooperate to improve forest law making and law enforcement to combat illegal logging. http://illegal-logging.info/dfid/DFID%20FLEG%20web%20output1.htm
Indonesia-Malaysia. 6/25/02	Malaysian government bans the importation of logs from Indonesia. On 6/1/03, Malaysia banned the importation of squared logs from Indonesia. http://www.ran.org/news/newsitem.php?id=693
Indonesia-China. 12/18/02	MOU concerning co-operation in combating illegal trade of forest products contains a list of objectives and areas of cooperation, including identification of illegal timber, data collection and exchange of information. http://dte.gn.apc.org/53MoU.htm
Indonesia-Japan. 6/24/03	MOU to cooperate over their opposition to illegal logging and trade in illegal forest products by building on existing bilateral schemes and multilateral frameworks. Contains a list of objectives for the partnership and areas that the partnership will focus on. http://www.illegal-logging.info/textonly/documents.php?sortByMode=title
Indonesia-Korea. 7/12/01	MOU to cooperate in some projects including trees planting, investment in ecotourism, human resources training, illegal logging and forest fires fighting. http://forests.org/archive/indomalay/siforagr.htm

As these two tables demonstrate, GoI has made a variety of formal commitments with the international community to protect and manage the country's biodiversity and forest resources. Additionally Indonesia actively participates in forest related international forums such as the ITTO and UNFF. There is an explicit awareness between GoI and the international community that properly managing Indonesia's natural riches is a transnational affair.

2.1.6 Legislative and Institutional Issues Affecting Biodiversity and Forest Conservation.

Two key issues significantly affect current opportunities and constraints for biodiversity and forest conservation and management and require some discussion. First is the transition to decentralized government, begun in 2000. Second is the issue of land tenure and access to resources.

Decentralization. In Indonesia, forests and natural resources have long been arenas of conflict among stakeholders with differential political power, especially in regions that are rich in commercially valuable natural resources (Barber et al. 1994; Dove 1993; Lynch and Talbott 1995; Poffenberger [ed.] 1990). Until the fall of the New Order regime, control over natural resources lay within the authority of a highly centralized state, characterized by authoritarian rule, aggressive exploitation of natural resources, and the marginalization of forest dependent communities justified by national laws and policies (Lynch and Talbott 1995, Poffenberger [ed.] 1990, and Barber et al. 1994).

The basic statutes of decentralization were discussed in Section 2.1.1. The Regional Autonomy Law (No. 22/1999) transfers responsibility and decision-making authority for the management of natural resources from the central government to provincial and regency/municipal governments. The Intergovernmental Fiscal Balance Law (No. 25/1999) delineates the natural resource revenue sharing allocations and the levels of government that will manage them.

Early analysis of the regional autonomy legislation identified some internal inconsistencies and contradictions with previously passed legislation and regulations (Kartodiharjo 1999a). During early 2000, the work of the Institutional Task Force for Forestry Sector Decentralization under the auspices of the Ministry of Forestry and Estate Crops (MoFEC 2000) revealed that there was no consensus on what decentralization means, how it should be implemented, and how roles and responsibilities were to be divided. The Task Force also found that central government and regional government officials had significantly different opinions regarding virtually every aspect of authority over and responsibility for forests (MoFEC 2000).

Decentralization is an attempt to resolve the long-standing problem of resource wealth flowing to the central government without equitable distribution at the regional level

(Dove and Kammen 2001). In response to prior perceptions of inequity, the decentralization process attempts to ensure that those regions that have natural resources and bear the costs of their management in turn gain the benefits from their exploitation (MoFEC 2000). Prior to decentralization, the most resource-rich regions received little benefit from the immense tax revenues, royalties and profits that those resources generated (Dove and Kammen 2001). Yet, due to the unequal distribution of natural resources in Indonesia, the impacts of this natural resource-based revenue allocation system differ throughout the country. For example, only four provinces gain significantly from natural resource-based revenue sharing, whereas ten natural resource poor provinces obtain little under the new resource revenue sharing formulas (Brown 2000). Equalizing these disparities in natural resource revenue sharing puts strains on the other fiscal balancing instruments, mainly the General Allocation Fund (Lewis 2001).

The decentralization process has replaced the hierarchical relationship between national, provincial and district governments with a parallel structure. In this new structure, district governments wield a broad range of powers both *de jure* and *de facto*, including those related to management of forests and coastal zones, and natural resource management more generally. This new system has also revised the structure of government agencies. Formerly, each sectoral ministry had branches at the Provincial and District level. These district-level agencies implemented rules and guidance and were directly accountable to the national level line ministries. Now, district level sectoral agencies (e.g., forestry, mining, and environment) are accountable to the district government and not the national government. Thus, central agencies have reduced capacity to implement programs, while local agencies have increased capacity, but less central guidance, management, and control.

The decentralization process has resulted in confusion of roles and responsibilities, with conflicting interpretations of rules and competing priorities, particularly with respect to forestry and natural resource management issues, which affect biodiversity conservation in many ways (MoFEC 2000). District governments issue regulations and permits that allow or prohibit actions that may not conform to national laws. The central agencies may not recognize local rules as legitimate, but they do not have sufficient resources to enforce the rules consistently across Indonesia. In fact, the decentralization process has created such a feeling of empowerment at the level of local government that attempts to exert central authority meet strong vocal protests.

De facto decentralization has been taking place. *De jure* implementation processes have been slow and uncertain, thus, social actors with vested interests (e.g., local communities, government, companies, and NGOs) have strategically maneuvered themselves, taking actions regarding natural resource use and interpreting the meaning of decentralization in a way that suits their own ends. Further complicating the socio-political situation is that the *de facto* implementation of decentralization occurs in the context of local government institutions with weak capacities and limited experience in managing or governing. This is the legacy of the New Order regime's successful efforts to weaken local institutions and create a state bureaucracy accountable only upwards (Barber 1989, Dove and Kammen 2001, Winters 2002)

While implementation has proceeded over the past four years, uncertainty and conflicts in interpretation are still present. There is conflict between the three levels of government, between government agencies, as well as conflict – sometimes violent – between and within communities (ICG 2001, FWI/GFW 2002). The legislature is now in the process of considering revisions to the key decentralization laws. While this process may ultimately succeed in clarifying authorities and responsibilities, at present it is creating more uncertainty as various sectors and regions compete for influence over the legislative process.

Decentralization promises both great opportunities and challenges. In theory, devolving control of biodiversity and forest resources to the level of the users most dependent on them should lead to improved management practices, compared to a situation where management is from afar and control is weak. Yet to date, the effects have been primarily negative for Indonesia’s biodiversity, forest resources and forest dependent communities. This is, of course, not due to decentralization per se, but rather the context within which it was instituted, namely, it was a reaction to the prior situation and it has been implemented by a set of historically weak government institutions. Thus, a key challenge for biodiversity and forest conservation and management is to (re) build government and civil society institutions for sustainable and equitable development. The changes in the post-Suharto era, particularly decentralization, afford many opportunities to do precisely this.

Land Tenure and Access. Tenure is perhaps the most contentious and sensitive issue with respect to state-society relations in Indonesia. There is wide recognition that clear and secure tenure is a critical factor in proper management of forests, coasts, and natural resources. At the national level, land tenure, especially in "forest lands,"[4] is a particularly difficult issue. Officially, the state has jurisdiction over all resources, which it manages for the welfare of all under a constitutional mandate. In practice, however, in carrying out development projects, the state has often ignored or denied the land use or ownership claims of local people (FWI/GFW, 2002, Lynch and Talbott 1995). For example, throughout the 1970s and 1980s large forest concessions for timber harvesting or for plantations were granted to business groups by the central government in remote areas. In many cases, traditional communities had been using these lands for centuries for swidden agriculture, rattan cultivation, harvesting of non-timber products, hunting, fishing, and other cultural and religious uses. This process of nationally granted land claims and use rights laid over traditional and tribal ownership claims and use patterns has led to significant conflicts over rights and ownership in the field. The decentralization laws, discussed above, deal mainly with the allocation of administrative responsibilities and government authorities; they did not create institutions or processes that would help resolve the numerous conflicts over land, forests, and natural resources.

There is general recognition that "tenure" consists of a "bundle of rights," which may include rights to use, traverse, manage, own, inherit, or transfer land (Lynch and Talbott 1995). A spectrum of different tenure arrangements can be achieved through the bundling of different rights for different users. Less clearly understood is the notion that rights can be conferred individually or communally. Currently, the debate over which rights should be bundled for which users is far from settled. The Ministry of Forestry's understanding of tenure in the forest estate excludes the possibility of community ownership. Some NGOs and community activists dispute this interpretation and advocate a change in legal status.

Thus, the conflict over tenure persists, even though the 1998 reform movement brought these conflicts into the open and some progress was made with respect to policy. Several key pieces of legislation have been developed that were expected to help resolve community tenure issues, for example:

- **MPR Decree IX/2000 on Agrarian Reform and Natural Resources** provides a legal opening for indigenous people and communities to claim land and resources and

[4] As discussed in more detail in Chapter 6, "forest lands" refers to lands administered by the Ministry of Forestry. These lands may or may not have actual forests on them.

calls on the government to create institutions to resolve land use claims and conflicts and to revise natural resource management laws to achieve greater consistency.

- **Regulation from the Minister of Agrarian Affairs/Head of the Bureau of Lands No. 5/1999** regarding the Guidelines to Resolve *Adat* (Customary) Communal Rights Conflicts, in which the National Land Agency would accept the registration of *Adat* lands and treat them as a communal and non-transferable right (Fay and Sirait 1999).

However, the MPR decree has not yet been implemented effectively and the Agrarian regulation is difficult to apply in the forest estate, so does not address a large portion of conflicts and claims.

Enactment of the new Basic Forestry Law (No. 41/1999) and its implementing regulation (PP No. 34/2003) does little to resolve the tenure issue, which is related to the manner and degree of decentralization. Some perceive these rules as attempts to regain authority and regulatory power at the center. For example, although the regional autonomy law devolves substantial authority to the regions, a key implementing regulation (PP No. 25/2000) still provides MoF the authority to designate boundaries, functions and zones of forest areas. The 1999 Forestry Law does establish a category of customary forest (*hutan adat*), defined as "state forest that happens to lie within the territory of a 'customary law community,' whose definition the government notes it will elaborate in future regulations" (FWI/GFW 2002: 64). Thus, in this legal product, the concept of state forest still takes precedence over the concept of traditional (*adat*) land use claims.

For many involved in biodiversity and forest conservation and management, clear and secure tenure for forest dependent communities is a necessary, albeit insufficient, prerequisite for equitable and sustainable natural resource management. It is not this issue that has engendered such heated debate, but rather the struggle is over what is deemed appropriate and inappropriate within the rubric of tenure. Although the debate has waxed and waned for some time, recently the term "tenure" itself has become so politically charged that it almost precludes dialogue about meanings, options, and practical implementation approaches.

2.2 Non-Governmental Organizations Involved in Forestry and Biodiversity Conservation

This section provides an overview of some of the key Indonesian and international NGOs active in biodiversity conservation, forest management, coastal and marine conservation, and environmental management, more generally. This discussion is not exhaustive, but rather illustrative because hundreds of new NGOs have been formed in the recent era of reform. A more detailed list of approximately 75 NGOs concerned with environmental issues in Indonesia is contained in Appendix V, including addresses and contact information. The section also provides some assessment of capacity and describes how these organizations are adapting to the rapidly changing socio-political landscape. Detailed and specific information on the funding available to NGOs in this sector is not available. However, some qualitative statements and comparisons are made.

2.2.1 Descriptions of Some Key Indonesian NGOs

National NGOs

This section describes several prominent NGOs focused on forestry, biodiversity, coastal, legal, and environmental issues. This is because National NGOs often have a range of interests and advocacy positions. Also, conservation and forestry issues are widely seen to be integrally related to legal, rights, and governance issues. So, one finds that traditional governance or human rights NGOs are sometimes active in environmental or resource issues, while forestry or environmental NGOs may sometimes take on issues related to land tenure or national development policy. The following discussion is not comprehensive.

- The Indonesian Forum for Environment, ***WALHI or Wahana Lingkungan Hidup Indonesia*** was established in 1981 to promote protection of the environment, justice in the exploitation of the environment for the society at large, and the welfare of future generations. WALHI's main activities are related to the environment, human rights, democracy, urban development, community forestry, and marine development and fisheries. Activities include research, education and training, community development and facilitation, publications, advocacy and seminars. WALHI consists of a network of organizations and activists committed to social transformation as the primary vehicle to equitable and sustainable NRM in Indonesia. The Forum has close links to the UK organization Friends of the Earth and takes a non-violent, direct action approach to campaigning on water, forest, mining and globalization issues in Indonesia. WALHI has been seminal in publicizing and campaigning against environmental injustices, while also challenging the "environmental mainstream," such as the feasibility of forest certification in Indonesia. (Colchester 2003)

- The Indigenous Peoples' Alliance of the Archipelago, ***AMAN or Aliansi Masyarakat Adat Nusantara***, is an independent social organization composed of indigenous peoples' communities from the whole of the country. The Alliance aims to be an organization for indigenous peoples to struggle for their existence, rights and sovereignty in running their lives and in managing their natural resources. AMAN's programs include strengthening indigenous organizations and developing networks among them, developing effective information exchange and communications, advocating indigenous rights and supporting legal defense, strengthening customary (*adat*) economic systems, strengthening indigenous women and their organizations, and providing education for youths.

- The Indonesian Biodiversity Foundation, or ***Yayasan Kehati***, is an independent, non-profit donor institution concerned with Indonesian biodiversity conservation and its sustainable and fair benefit for all people. Kehati's vision is to realize a society that is concerned, capable and self-reliant in maintaining biodiversity conservation as well as in controlling, managing, and utilizing biological resources to achieve the highest quality of life. Kehati's mission is to support and facilitate groups of people to obtain their rights in accordance with their obligations to improve their capabilities and to uphold self-reliance in controlling and managing biological resources; support policy reform efforts and advocacy to uphold the law to achieve sustainable development with a biodiversity basis; gather funding support, resources and participation from communities and other stakeholders to assure the sustainability of biodiversity programs in Indonesia.

- **Forest Watch Indonesia (FWI)** is a network that consists of individuals and organizations committed to concrete, sustainable forest management. FWI strives to develop data transparency in forest information, by strengthening data and alternative information sources, increasing technical capacity and constituency, and supporting public response to sensitive forestry issues. A key result of FWI's activity is the State of The Forest Report published in collaboration with Global Forest Watch. FWI also makes serious efforts to promote policies and practices of forest management that work to protect and conserve forest resources and to guarantee the justice for local community.

- ***Telapak*** was established in 1995 and legally founded in 1997 to work toward a direction in natural resources management that embraces community, intra-generational, and the unity of life. *Telapak*'s mission is to facilitate and strengthen the organization and partners, NGO networks, local communities and their leader; to pressure national companies and international financial institutions with poor environmental performance; and to promote improved NRM policies and practices. *Telapak's* motto is "All of the area of Indonesia is conservation area." *Telapak* has produced many documentaries about natural resources management in form of high quality research and translation of advocacy policy in local and national level. Since 2002, Telapak Indonesia Foundation (*Yayasan*) changed its legal status to Telapak Association (*Perkumpulan*) a form that facilitates its ability to spread its mission and work in the wider community.

- The National Consortium for Forest and Nature Conservation in Indonesia ***(KONPHALINDO)*** aims to collect and disseminate information on sustainable development specifically in the areas of sustainable agriculture, forest fires, urban ecology and mangroves. It also serves as an information center through publications, and conducts education and community development activities. Other activities include publishing a monthly environment journal, and holding seminars/workshops in conjunction with the government, NGOs and universities.

- The Consortium for Supporting Community-based Forest Management System ***(KpSHK)*** is a network organization established in 1997 in response to initiative of NGOs, indigenous peoples' organizations, researchers and participants concerned with the issues of natural resources, especially forest resources in Indonesia. The consortium has been positioned as a movement to support systematically the patterns of natural resource management practices developed by indigenous peoples throughout Indonesia since years ago. The support is needed as an answer to practices of commercial forest management ignoring environmental sustainability and indigenous peoples' rights. The consortium's vision is the realization of people's sovereignty over sustainable natural resources, especially forests. Activities focus on revitalizing indigenous institutions for NRM and law, providing technical assistance in developing NR management models, empowering local people economically through capital and market links, fighting for people's sovereignty through policy reform, and networking, documentation, and media communication. Emphasizing an ecosystem approach, KpSHK has advocated reform that values local knowledge, customary institutions, community control over forests, and tenure reform. This became known as the "SHK approach," which was developed and tested mainly in communities where customary law remains strong. This was in explicit contrast to the GoI's community forestry process, known as the HKM approach, which retains government oversight and control of many decisions and has been developed and tested mainly with migrant farmers and displaced peasants with little history of forest management.

- The Indonesian Tropical Nature Institute, ***LATIN or Lembaga Alam Tropika Indonesia***, has a mission to accelerate good forest governance processes at various levels. To achieve its mission Latin has developed an organization system that is flexible and responsive to fast-moving changes, as well as accountable, transparent and democratic. Latin collects data, conducts analysis, and offers the results to the public through a variety of media. Latin has published 17 books and uses its library, community forestry journal, websites, seminars, workshops, and discussion to disseminate information to the public.

- The Community Natural Resources Managers Group Foundation, or ***Yayasan Kemala, an abbreviation for Kelompok Masyarakat Pengelolaan Sumber Daya Alam***, was formed in 2000 as a local institution transformed from a base in a USAID project known as the Biodiversity Support Program. The KEMALA program partners are NGOs and local community organizations with varying experiences working with local community groups, university or government on issues related to education, community organizing, income generation, mapping, participatory rural appraisal, research, advocacy of rights, and protected area management, among others. The overarching focus of their work is environment protection and human rights. Kemala partners strive to influence the political and legal agenda to recognize community rights in natural resource management. Focus area includes the region of Kalimantan, Sulawesi, Maluku, Papua and parts of Java and Sumatra. Yayasan Kemala's network includes community organizers, coastal and marine advocates, agrarian and conflict resolution trainers, and regional autonomy specialists.

- The Communication Forum on Community Forestry, ***FKKM or Forum Komunikasi Kehutanan Masyarakat***, strives to accommodate people's aspirations for justice in natural resource management, promotes sustainable natural resource and ecosystem management, and promotes social welfare improvements through community forestry. Community forestry is defined as the ability of local or traditional people in managing forests continuously either for commercial purpose or as an ecosystem. Founded in 1997, with funding from the Ford Foundation, FKKM strives to create an inclusive forum to stimulate dialogue among the multiple stakeholders concerned with community forestry. The Forum includes government officials, academics, NGOs, and the private sector. Links with community-based organizations however have been weak. FKKM invested heavily in two initiatives that it hoped would move the community forest cause forward: lobbying the IMF and World Bank to introduce conditionalities in their economic rescue package and acting as a think tank during the drafting of the Forestry Law. FKKM functions as a loose email network, remains open to all and is used as a means of sharing advice and experiences. (Colchester 2003)

- **Indonesian Center for Environmental Law (ICEL)** specializes in research and capacity building, advocacy and community empowerment to accomplish the principle of Good Sustainable Development Governance. ICEL carries out activities in legal and policy reform. It seeks to defend the public interest by pursuing the recognition of their rights with respect to the environment and natural resources. It also endeavors to enhance the capability of environmental NGOs and the GoI with respect to Good Environmental Governance.

- The Natural Resources Law Institute, ***IHSA or Institut Hukum Sumber Daya Alam,*** was established in 1998 in Yogyakarta as a foundation focusing on law and policy research and advocacy initiatives related to natural resources issues. IHSA works with the spirit of independent, professional, non-profit, and non-political party interest. IHSA's vision is "supremacy of law in the field of natural resources to guarantee its management, which is based on justice, democracy, recognition and respect on community rights to create social welfare for either nowadays generation or future generation." IHSA contributes to strengthening and reform of policy and law on natural resources; provides technical expertise in policy and law-making processes, supports the efforts of policy and law advocacy in natural resources management using the principles of good natural resources governance; provides technical support for civil society institutions working on strengthening a more decentralized and democratized natural resources management.

- The Indonesian Eco-labeling Society, ***LEI or Lembaga Ekolabel Indonesia***, is an organization that strives to improve natural resources management and biodiversity through a credible certification and eco-labeling system. LEI gives accreditation for other parties to act as certification/eco-labeling organizations. LEI also conducts policy studies and provides input to the government to make more conducive eco-labeling policies.

- The Participatory Mapping Network, ***JKPP or Jaringan Kerja Pemetaan Partisipatif,*** focuses on developing institution capacity for community mapping, providing training and technical assistance to communities, organizations, and activists.

- The Indonesian Institute for Forest and Environment, ***RMI or Rimbawan Muda Indonesia,*** was established in 1992 in response to the low attention given by the society to natural resources preservation, notably forests that have been damaged by exploitation. The institute aims to develop conservation and protection of Indonesia's natural resources so that they will contribute to the welfare of the society. RMI's activities focus on environment, community forestry, agriculture, gender and women in development. It also has supporting activities in small enterprises/cooperatives, human rights and democracy. These activities take the form of study, research, survey, education and training, and community development, facilitation, and publication. Past programs have included study and development of bamboo ethnobotany, ecotourism development for the basic community, conservation education, development of energy plantations, training on agriculture utilization for the rural village community, and the dissemination of information about environment issues.

Regional NGOs

Appendix V identifies 68 regionally-based NGOs working on forestry, environmental, or biodiversity issues. Some of these regional NGOs are actually branches of national organizations, such as Walhi, WWF, or FWI. Of these, 17 are in Sumatra, 16 in Java, 10 in Kalimantan, 17 in Sulawesi, 3 in Maluku, and 5 in Papua. This distribution suggests that the more developed and populated islands have more NGO representation than the eastern islands. Maluku in particular has few active NGOs, partly attributable to the civil conflict in that province. A brief description of two regional NGOs is offered for illustration.

- **Volunteers Alliance for Saving Nature (ARuPA)** was founded in 1998 as an action committee for students and environmentalists to encourage reform in Indonesia. ARuPA was founded with the intention of revising inappropriate national forestry and natural resource management paradigms and policies. ARuPA is also pushing the government to reform its uniform, centralized tenurial system into more local specific and participative policies. ARuPA's vision is the sustainable, fair, and democratic management of natural resources. The mission is to preserve and sustainably manage natural resources through community based management. Goals of the organization are: to promote balance between natural resources and environment stake holders; to investigate the application of policies regarding the management of natural resources and the environment; to participate in planning, conducting, and monitoring natural resources and environmental management activities; to involve local people in productive activities that use their knowledge of local natural resources; and to develop more appropriate environmental best-practice management.

- **WARSI** is a regional network organizational established in 1992 with membership made up of twelve NGOs from four provinces in Sumatra (South Sumatra, West Sumatra, Bengkulu and Jambi). The organization's focus is biodiversity conservation and community development. WARSI cooperates with a number of different parties connected with conservation and development in the four southern Sumatran provinces, including the Regional Planning Authority (Bappeda), the Nature Conservation Agency (PHPA), institutions of higher learning, private agencies and other concerned groups. WARSI is also not limited to NGOs but is open to professionals and teachers, as well as other groups. WARSI was formed with the intention to work towards bringing about sustainable development, or, in other words, development that can fulfill the needs and guarantee the welfare and prosperity of people in the present, without endangering the continued survival of future generations.

2.2.2 Descriptions of some Key International NGOs

Many international conservation NGOs have operated programs in Indonesia for many years, even decades. Of these, Birdlife International, Conservation International, and World Wildlife Fund have transformed their programs into local Indonesian institutions, which retain links to the parent organization, but are free standing. This information is taken from the organizations' web sites and promotional materials and is roughly in order of start date in Indonesia.

- **World Wide Fund for Nature (WWF).** WWF, the largest independent conservation organization in the world, has collaborated with government agencies, NGOs, Universities, and community leaders in Indonesia for more than 30 years. WWF promotes sustainable development and conservation in Indonesia, as a region with the highest biodiversity in the world. WWF Indonesia was created in 1998 as a national organization within WWF's international network. It is the largest WWF program in the Asia Pacific Region. WWF Indonesia works on conservation efforts in more than ten national parks and protected areas in Indonesia under a bioregional approach that strives to consolidate conservation efforts, increase conservation awareness, and promote sustainable use of natural resources. At present, WWF Indonesia offices for implementing its bioregional approach are located in Jakarta, Denpasar (Wallacea), Balikpapan (Sundaland), and Jayapura (Sahul). With coordination from Jakarta, these three offices work with local communities, local governments, and other NGO to promote conservation and sustainable development to protect the highest biodiversity regions in the world.

- **Conservation International/Indonesia Program.** Conservation International (CI) started working in Indonesia in 1991, employing conservation efforts supported by scientific information and focusing on priority areas facing threats to biodiversity. CI emphasizes partnership with multiple stakeholders, including non-profit organizations, government, scientific community, local communities, and the private sector. CI Indonesia works to strengthen organizational capacity for environmental conservation in threatened forest and marine habitats. At present, CI works in Papua, Togean Islands (Sulawesi), Gunung Gede National Park (Java) and Aceh (Sumatra). The strategy used by CI includes technical assistance and funding to local institutions to improve conservation with community-based, sustainable development. CI's work capitalizes on the recent democratization and decentralization of the government, which has created opportunities for policy change that may greatly support biodiversity.

- **Birdlife International.** The BirdLife International Indonesia Programme was established in 1992 as a collaborative conservation programme with the Directorate General of Nature Protection and Conservation of the Ministry of Forestry. In addition, BirdLife works closely with the Indonesian Institute of Sciences (LIPI) and maintains strong links and collaboration with NGOs and nature clubs throughout the country. The goals of the Indonesia Program are to: identify and determine the conservation requirements of bird species and to promote actions to prevent their decline or extinction; identify and determine the conservation requirements of key sites and habitats in Indonesia and to promote the establishment and management of conservation areas, as well as appropriate land-use planning; strengthen conservation awareness and skills among all stakeholders to build capacity for nature conservation.

At least five other international environmental NGOs have operations in Indonesia. These organizations maintain their international status and affiliations in their collaborative work with Indonesian partner organizations.

- **The Nature Conservancy (TNC).** TNC is a private international conservation organization with the largest system of private nature protection sites in the world. The mission of TNC is to protect flora, fauna and natural communities that represent biodiversity in the world, by protecting the land and water that they need to survive. TNC's program in Indonesia has been established for more than 10 years, and at present has 5 offices, with field initiative in Central Sulawesi (Lore Lindu National Park), Nusa Tenggara Timur (Komodo National Park), and East Kalimantan (Berau Region). TNC is a USAID implementation partner in a Global Development Alliance with WWF to combat illegal logging in East Kalimantan and the East Asia Region. Also in East Kalimantan, TNC is working with local governments and forest concessionaires to protect and conserve an important population of orangutans and their habitat.

- **The Wildlife Conservation Society (WCS).** The Wildlife Conservation Society saves wildlife and wild lands through careful science, international conservation, education, and the management of urban wildlife parks. In Indonesia, WCS is specifically involved in: Bukit Barisan Selatan National Park, Sumatra, the third largest national park on Sumatra, which contains more lowland forest than any other protected area on the island. WCS's Indonesia Program conducted the first systematic surveys of BBSNP in 1994 and subsequent work has documented significant populations of globally important wildlife. WCS is prominent in North Sulawesi with a long standing program in Tangkoko nature reserve, a site of outstanding biodiversity. WCS also has important programs addressing the illegal trade in wildlife.

- **Wetlands International,** dedicated to the crucial work of wetland conservation and sustainable management, was created in 1995 through the integration of Asian Wetland Bureau (Asia-pacific region), International Waterfowl and Wetlands Research Bureau (Europe and Middle East region), and Wetlands for the Americas (American region). The mission is to sustain and restore wetlands, their resources and biodiversity for future generations through research, information exchange and conservation activities, worldwide. In Indonesia, Wetlands International operates in cooperation with the Ministry of Forestry with programs that date back 20 years. Numerous activities have been carried out, including site potential surveys, wetlands rehabilitation, public awareness, and policy and institutional strengthening.

- **Fauna and Flora International (FFI)** was established in 1903 and has been active in Asia since 1935, starting in India. At present, FFI has offices in Indonesia and Vietnam, and is active in Cambodia, Thailand, the Philippines, and other part of East Asia. In Indonesia, FFI is active in biodiversity assessment efforts and the protection of tigers in Kerinci Sebelat National Park in Sumatra, Eagle conservation effort in Java, and Elephant conservation in Aceh.

- **The Environmental Investigation Agency (EIA)** is an international campaigning organization committed to investigating and exposing environmental crime. EIA has been working to protect the world’s forests and the wildlife and people dependent on their resources, since the early 1990’s. Since 1997, EIA has worked in partnership with Telapak, an Indonesian NGO. Together, the two have exposed illegal logging in National Parks, worked with other organizations and communities, and promoted ideas and information to improve forest policy.

2.2.3 Indonesian NGO Transition Issues and Capacity Needs

The New Order placed strict limitations on civil society organizations and the scope of their speech and advocacy. The reform area has seen a blossoming of Indonesian NGOs addressing biodiversity and forest conservation and management issues. The growth of NGOs and the rapid political transition have been accompanied by changing priorities, evolving capacity needs, and growing pains as well. National environmental NGOs often focus on advocacy and policy agendas, because of the perception that many environmental governance issues need to be resolved. Regional and local NGOs (sometimes branches or local chapters of the national NGOs) have been more involved in direct community development or PA management. Some NGOs need capacity development to take on greater roles in managing biodiversity and forest resources at the local level, or advocating appropriate means to achieve sustainability at the national level.

During the New Order, many NGOs used the "environment" label as the only legitimate means to deal with political issues such as human rights violations. Because of this past emphasis on advocacy, some NGOs need new technical skills to better engage locally, e.g., developing approaches to assist communities with livelihood concerns.

Under the New Order and still today, many NGOs advocate greater community inclusion and recognition in forestry and conservation policies and decisions for two reasons. First, they believe control should be devolved to correct past resource allocation injustices. Second, devolving control of resources to the local or community level should, in theory, yield better stewardship. For these reasons, many NGOs laud the move toward decentralization, even though they may still advocate for reforms in the process or the results. However, ambiguity in the decentralization laws, as well as the weak capacity in local governments, has allowed a new level of opportunism in resource exploitation at the local level that has not always benefited conservation efforts and ecosystems. This poses a challenge to arguments for devolving authority to local people based on simplified representations of "traditional" communities opposing the "state" to preserve local institutions and practices of sustainable natural resource use (Li 1999).

In the decentralization era, unclear boundaries created by a history of migrations and state territorialization[5] have exacerbated conflicts both between and within forest dependent communities. For NGOs, the overlapping claims to territory present a problem that has yet to receive adequate attention (Campbell 1999), but will be important to moving decentralized forest and coastal management forward. Effective decentralized resource management and local conservation efforts require attention to be placed on the diverse interests within a community, the ways stakeholders influence decision-making, and the institutions that structure decision-making (Agrawal and Gibson 1999).

Adjusting to new socio-political dynamics in this transition period in Indonesia, as well as opportunities for new approaches for reform, means that some NGOs are seeking new skills and capacities. For example, planning, management, research, and technical skills will be important to improving the livelihood conditions of rural communities. Also, for example, newer NGOs are often led by a key individual with the skills and credibility to attract resources and partnerships. As the organization expands, this leader may become overstretched. Developing skills and capacity in the middle ranks of NGOs will help to keep up with expansion of opportunities and work load.

Many local NGOs have been key partners of international donors, NGOs, and other agencies in implementation of biodiversity and forestry conservation programs. This relationship can be successful. However, many Indonesian NGOs would prefer greater autonomy in their planning and activities and may feel constrained by donor agencies' administrative requirements (Colchester 2003). Capacity development in grant or contract administration could help address this issue. Although Indonesian and international NGOs often form successful partnerships around specific issues, there is also an aspect of their relationship that involves competition for resources (Colchester 2003).

Some NGOs have experience with basic environmental awareness campaigns. These efforts are often short-lived and project-based. Capacity is needed in producing and managing integrated multi-media campaigns, managing media relations, and producing effective materials that foster and inform a wider environmental constituency.

[5] The term territorialization refers to "the process through which 'all modern states divide their territories into complex overlapping political and economic zones, rearrange people and resources within these units, and create regulations delineating how and by whom these areas can be used'" (Vandergeest and Peluso 1995, 387, cited in Li 1999, 12).

2.2.4 NGO Resource Base

Some anecdotal or donor-specific information is available on NGO funding sources and levels, but there is no comprehensive inventory, such as the EU database on Donor Projects in Forestry (discussed in Section 2.3.1). However, some inferences can be made based on the size of the NGOs, their programs, and the limited donor-specific information that is available.[6] Grouping national and international NGOs by size provides some indication of their resource base.

Some national network NGOs and some international environmental NGOs are quite large, with programs, staff, and activities in many provinces across the country. Many of these organizations receive funding from international donors, foreign foundations, direct fund raising, and endowments. Based on anecdotal evidence about some specific grants, it can be assumed that NGOs in this group (mainly internationals, but some nationals also) have budgets in the range of several millions of dollars per year. A substantial portion of this could be coming from sources outside Indonesia, or at least beyond the existing pool of donor projects summarized in the next section, 2.3.

Another set of NGOs working at the national level are of an intermediate size, with reasonable research, administration, and project staff. These groups often have access to multiple funding sources, such as grants or projects from the international donors or from the larger NGOs. Annual budgets for this group are likely based around one or several large grants from the key donor grant programs (e.g., Ford, UNDP/GEF, DFID, Kehati). These groups would have budgets in the range of US$ 100-500,000, most of this coming from within the pool of resources summarized below.

Other NGOs that are local, new, or narrowly issue based are quite small and focused in their activities. These groups may receive funding as branch offices of larger, national NGOs. These smallest NGOs would have annual budgets well below $100,000, with most of this coming from within the pool of resources already discussed: funds from donor projects or sub-grants from larger NGOs. The overlap in funding sources and the sub-granting process complicates efforts to summarize overall available funding for conservation and forestry in the NGO community.

[6] Several donors provide grants to NGOs as a major part of their agenda, notably the Ford Foundation and the DFID Multi-Stakeholder Forestry Program. The Indonesian NGOs, Kehati and Kemala, are also in the business of providing grants to local NGOs. USAID has several current and former NGO grant programs.

2. 3 International Organizations

This section discusses donors and international organizations that play a role in biodiversity and forest conservation and management. First is a discussion of patterns and trends among donors active in the forestry sector, which is then followed by a discussion of internationally funded initiatives focusing more specifically on biodiversity conservation. Finally, this portion of the report closes with a description of several US government's biodiversity and forestry initiatives with relevance for Indonesia.

2.3.1 Major Donor Programs and Trends

Many donor agencies are active in the forestry sector. The three largest are the European Union, the United Kingdom Department for International Development, and Japan through both JICA and Japan/Komatsu Ltd. Also active with substantial funding levels are USAID, German GTZ, Denmark/DANIDA, Canada/CIDA, the International Tropical Timber Organization, and the Netherlands through Tropenbos and universities. The following discussion is based on Bennett and Walton (2003), as well as the EU database of forest sector projects, described in the next section.

The European Union funds many projects in the forestry sector (US$ 112.6 million of grants), covering a range of issues from biodiversity conservation, to illegal logging, to concession management. The EU's flagship forest and biodiversity conservation project is its long standing (1995-2004) investment in management of Gunung Leuser National Park in Aceh and North Sumatra. The EU is also supporting an illegal logging response center in Jakarta. The EU has funded projects to support production forest management in both South Kalimantan and Berau. It is currently starting up an initiative (2003-9) to support participative management of all natural resources in the Berau and Bulungan districts of E. Kalimantan. The EU has also supported efforts to control forest fires, to strengthen the MoF institutionally, to develop a forest ecosystem inventory project, FIMP, for three provinces came to an end (US$ not included in above total). The EU also supports the Forest Liaison Bureau to link its own projects and to provide technical assistance and coordination to the MoF.

The United Kingdom, through DfID, funds the Multistakeholder Forestry Program or MFP, the largest single donor project in the forestry sector (US$ 41.3 million from 2001-

5) for. The MFP is active across Indonesia, supports participatory processes for forestry resource management, and provides substantial grant funds for NGOs.

Japan, through JICA (US$ 21.5 million) supports programs concerned with carbon-fixing, forest tree Improvement, and propagation of native species for rehabilitation and reforestation across Java, Kalimantan and Sumatra. Biodiversity conservation assistance is provided to Way Kambas NP, Lampung and Halimun NP, West Java (US$ 4 million, 1998-2003). JICA also supports a mangrove information center to be established in North Sulawesi and a Forest Fire Prevention Management Project in Jambi, in its third phase. JICA also funds a project for Forest Sector Development Strategy at the Ministry.

USAID's assistance program of about US$ 10 million is actually the fourth largest on an annual basis. USAID funds both the Natural Resources Management Program and the GreenCOM Environmental Education and Communication Project. More detail on other donor project investments can be found in Appendix VI.

The multi-lateral donors, World Bank and Asian Development Bank, have also supported activities that touch on the forestry sector, through both policy reform efforts and land management efforts. The World Bank has been active in biodiversity conservation and PA management, but absent from the commercial forestry sector until the economic crisis in 1997. After the economic crisis, the World Bank helped to include forest policy reform conditions in both the IMF rescue package and its own structural adjustment loans in 1998 and 1999. At the end of January 2000 a high-level seminar on forest issues in Indonesia was co-sponsored by the World Bank, providing a venue to discuss issues such as deforestation, over-capacity of the wood industry, and exclusion of forest dwellers from forest management decision making. Since then, the World Bank has been involved in forest policy dialogue with GoI and has served as coordinator of the Donor Forum on Forestry, an informal technical advisory body to the Consultative Group on Indonesia (Bennett and Walton 2003).

The ADB has a number of large projects in development that are related to forestry, land rehabilitation, and watershed management. When these projects are implemented, the relative funding levels discussed above will change markedly. ADB support in forestry has emphasized watershed management, including reforestation initiatives that incorporate community-based approaches for agroforestry in upper catchment areas. The on-going Watershed Management Project, Central Java has a community forest component and includes reforestation initiatives. A very large (US$100 million) Land Management and Rehabilitation Project is in preparation. ADB poverty initiatives also have some bearing on forest lands and rehabilitation. For example, the Poor Farmers Income Improvement through Innovation Project (US$56 million) has just started in Central Sulawesi, NTT, and Lombok where it may build on a GTZ fruit tree lease initiative for state land. ADB also has several large flood control projects, which could be considered as contributing to forest sector improvement. The South Java Flood Control Project (US$88 million) includes nursery development and tree seedlings for farmers. The Flood Management in Selected River Basins Project (US$100 million) was scheduled for preparation in 2003.

Trends in Donor Assistance. The World Bank has also recently developed a review of donor assistance to the forestry (Bennett and Walton, 2003), which notes the following: In the 1970s, when assistance was initiated, aid to the forestry sector focused on proper development of forest transmigration sites and watershed management. In the 1980s, donor assistance covered reforestation for watershed management, a national forest inventory, protected area management, and training and research. From the 1980s to the 1990s, donor aid also moved towards supporting management of natural forests. Starting in the mid-1980s until now, forest co-management with village communities became a central focus of donor assistance, e.g., the Ford Foundation's support of social forestry in Java and other islands and GTZ's decade-long community-based forest resource management program in West Kalimantan. Other manifestations of donor focus on communities include DfID's Multistakeholder Forestry Program, initiated in 1998, and the series of USAID-supported NRM projects that began with assistance for management of both protected areas and concessions and later moved to more decentralized approaches and community-based initiatives. Once exception to this trend was a long-term project (1992-1999) to replace the existing forest concession systems with the establishment of permanent production forest areas, which ultimately did not materialize because in 1994 MoF decided not to accept anymore loan-based projects (Bennett and Walton 2003).

Other International Organizations

Center for International Forestry Research (CIFOR). CIFOR is an international research (CGIAR system) and global knowledge institution committed to conserving forests and improving the livelihoods of people in the tropics. CIFOR's research helps local communities and small farmers gain their rightful share of forest resources, while increasing the production and value of forest products. CIFOR's mission is to contribute to the sustained well-being of people in developing countries, particularly in the tropics. It achieves this through collaborative, strategic and applied research and by promoting the transfer and adoption of appropriate new technologies and social systems for national development. In Indonesia, CIFOR has links to the Ministry of Forestry's division for research and has had important research efforts aimed at shifting land cultivation systems, forest and land fires, forest industry restructuring and debt, forestry decentralization, biodiversity inventories, and integrated field activities with local governments and communities in Malinau, East Kalimantan.

International Centre for Research in Agroforestry (ICRAF). ICRAF, established in 1978, is a research institution of the CGIAR system whose goal is to help mitigate tropical deforestation, land depletion and rural poverty through improved agroforestry systems. ICRAF's objectives focus on conducting strategic and applied research, in partnership with national institutions, aimed at developing appropriate agroforestry technologies for more sustainable and productive land use. The centre seeks to strengthen national capacities to conduct agroforestry research by encouraging inter-institutional collaboration and dissemination of information through training, education, documentation and communication activities. ICRAF works in many countries of Southeast Asia, with a strategic research program on a 'watershed triangle' of key field locations in Sumatra (Lampung and Jambi), northern Thailand (Mae Chaem), and northern Mindanao (Claveria and Lantapan). In Indonesia, ICRAF has produced research on customary agroforestry systems and promoted policy dialogue on legal issues in the definition of "forest land" and tenure systems.

The Ford Foundation began working in Indonesia in 1953 and has provided over 125 million dollars in grants in selected fields. Although it is a non-governmental organization, it is also an important donor agency because of its substantial grants program. The substantive focus of the Foundation has evolved over the years in response to changing needs and priorities in Indonesia. The Foundation has made major commitments in the areas of education, agriculture and rural development, health and population, rights and governance, and culture. The Foundation's goals are to strengthen democratic values, reduce poverty and injustice, promote international cooperation, and advance human achievement. In Indonesia, the Ford Foundation has had a program focused on environment, forestry, and natural resources since at least the early 1990s.

Ford Foundation grants (about US$ 3 million per year) both to government and NGOs have been instrumental in evaluating, testing, and promoting community-based forestry and natural resource management approaches, including social forestry, in Indonesia. In recent years, Ford has expanded support to cover good governance of natural resources in general.

The International Tropical Timber Organization (ITTO), a multi-lateral agency, supports 15 forestry projects ranging from about US$ 0.05 to 1 million. The largest of these is the Sustainable Forest Management and Human Resources Development Project (US$ 1.1 million, 2001-2003), which include guidelines for illegal logging control, breeding, plantation management, community-based forest management, wood-based industry development and strategy and forest certification.

In the 1990s, two CGIAR centers, CIFOR and ICRAF, began a series of action-oriented research initiatives on the dynamic relationship between communities and forest resources. Both centers also conduct research on the impacts of decentralization in the forestry sector, and CIFOR has carried out research on inter-sectoral problems such as forest industry overcapacity, restructuring and financing.

Many other initiatives to support sustainable forest management are taking place across Indonesia as well, albeit at a more modest level:

- Tropical Forest Trust (TFT) and Tropical Forest Foundation (TFF) focus on reduced-impact logging and improved natural production forest management as well as linking legal log producers with foreign buyers.
- SmartWood, SGS and the Indonesian Ecolabelling Institute develop forest certification systems, partly in collaboration. SmartWood certified the first community forest in Indonesia in 1999 and is interested in expanding this type of certification
- Birdlife Indonesia with European and Japan partners redesign and restructure the last remaining lowland forest in South Sumatra and Jambi to become a forest management unit co-managed with the MoF for production, plantation and special purpose forest.

2.3.2 International Funding in the Forestry Sector

The European Union's (EU) Forest Liaison Bureau (FLB) intermittently collects data on funding of donor projects in the forestry sector. This database provides a good overview of forestry-related donor project funding. However, it specifically does not include all projects and funding agencies that could have impacts on forestry and biodiversity conservation. The EU estimates total donor project assistance to the forestry sector of US$248.7 million. This is the sum of all "life of project" funding commitments. This is a useful benchmark, but because projects vary in length this figure does not provide a full picture of current or annual funding available. It would also be helpful to have information about trends or projects in the planning phase. Please see Appendix VI for a detailed matrix of donors involved in the forestry sector, their individual project contributions, and the topical and geographic nature of the assistance.

There are a number of funding sources in the forestry sector that are not reflected in the donor project data summary. For example, the ADB is sponsoring a US$ 40 Million watershed rehabilitation and rehabilitation loan project for the period 2000-2005. ADB projects for flood control are not included, though they may have substantial funding for forest rehabilitation. The international research agencies, CIFOR and ICRAF, are not included, presumably because they are not donors. Also, for example, the Ford Foundation is not a donor project, but it provides funding in the forestry sector of about US$ 3 Million per year. The Global Environment Facility, implemented by the World Bank and UNDP, provides millions of dollars in funding for many types of conservation projects, but most of these are currently not focused in the forestry sector. Appendix VI also includes a list of projects funded through the GEF.

The following table summarizes the EU data on donor project funding in the forestry sector. Ford and ADB funding have been added for completeness and an analysis of average annual spending has been developed based on project years of funding. Funding levels are ranked by size and percentages are calculated for ease of comparison.

Table 2.4: Summary of Funding for Donor Projects in the Forestry Sector
(does not include all conservation funding, see additional caveats in text)

Country/Donor	Life of Project Commitment (USD)	% total	Ave. Annual Spending (USD)	% total
European Union/EC	112,600,000	37.5%	17,287,937	27.1%
United Kingdom/DfID +	42,700,000	14.2%	10,605,000	16.6%
ADB (loans and grants)	40,000,000	13.3%	8,000,000	12.6%
Japan/JICA +	22,246,496	7.4%	5,174,400	8.1%
Germany/GTZ	20,000,000	6.7%	2,786,667	4.4%
Ford	18,000,000	6.0%	3,000,000	4.7%
Denmark/DANIDA	10,349,153	3.4%	2,733,192	4.3%
U.S.A./USAID	10,000,000	3.3%	4,666,667	7.3%
Canada/CIDA	9,220,000	3.1%	3,289,333	5.2%
I.T.T.O.	6,294,794	2.1%	3,527,963	5.5%
The Netherlands/ Tropenbos +	6,080,655	2.0%	1,520,164	2.4%
Korea/KOICA	1,485,000	0.5%	495,000	0.8%
WB/Alliance + GEF	1,160,662	0.4%	656,705	1.0%
Grand Total	**300,136,761**	**100.0%**	**63,743,027**	**100.0%**

This shows that although total donor project funding is in the hundreds of millions of dollars, annual funding for the most recent 5-7 year period has been closer to US$ 60 Million. To put this figure in some perspective, it is useful to note that Indonesia's GDP attributable to forestry and processed wood products in the year 2000 was nearly US$ 4 Billion and export earnings were about US$ 3.5 Billion (excluding pulp and paper, worth another US$ 2.2 Billion). Also in the year 2000, the GoI earned US$ 275 Million from forest sector revenues and reforestation funds (not including corporate taxes).

2.3.3 International Funding for Biodiversity Conservation and PA Management

In addition to international funding aimed at the forestry sector, other funding has focused more on biodiversity conservation and management, both within PAs and beyond their boundaries into production areas. Since 1992, the Global Environment Facility (GEF) has been a key funding mechanism for this purpose, with most projects taking an ecosystems approach to conservation. Indonesia has a substantial GEF portfolio across several islands and different ecosystems, totaling approximately US$ 31.6 million. The World Bank implements most of these projects and the United Nations Development

Program (UNDP) manages a GEF small grants program (World Bank 2001). Some illustrative GEF projects include:

- Biodiversity Collections Project to upgrade biodiversity collections of the Bogor Herbarium and Zoology Museum ($7.2 million GEF, $4.2 million GoI).
- Kerinci-Seblat National Park Integrated Conservation and Development Project ($15 million GEF, $19 million IBRD, $13 million GoI); now closed.
- Coral Reef Rehabilitation and Management Project (COREMAP) to establish a coral reef management system in priority areas and develop models for greater involvement of communities in reef protection and management ($4.1 million GEF, $6.9 million IBRD, $1.8 million GoI). COREMAP II will be a second phase ($7.5 million GEF and $30 million WB). Please see below.
- "Asian Rhinos" is a two-nation project for rhino protection in Malaysia and Indonesia, with primary focus on the rare and threatened Sumatran rhinoceros (*Dicerorhinus sumatrenis*).
- GEF Medium-Sized Project (MSP) window provides an opportunity to channel GEF resources directly to NGOs, universities, local communities and indigenous groups for conservation activities. Indonesia is developing a strong pipeline of MSP projects for Berbak-Sembilang (Sumatra), Sangihe (Sulawesi), Mamberamo (Papua); all involve partnerships between the Directorate-General of Nature Conservation and international NGOs.
- "Aceh Elephant Landscapes" is a GEF MSP with Flora and Fauna International (FFI) to protect Indonesia's largest remaining population of Asian elephants through conservation awareness programs ($750,000 GEF, $ 295,000 Co-financing).

In addition to these GEF funded initiatives, there are other notable projects addressing marine and coastal issues that are noteworthy. The ADB has committed US$ 50 million in loans for their Marine and Coastal Resources Management Project (MCRMP), which focuses on provincial coastal strategic plans and local government regulation models. The World Bank, ADB and AusAid jointly fund a new phase of COREMAP (Coral Reef Rehabilitation and Management Project) (mentioned above). This project, which will be funded in the range of US$ 35 to US$ 80 million, consists of US$ 15 million in grants with the remainder in loans. Grant funds will be used to support community-based co-management of three marine protected areas – Taka Bone Rate, Wakatobi, and Raja Ampat -- and to support the creation of province-level marine protected areas in seven provinces. The loans will primarily fund infrastructure improvements.

Assessment of International Funding of Protected Areas
(World Bank, 2001)

"There is a great disparity in funding and staffing levels in different PAs in Indonesia. National parks are eligible for relatively large government budgets. Because of this, several PAs receiving donor support became national parks to ensure recurrent cost financing. Both the number of parks and the amount of funding increased through the late 1980s and 1990s, until the economic crisis struck. Although more money was allocated to national parks, these budgets were not always well spent. Since the onset of the crisis, government funding for conservation has been seriously reduced. Funding by multilateral development banks and bi-laterals has increased significantly over the past six years. Since most donors require substantial government counterpart funding, parks and other PAs receiving outside assistance have generally received increased government funding. This insistence on adequate counterpart budgets makes good sense in attempting to ensure sustainability of activities beyond a project lifetime but does mean that both government and donor funds are concentrated in just a few areas. (It has been estimated that, in 2000, about 40% of the budget of the Directorate-General of Nature Conservation development went to just two donor-assisted parks, Gn. Leuser and Kerinci)." (pp. 37-8)

"The only question that ultimately matters is whether these efforts are sufficient to slow, and ultimately stop, losses in the country's biological diversity. The answer is clearly 'no.' Projects often suffer from a lack of local support, social and political opposition, problems with capacity among the executing partners, and corruption (petty or otherwise). The 30 PAs with major donor financing represent only 10% of the total number of PAs in the country but just over half of the total land area of terrestrial PAs, that is, donor funding has focused on some of the largest PAs. Current PA projects have tended to focus primarily on the western islands and on forest habitats rather than coastal, marine and freshwater ecosystems.

"Conservation funding has been concentrated in priority areas but not always allocated to secure maximum biogeographical representativeness and diversity. Engaging local support for PAs will require greater emphasis and understanding of the ecosystem services they provide and innovative ways of either financing PAs or providing district development assistance linked to environmental performance. Many of the PAs in Indonesia … cover typically marginal lands. The densities of fauna will decline even further unless corridors of natural habitat are retained. Current PAs must be supplemented by a landscape approach to conservation, involving management of forests and other natural habitats outside PAs in a manner consistent with conservation objectives. In this context watershed and production forests can play an important role provided that they remain as forests." (p. 41)

In addition to the GEF mechanism, the major international conservation organizations all implement a broad suite of biodiversity and forest conservation and management programs in Indonesia. As noted in Section 2.2.2, The Nature Conservancy (TNC), Conservation International (CI), The World Wildlife Fund (WWF), Birdlife International, Wetlands International, the Wildlife Conservation Society (WCS), Flora and Fauna International (FFI), and others implement a diverse set of activities across the country. Some are involved in protected area management, while other initiatives focus on the transnational problem of illegal logging. As discussed previously, each of these international NGOs may have a budget of millions of dollars per year. Some of this amount is already reflected in funds attributed to GEF, UNDP, Ford, DfID, or other donors. However, these organizations also bring funds from foundations, membership, etc. Funding above and beyond that discussed in the donor section could be the range of US $5 to 15 million per year.

2.3.4 US Government Initiatives for Biological Resource Conservation and Management

This section describes several US Government initiatives and explains their relationship to forest and biodiversity conservation in Indonesia.

USAID Global Conservation Program (GCP)

The GCP began in October 1999 and is now USAID's only global conservation initiative. It complements a wide array of prior and existing USAID-funded biodiversity activities around the world. The GCP works through six NGO partners: the African Wildlife Foundation, Conservation International, EnterpriseWorks Worldwide, the Nature Conservancy, the Wildlife Conservation Society and the World Wildlife Fund. The GCP takes a "threats based" approach, i.e., tackling direct threats to biodiversity through management on the ground. This approach helps keep field staff, communities and other stakeholders focused on the resource management task at hand. Moreover, assessment of causal linkages is useful to identify where and how interventions can be effective and where monitoring can be done. Further, the "threats based" approach that integrates these causal linkages ensures a holistic approach to the conversation and management issue (Parker 2003).

In Indonesia the GCP supports TNC's coral reef and marine biodiversity conservation work in Komodo NP, Wakatobi NP, and the Raja Ampat Islands and conservation financing work with the Indonesian government and private sector, e.g., debt-for-nature swaps. It has also supported WWF's eco-region based program work in the Sulu-Sulawesi sea.

US Presidential Initiative Against Illegal Logging

As Secretary of State Colin Powell noted, "this initiative reaffirms America's leadership, and President Bush's leadership, in fighting environmental crime and promoting democratic principles" (July 28, 2003). The initiative "will work with developing countries to combat illegal logging, halt the sale and export of illegally harvested timber, and fight corruption in the forest sector" (Powell 2003). It will "attack the root cause of illegal logging – the weakness of institutions and democratic governance in so many developing countries" (Powell 2003). Further, it will "also help countries build their capacity to give their laws teeth through enforcement" (Powell 2003). The initial budget is approximately US$15 million for 19 programs, and "[a]s we demonstrate the success of our approach, we will work with Congress to secure additional funding for a full range of programs" (Powell 2003). Moreover, as Secretary Powell has noted, this initiative builds "on America's record of leadership in combating illegal logging," "will support and build on existing successful projects," and "complement our ongoing bilateral work with countries around the globe" (Powell 2003). USAID/Indonesia's programs that support this initiative include the NRM Program, GreenCom Environmental Campaign, and the WWF-TNC GDA for illegal logging and timber trade.

US Presidential Initiative on Climate Change

In June 2001, President Bush committed the US to work within the UNFCCC framework and elsewhere to develop an effective and science-based response to the issue of global climate change. The goal of USAID's climate change programs are to promote development that minimizes the associated growth in greenhouse gas emissions, assists vulnerable populations and ecosystems to adapt to potential impacts from climate variability and change, and supports climate observation systems. To accomplish this goal, USAID works in developing and transition countries, of which Indonesia is one, to implement solutions that provide climate-related benefits while also meeting development objectives in the energy and water sectors, urban areas, forest conservation, agriculture and disaster assistance. USAID/Indonesia contributes to the GCC initiative through the efforts of the Natural Resource Management Program and Coastal Resource Management Program II.

USAID Global Development Alliance (GDA) and Public-Private Partnership Initiative

USAID has catalyzed a groundbreaking public-private alliance to combat illegal logging. This alliance builds on the strengths and talents of a variety of partners to confront the unique challenges of forest conservation in Indonesia. The alliance is comprised of the U.S. Government, the Government of Indonesia, five international NGOs, numerous local NGOs, an international forestry research institution and more than 17 companies. This timber alliance brings in three dollars in resources for every dollar that USAID commits. This ensures that the impact of US taxpayers' money is multiplied by the leverage gained from the private sector.

These alliance partners are working to: (1) promote the sustainable harvest of forests; (2) develop a tracking system that identifies legal sources of wood; (3) link legal and sustainable wood products to buyers such as the Home Depot and (4) provide information needed by international banks and other financial institutions to avoid financing forest destruction.

Among the partners in the Alliance are Home Depot, IKEA, Carrefour, Goldman Sachs, ABN-AMRO Bank, Caterpillar, Inc., ERDAS, ESRI, BP, the Association of Indonesian Forest Concession Holders, The Forests Dialog representing a group of the world's largest forest products companies including MeadWestvaco, the United Kingdom's Department for International Development and the Indonesian Ministry of Forestry. The Nature Conservancy and the World Wildlife Fund-Indonesia are coordinating this alliance whose members include Global Forest Watch of the World Resources Institute, the Tropical Forest Foundation, the Tropical Forest Trust, the Center for International Forestry Research and numerous Indonesian NGOs.

The momentum of this alliance has already achieved commitments from the government of Indonesia, concessionaires, and pulp and paper companies to stop logging in areas of high biodiversity. These areas include Tesso Nilo, Sumatra, which is reported to contain the highest plant biodiversity found anywhere in the world and which is a candidate for declaration as a National Park. Collaboration is also occurring with concessionaires and local government in East Kalimantan to protect the habitat of what may be Indonesia's last viable population of orangutans in that province.

In August 2003, alliance partner Tropical Forest Foundation facilitated the first shipment of Indonesian lumber verified as legal into the United States. This wood was harvested using reduced impact logging, and is documented to be legal with a recognized tracking system. This shipment originated from sites under which the Tropical Forest Foundation has been assisting Indonesian concessionaires to responsibly harvest. The Tropical Forest Trust (TFT) is also training concessionaires on sustainable management techniques.

Formal partnership commitments with various large Indonesian forest products companies have been developed by TNC in East Kalimantan to help those companies transition to sound forest management and participate in tracking systems that verify wood as legally sourced.

Forest Watch Indonesia and Global Forest Watch of the World Resources Institute have finalized data collection (spatial and non-spatial) of 15 logging concessions in Central-Kalimantan. This information will be provided to commercial banks to use as an investment screen to ensure legality of concessions and sound forest management practices.

Growing numbers of retailers, such as the Home Depot, IKEA, Lowes, and Carrefour have joined the alliance because it will enable them to purchase legal and responsibly-harvested wood products from Indonesia. Their buying power is a positive incentive for Indonesians to ensure that their products are legal. Banks such as ABN-AMRO are co-financing the establishment of a database of concessions and forest conditions to be used as an investment screen.

US Dept. of Interior's Office of Surface Mining (OSM) Technical Support to GoI

The DOI Office of Surface Mining provides technical assistance to the Ministry of Energy and Mineral Resources (MEMR) to improve human resource capacity of the MEMR and provincial and local institutions to implement decentralized programs of environmental management of mining activities. OSM's environmental management training program includes environmental assessment preparation and review, mine permitting and inspection, water quality protection, soil conservation, sediment and erosion control and minimization of habitat loss.

Focused assistance has been provided to the MEMR's training agency and to local governments with environmental management and resource conservation responsibilities. Much effort has been spent trying to reorient the Ministry's training program to focus on the needs of the institutions and individuals with the direct responsibility to regulate mining activities—the professional staffs and management of local governments. OSM's technical assistance has included joint Indonesian/US team-designed training courses in environmental impact assessment, mine plan review and mine inspection.

OSM also provides technical assistance in governance, regulatory program development and institutional capacity building. A number of decrees and technical guidance documents have been prepared with OSM assistance, including Ministerial Decrees on reclamation guarantees, coal fire management, and mine closure.

OSM's program has also concentrated on establishing linkages between MEMR and the Ministry of Environment (MLH), and regional environmental management agencies (BAPEDALDA) at the provincial and district levels. These linkages and joint training sessions improve the capacity of local units with overlapping responsibilities to work together to better manage natural and mineral resources. This interagency team approach has contributed to a greater degree of trust and cooperation between agencies that have a long history of mutual suspicion and mistrust.

Another result from this "bridge building" between MLH and MEMR was a request from MLH for assistance in developing new water quality standards for Coal Mining discharges. Earlier, MLH issued standards that were generally unattainable (in some cases ten times as stringent as US standards), were opposed, and finally withdrawn. OSM's technical assistance enabled MLH to issue effective water quality standards in July 2003 that were accepted by other Ministries and the coal industry while still protecting water quality.

OSM has helped the Ministry and local officials to implement a program of maximum economic recovery of the coal resources in the coal basin along the Mahakam River. In addition to increased revenues to local governments, a major benefit of this effort is the improvement of water quality on a critical watershed in East Kalimantan. As new regulatory requirements are imposed and new technologies introduced, fine coal waste discharges are being reduced significantly along the mined areas in the Mahakam watershed.

3. Indonesian Biodiversity Patterns

3.1 Introduction

The biological history of Indonesia is one of the least understood in the World (Heaney 1984). This is because of two major factors. First, the immense past and ongoing geological activity of the region has created a complex and fragmented pattern of 17,500 islands. Second, the paucity of tertiary fossil deposits does not allow for a reconstruction of past faunas (Meijaard 2004). What is known is that, generally, isolation of animals and plants on islands for long periods of time provides ample opportunities for speciation events to occur. Long periods of insularity have occurred in Indonesia, such that speciation in Indonesian mammals, for example, dates back hundreds of thousands or even millions of years (Meijaard 2004). The modern biogeography of Indonesia, however, is also greatly impacted by events occurring during the glacial periods, up to as recently as 10,000 years ago, when most Indonesian seas fell about 125 m from their current levels (MacKinnon et al. 1996, Heaney 1986).

During these periods of maximum glaciations, many of the current Indonesian islands were connected by dry land. For example, Sumatra, Borneo and Java (including Bali) were connected to each other and to Peninsular Malaysia by dry land to form a great land mass called Sundaland. It has long been considered that during these intense glacial periods, most species could move freely throughout Sundaland (Heaney 1986). Many of the islands in Nusa Tenggara were also combined into larger groupings, such as Sumbawa, Komodo and Flores. Islands on the Sahul shelf to the east, such as the Aru group of islands, were connected by dry land to both Papua and Australia. Sulawesi, the outer Banda islands and many of the Maluku Islands have not had dry land connections to other islands. Consequently, many of these isolated islands, particularly Sulawesi, retain a high proportion of both unique and endemic species and lower numbers of species that may have originated in the west from the large landmass of Asia via Sundaland (the Oriental Bioregion), or from the east from Australia and New Guinea (Australasian Bioregion) via the Sahul Shelf. Conversely, the islands that formed Sundaland tend to have a large number of species in common, as do those islands on the Sahul shelf.

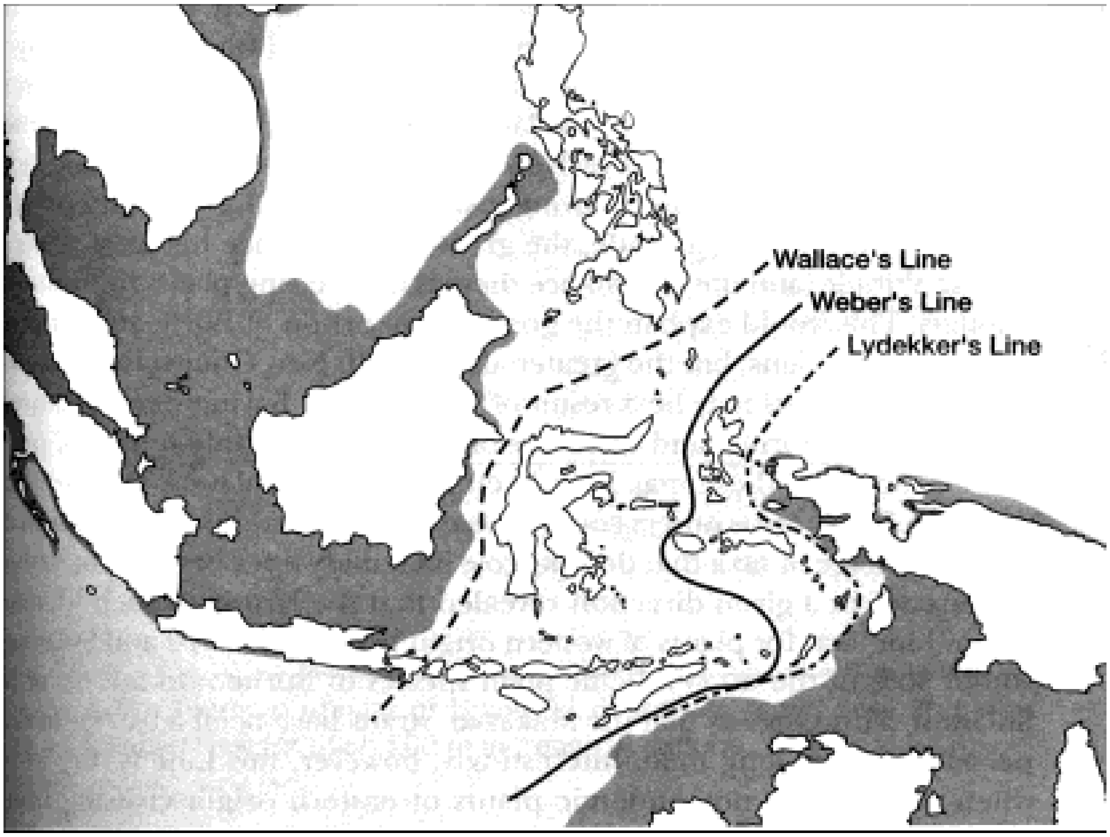


Figure 3.1: Indonesia with Sundaland, Wallacea and Sahul Boundaries

There are a great number of lines that have been drawn on maps to divide Indonesia into faunal and floral regions (Simpson 1977). Many of these lines are located differently depending on the manner in which the biogeographic data has been analyzed and depending on faunal or floral group studied. This Report will use the broad faunal and floral regional groupings of Sundaland, Wallacea and the Sahul, bearing in mind that Wallacea is not considered to be merely a transitional region swamped by species from the adjoining areas, as it is frequently considered to be (see Monk et al. 1997). In fact, Wallacea is a unique region with extensive autochthonous speciation and proportionately a large numbers of endemics; it is an important contributor to the overall mega-biodiversity of the Indonesian archipelago (Kitchener et al. 1998 and references therein).

3.2 Indonesia's Marine Environment and Region Specific Biodiversity

For convenience of both reporting and presenting recommendations, this Report will present Indonesia's biodiversity through a composite based on the following major islands or island groups: Kalimatan (Indonesian Borneo), Sumatra, Java, Nusa Tengggara, Maluku, Sulawesi and Papua. Smaller islands and coastal marine areas for the archipelago will be associated with these above island(s). This will facilitate the selection of conservation actions that are both for the entirety of Indonesia and for specific islands or seas in the archipelago. Further, some of the above islands have similarities with those that are biogeographically closer. For this reason, Kalimantan, Sumatra and Java will be grouped under Sundaland. Kalimantan will be dealt with in slightly more detail because many of the statements on its biota will also apply to Sumatra and Java. The same will be true of the Wallacean islands, although Sulawesi will be dealt with in slightly more detail.

Before the descriptions of the major islands and their associated smaller islands and coastal marine communities, the broader Indonesian marine environment, coral reefs and mangrove communities will be dealt with as an opening section. This is because the extent of the Indonesian archipelago is such that a presentation focused on the major terrestrial island groupings will not capture, as a focus, the biodiversity importance of and threats to the broader expanse of oceans and reefs and mangroves in Indonesia.

3.3 Marine Environments, Coral Reefs and Mangrove Communities

Coral Reefs

Globally, coral reefs cover 12% of the ocean area, fringe one-sixth of the world's coastlines (Birkland 1997) and contain hundreds of thousand of species of fauna and flora (Reaka-Kudla 1997). Southeast Asia is recognized as having the world's richest marine biodiversity at the genetic, species and ecosystem level (IUNC/UNEP 1985, Kelleher et al. 1995). The "coral triangle" is an area including northern Australia, the Philippines, Indonesia and Papua New Guinea that has the highest coral diversity on Earth. The region contains more than 2000 species of near shore fishes (Briggs 1974), sea snakes, and marine mammals, and contains critical habitats and large rookeries of four species of sea turtles, all of which are on the endangered species list. For all taxa, species richness peaks in the "coral triangle" of Southeast Asia, then falls off moving east toward the Pacific (Werner, T.B. and G.R. Allen. Eds 1998).

Fifty-eight percent of the world's reefs are reported to be threatened by human activities. Threats include terrestrial agriculture, deforestation and development that introduce large amounts of sediment, nutrients and pollution into the coastal areas (Bryant et al. 1998).

These threats cause eutrification and create degraded habitats in the most productive parts of the tropical oceans that supply the majority of food biomass from the seas. Added to these threats is the overexploitation of coastal fisheries, often through unsustainable destructive fishing practices such as cyanide and blast/dynamite fishing. Further, more than 25% of the world's coral reefs have been destroyed or seriously degraded by climate change and its related impacts, such as floods, etc.

Indonesia's coastline, estimated to be around 81,000 km long, is ranked as the second longest in the world[1]. Approximately two-thirds of the Indonesian coastline is protected by coral reefs. All types of reefs are present in Indonesia, including fringing reefs, which are the most common, barrier reefs and patch reefs. These reefs also represent most of the morphological types, such as sloping reef faces, steep 'drop offs' and pinnacles. Although Indonesia's population is not equally distributed, it has been estimated that between 60% to 95% of Indonesians live within 100 km of the coast (World Resources Institute, 2001). It is estimated that 80% of Indonesians living in coastal areas engage in marine resource-dependent activities, such as fishing and mariculture or related activities (WWF 1994). Fish products are an important food source and on average contribute two-thirds of animal-based protein uptake in Indonesia (FAO 2000).

Indonesia has about 15% of the world's coral reefs (Tomascik et al. 1997) and lies at the center of the world's diversity of corals (Veron 1993), molluscs (Paulay 1997) and reef fish (Randall 1997). Indonesia has the highest number of coral species in the world, with more than 77 genera and 450 identified species of scleractinian (stony) corals (Veron 1995). Of the 25 marine sites recommended for certification as Natural World Heritage Marine sites, seven are located in Indonesia (UNESCO 2003). Indonesia has some 5.8 million km² of marine area, and its fisheries represent more than 37% of the world's total species (NOAA 1999). The most diverse marine sites in Indonesia are those least impacted by humans. These are near Ambon and Sulawesi in eastern Indonesia, and they are about 20% more diverse than sites in the Java Sea, e.g., Pulau Kecil, G. Cemera and Karimunjawa) (Edinger et al. (1999). This is attributed to both biogeographical differences and to greater over-fishing in the Java Sea. Table 3.1 presents a recent comparison of the coral diversity for several of the most recognized areas of marine biodiversity in the world. Five of the seven regions surveyed include Indonesia, and they show the global importance of the diversity of coastal and marine regions within Indonesia to global sustainable development of marine resources.

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[1] Discussions with some experts in the field indicate that this number may vary significantly on the mapping protocols

Table 3.1: Comparison of Coral Diversity and Various other Ecological Characteristics for Seven Indo-West Pacific Coral Reef Areas[2].

Attribute	BNP	S-T	W	RA	BI	KB	MB	GBR
No. locations surveyed	20	52	27	51	18	27	28	26
Total # of species of reef-building corals (species diversity)	390	440	387	487	301	351	393	318
Mean diversity (# coral species) / location (2 sites)	155	100	124	131	106	124	147	100
Proportion (%) of locations hosting > 1/3 total (beta) diversity in region	85	8	41	18	61	74	82	
Mean % Hard Coral cover	42	21	32	33	40	30	33	35
Approx. area (10^3 km^2)	0.9	23	10	30	0.4	1.1	15	0.8

Centers of endemic marine species frequently occur in places that are isolated by distance or oceanography, especially in areas of non-reversing currents that flow from the tropics to the temperate regions. However, the high number of centers of endemics in closely connected regions, such as the Philippines and the Sunda Islands, concurs with growing evidence that species with pelagic larval stages (i.e., most tropical marine fish and invertebrates) do not always disperse widely (Jones et al. 1999; Barber et al. 2000; Robertson 2001 *in* Roberts et al. 2002).

Global analyses of the geographic ranges of 3,235 species of marine organisms were carried out using reef fishes, corals, snails and lobsters as four representative phyla that have regularly served as proxies for overall biodiversity assessments. These analyses indicate that between 7-50% of each taxon have small and restricted ranges, which makes them vulnerable to extinction if their habitats are threatened. Also, it showed that endemic marine species are clustered into centers of endemism, similar to those seen in terrestrial taxa. Threatened centers of endemism are considered major biodiversity 'hotspots.' Roberts et al. (2000) consider that conservation efforts targeted to protect and conserve these 'hotspots' could help avert extinctions and the loss of tropical marine biodiversity.

[2] **BNP** = Bunaken National Marine Park, North Sulawesi; **S-T** = Sangihe-Talaud Islands, North Sulawesi; **W** = Wakatobi National Marine Park, South East Sulawesi; **RA** = Raja Empat, Papua; **BI** = Banda Islands, Banda Sea, Maluku; **KB** = E. Kimbe Bay, Bismark Sea, Papau New Guinea; **MB =** Milne Bay, Papua New Guinea; **GBR =** Northern Great Barrier Reef, Australia. Data from Turak 2002, Turak in prep., Turak and Fenner 2002, Turak and Shouhoko 2003, Turak and Aitsi 2003, Turak et al. 2003 and for GBR - Turak, unpublished data.

Focusing conservation effort on the 10 highest marine biodiversity ‘hotspots’ could be highly effective in preventing species loss. These same 10 centers represent between 59% and 75% of all species in the global survey. Two of the 18 areas of greatest global marine biodiversity and endemism include the Sunda Islands hotspot in Indonesia (as well as the southern Philippines hotspot – both of which lie the Coral Triangle). Within those biodiversity hotspots, the Sunda Islands (includes Wallacea, east of Borneo) have the third highest reported threats to reefs (Philippines has the highest).

Major causes of Indonesian coral reef degradation are bleaching events associated with elevated seawater temperatures and the El Niño Southern Oscillation (ENSO) effect (Brown and Suharsono 1990), human overexploitation, physical damage and death due to marine pollution, destructive fishing practices and proximity to major urban centers that generate pollution (Bryant et al. 1998). Of the 15 reefs studied in three regions of Indonesia (Java Sea, seven reefs; South Sulawesi, four reefs; and Ambon, four reefs) that are subject to land-based pollution, such as sewage, sediment, and/or industrial pollution, 30-50% had reduced coral diversity relative to unpolluted reference reefs in their region at a depth of 3 m, and 40-60% had reduced diversity at a depth of 10 m. Bombed or anchor-damaged reefs were similarly less diverse in shallow water at 3 m than undamaged reefs in the same areas. At 10 m depth, the relative decrease in diversity was only 10%. It is difficult to separate clearly the effects of sewage, agricultural and aqua-cultural runoff, sedimentation -- mainly due to erosion from logging -- and industrial effluent. In all cases, the unimpacted reference reefs in the three areas had a greater diversity than those exposed to urban and riverine pollution. At all sites, pollution had a greater negative impact on coral diversity than mechanical damage caused by, for example, anchoring on the same reefs.

Land-based pollution constitutes the greatest threat to reef coral biodiversity in Indonesia, in particular, the combination of sedimentation and nutrient loading (Edinger et al. 1999). Pollution reduces the amount of *Acropora* coral, one of the more important reef builders, and causes a reduction in habitat complexity. Fish diversity is directly related to habitat complexity. Therefore, the closer the survey sites are to the pollution sources, which are, primarily urban centers, the less coral cover and habitat diversity is found, with a concomitant reduction in fish diversity. Pollution effects on corals endure until the stress or source is removed. Recovery from eutrophication damage to reefs appears to require at least 10 years after restoring water quality (Maragos et al. 1985; Grigg 1995). Cesar et al. (1997) modeled the economic effects of reef degradation in Indonesia and estimated that the loss to the fishery sector alone (i.e., not including tourism) from reef degradation and over fishing to be \$410,000 per km². Extrapolations from these two studies (Edinger et al. 1999 and Cesar et al. 1997), suggest that Indonesia has already lost 40% of its reef fisheries resource, yielding an estimated loss of \$30 billion to the Indonesian economy over 25 years.

Mangroves

Mangrove Forests are considered to be one of the most productive and biologically diverse wetlands on earth, providing habitats for more than 2,000 species of coastal marine flora and fauna including the endangered dugong and Indo-Pacific crocodile. Mangrove canopies also shelter hundreds of species of birds. The largest expanse of Mangrove Forests, around 20% of the world's total, borders the Sunda Shelf, a region of Southeast Asia that includes Vietnam, Kampuchea, Thailand, Malaysia and the Indonesian islands of Sumatra, Java and Borneo. Indonesia's Mangrove Forests remain the most extensive in the region, covering some 4.2 million hectares (see Table 3.2) with about 75% of the total amount concentrated on Irian Jaya, and nearly 400,000 hectares along the south and western coasts of Kalimantan.

Table 3.2 Mangrove Area (ha) by Island (group) in Indonesia

ISLAND	MANGROVE AREA		
	Original during 1980s	Current as of 1998	In protected areas as of 1998
Sumatra	857,000	485,025 (53%)	61,900
Java and Bali	171,500	19,577 (27%)	2,600
Nusa Tenggara	38,600	25,300 (65%)	2,500
Kalimantan	1,092,000	353,450 (32%)	78,000
Sulawesi	272,500	84,833 (31%)	6,300
Maluku and Papua	4,129,000	2,450,185 (59%)	680,900
TOTAL	**6,560,600**	**3,418,370**	**832,200**

Source: Wetlands International Indonesia Program, 1998, in BAPPENAS (National Development Planning Agency), 2003. National Document: Indonesian Biodiversity Strategy and Action Plan 2003-2020, p.26.

3.4 Sundaland

3.4.1 Kalimantan

Introduction

Kalimantan is 73% of the island of Borneo, which is the third largest island in the World. It is a relatively flat island dominated by large meandering river systems in which the water may be tidal up to 150 km inland. Most landscapes have been modified by the activities of the indigenous people who have been in Kalimantan for at least 35,000 years (Majid 1982).

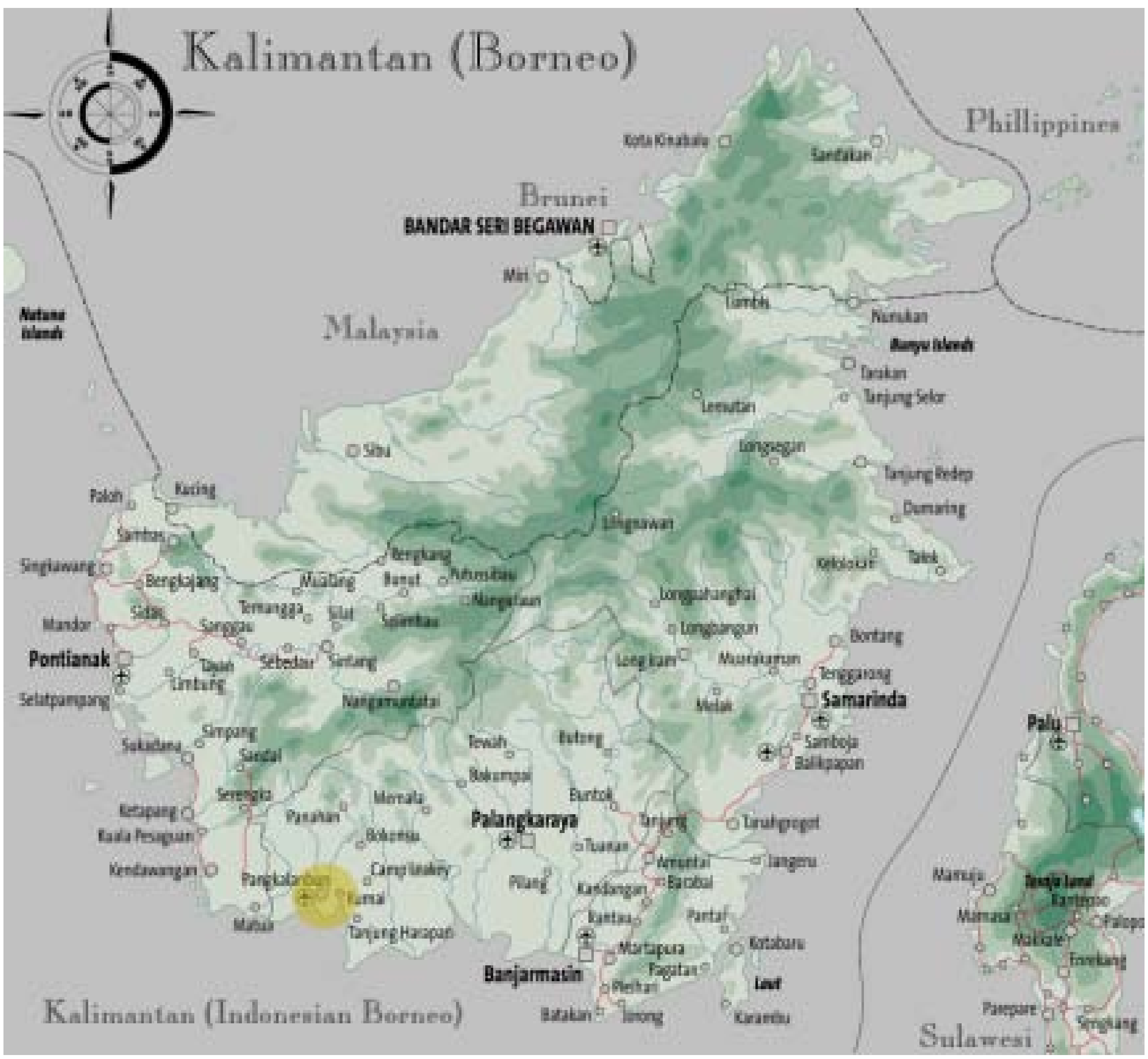


Fig.3.2: Map of Kalimantan

Borneo (including Kalimantan) supports the largest expanse of tropical rainforest in the Indomalayan realm. It is the main center for the distribution of genera of Malesian flora and Indomalayan fauna. Forest types include Mangrove Forests, Peat Swamp Forest, freshwater non-peaty swamp forest, the most extensive Heath Forests (*kerangas*) in the Realm, lowland *Dipterocarp* forest, forests on limestone and a variety of Montane Forest formations (MacKinnon et al. 1986).

Tropical forest species tend to be somewhat fragile assemblages where many species of trees, mammals, birds and even invertebrates occur at low densities and are often restricted to a specific forest type (MacKinnon et al. 1986). Consequently, these forest species are especially susceptible to extinctions. This is a reflection of the observation that species richness of tropical forest species is often linked to species rareness (Elton 1975; Whitmore 1984). Massive and expansive threats are dramatically reducing biodiversity in Kalimantan. These threats usually involve the interplay between serial uncontrolled wildfires during the 1980s and 1990s, land conversion for agricultural purposes and unrestrained logging practices, both legal and illegal, that have deforested Kalimantan at Amazonian rates (e.g., The World Bank (2001) predicts that Lowland Rainforests of Sumatra and Kalimantan will be exhausted as a source of commercial timber by 2005 and 2010, respectively). The habitats most threatened by these developments are the more accessible lowland forests, where species richness is greatest (MacKinnon 1990).

Terrestrial Fauna and Flora

The plants and animals of Kalimantan show much closer relationships to the Asian mainland and other Sundaic islands than to nearby Sulawesi.

Borneo (including Kalimantan) is the richest of the Sundaic islands for plants, both in terms of total species richness and diversity, with small plot tree diversity as high as that found in New Guinea. The island is a major center for plant diversity with 10,000 to 15,000 species of flowering plants, a flora as rich as that found for the entire African continent, which is 40 times larger (MacKinnon et al. 1986). Borneo has at least 3,000 species of trees including 267 species (58% endemic) of *Dipterocarps*, which is the most important group of commercial trees in Southeast Asia (Ashton 1989). The island also has 2,000 species of orchids and 1,000 species of ferns. Endemism levels are high (34%) throughout all the plant groups (MacKinnon et al. 1986).

For vertebrate groups, Borneo has a similar number of species to the smaller island of Sumatra (see Table 3.3) For example it has 222 mammals compared with 196 on Sumatra and its offshore islands and 183 on Java. The leopard, *Panthera pardus* (found on Sumatra), and the Wild Dog, *Cuon alpinus* (found on Java), are not found in Borneo, but it has more endemic land mammal species than Sumatra (44 versus 23, MacKinnon et al. 1986).

Borneo has 13 species of primates and 10 species of tree shrews, which is more than any other Asian mainland or island of similar area. Charismatic mammals in Kalimantan include the Asian Elephant (*Elephas maximus*), Banteng (*Bos javanicus*), Orangutan (*Pongo pygmaeus*), Proboscis Monkey (*Nasalis larvatus*), Bornean Gibbon (*Hylobates muellerii*), Flat-headed Cat (*Prionaluris planiceps*), Clouded Leopard (*Neofelis nebulosa*) and the Sun Bear (*Helarctos melayanus*).

A great deal of public concern has recently been focused on the impact of the destruction of the Kalimantan (and Sumatran) Lowland Rainforests on the survival of the Orangutan. Recent discoveries of substantial new populations of orangutan in Central, West and East Kalimantan, including in secondary forests, have led to an estimation doubling the population to 50,000-60,000 individuals for the combined population size in Kalimantan and Sumatra. However, given the rate of degradation of their preferred Lowland Rainforest habitats, it is still predicted that there will be no wild orangutans surviving in 20 years time (Jakarta Post 2/3/2004).

Borneo has 420 species of resident birds compared to 465 on Sumatra and 340 on Java and 240 on Sulawesi. Thirty-seven of these are endemic to Borneo. Some 28 Bornean bird species, including 4 endemic genera (*Haematortyx, Chlamydochaera, Chlorocharis* and *Oculocincta*), are restricted to the Bornean mountains – many of these are restricted to montane habitats. They include the Storm's Stork (*Ciconia stormi*), the Black-shouldered Ibis (*Pseudibis davisoni*), Galliformes pheasants and the Straw Headed Bulbul (*Pycnonotus zelanicus*).

MacKinnon et al. (1986) consider that Borneo is also probably one of the richest islands of the Sunda Shelf for fishes, amphibians, reptiles and invertebrates. It has at least 166 species of snakes, compared with 136 species on the Malay Peninsula, 150 species on Sumatra and 64 species on Sulawesi. It is also much richer in amphibians than the other Sundaic islands, with at least 100 species, (36 for Java, 29 for Sulawesi). A total of 394 species of freshwater fish are known from Borneo and 149 of these are endemic. This compares with 272 species (30 endemic) for Sumatra, 132 for Java and 68 species for Sulawesi (Kottelat et al. 1993).

Table 3.3: Species Richness on Major Indonesian Islands. Kalimantan included in Borneo statistics

	Borneo	Sumatra*	Java	Sulawesi	New Guinea	Nusa Tenggara	Maluku
Plants	10,000-15,000	9,000	4,500	5,000	15,000-20,000		
Mammals	222 (44)	196 (9)	183 (19)	127 (79)	220 (124)		
Resident Birds	460 (37)	465 (18)	340 (31)	240 (88)	578 (324)		
Snakes	166	150 (8)	7 (4)	64 (15)	98		
Lizards			42 (1)	40 (13)	184 (59)		
Freshwater Turtles		8			8		
Amphibians	100	70	36 (10)	29 (19)	197 (115)		
Fish	394 (149)	272 (30)	132 (12)	68 (52)	282 (55)		
Swallowtail Butterflies	40 (4)	49 (4)	35 (2)	38 (11)	26 (2)		

Note:
Numbers in brackets are island endemics
** Sumatra mainland*

Invertebrate groups are generally poorly known for Kalimantan. Swallowtail butterflies, with four endemic species, are one of the few well-known groups (MacKinnon et al. 1986).

The many threats to the fauna of Kalimantan have already caused several species to be listed as endangered and placed on the IUCN red list of threatened animals. These include the Malay Peacock Pheasant (*Polyplectron m. schleiermacheri*), Clouded Leopard, Bay Cat, Marbled Cat, Flat Headed Cat, Orangutan, Proboscis Monkey and Western Tarsier (*Tarsius bancanus*), Elephant and Banteng (*Bos javanicus)*. In the last several decades, the Sumatran Rhinoceros has disappeared from Tanjung Puting and Kutai National Parks and may be extinct on Borneo (MacKinnon et al. 1986). MacKinnon and Phillips (1993) and MacKinnon et al. (1986) list another 23 birds that are endangered. Overexploitation of the crocodile (*Crocodylus porosus)*, the False Gavial (*Tomistoma schlegeli*) and marine and river turtles has also caused these species to be endangered. Three of the swallowtail butterflies are also endangered. These are *Pailio acheron, Graphium procles* and *Triodes andromache.* Many of the above species that have become endangered are mobile predators, such as all species in the cat family, or are species that are large (Rhinoceros, Elephant, Orangutan, Banteng) and require large home ranges to obtain their living resources. Or if small, such as some of the birds and bats, they obtain there living resources from widespread areas. To survive in the long-term, such species require areas that exceed the boundaries of any single gazetted protected area (MacKinnon et al. 1986).

Coastal and Marine

Major habitats around Kalimantan include the island's rocky coastlines, mangrove/Nipa palm associations, mudflats and estuaries. Few studies have been published to describe the west and south of Kalimantan. In these areas mangroves are well-developed and many large rivers flow into the sea. Almost all of the eastern side of the island is covered with pristine mangrove swamps, followed by sea grass beds, and then fringing reefs. The fringing reefs are well developed along the offshore islands at a distance of about 20-40 km (Suharsono 1998). Because of the island's mountains and morphology, much of the coastline is influenced by the environment of large bays and estuaries at the base of the watersheds. Some of the small islets have important colonies of nesting terns (*Sterna sumatrana, S. anaetheta*), Brown Noddy (*Anous stolidus*), Bulwers Petrel (*Bulweria bulweri*), boobies (*Sula dactylat*ra and *S. leucogaster*) and the Lesser Frigate Bird (*Fregata ariel*) (Salm and Halim 1984). Megapods (*Megapodius freycineti*), a medium sized bird that buries it eggs in mounds, were formerly common on the coastal islands, but are now rare due to the excessive collection of their eggs (MacKinnon and Phillips 1993). Major Green Turtle (*Chelonia mydas*) rookeries are found on the beaches of the Anambas, South Natuna and Tambelan islands (Schulz 1987). Green Turtles, Hawksbills (*Eretmochelys imbricate)* and occasional Leatherbacks (*Dermochelys coriacea*) nest on the beaches and islands at Paloh, West Kalimantan. Loggerhead Turtles (*Caretta caretta*) nest occasionally on Pulau Lemukutan (Salm and Halim 1984). One of the most important Green Turtle breeding grounds in Indonesia is on the Berau islands off East Kalimantan, especially Sangalaki, Bilang-Bilang, Belambangan, Sambit and Mataha. Some 12,000 female Green Turtles nest in the Berau Island each year. Schulz (1984) estimates that 2-3 million turtle eggs are collected from the Berau islands each year. These eggs are still commonly sold in the streets of Samarinda, the capital of the province of East Kaliamantan, and other smaller towns throughout the province. The collection of turtle eggs threatens the populations of turtles throughout Kalimantan and elsewhere in Indonesia.

Mineral extraction in Kalimantan is impacting the coastal areas. Since the 1970's, Samarinda, on the east coast, has grown as an industrial city due to oil and gas extraction in the area. Fifteen percent of Indonesia's oil and gas reserves are concentrated in this coastal area with another 30% located nearby inland. Everyday, approximately half a million barrels of oil water are discharged untreated into the Makasar Strait which separates the islands of Borneo and Sulawesi. In addition, a large fertilizer plant near Samarinda dumps untreated ammonia wastes into the sea, and massive fish kills have been reported periodically since the 1980s. Gold mining and logging are choking the bays and estuaries with toxins, such as mercury and sediments that destroy the corals at the mouths of the bays (Wenno pers. comm.).

Apar and Adang Bays located in central East Kalimantan are major national wetland reserves (*Cagar Alam*), primarily to protect the mangrove areas and the species that inhabit them. The areas of Sangalaki and the Derawan Islands in the Berau district are scheduled to become a district level marine park that protects turtle nesting sites and dugong habitats. Mauatua Island is an area for the protection of the molluscs, Giant Clams, and Trochus and Green Turtles.

In the 1980s, Kalimantan, with one million ha of mangroves, was second only to Papua/Maluku in its area of mangroves (four million ha). However, recent surveys indicate that only about 350,000 ha remain of the original mangrove in Kalimantan, a reduction of more than 60%. This moves Kalimantan to third place behind Papua and Sumatra for extent of remaining mangroves (Wetlands International 1998 *in* BAPPENAS 2003). The primary causes of mangrove loss are conversion to fish and shrimp ponds, sediment dumping from the rivers due to erosion from over-logged areas, and loss to other development causes, such as urban pollution and reclamation.

All major types of Mangrove Forest are found in Kalimantan; these are most extensive at the mouths of the Kapuas, Mahakam and Sembuku Rivers. Mangroves play a vital role in consolidating coastlines and offer habitats that are used for a rich assemblage of plants and animals and are used exclusively by certain species of birds, including the Mangrove Pitta (*Pitta megarhyncha*) and the Blue Flycatcher (*Cyornis rufigastra*), bats, Proboscis Monkeys (*Nasalis larvatus*) and Silver Langurs (*Presbytis cristata*). They also provide nutrients that are important to sustain pelagic fish and prawn nurseries. These mangroves are dwindling at a rapid rate, particularly in the last five years. This is a direct result of their conversion to *tambak* fish and shrimp ponds and removal for wood, building material and conversion to charcoal. It appears that one of the best remaining areas of mangrove in Kalimantan is in the Sembuku River delta (Momberg et al. 1998).

Until recently, the Mahakam delta once had the largest expanse of Nipa palm forest in Indonesia. The last 10 years, however, has seen a massive reduction in the extent of this forest. This is a consequence of a huge increase in *tambak* fish ponds and alterations in the extent of silt and flow rate of the waters of the Mahakam River, which has resulted in a seaward progression of the brackish/marine water boundary. For example, in 1992 there were approximately 2,800 ha of *tambak*, and by 1998, more than 13,800 ha were converted into *tambak* ponds. (BAPPENAS 2003).

Nutrients flowing downstream and falling from Mangrove Forests produce a rich environment for estuarine fauna. Hardenberg (1937 in MacKinnon et al. 1986) reported 80 species of fish from Kumai estuary in Central Kalimantan and 222 species from the estuary and lower reaches of the Kapuas River. Coastlines throughout Kalimantan are being degraded and eroded by the removal of fragile coastal vegetation, especially mangrove and freshwater forests. This has a large impact on the populations of fish and invertebrates that rely on these nutrients. Increased sedimentation and diminished nutrient loads also impact and reduce the sea grass beds along the coasts. These beds are important for dugongs (*Dugon dugon*), sea turtles, and some fish and sea urchins. Kalimantan also has several important fringing reefs, especially those around Karimata Island off West Kalimantan and the Berau islands off East Kalimantan. Barrier reefs and atolls are also found off East Kalimantan (Salm and Halim 1984).

Shorelines and mudflats along major rivers and lakes are important feeding grounds for a number of northern Asian migratory birds. For example, Pulau Bruit off Sarawak, northwestern Borneo, had 10% of the known population of Asian Dowitchers (*Limnodromus semipalmatus*) during November 1984 (NPWO/ Interwader 1985). Eve and Guigue (1989) recorded 146 species of birds in the Mahakam River delta, East Kalimantan.

<u>Protected Areas with Coastal and Marine Implications:</u>

There are seven national parks, numerous reserves and other types of protected areas in Kalimantan. These include:

- Gunung Palung National Park, with an area of 300,000 ha, ranges from the coast to 1160 m. Consequently, it has a wide range of habitats, comprising Peat Swamp Forest, Montane Forest, Lowland Rainforest and freshwater. The beaches of Datok Island are a tourism center. It has for many years been the focus of a Harvard University protected area management program that has focused on encouraging reduced impact logging, exploring markets for high quality added value timber and establishing a managed forest area that is capable of generating funding to support conservation measures throughout the Park. In the last four years, this Park has been subject to intensive illegal logging, encroachment, hunting and removal of non-timber products. These intrusive activities have severely damaged the conservation value of the Park and the current research programs there.

- Kutai National Park has an area of almost 200,000 ha, created to protect flora and fauna. This area encompasses a broad lowland region that extends from the coast to 65 km inland, with a width of about 40 km. It contains at least six forest structural types; more than 800 species of plants (with an average of 250 species per ha); and more than 300 species of birds, 80% of which are endemic to Kalimantan (BAPPENAS 2003). It has also been nominated as a center for plant diversity (IUCN 1990, MacKinnon 1990). This Park has suffered as much as any of Indonesia's National Parks over the last five years. Momberg et al. (1998) classified the Park as severely degraded, and this degradation continues unabated to the present. There has been encroachment on all of its boundaries, but particularly on the western half; much of the vland has been claimed by local villagers who have converted large tracts of it to gardens. Additionally, intense fires during the 1980s and 1990s from the west, south and north have degraded large areas and provided opportunities for loggers to enter the Park and cull trees killed by fire. In the last several years, there has also been a great increase in illegal logging in the Park, the center of which is now traversed by logging roads. Many non-timber forest products have also been removed from the Park and hunting is extensive. The Nature Conservancy's ecoregional plan for East Kalimantan lists all protected areas, including Kutai National Park, as a priority conservation area, despite its degradation (Kitchener et al. 2002).

- Tanjung Puting National Park is a coastal site that does not rise more than 100 m above sea level. It has freshwater habitats, Heath Forests, Mangrove Forests and Peat Swamp Forests. It has been the focus of a 19-year intensive research program to study the ecology of the orangutan and associated primates in the Park and the effect of fire on the vegetation and the orangutan. In 1999, encroachment on the Park from neighboring villagers and migrants resulted in direct conflicts with researchers in the Park, and their research centers were vandalized. Illegal logging and hunting continues unabated. The wild fires of the 1990s burnt large areas of the fringes of the peat swamps.

Freshwater and Key Watersheds

Wetlands, comprising peat swamps, freshwater swamps and mangroves, are a major habitat in Kalimantan, and occupy some 20% of its land mass (MacKinnon and Artha 1981). They play a key role in regulating water quality and flow rates and are important habitats for a broad assemblage of plants and animals. Crucial to the conservation of river systems and wetlands is protection of their water catchment areas. Water basin and water catchment maps are available in various forms for some parts of Kalimantan. But in effect the entire inland mountain region defines the focus of the catchment areas for the major river systems. Some of catchment areas for the major rivers are partly inside the boundaries of protected areas (e.g., Kayan River and Kapuas River). However, many are not protected (e.g., Mahakam, Sembuku, Barito Rivers and other major south flowing rivers). Increasingly logging and agriculture are moving into the lower slopes of the unprotected catchment areas, including the Kapuas catchment, which is protected in part by the Gunung Bentuang and Karimun Reserves, causing extensive erosion and increased flow and silt in the rivers.

The lowland regions of Kalimantan are drained by major rivers. Kalimantan has in fact the three longest rivers in Indonesia (Kapuas, Barito and Mahakam). The Kapuas River drains two-thirds of East Kalimatan and has a watershed of 100,000 km2 (Giesen 1987). Several of these rivers have extensive lake systems in their inland basins and lowland reaches. The extensive Kapuas, Negara and Mahakam lakes have important inland fisheries. The Mahakam also is home to the rare Irrawaddy River Dolphin, *Orcaella brevirostris*. Once widespread along the east coast, this dolphin is now reduced to about 50 individuals, which live hundreds of kilometers from the sea. (Chan et al. 1985).

More than 290 species of fish are recorded from the Kapuas River alone. The lower reaches of Kalimantan rivers are especially rich in species, more than one-third of them marine species. There is a high level of endemism in separate rivers (MacKinnon et al. 1996). In the Kala'an River in South Kalimantan, the fish species community in shaded areas of rivers is different from that found downstream. The adjacent lake community of Riam Kanan again is different (see in MacKinnon et. al.1986).

These major rivers and their associated basins define boundaries between major landscapes and frequently delimit the distributional boundaries of numbers of plants and animals, including some of the primate species. This is particularly the case for lowland species, because in the lowlands rivers are wide and treacherous and are effective boundaries to the movement of large numbers of species. For example, the land between the Kapuas and the Barito Rivers is occupied by the Agile Gibbon (*Hylobates agilis)*, whereas the endemic Bornean Gibbon (*H. muelleri)* occurs elsewhere in Kalimantan and Borneo. In the headwaters of the Barito, where the two species meet, they interbreed and hybridize (Marshall & Sugardjito 1986).

Peat Swamp Forests are a unique feature of the Kalimantan landscape, where they cover from 8% to 11% of the area of the lowlands (MacKinnon and Artha 1981). They are most abundant along the lower reaches of the Barito River and other south flowing rivers and around the lakes of the Kapuas and Mahakam Rivers (RePProT 1990). These swamps support a distinctive forest formation but are rather depauperate in flora and fauna (Anderson 1972).

Biodiversity Centers

The distribution of animals and plants species in Kalimantan and associated islands are far from uniform. MacKinnon & MacKinnon (1986) divide Borneo and associated islands into nine biounits, with seven of these units being on the island itself.

The Meratus Mountains of South Kalimantan are floristically distinct from other hilly regions and are a site of plant richness and endemism, especially orchids (MacKinnon et al.1996). The northeast of the island of Borneo, including Sabah and northeastern Kalimantan and the north coast, including Brunei and East Sarawak, are also noted for their plant species richness (Myers 1988). Borneo (including Kalimantan) is also the center for the distribution of the carnivorous pitcher plants, *Nepenth*es. The northern lowlands are faunally and floristically much richer in species than the south, including two endemic squirrels (*Petaurillus hosei* and *P. emiliae)*, a rat (*Chiropodomys major)* and the Mongoose (*Herpestes hosei*), all of which are confined to this biounit, as are the

Bornean elephants. Recent DNA studies by WWF, as yet unpublished formally, confirm that these elephants are a distinct species and are endemic to Borneo.

Lowland Rainforests are the richest habitat for biodiversity in Kalimantan. They contain major populations of the larger animals, including the charismatic species, such as Orangutan (*Pongo pygmaeus*); gibbon (*Hylobates* spp.); langurs (*Presbytis*); Clouded leopard (*Neofelis nebulosa*); other cat species (*F. bengalensis, F.marmorata, F. planiceps, F. badia*), Muntjak (*Muntiacus muntjak*); elephant (*Elephas* sp.); Sumatran Rhinoceros (*Dicerorhinus sumatrensis*) and Sun Bear (*Helarctos malayanus*). Bird species richness is also high and comparable to that in South and Central America (Wells 1971).

The central Bornean mountains including mount Kinabalu, Sabah, and Kalimantan's highest ranges, contain the distinct montane fauna of the island with 28 restricted range birds, including 24 endemics and 21 endemic mammals. The hilly country in the center of Kalimantan is little explored and may contain further endemics.

The Sangkulirang limestone ranges and forests in East Kalimantan also have a rich flora that has limestone specific elements (Anderson 1965). The area also has a terrestrial molluscan assemblage unique to the area (WWF unpublished report). It is also a center for caves in Kalimantan. As caves are uncommon, it is likely that they will contain a fauna, particularly bats, poorly represented elsewhere in Kalimantan.

Forestry Resources

MacKinnon et al. (1986) stated that during the 20 years prior to 1990, Kalimantan had lost seven million ha of forests. This rate of loss has increased markedly over the last five years. Most of the timber from Kalimantan is harvested from natural forest, rather than plantations. Large scale cutting of forests began in Kalimantan in 1967. Mostly this has occurred in the valuable lowland and hill dipterocarp forest, in large areas of peat forest, in freshwater forests and in ironwood forests. Logging on limestone has not occurred much because of the difficulty of the terrain and the decreased commercial value of trees on limestone. The same applies to Heath Forest (*kerangas*) (Whitmore 1984). Mangrove Forests are greatly exploited for chipwood, raw material and charcoal production; they are also converted to *tambak* fish ponds. Logging and subsequent agricultural activities have reduced and degraded large amounts of specific forest type. More than 60% of the original area of ironwood has been lost, while lowland dipterocarp forests have been reduced by a third (MacKinnon and MacKinnon 1986). Many freshwater swamps have been converted to open swamp habitat, as in the Sungai Negara wetlands and the Mahakam River Basin.

Loggers focus on less than 100 tree species in Borneo (including Kalimantan) (Burgess 1966), with exports predominantly of 12 species only. In Kalimantan, the most valuable trees are ironwood (*Eusideroxylon zwageri*) and dipterocarps, including Meranti (*Shorea* spp.), Merawan (*Hopea* spp.), Kapur (*Dryobalanops* spp.), Keruing (*Dipterocarpus* spp.), Ramin (*Gonystylus bancanus)*, and legumes (*Intsia bijuga*; *I. palembanica; Pericopsis Mooniana* and *Pterocarpus indicus*) (Myers 1984).

It is doubtful whether current selective logging practices in Indonesian forests are sustainable. This is because the logging rotation cycle of 35 years is considered too short to allow for regeneration of commercially valuable trees. It may in fact take more than a 100 years for canopy trees to mature (Soedjito 1988), or even longer, because the impact on the soil fertility and structure of removing forest canopy in such a brief rotation period is unknown. The general absence of long-term mature forests in Kalimantan can be predicted to heavily impact those species that require old and senescent trees as habitat.

Protected Areas

Gazetted and proposed protected areas in Kalimantan account for 7.1% of the total land area and cover most major habitat types and areas of high biodiversity (MacKinnon and Artha 1981). Protected areas that have 'international' status are Tanjung Puting (Biosphere Reserve), Gunung Karimun and Bentuang and Kayan Menterang (proposed Trans Border Reserves).

Kalimantan's mountains are some of the most important sites for biodiversity on the island. More than 10% of the islands montane habitats are gazetted or proposed as protected conservation areas (MacKinnon et al. 1986). Important mountain reserves in Kalimantan include Bukit Baka Bukit Raya, Gunung Palung, Gunung Karimun and Bentuang, Gunung Nuit and Kayan Menterang. These reserves represent most of the major habitat types of Kalimantan, encompassing as they do lowland, limestone and Montane Rainforests and sub-alpine ridges, and provide protection for more than half the islands recorded plant and animal species (MacKinnon et al. 1986).

The most highly threatened habitats in Kalimantan, the lowland forests and coastal wetlands, are poorly protected (MacKinnon et al. 1986). The most important lowland protected areas are Kutai, Gunung Palung, and Tanjung Puting National Parks. The importance of Kutai National Park is confirmed by the observation by MacKinnon (1990) that the Park supports at least 74 mammals, excluding bats, and 274 species of resident and visiting birds, which is about half the total for Borneo. The last five years has witnessed serious encroachment, logging and hunting in all three of these protected areas. Additionally, these areas have been subject to intense and repeated burning by wildfires. It is important that these areas are not abandoned to developers, especially Kutai, because they still retain important assemblages of lowland forest plants and animals. Data from the heavily burnt and degraded lowlands of Bukit Soeharto, north of Balikpapan, East Kalimantan (F. Slick, pers comm.), indicate that with careful future management much of the forest of Kutai, for example, could recover an impressive floristically rich forest community and presumably also a good proportion of its associated fauna.

Summary

Among Indonesian islands, Kalimantan is second only to Papua in terms of species richness for plants, mammals, birds and reptiles. It also has high levels of endemism. Consequently, Kalimantan is a priority area for conservation. Species richness and species diversity is greatest in the Lowland Rainforests. Also the greatest threats to biodiversity are in the Lowland Rainforests, freshwater systems, coastal communities and fringing reefs.

Important areas for conservation action in Kalimantan have not changed much since the 1993 Biodiversity Action Plan for Indonesia, although the extent of degradation to many of these areas has changed dramatically. Momberg at al. (1998) have suggested some additional areas for East Kalimantan, such as the complex forested area of Sembuku/ Sambakung and the various limestone forests on the Sangkulirang/ Mangkaliat Peninsula.

This Report considers the most important single areas for conservation action in Kalimantan are those with both the highest biodiversity and greatest threats. These are the three major lowland/coastal National Parks (Gunung Palung, Tanjung Puting and Kutai). Further, the most important ecological systems for such action are the major river systems, especially their water catchments, lakes, swamps and deltas. These include the Mahakam, Kapuas and Barito River systems.

Many other areas are important to the conservation of overall biodiversity in Kalimantan. But their biodiversity is less threatened than the above mentioned areas, either because of their large size and location in mountainous terrain (e.g., Bentuang-Karimun, Kayan Menterang and Bukit Baka Bukit Raya), or because they are on rugged limestone terrain that is largely inaccessible for exploitation (and which has frequently avoided large scale burning by the wild fires of the 1980s and 1990s). The river systems are selected as priority systems because in Kalimantan their trajectory of flow largely defines the major landscapes and determines in large part the landscape function. Furthermore, management of the entire river system is fundamental to the health of all biotic (and human) communities downstream.

3.4.2 Sumatra and Associated Islands

Introduction

Sumatra, which has an area of 473,607 km² and is the sixth largest island in the world, is extremely rich in biotic habitats. It has extensive lowland dipterocarp forests throughout the island, which form the vegetation matrix of the island. The east coast is dominated by extensive Mangrove Forests, but also with patches of Peat Swamp Forest. The sandy west coast supports various types of Coastal Forests. Large peaty freshwater swamps are found in the south. It also has a number of mountains, some formed by uplift of sedimentary deposits (Barisan Range) and some by volcanic action (Mts Kerinci, Sinabung, Merapi, Singgalang). Further, it has had different associations to many of the small islands that surround it, ranging from recent land connections with them to no connections at all. It also has a number of major rivers, which in the lowlands have caused ecological barriers to the distribution of animals and plants, as also have some of the mountain ranges. Barriers to movement of animals and plants have afforded opportunities for their speciation in Sumatra. This, coupled with the wide range of habitats in Sumatra, has been in large part responsible for the island's rich fauna and flora.

Fig. 3.3 Map of Sumatra

__Terrestrial__

Sumatra has the most mammal species in Indonesia (201 spp.), of which nine are endemic to the Sumatran mainland and a further 14 are endemic to the associated Mentawi islands. Sumatra also has 22 other species of Asian mammals found nowhere else in Indonesia, attesting to the close links with Peninsular Malaysia. It is also the repository of the Sumatran Rhinoceros, Elephant, Tiger (*Panthera tigris*) and the Forest Dog (*Cuon alpinus*), all of which are virtually extinct in other parts of Indonesia (FAO/ van der Zon 1979).

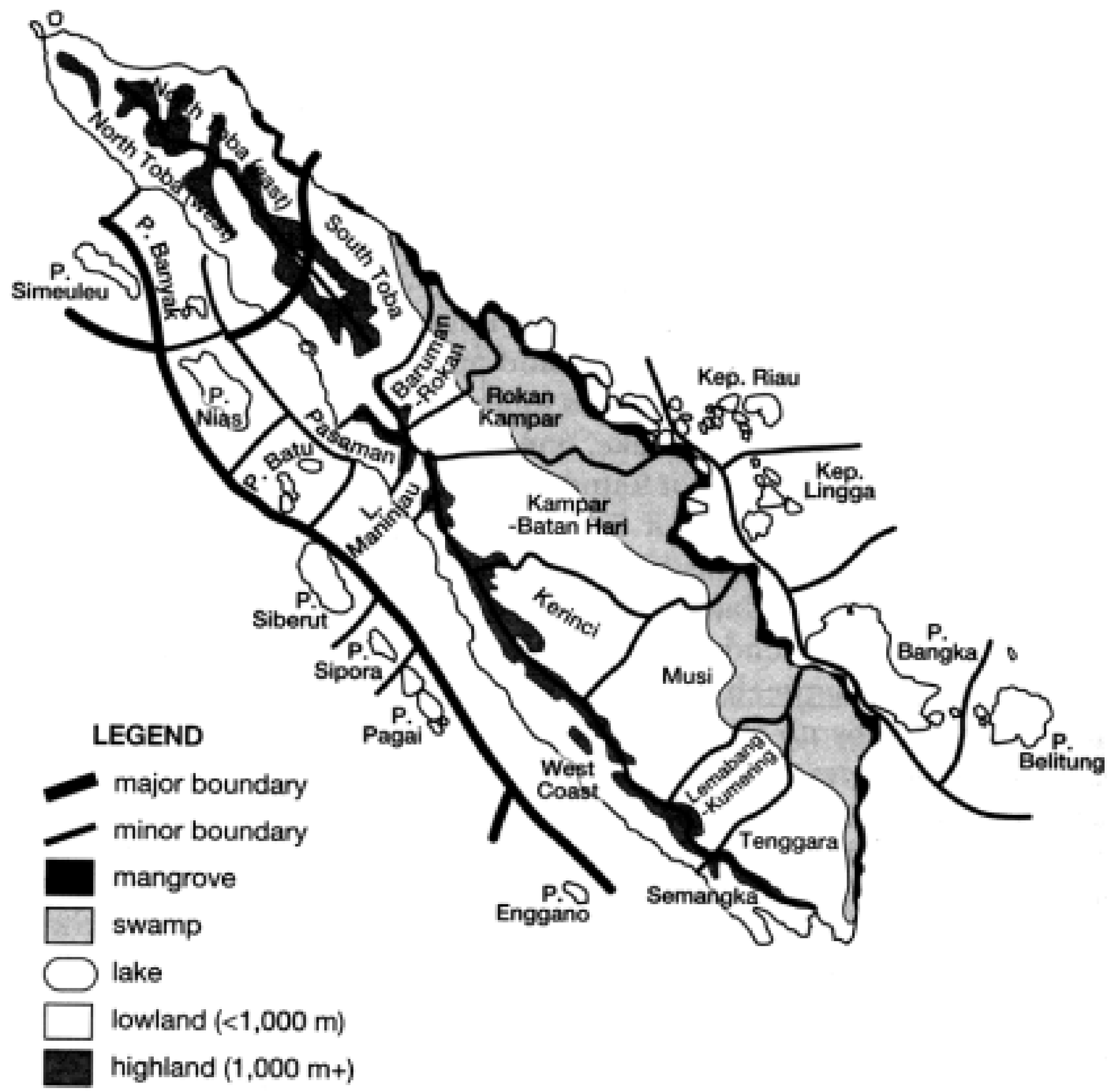


Fig. 3.4: Map of Biounits of Sumatra and its Associated Islands (Whitten et al. 1996)

Small islands with animals and plants are closely associated with those on Sumatra, include Bangka, Biltung and Anambas/Natuna. These have had recent land bridges with both Sumatra and Borneo (including Kalimantan). They have an essentially Sumatran/Bornean fauna and flora, albeit with much fewer species.

The small islands that have been more isolated from Sumatra, such as the Mentawi Islands and the smaller Simeulue and Enggano Islands, have developed more distinct faunas. For example, the Mentawi islands, which have been isolated for long periods without any land connection to Sumatra, have a unique assemblage of endemic mammals, with 85% of their non-flying species endemic. These endemic mammals are: Pagai Islands Horshoe Bat (*Hipposideros breviceps*), Mentawi Macaque (*Macaca pagensis*), Mentawi Snub-nosed Monkey (*Simias concolor*), Mentawi Leaf Monkey (*Presbytis potenziani*), Mentawi Gibbon (*Hylobates klossii*), Loga Squirrel (*Callosciurus melanogaster*), Soksak Squirrel (*Lariscus obscurus*), Mentawi Black-cheeked Flying Squirrel (*Iomys sipora*), Mentawi Orange-cheeked Flying Squirrel (*Hylopetes sipora*), Mentawi Civet (*Paradoxurus lignicolor*), Giant Mentawi Rat (*Leopoldamys siporanus*), Mentawi Forest Rat (*Maxomys pagensis*), Mentawi Rat (*Rattus lugens*), and Mentawi Pencil-tailed Tree Mouse (*Chiropodomys karlkoopmani*).

The two small islands of Simeulue and Enggano Islands, which probably have never been connected by land to Sumatra, have an impoverished fauna. For example, there are no squirrels on either island. However, Simeulue has three endemic species of snakes, an endemic bird and a morphologically distinct macaque monkey and a pig, which may also be taxonomically distinct (Mitchell 1981). Enggano has three endemic mammal species (Sody 1940), two endemic bird and one endemic snake species (Lieftinck 1984).

Sumatra also has an extremely rich bird fauna. Its bird list of 580 species is second only to New Guinea. A total of 465 of these bird species are resident and 21 are endemic. At least 31 species of birds of Asian origin are found on Sumatra, including the Great Hornbill (*Buceros bicornis*), which occurs nowhere else in Indonesia (FAO/ MacKinnon and Wind 1979). Sumatra is also extremely important for migratory species, mostly from the Palaearctic region, but also from tropical South and Southeast Asia. Nisbet (1974) suggests that 11 of these migrants principally winter in Sumatra.

Sumatra lies in the West Malesia plant region along with Peninsular Malaysia, Borneo, Philippines and part of southern Thailand. Sumatra probably has more than 10,000 species of higher plants, most of which are found in lowland forest. The number of tree species per unit area equals that of Borneo, and like other Sunda forests are probably the richest plant communities in the world (Whitmore 1984). The Sumatran forests have a species diversity that is comparable to Borneo (Meijer 1981), but it has far fewer endemic genera of plants (17 versus 59). It does have some spectacular plants, including *Rafflesia arnoldii*, the largest flower in the world, and *Amorphophallus*, the tallest flower in the world.

The Peat Swamp Forests of Sumatra, which are mainly ombrogenous (gaining nutrients from rainfall), are large areas mostly concentrated along the southern and central parts of the east coast of Sumatra. They are mostly drained by blackwater rivers. These rivers are low in nutrients, containing fewer inorganic irons, lower levels of dissolved oxygen and higher concentrations of humic acids than clear rivers (Janzen 1974). Vegetation in these swamps generally is both floristically and structurally concentric as plants respond to the poorer fertility towards the center of a given peat swamp (Anderson 1976). Trees may be large and as high as 45 m, or stunted and only about 12 m high. Common species are *Tristania obovata* and *Ploiarium alternifolium*. No vegetation appears to be confined to these peat swamps with perhaps the exception of several species of palm (*Salacca conferta* and *Livistona hasseltii*). Blackwater rivers have an impoverished fauna characterized by airbreathers, including the fish (Johnston 1967). They also have an impoverished fauna with low densities of mammals and birds (Merton 1962).

Freshwater Swamp Forests are physically similar to Peat Swamp Forests, but there is a lack of deep peat; they receive water from both rainfall and rivers. They are mainly on riverine alluvium and occasionally on alluvium deposits of larger lakes, such as 'lake' Bento, Kerinci. Their distribution is generally contiguous with peat swamps. Few plant species are restricted to these forests, but their species composition is more similar to lowland forests than to Peat Swamp Forests (Whitten 1982). Structurally they are also variable and range from grassy marshes, pandan dominated forests, to a lowland forest form. They are richer in animals than Peat Swamp Forest and appear to retain a slightly impoverished assemblage of those found in lowland forests. They used to have large populations of the Estuarine Crocodile (*Crocodylus porosus*) and the False Ghavial (*Tomistomus schlegeli*), but their populations are now low; the endangered White-winged Wood Duck (*Cairina scutulata*) also occurs there. The high agricultural value of their soils (Burnham 1975) has meant that they have suffered greatly from human activities, such that in 1982 as little as 22% of the original extent of this formation survived.

The lowland forests of Sumatra are, like those in Borneo, extremely diverse in both plants and animals. They form the matrix vegetation community for the island. The vegetation is characterized by thick buttressed trees dominated by tall, up to 70 m, *dipterocarp* species (*Dipterocarpus, Parashorea, Shorea, Dryobalanops*), of which there are 112 species, including 11 endemics (Ashton 1982). Other dominants are usually in the family Caesalpiniaceae (*Koompasia, Sindora, Dialium*). They are dynamic stratified plant communities constantly suffering perturbations that produce a range of different gap types. Huc and Rosalina (1981, 1981b) calculated that at various locations in Sumatra, the growth cycle in forests averaged 117 years, which is similar to the 108 years calculated by Noordwijk and Schaik (in Whitten et al. 1996) at Ketambe. Variations in the particular phases of the growth cycle can be considerable. Even minor variations in such forests in Siberut Island are apparent to the gibbon monkeys (Whitten 1984). Animal diversity is not as high as for some other tropical regions though. For example, the birds at seven Sumatran sites were less diverse than in Africa and South America (Pearson 1982), although Wells (*in* Whitten et al. 1996), contests that conclusion. Many animals, particularly those that feed on fruits and pollen, are nomadic and roam over the forests in search of food. Most large mammals in Sumatra live primarily in the lowland forests. And some areas have up to eight species of primate. These are the Orangutan (*Pongo pygmaeus*), tarsier (*Tarsier bancanus*), Siamang (*Hylobates syndactylus*), White-handed Gibbon (*H. lar*) or the Dark-Handed Gibbon (*H. agilis*), Silvered Leaf Monkey (*Presbytis cristata*), Thomas' Leaf Monkey (*P.thomasi*), Banded Leaf Monkey (*P. melalophos*), Eastern Leaf Monkey (*P. femoralis*), Long-tailed Macaque (*Macaca fascicularis*), Pig-tailed Macaque(*M. nemestrina*), and Slow Loris (*Nycticebus coucang*). Sumatra has 10 species of distinctive hornbill birds; eight can be found in a single area of forest.

Heath Forest and Padang forest are largely restricted to Bangka and Belitung islands, although small areas exist in eastern Sumatra. Heath Forests are on infertile white sand soils relictual of ancient eroded sandstone beaches. They usually have a vegetation that is an impoverished and stunted assemblage of trees found in the lowland forest matrix. No species of animals are known to be restricted to Heath Forests. Padang is a shrubby and low (less than 5 m tall) vegetation. It is commonly thought to be a degraded Heath Forest (Whitmore 1984).

The lowland Iron Wood forests of Sumatra are dominated by the species, the Iron Wood (*Eusideroxylon* zwageri) generally found on sandy tertiary soils in the central southern part of Sumatra. Little is known of the fauna occupying this forest type, although, due to its dominance by a single tree species, it could be expected to be an impoverished assemblage of the typical lowland fauna. However, it appears to have bird fauna similar in diversity and number to lowland forests (Whitten et al. 1996).

The extensive mountains in Sumatra are covered from 1200-2100 m above sea level with lower Montane Forests, from 2100-3000 m with Upper Montane Forest, and above 3000 m with Sub-alpine Forest. Low Montane Forests are characterized by the Fagaceae and Lauraceae (laurels), diminution of dipterocarp trees and increase in tree ferns. The Upper Montane Forests are characterized by the order Coniferae (pines and related trees) and the families Ericaceae (e.g., bilberries *Vaccinium, Rhododendron*) and Myrtaceae. Trees are often quite low and gnarled, and mosses and liverworts are common. The Sub-alpine Forest is characterized by having dwarf forms of the Upper Montane Forest as well as grasses, rushes and sedges. A number of the mountain flora species are shared with mountainous flora in many countries, both tropical and subtropical (*Rhododendron, Deschampsia, Gentiana and Primula*). The invertebrate and lower vertebrate fauna on Sumatran mountains iare likely to be impoverished compared to lower altitudes (Whitten et al. 1996). Chasen and Hoogerwerf (1941) showed that this was decidedly the case with birds in Aceh, northern Sumatra. They showed that below 12000 m, 134 species were found, while above this altitude only nine were recorded, all but one also found in the lowlands. In the sub-alpine zone, 11 species were found but only two of these were shared with birds found in the lower altitudes, indicating that the Sub-alpine Forest has a distinct community of birds, including Sunda Whistling Thrush (*Myiophoneus melanurus*), Scaly Thrush (*Zoothera dauma*) and Island Thrush (*Turdus poliocephalus*) (van Strein 1977). The mammal community on Sumatra becomes impoverished above about 1,200 m above sea level (Robinson and Kloss 1918). At least 11 species of mammals are more or less restricted to mountains in Sumatra. These are the Grey Shrew (*Crocidura attenuata*), Grey Fruit Bat (*Aethalopes alecto*), Sumatran Rabbit (*Nesolagus netscheri*), Volcano Mouse (*Mus crociduroides*), Giant Sumatran Rat (*Sundamys infraluteus*), Edward's Rat (*Leopoldamys edwardsi*), Hoogerwerf's Rat (*Rattus hoogerwerfi*), Kerinci Rat (*Maxomys hylomyoides*), Kerinci Rat (*Maxomys inflatus*), Kinanbalu Rat (*Rattus baluensis*), Mountain Spiny Rat (*Niviventer rapit*), and Serow or Mountain Goat (*Capricornis sumatraensis*).

About 30% of the plant species from similar forests in Malaysia have some economic value (Burkill 1966); a similar proportion of economically useful trees could be expected to be found in Sumatra. Unfortunately, the previously extensive dipterocarp forests, which provide about 25% of the hardwood timber on international markets, have been so over-exploited that it is expected that the supply of timber from Lowland Rainforests will be exhausted by 2005 (World Bank 2001).

The full range of threats to vegetation, plants and fauna from human activities encountered in Borneo are also found in Sumatra. In addition to dramatic reduction in the extent of Lowland Rainforest, Heath Forests and Freshwater Swamp Forests have also declined greatly, the latter converted to irrigated agricultural land. Loss of Mangrove Forests is also widespread, mainly converted to aquaculture (Whitten et al. 1996).

Coastal and Marine

Coastal ecosystems commonly encountered in Sumatra are mangroves, beach vegetation on accreting coasts, beach vegetation on abrading coasts, brackish water forests, rocky shores and coral reefs.

Mangroves are located along the coast of all provinces in Sumatra and are common also on the adjoining islands. In the 1980s, Sumatra had more than 850,000 ha of mangroves, the third largest area of the islands in Indonesia. By the late 1990s, only a little more than 480,000 ha (53%) remained. However, the loss of mangroves on other islands moved Sumatra to now having the second largest area of mangroves among the other islands (BAPPENAS, 2003). Mangroves are well developed on the inshore and offshore islands due to the many large rivers that flow into the sea bringing in high sediment and decreasing salinity.

Similar to Kalimantan, mangroves are a key ecosystem for coastal stability and for the conservation of a wide range of plants and animals that are dependent on the habitat of and nutrient flow from mangal and to the economy of Indonesia. Whitten et al. (1996) document dramatic changes in the accretion of parts of the Sumatran coastline, indicating that both Jambi and Palembang had been ports at the end of promontories about 1000 years ago, and speculate on the crucial role of mangroves in coastal accretion.

The most commercially valuable mangrove related species is the paenaeid prawns, which supports an export market worth $150 million annually (Anon 1979). Conversion of mangroves to *tambak* fish ponds is the major factor in the destruction of the mangrove communities, particularly in eastern Sumatra. Turner (1977) also observed that the conversion of mangroves to *tambak* is commercially unprofitable and would lead to a loss of jobs. To indicate this, Turner (op. cit.) showed that the average coastal *tambak* produces 287 kg of fish/ha/yr, which is more than the offshore shrimp yield, but the loss of one hectare of *tambak* actually leads to an approximate net loss of 480 kg/ha/yr of offshore fish and shrimp per year.

On accreting coasts, there are a wide variety of sand binding, salt tolerant, hardy herbs, grasses and sedges (Whitmore 1984), inhabited by adapted assemblages of crabs and crustaceans. These coasts are also used as nesting sites for Green Turtles, the eggs of which are commonly sold in Padang; Hawksbill Turtles in the region of Sibolga; and the rarer Leatherback Turtle at scattered sites. Most concentrations of turtles are on the offshore islands and the west coast of the mainland (Soegiarto and Polunin 1980), but there is little recent confirmation of turtle nesting sites.

Brackishwater forests or Nipa (*Nypa fructicans*) forests are scattered along the inner boundaries of mangroves. It has only the date palm (*Phoenix paludosa*) restricted to it.

The coastal environment of West Sumatra consists of a chain of islands and shallow water reefs, separated from the mainland of Sumatra by deep water. The islands extend from Simuelue Island in the north to the Enggano Islands in the southeast. The eastern sides of these islands are, in some places, covered by mangrove. Some coral species are adjacent to the mangrove roots. Further eastward, more corals appear and among the most abundant are massive *Porites,* which can form minor atolls. They are mostly dominated by coral boulders of *Porites* and big columns of *Goniastea* corals. The reef flats are wide, and they slope down gently to 5-10 m depth. The soft bottom substrate coral communities are dominated by various species of *Acropora, Seriatopora* and *Pocillopora*.

There are two chains of small islands running parallel to the east coast of Sumatra at a distance of approx 10 km and 30 km, respectively. The inshore chain is located on the continental shelf with a depth around 50-100 m while the outer chain is in the 200 m isobath on the continental slope. The reef flats are narrow and gently sloping down to 10 m depth. On the western side of the island are spur and groove formations, and the eastern side is well protected from strong wave action. Coral reef communities are subject to heavy sedimentation from the Sumatran rivers. Coral sites surveyed here ranged from good to poor, and 49 genera were noted (Suharsono 1998). Reefs are poorly developed on the northern part of the east coast of Sumatra but are widespread around the offshore island to the south of Riau Kepulauan as far as the islands of Bangka and Belitung.

Freshwater and Key Watersheds

Major lakes occur in every province in Sumatra. Because these lakes have been isolated for long periods of time they have extremely different fauna and flora. However, past palaeo connections between the rivers of eastern Sumatra and western peninsular Malaysia insinuate closer faunal relationships between some elements of the freshwater fauna of these areas than occurs between rivers in eastern Sumatra and those elsewhere in Sumatra.

Table 3.4: The Major Lakes of Sumatra

Province	Lake	Area (km^2)	Depth(m)
Aceh	Tawar	55	-
	Realoib	3	-
North Sumatra	Toba	1,146	450+
	Hulu Batumundam	2	-
West Sumatra	Maninjau	98	169
	Singkarak	110	269
	Di Bawah	15	-
	Di Atas	12	44
Riau	Lakes along the Siak Kecil River	-	-
Jambi	Kerinci	42	-
Bengkulu	Tes	2	-
	Dusun Besar	2	-
South Sumatra	Ranau	80	229
	Jemawan	8	-
Lampung	Ranau	45	229

Source: Ecology of Sumatra. Whitten et.al. 1996

For example, the same species of Freshwater Stingray (*Dasyatis* sp) occur in both the Indragiri River, East Sumatra, and the Perak River, western Malaysia (Taniuchi (1979).

Seven of the 15 Sumatran lakes listed in the above table have been studied. In none of these were there sharp temperature gradients -- the maximum difference between top and bottom did not exceed 5.5 degrees centigrade. The euphotic zone was generally the same as the epilimnion, and the lakes were stratified with relative little overturn of water strata (Ruttner 1931). Some of the deeper lakes, such as Lake Kawar, have few biota whereas the shallower higher nutrient lakes have a rich invertebrate fauna and probably also fish fauna (Whitten et al. 1997).

Biodiversity Centers

John MacKinnon in Whitten et al. (1997: figure 1.32) described 14 biounits for Sumatra and 12 biounits for associated island groupings (see map above, Fig. 3.3). Some of these centers of distribution may be enigmatic as a consequence of the massive volcanic explosion that formed Lake Toba 30,000 years ago. For example, there appears to be a boundary that runs northeast and southwest through Lake Toba; some 17 species of bird are found to the north of the lake and only 10 to its south (Mackinnon *in* Whitten et al. 1997).

As stated above, the Lowland Rainforests, Mangrove Forests and mountain tops are centers of biodiversity. The Lowland Rainforests are recognized primarily for their high biodiversity and species richness, and the Mangrove Forests for their bird, crustacean, molluscan, fish and prawn assemblages. The mountain tops are known for their unique and frequently endemic species of animals.

The Mentawi, Simeulue and Enggano Islands are centers of biodiversity. The Mentawai is an important jewel in the Indonesian biodiversity crown, particularly for its endemic primate assemblage.

The oriental family Irenidae, comprising the fairy blue wren birds (*Irena*), leafbirds (*Chloropsis*) and ioras (*Aegithina*), appear to have their center of evolution in Sumatra (Dunn 1974).

The Tesso Nilo forest in Riau Province consists of 188,000 ha and is one of the remaining extensive areas of Lowland Rainforest in Sumatra. This forest has one of the highest known diversities of vascular plant species in the world. It is also one of the few remaining safe havens for elephants in Sumatra (WWF Indonesia 2003).

Forestry

In Sumatra, more than a hundred species of trees are probably commercially exploited. This has resulted in the total forest decreasing from over 23 million ha to less than 16 million ha, with provinces of South Sumatra and Jambi recording the most rapid rates of forest loss (Lampung already had little forest cover in 1985).

North Sumatra has 2.18 million ha of protected areas and 1.63 million ha of production forest, yet the forest cover is only 1.89 million ha. Substantial portions of protected areas are no longer forested. Over the three islands of Sumatra, Kalimantan and Sulawesi, 82% of the conservation forest area has forest cover, but in some provinces the amount is only half of the designated area. Only Aceh in North Sumatra, Central Kalimantan and North Sulawesi still have intact forest cover in their conservation areas. Great swathes of protection forest in North and South Sumatra, Lampung and South Kalimantan are no longer tree covered. Over all of Indonesia, only 60% of the protection forest still has forest cover. In Lampung, this is only 6% and in South Sumatra it is 25%.

In Sumatra, the dry lowland plains will lose essentially all their dominant forest cover soon after 2005. Land clearing will continue in the swamp forests and is likely to increase in the hill and mountain forests as the area of the other types diminishes. Thus in Sumatra, in a decade or so, most of the remaining intact forests will be in the hills and mountains. Between the mid 1980s and 1993, Sumatran mangroves decreased by 29% (681,700 ha to 485,025 ha) (World Bank 2001).

Regeneration in Sumatra after selective logging suggests that it is unlikely that regenerated forests will grow to their original heights (Ng 1983). Forestry practices directly and indirectly affect animal distributions and numbers. Some animals will be found in the most disturbed areas. Proper selective logging is considered not disastrous for much of the Sumatran forests, although squirrels and birds can be expected to fare badly (Whitten et al. 1997).

The extensive forest fires of 1997 and 1998 in Sumatra damaged 1,740,000 ha. The majority of forest that was burnt was 380,000 ha of lowland forest, 300,000 ha of swamp forest and 260,000 ha of scrub and grass, with the remainder timber plantations, agricultural lands and estate crops.

Protected Area Coverage

Sumatra has nine national parks; these are at the core of the protected areas system of Sumatra. Two of these National Parks are huge. These are Gunung Leuser in South Aceh and North Sumatra, and Kerinci Seblat in West Sumatra, both of which are approximately 1,000,000 ha. Gunung Leuser is also a Biosphere Reserve established because of its unique assemblages of fauna, including hornbills, Golden Cat (*Catopuma* *temminckii*), and its habitats that range from Lowland Rainforest, Peat Swamp Forest, Freshwater Swamp Forest and lakes to Sub-alpine Forests. The World Bank (2001) report did not recommend any specific additions to the protected area system in Sumatra, indicating that they considered it, by comparison to other islands in Indonesia, to be representative.

Sumatra has had two important recent additions to its protected areas: Bukit Tigapuluh National Park, Riau Province, and important additions to Gunung Leuser (such as Singkil). However, both of these two National Parks have become increasingly threatened from local communities. For example, there are at least 25 sawmills operating in the neighborhood of Bukit Tigapuluh National Park. Gunung Leuser is also under great threat from illegal logging (World Bank 2001).

In fact, most national parks in Sumatra are currently suffering multiple threats from human activity. Some 30,000 ha of forests in the northern areas of Bukit Barisan Selatan National Park have been lost in the last few years, and there are major problems with illegal logging in both Gunung Leuser and Bukit Tigapuluh National Parks (World Bank 2001).

The management of Gunung Leuser National Park has been assigned to a NGO, the Lueser International Foundation, which also has responsibility for managing protection and productive forest lands on the border of North Sumatra an Aceh. Most funds to this Foundation are from the European Union. Despite this innovative management approach, the National Park has suffered high levels of damage, and the increase in illegal logging inside the Park was stated to be "dramatic" by the World Bank (2001). The World Bank (2001) further states "the army, police, national park staff and other members of the local elites are usually involved." The World Bank (2001) considers that the habitat of the Orangutan in the Park will be destroyed by about 2006, and that its herds of elephant have been so fragmented that they are now below the threshold for their long-term survival.

Kerinci Seblat National Park, even after an ambitious integrated conservation and development project involving some $47 million, has not been able to show success in conserving its biota. In fact, the Park has fallen under increased threats. These threats involve the building of roads that increase access into the Park, conversion of land for agricultural purposes, removal of timber and non-timber products and hunting.

Many forest people in Sumatra, such as the forest edge people on Siberut Island and the Kubu on the mainland, are now hunting with access to new markets and new technologies; their hunting is becoming increasingly less sustainable. Numerous non-timber resources are also extracted from protected areas in Sumatra.

In the year 2000, it has been estimated that about 40% of the budget of the Director General of Nature Conservation went to just two donor-assisted national Parks in Sumatra -- Gunung Leuser and Kerinci Seblat.

Summary

Sumatra has a rich biodiversity similar to that of other Sunda islands, but slightly impoverished for most groups when compared to Borneo/Kalimantan. It has a number of unique and endemic fauna not found elsewhere, and retains a higher representation of the Asian mainland fauna and flora than elsewhere in Indonesia. Most of the broad habitat types on Sumatra and Kalimantan are fairly similar and most of the threats to the destruction of these islands are also similar. Both islands had extensive lowland forests, which are the most biodiverse habitats. However, the continuing degradation of Sumatran Lowland Rainforests and their associated faunas is advanced over that of Kalimantan, such that the World Bank predicts that almost all these forests on Sumatra will have a damaged vegetation canopy cover by 2005.

Support for activities to conserve the biodiversity of national parks in Sumatra that include Lowland Rainforest (Gunung Leuser, Siberut, Kerinci Seblat, Bukit Tigapuluh, Berbak, and Bukit Barisan Selatan) is, as with similar national parks in Kalimantan, of the highest priority. In fact it can be argued, because proportionately more of the Sumatran Lowland Rainforests are degraded than in Kalimantan that the Sumatran national parks are of a higher priority.

Of the six Sumatran national parks with Lowland Rainforest, those that are of a landscape scale and include mountain forests, particularly low Montane Rainforest (also inhabited by many species from the Lowland Rainforest) should be singled out for urgent conservation support. This is particularly true because with the destruction of the Sumatran lowland forests, it is predicted that loggers will move to the Peat Swamp Forests and to the hilly and lower mountains to obtain their timber. Thus, among the above group of six Parks, Gunung Leuser, Kerinci Seblat and Bukit Barisan Selatan are of the highest priority. However, Siberut National Park, because of its unique endemic animal assemblage, should also be elevated to the highest priority for support.

The Tesso Nilo Conservation Landscape concept, including the Tesso Nilo proposed National Park (WWF Indonesia 2003), is also of the highest priority for support as a special conservation management area. This area is some 3 million ha encompassing parts of Jambi, Riau and West Sumatra Provinces. It represents a cross-section of some of Sumatra's most important habitats, from Montane Forests in the west, through lowland forest to Peat Swamp Forest in the east. It would allow for wildlife corridors so that elephants could move freely between existing protected areas, including Kerumutan, Rimbang Baling and Bukit Bungkuk Wildlife Reserves and Bukit Tigapuluh National Park.

The largest and most important national parks in Sumatra, Leuser and Kerinci Seblat, are trans-provincial parks. Their successful management necessitates the collaboration of a number of informed governments at provincial and more local levels as well as civil society. Consequently, considerable support needs to be provided to inform all stakeholders of the value to them of the ecosystem services provided by these parks.

3.4.3 Java and Associated Islands

Introduction

Java, with an area of 130,000 km², which is slightly larger than New York State, has two large associated islands, Madura (5,672 km²) and Bali (5,560 km²). Java and Bali have 20 volcanoes that have been active in the past, making them the most volcanically active islands in the world (van Bemmelen 1970). These volcanoes impact the biodiversity of these islands enormously, creating as they do the highly fertile alluviums that once sustained enormous forested areas and now the high density of humans. In the recent past, volcanoes also dramatically changed the surface landscapes and altered river flows in both Java and Bali (Bennett and Bennett 1980)

In 1995, Java had a population of 114 million people living at an average density of 862 people/km². This high density of people is a result of historical influences and the high fertility of its volcanic soils, which lend themselves to terracing for irrigated rice farming. Nearly 200 years ago, the Dutch colonial office described Java as being overcrowded (van der Kroef 1956). Whitten et al. (1996) state that in 1817, 12% of Java was cultivated but that by 1870 the figure was 18%; 1920, 50%; and at present 64%. The rate of population increase only accelerated rapidly at the end of the nineteenth century, probably because of a combination of factors including cultivation of the dry uplands, improvement of irrigation systems, intensification of rice field cultivation, a diversifying economy and growth in the major commercial activities of towns. The extremely high density of people in Java and Bali is in part sustained by the fact that these two islands have had a disproportionate share of Indonesia's revenues from natural resources and international commerce (Whitten et al. 1996).

The biodiversity and natural resources of Java and neighboring islands are severely impacted by human population pressures. These impacts include the continuing decline of forested areas, particularly on higher dry lands; coral reef destruction; coastal and inland erosion; blocking of watercourses by human refuse; overloading the natural oxidizing capacity of inland rivers with human effluent; loss of many common species of animals and plants by conversion of natural or complex habitats to simple agricultural systems, and use of air guns and agrochemicals (Whitten et al. 1996).

Some 15% of Java is 'critical land' subject to serious soil erosion, a fact recognized by the Dutch. The average loss of soil on agriculture land has been estimated at 123 tons /ha/year (World Bank 1990). Farming on uplands, particularly intensive farming of vegetables, clearing of trees from uplands and lack of consistency in applying expensive terracing has resulted in a recent increase in erosion, flooding and landslides that have resulted in significant loss of human life.

Terrestrial

Java is the best-known island botanically in Indonesia (Ashton 1989). The total number of plant species, including weeds and cultivated species, mostly from the Americas, is over 6,500, of which 4,500 are native. Java has about half the known plant genera that are of Malesian origin. However, some of the Sundaic families of plants are surprisingly poorly represented, such as the Palmae, rattans, *Calamus* and *Daemonorops* and dipterocarps, for which there are just 10 species -- compared with 267 on Borneo and 105 on Sumatra. Sixteen genera of plants are endemic to Java, eight from mountains and six from deciduous forests. The mountain fauna of Java and Bali has the greatest affinities with Sumatra and is singularly different from Borneo. Despite the land connections with

Borneo and Sumatra discussed earlier, Java has 111 genera, predominantly trees, and three families that might be considered Sundaic, which are absent from the others. Destruction of habitat, particularly lowland habitats, by both volcanoes and humans, may account for the impoverished flora on Java (Endert 1935).

Examples of the most spectacular plants on Java are first, the giant Rafflesia plant, of which there are two species in Java (*Rafflesia rochussenii and R. patma*). Rafflesia is remarkable in that it has no stem, no leaves and no proper roots. Secondly, Edelweiss (*Anaphas javanica*) is a famous plant found in Java and Bali. It grows in the mountains and can reach 8 m high and has a stem as thick as a person's leg. And thirdly, the Lettuce Tree (*Pisonia grandis*), which is an attractive relative of *Bougainvillea*.

There is a floristic gradient from west to east in Java, probably because the species rich everwet forests are more abundant in West Java, less so in Central Java and less again in East Java. The north coasts are also different than the south coasts because they are drier and have fewer beaches and headlands; they were originally bordered by mangroves. Swamps were common behind mangroves but these have long been converted to rice fields and fish ponds. There are virtually no primary or old secondary forests now within 35 km of the north coast. Compared to the south coast, the north coast now has far fewer beach formation plants, but many more mangrove plant species (23 versus one species). The number of species throughout Java decline with altitude, with a number of plant zonal disjunctions at 1000 m, 1500 m, 2000 m, 2400 m to 2500 m and 3000 m (van Steenis and Schippers – Lammerste 1965). For example, 99% of the 217 orchid species have been recorded between 800-1,200 m, although not exclusively (Comber 1990).

The flora on the islands off West Java are generally not different from mainland Java. Although, the Karimunjawa Islands, Central Java have some species absent from the mainland, such as the rare tree *Ouratea arcta*, and the floral affinities of this island are closer with Bangka Island and Kalimantan than with Java. Nusa Kambangan, close to the south coast of Central Java, has a relictual plant assemblage, including rare and endemic species of plants such as the Giant Voodoo Lily (*Amorphophallus decus-silvae*). These have been protected by the fact that the island has prisons and is off limits to most people. However, in recently some 30,000 trees are estimated to have been felled on Nusa Kambangan; a continuation of this activity will see these relict forests degraded in just a few more years (Jakarta Post 2/7/2004). The remote island of Bawean, about half way between Java and Kalimantan, has a distinctly Javan flora, although again some species recorded there are not known from Java. The Kangean islands to the east, such as Madura and Bali, have a flora that differs little from that of East Java.

Many of the plants introduced in the Bogor Botanical Gardens, West Java, have become spectacular weeds throughout Indonesia. The most notable is the Water Hyacinth (*Eichhornia crassipes*), which now clogs waterways on most of the island, but others include *Piper aduncum*, *Sagittaria platyphylla* and *Mikania micracantha* (Whitten et al. 1996).

Lowland Rainforests in Java (and Bali) do not have one dominant species or one dominant family of plants, and the variability in species composition is such that no typical assemblage can be described. However, four dominant species are common. These are *Artocarpus elasticus*, *Dysoxylum caulostachyum*, Langsat (*Lansium domesticum*) and *Planchonia valida* (Kartawinata 1975).

The deciduous forests of Java and Bali occur where there are four or more dry months. These forests contain only a few of the species found in lowland forests; one of the few emergents is *Salmalia malabarica*. Deciduous forests may be found near Indramayu, Madura where fragments still exist; near Pagantenan and Baluran National Park, which mostly consists of this vegetation; and eastern and western Bali. Nothing is known of the fauna of these forests.

Virtually all forests on limestone have been lost on Java. But apparently no species of plant was restricted to these forests (van Steenis 1931).

Swamp forests have all but disappeared from Java and may never existed on Bali. It is estimated that they once covered an area of 72,000 ha, but that now only 7,700 ha remain (Whitten et al. 1996). They were generally formed in depressions of volcanoes or behind riverbanks. Little has been written on the fauna of these Javan swamps.

Mountain forests show similar vegetation to that described for Sumatra in this Report. However, the vast array of mountains in Java has provided a natural laboratory to study variation between mountain flora and vegetation. Van Steenis (1972), among others, found that the composition of plant communities can differ significantly between mountains or even neighboring ridges as a result of minor differences in aspect or age of soil. As with other islands, the demarcation between lower mountain and lowland forests is at about 1000 m altitude and is largely floristic. The lower boundary of the Upper Montane Forests in most of Southeast Asia is generally quite abrupt, but on Java there is a gradual change, probably because the volcanic soils are relatively nutrient rich (Whitmore 1984). Lower Montane Forests in Java are characterized by oaks (*Lithocarpus* and *Quercus*), chestnuts (*Castanopsis*) and numerous species of laurels (*Fagaceae* and *Lauraceae*) (Mukhtar and Pratiwi 1991). The Upper Montane Forest and Sub-alpine Forest have an assemblage of plants similar to that described for Sumatra.

Java's mammals, like its flora, are less rich in species than Borneo and Sumatra, but Java does have a high level of mammal endemicity. Its terrestrial mammal fauna consists of 137 species, including 18 rats and mice, and 68 bats (Sody 1989, Kitchener and Maryanto 1993). Sody (1933) was correct in stating that the Bali mammal fauna was an impoverished form of that on Java, although a further four species of bat have been added to Bali since then (Kitchener and Foley 1984 and Kitchener et al. 1993). A collection on Kangean Island in 1982 added an additional 10 species of bat to the fauna of that island (Bergmans and van Bree 1986).

The degree of endemism among Java's mammals is moderately high at 22 species or 16% of the total mammal species. Of the 18 species of native rodent, seven are endemic to Java. Java also has three endemic monkeys (Javan Lutung, *Semnopithecus auratus*; Javan Leaf Monkey, *Presbytis comata*; and Javan Gibbon, *Hylobates moloch*). The last two species are among the most endangered primates in Indonesia. The Javan leaf-eating monkey has only 4% of its original lowland forest habitat remaining; it occurs in a few forest patches in West Java and Mt. Slamet, Central Java (MacKinnon 1987, Supriatna et al. 1992). Two forests with potentially good habitat for gibbon are Mt. Wayang and Mt Kendang, but neither area is protected.

The most famous carnivores on Java and Bali were the tigers. These are now extinct on Bali and appear to be also extinct on Java, but reasonable numbers survive in Sumatra's large national parks. The leopard (*Panthera pardus*) is still quite widespread in Java, but their ranges are diminishing rapidly. The Wild Dog (*Cuon alpinus*) used to be widespread in Java but is now restricted to Ujung Kulon National Park and Alas Purwo National Park (Whitten et al. 1996). The endemic Javan Pig (*Sus verrucosus*) is confined to lowland forest below 800 m altitude; it is common in teak plantations (Zuhud 1983). The Javanese Rhinoceros (*Rhinoceros sondaicus*) is the largest animal in Java and is now reduced to about 50 individuals in the Ujung Kulon National Park; it is an extremely endangered species. The Bawean Deer (*Axis kuhli*) has a total population of 200-400 individuals and is one of the rarest deer in the world, restricted as it is to the small island of Bawean (Notowinarno 1988).

Javanese mammals show a marked mountain zonation. A number of rat species are confined to montane and sub-alpine zones, and the majority of these are endemic; only one of these mountaintop rodents, the ubiquitous Polynesian Rat (*Rattus exulans*) ventures below 1,500 m (data from Corbet and Hill 1992). While the larger carnivores traverse many mountain habitats, the gibbon and two species of leaf-eating monkey are rarely found above 1,250 m.

Java has 430 species of birds, of which about 340 are resident; the remainder migrate to breed elsewhere. Bali has only 320 species, with all but six of the Bali residents also resident in Java. The exceptions are the Bali Starling (*Leucopsar rothschildi*), Rainbow Lorikeet (*Trichoglossus haematodus*), Elegant Pitta (*Pitta elegans*) (restricted to Nusa Penida); Brown Honeyeater (*Lichmera indistincta*), and Black-faced Fruit Dove (*Ptilinopus cinctus*) (van Balen in Whitten et al. 1996). A total of 30 bird species are endemic to Java and Bali, with one restricted to Bali and 20 to Java. All but one of the 20 endemics on Java are found in West Java. Nineteen of the endemic species are relatively common and give no reason for concern. However, the Javan Lapwing (*Hoplopterus macropterus*) appears to be extinct, and the status of seven others is precarious (MacKinnon 1988). Most of the endemic species are now confined to Montane Forests. Hoogerwerf (1948) demonstrated that there were marked trends in bird assemblages along altitudinal gradients. Most species (420 species) were found in the lowest zone, between sea level and 800m; there was another major boundary at 1,300-1,600 m.

Birds of special interest include the following species: Javanese Hawk-eagle (*Spizaetus bartelsi*), which is one of the rarest birds in the world and possibly one of the most endangered. It occurs in lowland forests and numbers as few as 50 pairs (Meyburg et al. 1989). The Javan Scops-owl (*Otus angelinae*) has been observed only on a few occasions. The Javan Lapwing (*Chettusia*) appears to be extinct; almost nothing is known of its ecology. The Bali Starling has been confined since 1970 to West Bali National Park, where the entire population is only about 60 birds. It is likely to become extinct in the wild (Simmonds 1993). Large numbers of the Bali Starling are, however, bred in zoos around the world.

Most birds from Java and Bali can be purchased in bird markets that flourish in large towns and cities throughout these islands to meet the people's traditional desire to maintain captive birds. This trade, combined with habitat destruction mainly through forest conversion, endangers many species of birds. One of the major threats to birds is the widespread netting of migrant waders and resident birds along the coastlines of northern Java, especially from Indramayu to Ceribon. This netting is said to involve 56 species from 20 families, with just five species accounting for the majority of the catch (Milton 1984).

Java and Bali have 87 species of terrestrial and freshwater snakes, 42 lizards, eight freshwater turtles and 36 amphibians (Whitten and MacCarthy 1993). More reptiles and amphibians are found in West Java than in East Java, but some species found in the East are not found in the west. These include: Indochinese Sand Snake (*Psammophilis condanarus*), Russell's Viper (*Vipera russelli*) and Fruhstorfer's Mountain Snake (*Tetralepis fruhstorferi*). A total of six reptiles and 11 amphibians are endemic to Java. The reptile and amphibian fauna of Java is relatively poor when compared to that of Kalimantan.

All five marine turtles still nest sporadically along the Javanese south coast. Well-known sites are Cikepuh (Ujung Genteng), Meru Betiri and Ujung Kulon. But their numbers are said to be well below levels of former times (Whitten et al. 1996). Liem (1971) studied frogs and toads on Mt. Gede Pangrango National Park and observed two endemic species: *Leptophryne cruenata* (the only Javanese frog or toad found to occur above 2,250 m altitude) and the rare *Rhacophorus javanus*. Most forest and non-forest species were found in the slow moving streams and standing water, but there was a marked fall in species richness with increasing altitude, from 10 species below 1,350 m to five species between 1,800-2,000 m, to a single species above 2,250 m.

Caves are specific environments and have a unique assemblage of fauna in Java and Bali. There are about 1,000 caves in Java and Bali, of which appoximately 200 have been mapped (R.K.T. Ko in Whitten et al. 1996). The majority has been formed in limestone areas and most of these are in the area of Mt. Sewu, C. Java and in the smaller area around the Karangbolong hills to the west of Jogyakarta in C. Java. Caves are the essential habitat for a number of insect eating and fruit eating bats (Bent-winged Bat, *Miniopterus spp.*, Leaf-nosed bats, *Hipposideros* spp. and *Rhinolophus* spp., False Vampire Bat, *Megaderma spasma*, *Myotis* spp., and the Cave Fruit Bat, *Eonycteris* *spelaea*). A number of other bats roost in caves but are not obligate cave dwellers. These include the Wrinkle Lipped Bat, *Tadarida plicata*; troglodite species whip scorpions, *Stygophrynus dammermani*; crab, *Sesarmoides* sp; prawn, *Macrobranchium poeti*; and possibly a blind fish, *Puntius microps* (Whitten et al. 1996).

Coastal and Marine

The Java Sea to the north is quite shallow, less than 200 m, making it vulnerable to coastal pollution because there is no deep trench nearby to capture sediments and pollutants. The Java Trench, to the south of the island, is where the Indian Ocean reaches its greatest depth of 7,450 m. Generally, the northern coast is a shallow set of river deltas created by the rivers from the island's mountains, interspersed by coral reefs. The western and eastern ends of the coast have a mixture of corals and mangroves. The south coast is primarily drop offs with a few fringing reefs. In the 1980s there were more than 171,000 ha of mangroves on Java, but by 1998, less than 20,000 ha (27%) remained (BAPPENAS 2003). On the eastern half of Java, mangroves used to cover 1600 km of coastal lands; by the late 1990s, less than 800 km remain, much of which is degraded (Hinrichsen 1998).

The fringing reefs along the south coasts of Java develop only in certain areas such as Panaitan Island, Pangandaran, Pangumbahab and Parangtritis. The most extensive reef developments on Java occur along the coast of Grajagan. Watu Ulo to Blambangan Peninsula. Coral reefs in this area are subject to high-energy waves and are dominated by the reef-building, shallow corals of *Acropora.* By contrast, the northern coast of Java lacks fringing reef except in Banten Bay and Jepara Bay. Millions of tons of sediment are deposited along the north coast of Java every year (Suharsono 1998). Jakarta Bay alone receives the sediments from the runoff of 13 rivers, creating a flat coastal plain subject to frequent flooding and vulnerable to sea level rise. Coral reefs are well developed on the offshore islands in the Java Sea such as the islands of Karimunjawa, Bawean, Kangean and Kepulauan Seribu (Thousand Islands). The Thousand Island Archipelago (which actually number about 110 islands) are scattered in a vertical group north from Jakarta in the shallow Java Sea. Due to their proximity to Jakarta, many of these coral islands have been developed into resorts. Coral reefs on the offshore islands north of Java are patch reefs or fringing reefs, which slope gradually down to a depth of 15-20 m (Suharsono 1998). The waters off the western tip of Java within the confines of Ujung Kulon National Park contain the submerged remnants of Krakatau Volocano. The seascape is cracked volcanic rock around Krakatau with caves and tunnels around Ujung Kulon. This area is still re-developing its coral reefs on top of the volcanic floor, but is known to harbor large schools of fish and other fauna (Muller 1999).

Coral reef ecosystems adjacent to rapidly growing cities such as Jakarta have collapsed or have deteriorated drastically due to pollution (Suharsono 1998). In Jakarta Bay, researchers had to travel 25 km offshore to find viable coral reef communities. (Hinrichsen 1998). In Jepara, Central Java, one study showed that at Pulau Panjang, the coral cay islands are threatened by sewage, sediment and aquaculture (Edinger et al. 1999). Coral bleaching event in 1983 caused large-scale mortality of reefs in the Sunda straits and at Kepulauan Seribu (Suharsono 1998).

Freshwater and Water Basins

The hydrology of Java is better known than any other Indonesian island; this is because of the requirement of managing the irrigation of agricultural lands. As a result there are no free flowing or 'wild' major rivers remaining on Java. Java has 36 reservoirs and 13 lakes, while Bali has just one reservoir and four lakes (World Bank 1990).

Most of the 24 water catchments in Java are short (30-70 km), narrow, steep and with an area less than 250 km^2. Seven of the catchments exceed 3,000 km^2; the largest are Brantas (11,050 km^2) and Bengawan Solo (15,400 km^2). The Brantas River drains water from the slopes of Mt. Kawi Kelud- Butak, Mt Wilis and the northern slopes of Mt. Liman-Limas and close mountains. Mojokerto, now 30 km from the sea, was a major port at least from the 10th century to the end of the 14th century; it has been silted up and stranded inland by sediment from this catchment. About 85 years ago serious degradation of the Brantas was already being observed as a consequence of deforestation of the watershed (Altona 1913). An integrated land use plan for the Brantas watershed has been completed by Taylor and Soetarto (1993). Waters of the Solo River that flow from the Bengawan Solo catchment on the slopes of Mt. Merapi and Mt Lawu, Central Java, deposit about 11 million m^3 at its mouth and extends the lowland alluvial flats about 70 m a year; tidal influences can be detected about 100 km upstream.

Despite the adequate rainfall, the small water catchments and inappropriate vegetation cover have led to water shortages in recent years (Trihadiningrum 1991). Management of water resources is a growing problem in Java because of the competition for water by farmers to irrigate their land, domestic urban users and industry (Hadwinoto and Clarke 1990).

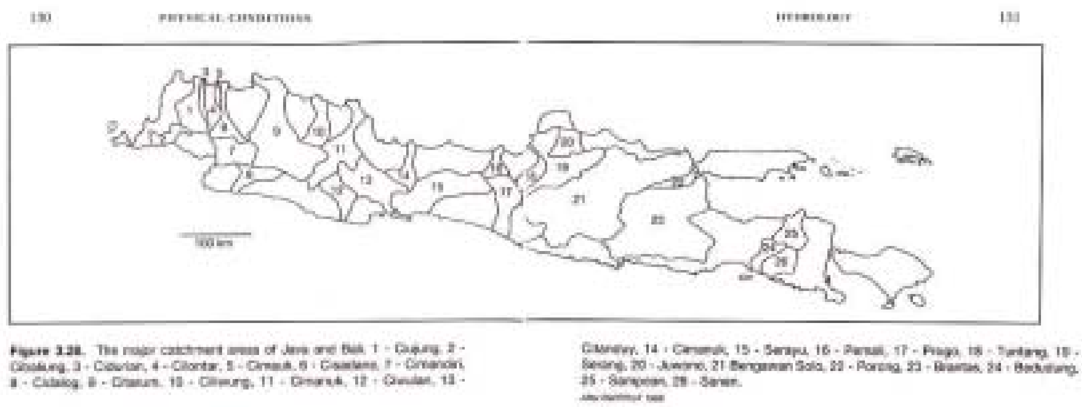


Fig. 3.5: The Major Catchment Area of Java and Bali
(Source: Whitten, et.al. Ecology of Java and Bali, 1996)

Java experiences some of the highest erosion rates in the world (Meijerink 1977). Studies in the upper Konto water catchment, East Java, showed that sediment originating from residential areas, dirt roads and footpaths are just as important to the overall basin sediment yield as dry land agricultural fields and bank erosion (Rijsdijk and Bruijnzeel 1991).

There are 132 species of freshwater fish known from Java and Bali; almost all known from Bali also occur in Java. Java has fewer fish species than are found in Sumatra or Borneo, but the density is the same as for Borneo and higher than for Sumatra. Surveys of Bali's rivers and lakes found that few indigenous fish survived. Apparently, Bali had an impoverished original fish fauna, and human activities have reduced it still further. Eleven of the Javan species and two of the Bali species are endemic (Whitten et al. 1996). The largest freshwater fish known from Java is the Giant Catfish (*Bagarius yarrelli*), which can grow to more than two meters long; it may, however, be extinct. The world's largest eel (*Thyrsoidea macrurus*) grows to 2.4 m and has been recorded from estuaries in West Java. The past connections between Java and other large paleo-rivers of Sundaland probably explain why northern flowing rivers on Java are richer in species of fish than the southern flowing rivers (Kottelat et al. 1993).

There are over 600 species of butterfly on Java and Bali, nearly 40% of which are endemic at subspecific level. The swallowtails and milkweed butterflies suggest that

Javan butterflies have their closet affinities with Sumatra and less so with Borneo (Whitten et al. 1996).

Biodiversity Centers

All the national parks in Java have been well selected and are the centers of diversity for some groups of animals and plants, with the possible exception of Pulau Seribu.

Sub-alpine and Montane Forests are significant for the conservation of biodiversity of Java, because they are among the most intact areas of forest remaining in Java. Further, they contain a number of endemic species and many lowland species that are able to also live in their lower montane zones.

Relatively extensive, but disturbed Mangrove Forest are confined to Alas Purwo National Park and on two small islands on the north coast, D. Dua and R. Rambut. These patches are undoubtedly centers for a complex mangal associated relictual community of animals and plants (see mangroves in Kalimantan, this report).

Rawa Pening is all that remains of a substantial lake before it became a peat swamp and then a reservoir. However, this swamp has been protected to a degree and has been much researched by a group working from Satya Wancana University, Salatiga. It retains a rich freshwater animal and plant community.

It is unusual to consider that disturbed gardens and mixed plantations should be regarded as centers of biodiversity. But in a dramatically changed landscape, such as occurs in Java, these places retain important relictual populations of a lowland biota that has all but disappeared from many areas. Further, vertebrate surveys on Java show that species richness is often highest at the disturbed edges of ‘natural’ forests than inside the forest (D. Kitchener pers. comm.).

Caves contain unique assemblages of vertebrates and are crucial habitats for a number of insectivorous and fruit eating bats, swiftlets, endemic whip scorpion and crickets.

Protected Area Coverage

Until the last five years, protected areas in Java were more closely protected than elsewhere in Indonesia, although all faced removal of forest resources that constituted a slow but steady rate of attrition. Each protected area has fixed boundaries, many of them marked in the field. In the last five years many of the largest protected areas, such as Baluran have been severely encroached by poor people and damaged by large scale removal of trees, bamboo, rattan, black leaf fibers of the wild sugar palm (*Arenga pinnata*) and non-forest products (World Bank 2001).

There are numerous protected areas in Java and Bali. They comprise 89 Nature Reserves (209,615 ha), eight Game Reserves (196, 064 ha), 32 Recreational Parks (6,086 ha), two Nature Marine Reserves (219, 625 ha) (RePPProT 1990), and nine National Parks: Ujung Kulon, Kepulauan Seribu, Gunung Halimun, Gunung Gede Pangerango, Karimunjawa, Bromo Tengger Semeru, Meru Betiri, Baluran, Alas Purwo (MFI/UNESCO/CIFOR 2003). Most of these National Parks are substantial areas and most have high conservation values. For example, Gunung Halimun (40,000 ha) embraces the largest area of Evergreen Forest in Java. Ujung Kulon is the largest remaining tropical rainforest in West Java and retains the remaining population of the Javanese Rhinoceros. Together with the island of Krakatau, this National Park has been declared a Natural World Heritage Site by UNESCO. Gunung Gede Pangrano (15,000 ha) represents mostly sub-alpine and montane communities. Karimunjawa is a chain of 27 islands that represents also Lowland Rainforest, sea grass, and algae fields, Coastal Forests and Mangrove Forests. Bromo Tengger (50, 276 ha) has sub-alpine and montane ecosystems. Meru Betiri (58,000 ha) has Mangrove Forest and Lowland Rainforest systems; it is most famous as a marine turtle rookery. Baluran (25,000 ha) represents expanses of dry lowland ecosystems, including Monsoon Forest. This park has been badly damaged by locals and its conservation value is largely surpassed by Alas Purwo to its south. Alas Purwo (43,420 ha) comprises moist deciduous forest. Some of its grazing grounds are a magnificent spectacle of the largest herd of Banteng (*Bos javanicus*) and Javanese Deer (*Cervus timorensis*) in Java.

Forestry

State forest land covers 3.1 million ha, about 24% of Java's total land area. Little of this, however, is still good quality natural forest, but rather is degraded, deforested, or converted to plantations or mixed agricultural uses. Of the "state forest area," about 20% is in protection forests, designated to preserve watershed and ecosystem functions, 14% is in protected areas (parks and nature preserves), and 65% is in production forests, mainly plantations. Java has over 2.1 million hectares of 'critical land' (land which has a level of degradation and reduced ecological function), which represents 9% of Indonesia's total and 16% of Java's area. This is well above the national average of 12%. Most of this critical land (82%) is outside the state forest area and the remaining 0.4 million ha is state forest land. The national land and forest rehabilitation program intends to address 0.2 million ha on Java. This represents 9% of the island's critical land and 6% of the area affected by the program.

Since 1961, Java has been unique among the islands of Indonesia in that the management of all forests outside nature reserves, game reserves, recreational forests and national parks is entrusted to Perhutani. Perhutani is a state owned enterprise with the joint aims of benefiting social welfare and making a profit to manage its own projects. Perhutani manages about 5,300 km² of protection forests (steep lands and mangroves, protected for their hydrological functions) as well as 19,000 km² of plantations. Perhutani land totals nearly 2.5 million ha or 19% of Java and is distributed more or less evenly throughout the major provinces. Recently tensions, sometimes violent, have emerged between forest communities and Perhutani. These tenisions have their roots in long standing disputes between these two groups over land tenure of forest land and ownership of trees. Although Perhutani has responded to these social and economic concerns of communities (Whitten et al. 1996), an increasing cycle of impoverishment of these communities sees a continuation of these conflicts, as villagers increasingly require trees and non-forest products to survive.

The extensive teak forests of Java almost certainly originated from trees bought from India by early Hindus. After the Dutch East India Company acquired large territories along the north coast of Java in the 18th century, all teak wood was owned by that Company. At the beginning of the 19th century, when the Dutch Government assumed control of these teak plantations, more sustainable logging of these forests occurred. Destruction of these plantations began under the Japanese occupation and has been accelerating in the last few years.

Home gardens (*kebun*) are an important aspect to vegetation and fauna of Java. They account for 17% of Java's agricultural land (Soemarwoto and Soemarwoto 1984). They are a mix of a wide range of fruit trees and coconuts that support a rich assemblage of lowland fauna. A typical home garden may have 50 species of plant, including 12 tree species and the total number of plant species in a small hamlet may be as high as 200 species, including 64 tree species (Penny and Ginting 1984). A two hectare area of garden and paddy field in Ungaran, Central Java, has at least four lizards, one rare freshwater turtle, 12 snake and 30 butterfly species (D. Kitchener pers. comm.)

Summary

Radical land use patterns over the last 150 years have left only small, scattered remnants of Java's natural ecosystems, especially in the lowlands. For this reason, the existing low lying national parks in Java are essentially 'habitat islands' embedded in an agricultural landscape. This makes the National Parks containing the biologically rich lowland forests (Ujung Kulon, Meru Betiri, Baluran and Alas Purwo) the top priority for conservation efforts in Java. Additionally, Meru Betiri is perhaps the most important marine turtle rookery in the entire Java and Nusa Tenggara region, which confirms further its position as a top priority for conservation. All these low-lying Parks are currently being degraded by human activities, including removal of non-forest products and trees for construction purposes. This damage is greatest in Baluran National Park, which recently has been severely encroached. Hunting of its wildlife has also increased dramatically. Both Baluran and Alas Purwo National Parks represent the drier lowlands. Both require support for the management of their biodiversity values. However, of these two parks, Alas Purwo National Park has the more intact ecosytems and Java's biodiversity would benefit more by focusing effort to manage the threats to Alas Purwo National Park, rather than Baluran National Park. Ujung Kulon National Park retains an impressive assemblage of Java's Lowland Rainforest fauna, including the flagship conservation species, the Javanese Rhinoceros.

Of the lowland National Parks in Java, Ujung Kulon is considered the most important National Park for support to conserve its biodiversity, followed in order by Meru Betiri, Alas Purwo and Baluran.

The Nusa Kambangan relictual lowland plant assemblage, including rare and endemic species of plants such as the Giant Voodoo Lily (*Amorphophallus decus-silvae*), urgently requires additional protection to prevent the destruction of its forests by local villagers.

Sub-alpine and Montane Forests are significant for the conservation of biodiversity of Java, because they are among the most intact areas of forest remaining in Java. Further, they contain a number of endemic species and many lowland species are able to also live in their lower montane zones. For this reason, Gunung Halimun, Gunung Gede Pangerango and Bromo Tengger Semeru National Parks are also of a high priority. However, all these Parks receive considerable management support from the Government of Indonesia, and the Gunung Gede-Pangerango is particularly well staffed relative to other parks in Java. While all the mountain parks are threated from human activities, these threats are not as severe as those experienced by the National Parks in the lowland areas. Consequently, the need for support to manage their biodiversity is less than is the case for the lowland parks.

The marine National Parks, Kepulauan Seribu and Karimunjawa, both suffer greatly from over fishing and damage to their reefs, particularly from physical damage caused by anchoring boats, pollution and general tourism. Of these two parks, Kepulauan Seribu National Park is much more threatened and degraded because of its proximity to Jakarta. It is in the direct path of huge off-shore water plumes that carry pollutants onto its reefs. Karimunjawa is much more protected and retains a fairly intact assemblage of small reef fishes. Karimunjawa is the priority choice for marine conservation effort in the waters around Java.

All extensive remaining patches of natural vegetation on Java, even if secondary, are of the highest conservation significance. Initiatives to conserve the remnant biodiversity of Java require exploration of new approaches to management, particularly outside protected areas. A wealth of biodiversity exists in village gardens, and their associated agricultural land, throughout Java. Strategies need to be explored to maintain and increase the variety of plants and animal in village gardens and plantations and to educate villagers of their vital role in conserving this important element of their biodiversity.

3.5 Sulawesi

Introduction

Sulawesi Island has an area of approximately 187,880 km² and a coastline of about 6,000 km. Sulawesi, while not having the richest terrestrial biodiversity of the Indonesian islands, does have the highest proportion of faunal endemics and contains one of the most fascinating and unique fauna found in Indonesia. It also harbors some of the greatest marine biodiversity in nearshore areas in Indonesia and in the world. It contains more endemic mammal species that any other island and is second only to Papua in the number of endemic birds and reptiles (BAPPENAS 2003) This terrestrial fauna includes the unique Babirusa ‘pig’(*Babyrousa babyrussa*), dwarf buffaloes (*Anoa depressicornis* and *A quarlesi*), Bear Cuscus (*Ailurops ursinus*) and a divergence of the tiny tarsier primates.

The reasons for the unique nature of biotic diversity in and around Sulawesi in part lies with the geological history of Sulawesi. The island’s unique shape results from the submarine collision between the Oriental and Gondwanic geological plates as a consequence of the continuous northern movement of the Gondwanic Plate millions of years ago. This collision forced the welding and buckling of the geologically disparate ‘arms’ of Sulawesi, with the major contact zone for this ‘welding’ process occurring in Central Sulawesi. This puts Central Sulawesi, and Lore Lindu National Park in particular, at the hub of the biodiversity integrity of Sulawesi. This is because it is in Central Sulawesi that the diverse habitat types and richly biodiverse mountains from two previous land masses connect from the north, south and south eastern regional provinces. Most of Sulawesi lies above 500 m in altitude; about 20% of the total land area is above an altitude of 1000 m. The highest mountains ranges are in Central and Northern Sulawesi. The fauna and flora of Sulawesi show a generally closer affinity with islands to the east. The Sulawesi bird fauna is exceptional in that 67% of the species have affinities with Sundaland (Mayr 1944). The mountain flora of Sulawesi is derived from autochonous speciation (endemics) and species that have migrated from other places in the world, mainly from cold climes (van Steenis 1972). Sulawesi butterflies and moths are most strongly associated with the Philippines (Hollaway 1987).

The modern distribution of plants and animals in Sulawesi does not appear to have been greatly impacted by volcanic eruptions such as those that have occurred at Tambora, Sumbawa or Lake Toba, Sumatra. Sulawesi has 11 active volcanoes (Whitten et al. 2002) and the most devastating eruption in Sulawesi in recent times was that of Colo volcano on Una-una Island in Tomini Bay.

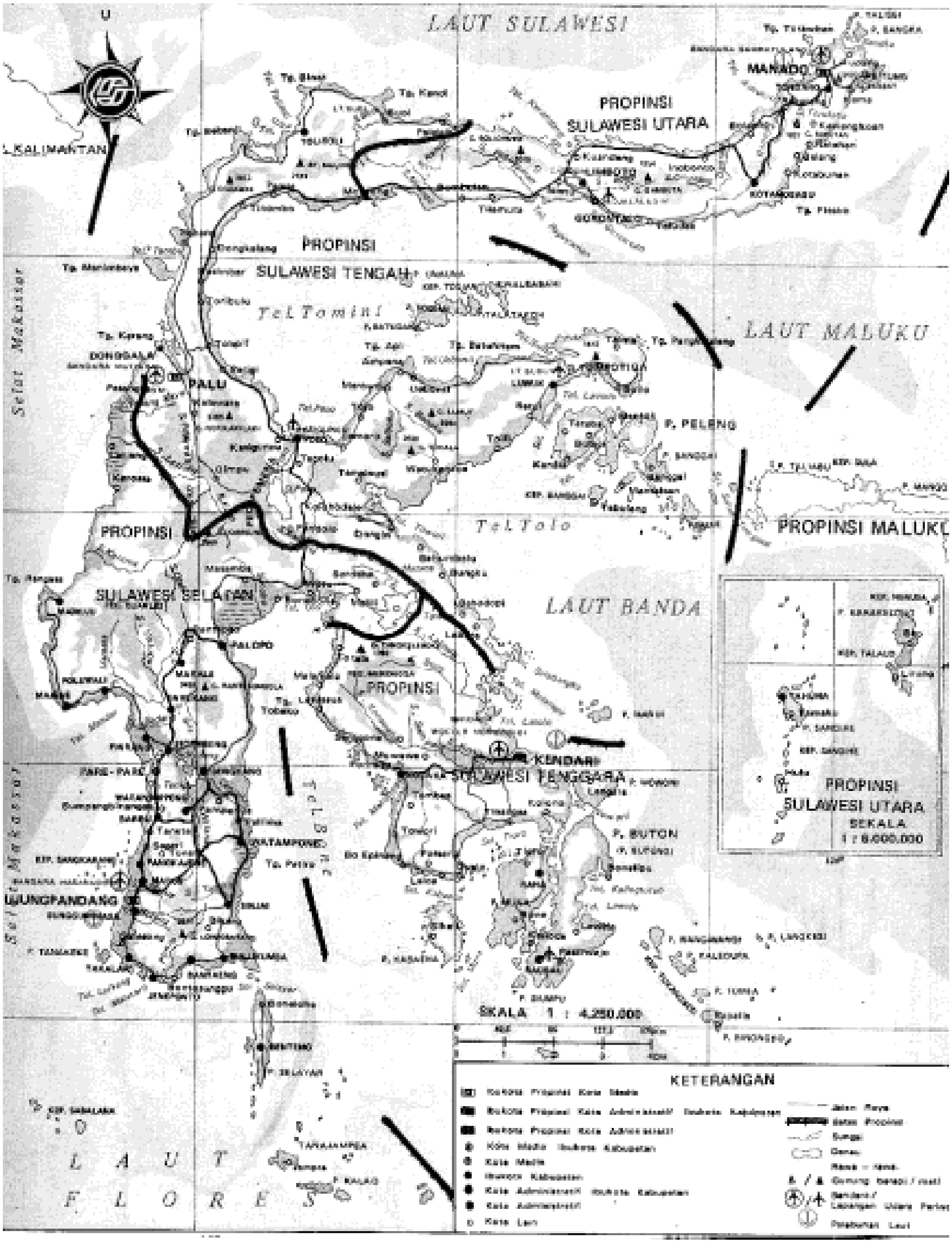


Fig. 3.6: Map of Sulawesi

Sulawesi has a relatively sparse human population but a diverse and complex ethnic mix. People began converting natural forests to other forms of vegetation in Sulawesi many hundreds of years ago but this process has only accelerated since 1970, when commercial logging, transmigration and estate crop projects began to receive enormous government support. Areas with high agricultural potential have clearly been utilized more than areas with lower potential. Thus, nearly all the wet lowland forest on volcanic soils has been felled, compared with only 10% of such forest on ultrabasic soils.

Terrestrial

Of the 128 indigenous mammal species, 79 or 62% of them are endemic to Sulawesi; that percentage rises to 98% if the bats are excluded. Rats and bats form a high proportion of the mammal fauna. New species of mammals continue to be found, as is the case throughout Indonesia (Hill 1983). A total of 17 genera of resident birds are endemic to Sulawesi and its surrounding islands. This includes a large number of spectacular species, such as the Dark Green Bee-eater (*Meropogon forsteni*), Brightly Colored Hornbill (*Rhyticeros cassidix*), Crowned Myna (*Basilornis celebensis*) and Finch-billed Starling (*Scissirostrum dubium*). Sulawesi's best known bird is the Maleo (*Macrocephalon maleo*), which incubates in pits built by the adult birds. Of the poorly surveyed amphibians of Sulawesi, 76% of the 25 indigenous species are endemic. A total of 13 of the 40 known lizard species on Sulawesi are endemic. The Sulawesi invertebrate fauna is generally poorly known. However, of the 38 species of large and striking swallow tailed butterflies, 29% are endemic (Whitten et al. 2002).

Whitten et al. (2002) guess that the number of higher plant species in Sulawesi may be relatively low, approximately 5,000 species. They have had to guess because the flora of the island is incompletely surveyed and poorly known. Only seven species are known to be endemic (E. de Vogel in Whitten et al. 2002). While Sulawesi has the usual coastal habitats found elsewhere in Indonesia, freshwater habitats are generally nutrient poor and so freshwater vegetation is impoverished. Lowland and hill forests have the most tree species of forest types in Sulawesi, but they have a reduced assemblage of dipterocarps (seven species).

Sulawesi has relatively small areas of both Peat Swamp Forests (at Rawa Aopa-Watumohai National Park) and Freshwater Swamp Forests. These peat swamps appear to have a rich assemblage of animals, particularly birds. The vegetation varies over the swamp from low *Casuarina* sp. trees to large 35 m tall trees and many *Livistona* palms scattered among pools covered with lotus lilies (*Nelumbo nucifersa*) and mat plants. Freshwater swamps are normally found in Sulawesi in riverine alluvium, but they also occur on the alluvium around Lake Poso and the south of the Ranu Lakes (Whitten et al. 2002). The vegetation in these swamps is variable and none of the areas studied have dominant species in common. Nothing is known of their mega fauna.

Sulawesi forests growing on ultrabasic rocks occur in eastern parts of Central Sulawesi, South Sulawesi and Southeast Sulawesi. They are the most extensive such forests in the world; they cover some 8,000 sq. km. These forests are little studied, particularly their fauna, but on the western shore of Lake Ranu in Morowali Reserve, the trees are shorter and more scrubby than in other lowland forests (L. Clayton in Whitten et al. (2002). Such forests around Soroako are dominated by Iron Wood (*Metrosideros* sp), *Agathis*, *Calophyllum*, various Burseraceae and Sapotaceae and at least two dipterocarps (*Vatica* and *Hopea celebica*) (van Balgooy and Tantra 1986).

Forest on karst limestone in Sulawesi are distributed throughout the provinces, but are least common in Central Sulawesi, where they are absent from much of the western region. They tend to have vegetation that is an impoverished assemblage of forests found on deeper soils. A species of grass (*Cymbopogon minutiflorus*) appears endemic to limestone in Sulawesi. These limestone forests have been exploited to some degree, particularly those around Maros. Apart from molluscs, which are shown to have species endemic to limestone elsewhere in Asia, no fauna is known to be restricted to these limestone substrates.

The mountain forests have vegetation that is zoned and characterized similarly to that described for Sumatra; much of its flora is not found in the lowlands. Whereas the lowland forests are not dominated by one group of trees, the lower Montane Forests are dominated by the oaks (*Lithocarpus* spp.) and chestnuts (*Castanopsis* spp.). The Upper Montane Forests are characterized by *Rhododendron* spp. (19 of the 24 Sulawesi species are endemic) Wintergreen (*Gaultheria*) and Bilberries (*Vacinium*) (13 of the 16 Sulawesi species are endemic). The sub-alpine zone is dominated by myrtles (*Leptospermum* and *Decaspermum*) (Whitten et. al.2002).

One of the most alarming discoveries of the 1990's is the extent to which hunting of wildlife, including the endemic Babirusa, Anoa and the Crested Black Macaque, for bush meat markets is destroying wildlife and pushing some endemics to extinction (Allard

2000). Breakdown of traditional methods of harvesting the eggs of the Maleo birds has also seen a dramatic reduction of populations of this species (Whitten et al. 2002). Many of the small islands associated with Sulawesi were deforested by 1920. The southwest peninsula of Sulawesi has lost much of its original vegetation because of human activities. Extensive grasslands of non-*Alang alang* grasses occur in the valleys to the east of Lore Lindu National Park (World Bank 2001). Consequently there is concern that a number of species on Sulawesi and its associated islands, particularly Talaud and Sangihe, are endangered. The IUCN include the following endangered species on the red list: Sulawesi Tarsier (*Tarsius spectrum*), Sulawesi Civet (*Macrogalidia musschenbroeckii*), Dugong (*Dugong dugon*), Babirusa, lowland Anoa, Mountain Anoa, Chinese Egret (*Egretta eulophotes*), Milky Stork (*Ibis cinereus*), Maleo, Estuarine Crocodile, LeatherbackTurtle, Hawksbill Turtle, Forten's Tortoise (*Indotestudo forsteni*) Talaud Black Birdwing Butterfly (*Triodes dohertyi*), Palu Swallowtail (*Atrophaneura palu*) and Tambusisi Wood Nymph (*Idea tanbusisiana*).

Whitten et al. (2002) consider that this IUCN list is almost certainly incomplete and that a number of other species are also extremely vulnerable, such as the Caeulean Paradise-flycatcher (*Eutrichomyias rowleyi*) on Sangihe Island, the Blue and Red Lory (*Eos histrio*) (Sangihe and Talaud), Sangihe Hanging- parrot (*Loriculus catamene*) and Elegant Sunbird (*Aethopyga duyvenbodei*) (Sangihe) and the Talaud Kingfisher (*Halcyon enigma*). The endemic fish in Lakes Poso, Lindu, Towuti, Matano, Wawanto and Mahalona include four Duck-billed Fish (*Adrianichthys kruyti, Xenopoecilus poptae* and *X. oophorous* (Poso) and *X.sarasinorum* (Lindu). Recent introductions of fish to Lake Lindu and commercial fishing in the Lake by migrant Bugis people have likely exterminated its endemic fish.

Coastal and Marine

Within Indonesia, Wallacea, which includes Sulawesi, has the most extensive reef development and the highest coral species diversity (Suharsono 1998).

Sulawesi has a coastline of approximately 6,000 km that incorporates many diverse types of ecosystems and habitats. Sulawesi is a globally important natural laboratory of evolution and species diversity. It is second in Indonesia only to Papua as a center of endemism (BAPPENAS 2003). Three of the six national marine parks (Bunaken, Wakatobi, Take Bonerate) are located in Sulawesi, each different from the others because of their geographical influences. Two of those sites have been recommended to become Natural World Heritage Marine Sites – Bunaken and Wakatobi (UNESCO 2003), with some discussion of Take Bonerate also being included.

There are 24 important wetland areas in Sulawesi including Mangrove Lantung and Tondano Lake, North Sulawesi. These wetland areas include 43 sites for nesting water fowl, more than 50 migrant species of birds (23 species of which are threatened). There are 67 endemic species of marine fish reported from the mangrove areas (BAPPENAS 2003).

There are 16 nationally recognized wetland or marine conservation areas in Sulawesi, totaling 2,800,000 ha of marine and 695,000 ha of wetlands (BAPPENAS 2003).

Mangrove Forests were once widespread along the coasts of Sulawesi but are rapidly disappearing. From an original area of approximately 270,000 ha in the 1980s, there are less than 85,000 ha (31%) of mangroves remaining, and only 6,300 ha are under protection. The mangroves in Sulawesi previously accounted for a mere 4% of the national total area of mangroves, reduced now to 2% (BAPPENAS 2003). These have largely been destroyed by the same human activities mentioned earlier in this Report. South Sulawesi had more remaining patches of mangrove than the other provinces in Sulawesi combined (Darsidi 1982, BAPPENAS 2003). There are 16 species of mangrove in all Sulawesi, and 15 species of mangrove in Kwandang Bay, North Sulawesi (two of which are rare: *Excoecaria agallocha, Camptostemon philippinense*) and one which is endemic (*Xylocarpus moluccensis*) (BAPPENAS 2003). The mangrove habitats of Sulawesi support a wide variety of rare and endangered species such as the Estuarine Crocodile (*Crocodylus porosis),* the Sulawesi Civet (*Macrogalidia musschenbroekii*), the Vegetarian Pig (*Sus celebenis*), two monkey species (*Macaca tonkeana* and*, Macaca ochreata),* an endemic snake (*Enhydris matannenis)* and heron (*Mycteria cinerea)*. There are also 34 migratory bird species including the White - belly Marine Hawk (*Haliaeetus leucogaster*), a white egret (*Ciconia episcopus*), and the Black-necked Mermaid (*Sterna sumatrana*). A new move toward conservation has been the establishment of community mangrove reserves in North Sulawesi and programs to shift from burning wood from the mangroves and using charcoal made from coconuts instead. These practices are being supported and expanded through government and donor work in the areas.
The marine biodiversity is extremely rich and results from a mixing of Indian Ocean and Pacific Ocean waters along the coasts and between the islands of Sulawesi. Table 3.5

compares three sites in Sulawesi (Bunaken National Marine Park, Sangihe-Talaud Islands, Wakatobi National Marine Park) with some of the most prominent sites for biodiversity in the Indo-Pacific region and in the world.

Table 3.5: Comparison of Coral Diversity and Various Other Ecological Characteristics of three Sulawesi Marine Sites and other Indo-West Pacific Coral Reef Areas. [3]

Attribute	BNP	S-T	W	RA	BI	KB	MB	GBR
No. locations surveyed	20	52	27	51	18	27	28	26
Total reef-building coral diversity	390	440	387	487	301	351	393	318
Ave. coral diversity / location (2 sites)	155	100	124	131	106	124	147	100
Proportion of locations hosting > 1/3 total (beta) diversity in region	85	8	41	18	61	74	82	
Ave. % Hard Coral cover	42	21	32	33	40	30	33	35
Approx. area (10^3 km^2) of region surveyed	0.9	23	10	30	0.4	1.1	15	0.8

A brief summary of the biodiversity of the three national marine parks (Bunaken, Taka Bonerate and Wakatobi) follows, and as these sites are priority areas for conservation and protective management.

Bunaken National Park, North Sulawesi, consists of six islands and a coastal section that includes part of the Tanjung Kelapa coast near Manado Bay. It is a classic small, integrated reef ecosystem, including mangroves, sea grass and coral in a wide variety of habitats (fringing reefs, lagoons, drop offs, pinnacles, etc.). Numerous studies recently have identified this area as extraordinarily high in marine biodiversity, close to matching and second only to the Raja Ampat area in Papua.

One of the most famous and rarest endangered marine species in the world is found in North Sulawesi. This is coelacanth fish (*Latimeria chalumnae*), a rare and ancient genus (370 million years old) that was re-discovered in the western Indian Ocean in 1938. Until 1997, it had not been found anywhere else in the world. However, in 1997-98, two living animals were discovered in North Sulawesi, and DNA studies indicate that these may

[3] **BNP** = Bunaken National Marine Park, North Sulawesi; **S-T** = Sangihe-Talaud Islands, North Sulawesi; **W** = Wakatobi National Marine Park, South East Sulawesi; **RA** = Raja Empat, Papua; **BI** = Banda Islands, Banda Sea, Maluku; **KB** = East Kimbe Bay, Bismark Sea, Papau New Guinea; **MB =** Milne Bay, Papua New Guinea; **GBR =** Northern Great Barrier Reef, Australia. Data from Turak 2002, Turak in prep., Turak and Fenner 2002, Turak and Shouhoko 2003, Turak and Aitsi 2003, Turak et al. 2003 and for GBR - Turak, unpublished data.

indeed be a new undescribed species of the genus *Latimeria* , which is one of only two fish genera on the CITES Appendix I, a list of the most rare and endangered species in the world (Erdmann and Moosa 1999).

Several rare and charismatic species are also found near the shore of North Sulawesi, including molluscs, turtles, dugongs, cetaceans and strange fishes. The endangered molluscan species include the Giant Clam (*Tridacna gigas*), the Horned Helmet (*Cassis cornuta*) and the Pearly-chambered Nautilus (*Nautilus pompillius*) (Ministry of Forestry et al. 2003). Turtles found here include the Leatherback (*Dermochelyes coriac*), Green Turtle (*Chelonia mydas*), and Hawksbill Turtle (*Eretmochelys imbricata*). The endangered marine mammal, the dugong (*Dugong dugon)* is found regularly in at least one village within the Park. There are numerous cetaceans that transit through or spend parts of their lives in the marine waters within and near Bunaken National Marine Park. These include the following marine mammals that are all listed on the IUCN Red List (similar to the CITES Appendix I or II): the Sperm Whale (*Physeter macrocephalus*) with reports in 2003 of divers swimming with three individuals in Manado Bay; the Pygmy Sperm Whale (*Kogia breviceps*); the Pygmy Killer Whale (*Feresa attenuate*) and the Killer Whale (*Orcinus orca*) (Reeves et al. 2003). In addition, a variety of rare and beautiful sea horses (*Hippocampus* spp.), including sea dragons and pygmy sea horses, have also been found. All sea horse species have been put on the CITES lists due to their over harvesting and consequent rarity. Ecotourism has placed some of the endangered fauna in this Park at greater risk. This prompted the local private sector and government agencies in North Sulawesi to conduct a survey in 2003 to evaluate the number of tourists that the Park can carry. This was carried out as a basis for developing management tools to limit the impact of tourism on the Park.

Two of the world's leading coral reef biodiversity specialists, Drs. Lyndon DeVantier and Emre Turak, who compiled the marine biodiversity lists for Sangihe-Talaud, Raja Ampat and the Northern Great Barrier Reef, completed a survey in North Sulawesi in December 2003, primarily in Bunaken Marine Park waters. Bunaken's coral condition exceeded that of the other "pristine" areas like Raja Ampat and the Northern Great Barrier Reef, with an average live coral cover of 42%. This good condition was attributed by the authors to the management of the Park in the last few years. There were 390 species of hard coral representing 63 genera and 15 families recorded. This is an extremely high number for such a small area. If the extraordinary coastal habitats of Lembeh Straits and Likupang were included, the scientists predict that North Sulawesi's species richness might exceed that of Raja Ampat, which has an area 20 to 30 times as large. High diversity was also frequently recorded within a single site. This included a world record of 221 coral species in a single location near Mantehage Island. At least 20 species of rare and restricted-distribution corals were found in Bunaken. In addition, and importantly, 85% of the sites here included more than 30% of the full species list found in the Indo-Pacific region. This indicates that North Sulawesi is a reservoir of global marine biodiversity, like a "bank," should there be a need to replenish other reefs in the Indo-Pacific after a disaster.

Bunaken Marine Park is being proposed as a Natural World Heritage Marine Site along with four or five other marine sites (Raja Ampat, Wakatobi, Derawan Islands, Banda and Flores Islands and Taka Bonerate) as a "cluster" site to conserve the distinctly representative marine habitats in Indonesia. The area being proposed for the North Sulawesi "cluster" site incorporates Bunaken National Park, Manado Bay, north coast of Likupang, Talise Islands, Bangka and Gangga, as well as Lembeh Straits. This suggests that the key watershed for protection and the target areas for pollution control are the Tondano, and the Lembehan Strait-Likupan catchment areas (PWS), and the cities of Manado and Bitung, but this needs confirmation. (See Fig.3.4)

The Taka Bonerate National Marine Park, South Sulawesi, is an atoll of 220,000 ha that is surrounded by more than 500 km2 of corals. This atoll is the largest in Indonesia and the third largest in the world. The topography of this Park is unique, consisting of a chain of 21 islands of dry coral and a large flat sunken reef. There are 95 species of coral fish and several species of fish of high economic value such as the grouper (*Epinephelus* spp), skip jack (*Katsuwonus* spp.) and Napoleon Wrasse (*Cheilinus undulates*), all three of which are valued both as food and as attractions for tourists (Ministry of Forestry et al. 2003, BAPPENAS 2003). There are 244 species of molluscs found here, including the rare Triton Trumpet (*Charonia tritonis*), the Fluted Giant Clam (*Tridacna squamosa*) and the Pearly-chambered Nautilus (*Nautilus popillius*). The Hawksbill (*Eretmochelys imbricata*), the Pacific Ridley (*Lepidochelys olivacea*), and the Green Turtle (*Chelonia mydas*), which are on the CITES lists, nest there as well (Ministry of Forestry et al. 2003). Wakatobi National Marine Park, Southeast Sulawesi, lies in a remote area of small islands with sheer reef wall drop offs in many places. The Park has 25 chains of coral reefs with a total coast line of 600 km. Hundreds of coral species have been identified, including approximately one hundred species of ornamental reef fish. These include the Napoleon Wrasse, the Peacock Grouper (*Cephalopholus argus)*, and Titan Triggerfish (*Balistoides viridescens)*. Sea birds abound, such as the Brown Booby (*Sula leucigaster* *plotus*) and Hawksbill, Loggerhead and Pacific Ridley turtles are frequently found. This area is not threatened by pollution or input from major rivers or cities since it is a five hour boat ride from Kendari, the nearest major city, although it still suffers from some local coral reef degradation due to overexploitation and destructive practices.

Freshwater

Sulawesi is particularly well endowed with lakes; it has 13 lakes that have an area greater than five km^2. It has the second and third largest lakes in Indonesia (Towutu and Poso). Most significant lakes have been surveyed in the last decade. These lakes are extremely diverse, ranging from the extremely shallow Lake Tempe (<1m deep in the dry season) to the beautiful Lake Matano, which at 590 m, is the deepest lake in South East Asia. These lakes occur at all altitudes and are found in each of the provinces. Most are formed by tectonic activity, but Lakes Tondano and Moat were formed by volcanic activity and Limbota and Tempe are flooded lakes. Aopa Swamp is the only large water body that is a swamp. Freshwater molluscs are among the better known of the macro invertebrates from the Sulawesi lakes. A total of 45 species of molluscs are known from Sulawesi lakes; 17 of these are from Lake Poso. Most molluscs are endemic species. Lake Poso has the most distinctive molluscs, including two endemic genera, both of which may now be extinct (Whitten et al 2002).

Little is known of the river systems, although the size and shape of Sulawesi precludes the development of long rivers, such as those found in Sumatra and Kalimantan; the longest is about 200 km. Most rivers are typically meandering channels, but the Palu River, several in Morowali and the Jeneberang River, for example, are braided (Metzner 1981). Many Sulawesi rivers arise in mountainous catchment areas but others arise in lakes, limestone caves and swamps.

Water birds are far more common than they are in the Sunda islands, probably because they are closer to the migratory pathways. Most species found on the lakes may also be found along the coast. The exception is the Australian Pelican (*Pelecanus conspicillatus*), which is more common on the lakes. At certain times of the year, Lake Tempe is a major lake for water birds (Uttley 1986).

Biodiversity Centers

The terrestrial biota of Sulawesi is unevenly distributed over the island. It tends to form groupings or biounits that relate in large part to the geological history of the island. Of the Sulwesi peninsulas, only the southwest Peninsula has flora that has its strongest affinities outside Sulawesi – and that is with Sundaland (van Steenis 1972). This may be due to some possible, but unconfirmed, land connection through the Nusa Tenggara islands of Flores or Sumbawa (Whitten et al. 2002). The allopatric distribution of closely related congenerics such as the Sulawesi Macaque, carpenter bees (*Xylocopa* spp.), Pond Skater/Water strider (*Ptilonera*) and white - eye birds (*Zosterops* spp.), support the view that the Sulawesi biounits are: the North Peninsula, Central Area, including Banggai Islands, Southeast Peninsula and the South Peninsula. Among the endemic birds, some species are known only from a specific peninsula. Half of the endemic species are known from all regions of Sulawesi and half have partially restricted distributions.

Whitten et al. (2002) draw attention to the uniqueness of the Malili Lake system in the southeast biounit. The entire system is connected by rivers and contains three large lakes (Matano, Mahalona and Towuti), and two smaller lakes (Masapi and Wawantoa). Of the 100 or so species of copepod, mollusc, prawn and fish endemic to Sulawesi found in this system, only a prawn and a goby fish are shared by all five lakes. This leads to speculation that the system is both an important repository of species and information about the origins of the Sulawesi freshwater fauna (Whitten et al. (2002).

The islands of Sangihe and Talaud are centers for endemic birds and butterflies. This island group also contains sites for endemic fishes and coral species and coral morpho-types due to the islands' remoteness from other areas and the predominant oceanographic currents. They are one of the regions with the highest biodiversity relative to their area in Sulawesi and Indonesia.

The area in general from the southern boundary of Bunaken National Marine Park near Manado Bay along the northern coast of Sulawesi, and down the eastern coast to the southern tip of Lembeh Island is considered to be one of the two or three most diverse sites in the world for marine biota.

Bunaken National Park, is a classic small, integrated reef ecosystem, including mangroves, sea grass and coral in a wide variety of habitats (fringing reefs, lagoons, drop offs, pinnacles, etc.). It has an extraordinarily high level of marine biodiversity, close to matching and second only to the Raja Ampat area in Papua.

Taka Bonerate National Marine Park, South Sulawesi, is the largest atoll in Indonesia. It is surrounded by more than 500 km² of corals and has a diverse reef fish community.

Wakatobi National Marine Park, Southeast Sulawesi, has superb and representative coral reefs. It has approximately one hundred species of ornamental reef fish, many sea birds and Hawksbill, Loggerhead and Pacific Ridley Turtles.

Protected Area Coverage

Sulawesi has a diverse system of protected areas, including six national parks (Lore Lindu -- a World Heritage Site and UNESCO Biosphere Reserve, established to protect landscape wildlife values and social customs in the adjoining communities; Nani Warta Bone; Bunaken-Manado Tua Marine National Park; Taka Bone Rate; Rawa Aopa-Watumohai and Wakatobi) (Ministry of Forestry/UNESCO/CIFOR 2003). Sulawesi also has 19 nature reserves and an assortment of tourism parks and wildlife refuges (World Bank 2001). These areas cover most major habitats and at face value represent most of the key elements of the island's biodiversity.

The south peninsula of Sulawesi has 26 conservation areas, but none that are of a substantial size and capture the full dimension of a landscape. There are also no national parks in this biounit, despite the fact that, at least for some vertebrate groups, it is the most biologically divergent of the biounits. It is also a region where land conversion is most marked such that little land remains for selecting additional conservation reserves to represent the region.

The northern Peninsula biounit is the best protected, at least on paper. It has Bogani Nani Wartabone National Park (300,000 ha), which represents a range of habitats from 50 m to 2,000 m in altitude. It has a rich assemblage of vertebrates and most of the charismatic species for Sulawesi mentioned above. Tangkoko-Duasudara Nature Reserve (8,867 ha) on the northeast tip of the northern peninsula in the Kabupaten of Minahasa is one of the most important conservation sites in North Sulawesi. It contains the highest population densities of several of Sulawesi's endemic species including the Crested Black Macaque, Spectral Tarsier, and Red-knobbed hornbill. The reserve contains three volcanoes: the

1,109 m Gn. Tangkoko (formerly known as Gn. Batuangas) and the parasitic ash cone of Batuangasis. This topography provides for many habitats, including *Alang alang* grassland, secondary scrub, Casuarina Forest, Beach Forest, Lowland Rainforest, Montane Rainforest, and Cloud Forest. The Reserve suffers many threats, including logging, fires, agricultural encroachment, harvesting of Livistonia palms and other non-forest products (Lee at al. 2000).

Central Sulawesi has Lore Lindu National Park (217,991 ha), which ranges in altitude from 500 to 2,600 m. It is a landscape scale Park that has Sub-alpine Forest through to Lowland Rainforests that support 117 mammal, 88 bird, 29 reptile and 19 amphibian species. It was declared by UNESCO in 1977 as a Biosphere Reserve. Although the central Luwuk peninsula and Banggai and Togian Islands appear to be lumped with the rest of the central region as a biounit, few biological surveys have been carried out there. Further, there remain extensive forested areas and opportunities to gain additional representation of the Luwuk Peninsula and Banggai islands and to coalesce existing proposed conservation areas (Whitten et al. 2002:104) into larger more landscape scale representative protected areas.

The Southeast biounit, including Buton Island, has 17 protected areas or proposed protected areas (Whitten et al. 2002), including Rawa Aopa Watmohai National Park (105,194 ha). This Park ranges from the coast to an altitude of 981 m and has lower Montane Rainforest, Lowland Rainforest, Mangrove Forest, Coastal Savanna and Freshwater Swamp Forests. It has a remarkable variety of plants including at least 257 genera and 323 species as well as a wide variety of vertebrate species, including 155 species of bird (MoF/UNESCO/CIFOR 2003).

None of these protected areas are safe from encroachment, conversion or illegal logging, which is often tacitly accepted by conservation authorities and local governments, who remain unconvinced of the economic and social value of these parks. Mining, both legal and illegal, continues unabated in protected areas; it has been particularly damaging in Bogani Nani Wartabone National Park. Currently some 4,000 illegal gold miners work the slopes of the Park. An additional 5,000 gold miners work illegally a foreign owned lease near Manado, impacting the waters surrounding Bunaken Marine National Park (Sydney Morning Herald 2000). In Lore Lindu National Park, the Park authorities recently allowed local migrants to encroach park land and turned over 2000 ha to these migrants, rather than defend the Park (Indonesian Observer 2000).

Forestry

Much lower deforestation rates occur in Sulawesi than elsewhere in Indonesia, mainly because the Sulawesi lowland forests were cleared by the mid 1980s. Sulawesi is mainly a mountainous island with lowlands only occupying about 25% of the total area. By 1985, only a quarter of these lowlands still carried forest, with rapid clearing occurring in the transmigration areas. Further, Sulawesi has an impoverished assemblage of dipterocarp trees, which are the mainstay of forestry practices in the Sunda islands. For example its seven species of dipterocarp can be compared to 267 and 106 species found in Borneo and Sumatra, respectively (Ashton 1982). The main commercial timber trees in Sulawesi are the tall *Agathis,* the legume *Podocarpus indicus,* the gum tree *Eucalyptus deglupta*, Beremba (*Duabanga mollucana*) and Gutta Perca (*Palaquium spp*.). Sandalwood (*Santalum album*) is almost extinct in Sulawesi. Holmes (2000) further stated that lowland forests are now essentially defunct as a viable resource in Sulawesi. Although, Sulawesi's remarkable biodiversity and endemism are mainly found in the upland forests this should not preclude efforts to save the remaining lowland fauna and flora, particularly that in the coastal areas. Mangrove Forests along these coasts have been particularly hard hit by conversion. Between the mid 1980s and 1993, they decreased by 64% (84,833 ha to 152,567 ha).

Despite the relative low rates of deforestation in Sulawesi compared to that found on the Sunda islands, Holmes (2000) showed that between 1985 and 1997 Sulawesi lost 20% of its natural forest cover. This figure does not account for forest quality, or the fact that land classified as forests may contain logged or burned forest areas of reduced value for biodiversity conservation. While factors involved in deforestation are those reported earlier in this Report, an increasing threat are local migrants. Possibly as many as 200,000 people are moving into forested areas from urban areas of Sulawesi and from other islands. These migrants have converted vast amounts of forest to the high-value cash crops, coffee and cocoa (Whitten et al. 2002).

Summary

Sulawesi is the most spectacular center of endemicity for plants and animals in Indonesia. Its high mountainous terrain has protected much of its fauna and flora, although almost nothing remains of its lowland forests. It has the most extensive system of lakes in Indonesia as well as the largest forests on ultrabasic substrates in the world. It is one of the foremost two or three places globally as a center for marine biodiversity. While Sulawesi has on paper extensive protected areas, some additions are required, and planning is needed to integrate these protected areas into a system that conserves representative landscapes and their functions.

The terrestrial priority on Sulawesi should be to connect the existing protected areas with protected forests (*Hutan Lindung*) to form a more integrated system of protected areas, particularly to link protected areas in both the southern and southwestern arms of the island to those in North Sulawesi Province through the "hub' protected area in Central Sulawesi -- Lore Lindu National Park. Conservation of biological values in Lore Lindu National Park, which is a landscape scale park, through community participation in park management, is the top terrestrial priority. Other terrestrial protected areas in Sulawesi are extremely important for conserving important plants and animals, but none other is as geographically important or has the same variety of topography and diversity of habitats. There is urgency in all Sulawesi terrestrial protected areas to avert and ameliorate threats to these parks caused by encroachment, hunting and illegal logging. Lore Lindu National Park is facing all these threats and there is a steady attrition of its biological values and the value of its ecosystem services to the large community in Palu and its surrounds.

Conservation of the biota of Sangihe and Talaud islands is also a high priority. These islands have a unique endemic community of animals and plants.

Freshwater lakes have been severely degraded and their biota despoiled in Sulawesi. The Malali Lake system may be one of the few remaining Sulawesi freshwater systems that can be conserved. There is a priority to survey this system and evaluate its biological importance.

South Sulawesi is poorly served by protected areas, despite the fact that its biota is amongst the most degraded and threatened in Sulawesi. An initial study to determine priorities for biodiversity action in the Maros-Pangkajene area in South Sulawesi (Allard et al. 2000) should be progressed as a priority.

Bunaken National Park and Taka Bonerate National Marine Park both are nationally and globally important centers of marine diversity that are heavily impacted by a range of threats. They are the top priority areas for conservation activities. Wakatobi is also an immensely important center for marine biodiversity, but it is not threatened and requiring intensive management as are Bunaken and Taka Bonerate.

3.6 Papua

Introduction

The island of New Guinea is the second largest island in the World. The Indonesian province of Papua (Irian Jaya) comprises an area of greater than 416,000 km² and covers the western half of the island of New Guinea. It is perhaps the biologically richest and most diverse assemblage of ecosystems in the Tropical Pacific region. Papua contains almost half of Indonesia's total biodiversity; it contains a significant portion of the world's remaining tropical forests as well as some of the most pristine coral reefs in the world. It has a unique array of plant and animal species, including Bird of Paradise, bird wing butterflies, tree kangaroos, cuscus, orchids, Auricaria trees and rhododendrons. Papua owes this rich biodiversity to a combination of factors. The first factor is its wide altitudinal range, from sea levels to the highest mountains in the Asia pacific region. Second, Indonesia straddles two major Biogeographic Regions (Oriental and the Australasian) and is the only country to do so. This provides for a mixing of different faunas on Papua. Third, it has an enormous array of habitat types, ranging from alpine vegetation on the highest mountains, surrounding alpine valleys, a variety of Montane Forests in the many rugged ranges throughout Papua, a diverse mix of lowland forests, swamps, Coastal Savannas and mangroves. Fourth, much of the landscape has remained untouched by development until recent times, making it one of the last remaining tropical wilderness areas in the World (Conservation International 1999).

The Biodiversity Action Plan for Indonesia (1993), prepared by the National Development Planning Agency (BAPPENAS), reported that over 90% of forest cover of Papua remains intact. Conservation International (1999) stated that figure had fallen to 75%-80%. Clearly, threats to Papua's biodiversity are mounting rapidly. The major threats to Papuan ecosystems are from large-scale infrastructure projects, such as dams, roads, large- and small-scale mining, and oil and gas development. An example of the affect of roads is reported by the World Bank (2001), which stated that a new road constructed from Wamema in the Baliem Valley up to Danau (Lake) Habbema in the alpine zone and beyond through protection forests has opened these areas to illegal logging. This road has led to the systematic removal in January 1995 of low quality timbers that make up the Montane Forests on steep and erodible terrain at 3000 m altitude.

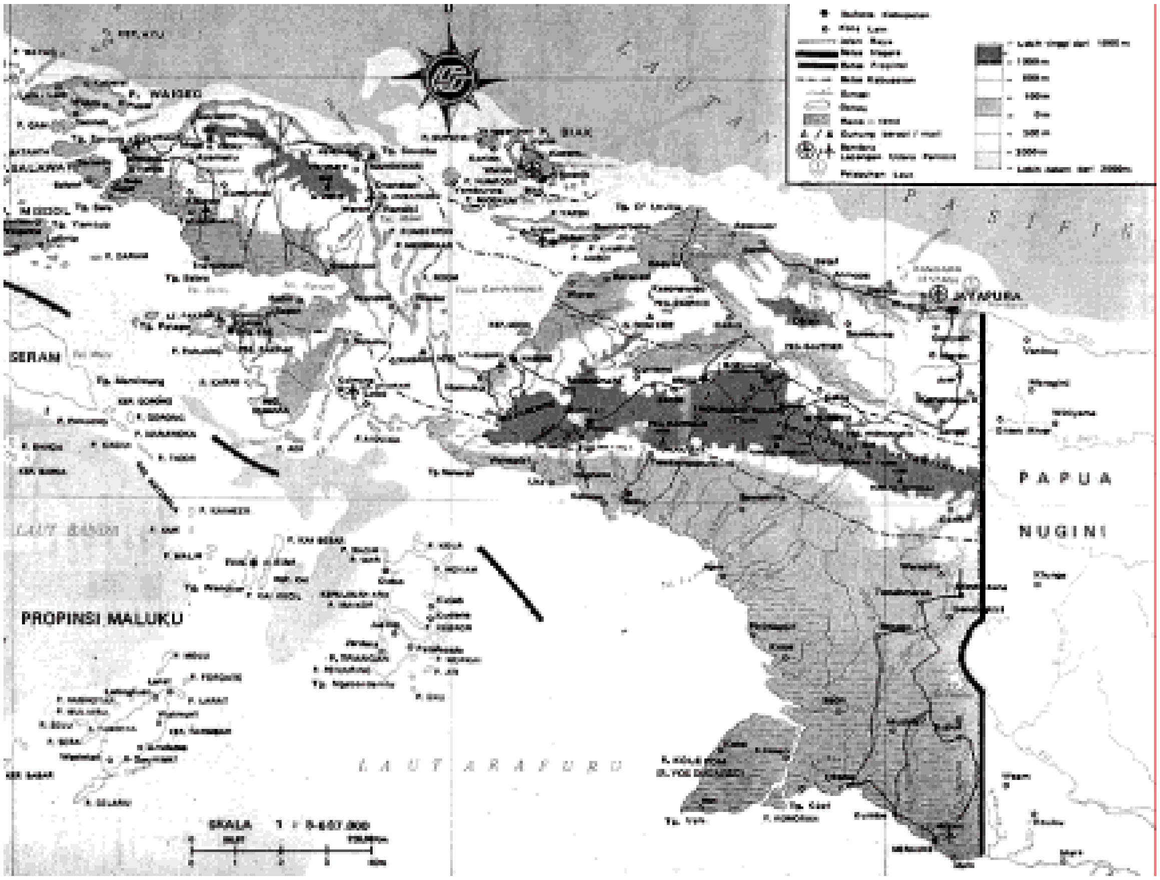


Fig. 3.7: Map of Papua

Other threats are forest conversion for transmigration and plantation, agriculture logging and the introduction of exotic species. Marine ecosystems are threatened like those elsewhere in Indonesia. There is an increasing awareness in Papua of the dangers of introduced animals and plants. Wasur National Park, for example, has a number of introduced plants that clog up waterways and replace riparian vegetation. The establishment of several populations of Macaque Monkeys (*Macaque fascicularis*) is a threat to Papuan birds and other fruit eating animals. Introduction of the toads *Bufo melanostictus and B. marinus* may well be disastrous for small mammals and amphibians. The introduced fish, the Striped Snakehead (*Channa striata*) and Climbing Perch (*Anabas testudineus*), are well established and compete with and predate on native fish.

The cultural integrity of many forest dwelling people in Papua (e.g., Asmat, Korowai, Dani, Bauzi) is closely linked to the biodiversity of their surrounds. Their traditional methods of utilizing forests and savanna may be closely related to the high biodiversity values of their forests and need to be intimately understood and incorporated into conservation management plans. The rise of large-scale development in Papua threatens the indigenous communities that comprise 250 ethnic groups and threatens activities to conserve the Papuan biodiversity.

An important factor in retarding the development of rational conservation strategies and practice is the general paucity of information available in Papua. Such information lacks sadly behind the availability of information on the biota in other major Indonesian islands and in Papua New Guinea (Richards and Suryadi, Eds 2002).

Terrestrial

There are few vegetation studies that have been carried out in Papua, but studies from neighboring Papua New Guinea show that undisturbed Humid Rainforests in Papua are likely to be more diverse than many tropical forests in South America, Africa or South East Asia. The Biodiversity Action Plan for Indonesia (1993) considered Papua to have the highest species richness and endemism in Indonesia for birds and plants, as well as a high ranking for mammals and reptiles.

It has been estimated that Papua may have as many as 20,000 to 25,000 vascular plant species. However, they state that the plants of Papua are extremely poorly known; only 180,000 specimens have been collected there -- most collections are restricted to a few small areas in the Vogelkop, Cyclops Mts, Mt. Jaya, Timika region and Mt Trikora-Lake Habbema. An astonishing 60-90% of the plants may be endemic to Papua. Lowland forests in particular, need greater protection. As is the case elsewhere, these are the most accessible forests for exploitation and they also have the highest species richness of plants (Conservation International 1999).

A recent survey by Conservation International (1999) lists 164 mammal, 330 reptile and amphibian, 650 birds, about 250 freshwater and 1200 marine fish and an estimated 150,000 insect species. These numbers are much higher than reported in the Biodiversity Action Plan for Indonesia (1993). Numbers of most of these animal groups are likely to be underestimated; amphibian and lizards combined, for example, may be as high as 500.

The mammal fauna of Papua, at 164 species, is poorly known and has much fewer species than Papua New Guinea (227 species). Apart from the survey by Kitchener et al. (1997) at Gag Island, Kitchener et al (1998) in the P.T. Freeport Contract of Work area, and Singadan and Patiselanno (2002) in the Mamberamo River Basin, there has been extremely little mammal survey work carried out in Papua, particularly that which attempts to compare species diversity with habitats or altitudinal gradients (Boeadi and Widodo 2000). In the Freeport Contract of Work area, Papua, there was no trend for small ground mammals species richness or mammal species diversity to change from sea level to almost 4000 m altitude, such as is commonly found in Nusa Tenggara and Sumatra (Kitchener and Yani 1997, Kitchener et al. 2000). However, the various lowland forest types had different mammal assemblages, and there were indications of recognizable mammal groupings below an altitude of 1,000 m, between 1,000 m and 1,600 m, and above 2,100 m. The richest known mammal area in Papua is the Lorentz National Park where 90-100 species have been recorded (Conservation International 1999), which is also among the highest species richness in the Australo-Pacific region.

The bird fauna of Papua is dominated by forest species, many of which are widespread lowland species (Beehler et al. 1986). Although the lowlands are among the most accessible habitats in Papua, their avifauna remains poorly documented. However, Conservation International (1999) reports that tropical lowland forests in Papua support almost 200 different breeding bird species. Endemic birds species richness is highest in the Vogelkop, followed in order by Raja Ampat islands, and the Biak/ Numfor islands; many of these endemics are rare. Endangered species numbers have risen sharply recently. Several years ago they included the Waigeo Brush-Turkey (*Aepypodius bruijnii*), Biak Pied Monarch (*Monarcha brehmii*), Brass Friarbird (*Philemon brassi*), Golden Fronted Bowerbird (*Amblyornis flavifrons*), and Salvadori's Fig-parrot (*Psittaculirostris salvadorii*). Conservation International (1999) listed a further 18 threatened bird species in Papua, including the New Guinea Harpy Eagle (*Harpyopsis novaeguineae*) and the MacGregor's Bird of Paradise (*Macgregoria pulchra*). Another 30 species were identified as near threatened. The recent Indonesian lists for endangered birds (Noerdjito and Maryanto 2001) greatly increases the endangered Papuan bird species, including a number of raptors and all the species of the Bird of Paradise. In addition to resident birds, Papua lies in the path of international migrants. Consequently, southwestern Papua, including Wasur National Park, is a globally significant staging ground for waterbirds and waders, both from the arctic and from Australia.

Papua's most fragile ecosystem for birds and mammals is probably the sub-alpine plateau region. It is important for montane endemics, such as the birds Orange-cheeked Honeyeater (*Lichenostomus chrysogenys*), Snow Mountain Quail (*Anurophasis* *monorthonyx*) and the Snow Robin (*Petroica archboldii*) (Conservation International 1999), and the rodents Arianus's Rat (*Stenomys omlichodes*), Glacier Rat (*Stenomys richardsoni*), Alpine Wooley-rat (*Mallomys gunung*) and Subalpine Woolly-rat (*Mallomys istapantap*) (Kitchener et al. 1998).

Anurans (frogs and toads) are the only amphibians found in Papua. Four native frog families are represented: the Hylidae (39 species, 2 genera) and Myobatrachae (5 species, 3 genera), which are of Gondwanic origin, The Ranide (13 species, 3 genera) and Microhylidae (39 species, 12 genera), which are of South East Asian origin. They are also the dominant groups in Australia. The microhylidae have undergone an extensive radiation in New Guinea and Papua. Introduced species are the toads *Bufo melanostictus and B. marinus*, although it is not certain if the latter species has in fact yet crossed into Papua from Papua New Guinea. The Papuan frog fauna shows much lower levels of endemism than that of Papua New Guinea (30% versus 63%). Furthermore, there are no frog genera endemic to Papua. These statistics are likely to change as the Papuan frog fauna is better documented; the microhylid genus *Oreophryne* is likely to be the most diverse genus in Papua (Richards et al. 2000). Many of the total of 98 species of Papuan frog have extremely restricted distributions, suggesting that this number will be dramatically increased with more surveys. For example, a recent survey in northern Papua collected 25-30 new species of frog.

The rather impoverished freshwater turtle fauna include some interesting members. For example, the Pig Nosed Turtle (*Carettochelys insculpta*) is the only member of the family Carettochelyidae. All six marine turtles recorded elsewhere in Indonesia occur in Papua and are threatened. There are 140 species of lizards and 75 species of terrestrial freshwater and marine snakes in Papua. The only endemic snake (*Heurnia*) is confined to the Mamberamo River drainage of northern Papua (Conservation International 1999).

Coastal and Marine

The marine biodiversity of Papua is extremely diverse, associated as it is with the Eastern Indonesian center of global marine biodiversity. This diversity is due it part both to the location of Papua on the border between the Pacific and the Indian Oceans and to the variety of landscapes found on the coasts and offshore (caves, cliffs, mangrove lowlands, steep drop offs, sandy and rocky beaches, reefs and sea grass, etc.). Oceanographically and biogeographically, the northern coast of Papua lies in a region that is on the western border of the equatorial Pacific Ocean and the northeastern entrance of the Indonesian flow of currents from the Pacific to the Indian Ocean. Raja Ampat, the group of islands in northern Papua, are part of the same geological ridge that forms the Palauan islands in the western Micronesia part of the Pacific Oceania; it is for this reason that many of the same dramatic and biogeographically diverse tropical habitats, flora and fauna are present in both areas.

Papua (combined with Maluku in this reference) was and still is host to the greatest area of mangroves of any island in Indonesia. In the 1980s there were more than 4 million ha of mangroves, which by 1998 had been diminished to less than 2.5 million ha (59%). The southern coast of Papua is continuously covered by mangrove. These rivers cause high sedimentation and salinity fluctuations. The extensive mangrove stands in Bintuni Bay and other regions are extremely wide with distance from shore to open water of more than 10 km, and dense, such that one can get lost for days in them trying to find the correct passages into the villages and landing sites.

Reefs along the southern coast are poorly developed. Papuan reefs are most developed in Cendrawasih Bay, Padaido Island, Auri Island, Mapia Island and Raja Ampat islands. Coral reefs in Cendrawasih are in good condition and are both diverse and well developed. Generally the offshore islands have narrow fringing reefs with a steep slope down to 20 m. (Suharsono 1998).

The Raja Ampat Islands, situated along the northwest coast of Papua, is an area of outstanding marine biodiversity and stunning marine and terrestrial habitats. It is considered to be the single most biodiverse marine site in the world at this time (BAPPENAS 2003, UNESCO 2002, Turek pers. comm. 2003). The Raja Ampat area has been given the highest recommendation for any marine site to have been nominated to become a Natural World Heritage Marine Site (UNESCO 2002). It is being proposed as part of the Indonesian Marine Cluster Site nomination. The island group encompasses more than four million ha of land and sea. The vast majority of the island group rests on the continental shelf edge that creates a strong gradient from clear water to wave-washed open oceanic conditions, to sheltered and turbid bays (Erdmann and Pet 2002). The archipelago is expected to harbor more than 70% of the world's known coral species. A total of 537 hard corals were identified, more than 10 of which are thought to be undescribed species. Overall reefs and coral communities in the Raja Ampat area are in good health. Coral cover is moderate (33%) but reefs did not seem to be suffering from any recent serious detrimental effects. There is little evidence of pollution, coral bleaching, despite the 1998 regional bleaching events, Crown of Thorns outbreaks or sediment pollution (The Nature Conservancy 2003).

At least two major marine turtle rookeries are found in the Raja Ampat area. The small beaches and coves of the Misool island chain have nesting sites for Hawksbill Turtles (*Eretmochelys imbricata)*. The Islands of Sayan and Piai support large rookeries of Green Turtles (*Chelonia mydas*). More than 65 Green Turtle carapaces were found on a beach, and local evidence indicates that some hunting for turtle eggs and animals continues, with some suggestion that products made from these turtles appear in the Bali market. Although there are no known Leatherback turtle (*Dermochelys coriacea*) rookeries in Raja Ampat, they have been sighted there; they are known to nest on the north coast of the Birdshead Peninsula (The Nature Conservancy 2003).

Papua's marine ecosystems are threatened, like those elsewhere in Indonesia, by overexploitation in some areas, land-based sources of pollution, which is a new phenomenon resulting from logging and other development activities, and destructive fishing practices.

Freshwater

Freshwater endemic species are found throughout Papua. Almost all lakes are unique ecosystem with endemic species. A number of these lakes have been identified below as centers of biodiversity. Conservation International (1999) identifies 23 freshwater systems (Fig. 3.6)

All river systems in Papua that traverse a broad range of elevations display obvious faunal zonation from the mouth to upstream. In the Wapoga Basin, for example, clear zones, identified by their distinctive assemblages of insects (*Zygoptera* and aquatic *Heteroptera*), were in the Lowland Swamp Forest, Lowland Rainforest, Pre-Montane Foothills, and Lower Montane areas. In the Wapoga Basin, generally the main river channels below 1000 m altitude presented a uniformly harsh environment with a limited aquatic insect fauna. By contrast, the most diverse sites were overflow channels and smaller rivers and tributaries of the mountain zone between 300 m and 1000 m (Polhemus 2000).

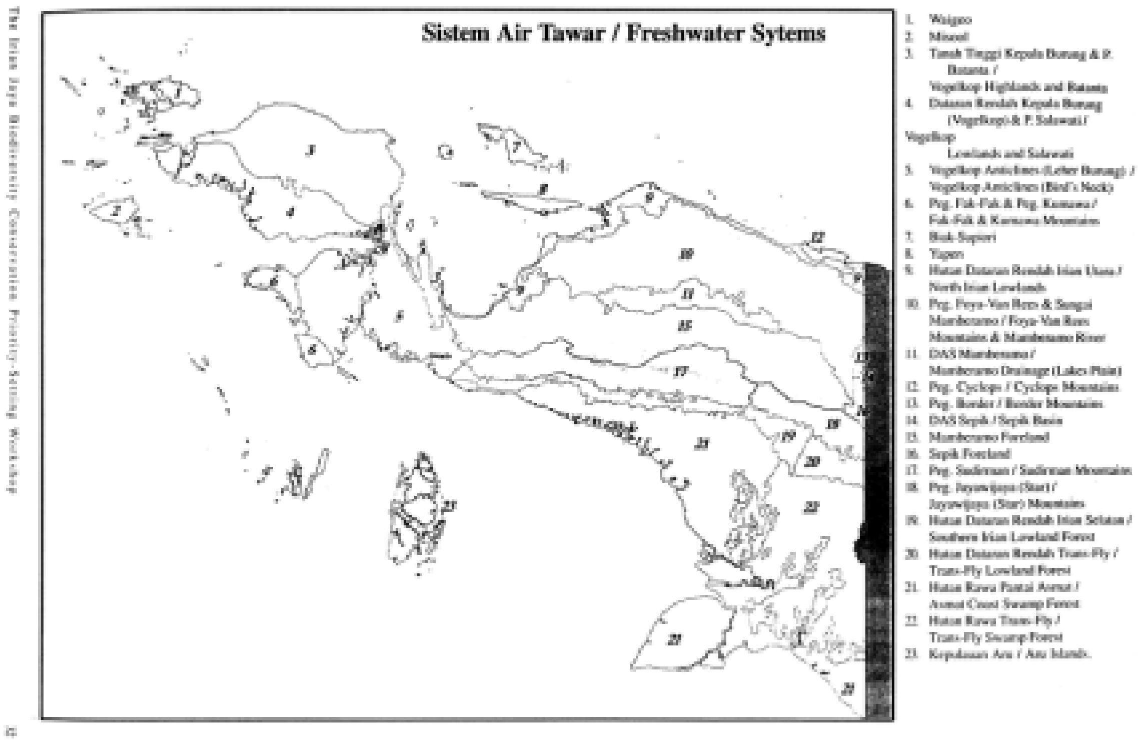


Fig. 3.8: Freshwater Systems

Source from CI [1999; page 32] The Irian Jaya Biodiversity Priority Setting Workshop

The best-known fauna in lakes and streams are the fish; this is a result of the extensive surveys by Gerry Allen and his colleagues over the last 15 years. Recent surveys by Allen et al. (2002) in the Yongsu-Cyclops Mountains and the southern Mamberamo Basin, Papua, illustrate two major types of fish communities in Papua. They are the coastal stream communities dominated by species with marine egg and pelagic larval stages (Yongsu) and communities where fish spend their entire life cycle in freshwater (Mamberamo). The Cyclops coast is probably the best example of a steep gradient coastal stream habitat in Papua. The only comparable areas are high offshore islands, such as Yapen, Biak and islands in the Raja Ampat Group. The Yongsu system remains in excellent condition, lending credence to the need for an integrated conservation management plan for the entire Cyclops coast. But it does not appear to contain endemic fish. On the other hand, the Mamberamo Basin contains the highest proportion of endemic fish of all the major New Guinea rivers. Although five species in Mamberamo are also endemic to the combined Sepik-Ramu systems, relatively few are unique to only one of these rivers. Of great concern is the observation that this endemicity is matched by the numbers of exotic fish (17%), introduced during the 1970s and 1980s that are also found in these rivers in the Mamberamo Basin. These include the Tilapia (*Oreochromis mossambica*) and carp (*Cyprinus carpio*), which are notorious for creating turbid conditions in previously clean lakes and frequently replace native fish due to their prolific breeding. (Allen et al. 2002). Specific freshwater fish that are threatened in Papua are: Freshwater Sawfish (*Pristis microdon*), Giant Freshwater Stingray (*Himantura chaophraya*), Bleher's Rainbowfish (*Chilatherina bleheri*), Sentani Rainbowfish (*C. sentaniensis*), Red Rainbowfish (*Glossolepis incisus*), Arfak Rainbowfish (*Melanotaenia arfakensis*), Boeseman's Rainbowfish (*M. boesemani*) and lake Kurumoi Rainbowfish (*M. parva*) (Conservation International 2002). In other areas of Papua, exotic fish that compete with or prey upon native fauna, such as the Striped Snakehead (*Channa striata*) and Climbing Perch (*Anabas testudineus*), are particularly threatening to the native fish.

Freshwater ecosystems, in Papua are susceptible to the full range of threats mentioned elsewhere in this Report. Conservation International (1999) states that there is serious discussion about a project to divert water in the Digul River to create irrigation for the transmigration settlements north of Merauke. The Danau Bian Wildlife Sanctuary and Kume Maurake Strict Nature reserve may be seriously and adversely affected by such a diversion.

Biodiversity centers

The Biodiversity Action Plan (1993) identified a number of key priority sites for the conservation of biodiversity in Papua. These were identified in large part because they are centers of biodiversity. The wetland sites identified were as follows: Danau Rombebai and Mamberamo Basin (lakes, swamps and mangroves), Bintuni Bay (mangroves), Kimaam Island (Swamp Forest), Wasur (Peat Swamp), Lorentz (Swamp Forest) Danau Sentani (lake ecosystems). The top priority terrestrial sites were: Gunung Lorentz (a broad range of habitats representing the a full altitudinal gradient from the sea), Cyclops (lowland forest, forest on ultrabasic substrates and Montane Forest), Wasur (Mangrove, Savanna grassland, Freshwater and Monsoon Forest), Kimaam Island (Mangrove , Freshwater and Savanna grassland, and the Jayawijaya Mts. (lowland forest, reshwater, Montane Forest and savanna grassland).

Conservation International (1999) carried out a semi-quantifiable process to determine priority Conservation Areas in Papua, based on the following criteria: the level of biological importance of an area, extent of human threats, urgency for conservation action, and importance of additional research required for an area.

A number of freshwater lakes were identified as high priority for conservation by Conservation International (1999). This was because they are important areas of fish and crayfish endemicity. These are Danau Bira (Lake Holmes), Lake Sentani, Lake Kamaka, Paniai Lakes, Ayamaru Lakes, Lake Kurumoi, Lake Yamur (which peculiarly contains Bull Shark (*Carcharinus*), which is usually marine or estuarine species), Lake Laamora, and Lake Aiwaso. The last five lakes mentioned, from Voglekop and Southern freshwater systems, are new priority areas additional to those identified by the Biodiversity Action Plan (1993). Also, Conservation International de-emphasized Kimaam Island as having only a medium priority for conservation.

The Biodiversity Action Plan for Indonesia (1993) lists the following as centers for plant diversity in Papua: Arfak (montane flora and endemism); Kumbe- Merauke (Swamp Forests and Moist Savanna); Mamberamo-Rauffauer (lowland flora); Mt Carstenz (Lorenz) (alpine flora and low swamps); and the Cyclops Mts (ultramaphic flora). Conservation International (1999) supports these areas but adds a great number in addition as having high conservation value. These include: the Salawatti- Batanta region, central Vogelkop, Fak fak and Bomberai Utara, Danau (Lake) Pianiai, Cyclops Mts, Mt Doorman, Jayawijaya Range, Southern Irian lowland forest, Wageo Island, Misool Island, Yapen Island, Biak- Supiori Islands and Kobroor Island, Aru). Because of the need to conserve animals, Conservation International would add the following areas to these plant conservation areas: all the Aru Islands (for insects); north coast mangroves and lowland forests, Foya Mts, van Rees Mts, the entire Maberamo Drainage, and a eastern extension of the southern Irian lowland forest and eastern extension of the southern savannas from Wasur (birds); Danau (Lake) Triton and some of the additional bird areas.

The Mamberamo Basin contains an almost intact assemblage of Lowland Rainforest on the northern side of the central Cordillera. It is the largest river catchment in Papua, draining all northward flowing streams that descend from the central mountains from the border with Papua New Guinea west to 137 degrees longitude. For example, a short survey there in the pristine lowland areas during a single dry season (Richards and Suryadi 2002) collected 129 butterfly, 480 moths, 23 fish, 21 frog, 36 reptile, 143 bird, 69 mammal and 234 plant (at one site, Furu) species. The Basin retains most of its forest cover and has only a sparse human population.

The Raja Ampat Islands, situated along the northwest coast of Papua, is an area of outstanding marine biodiversity and diverse marine and terrestrial habitats. It is considered to be the single most biodiverse marine site in the world at this time (BAPPENAS 2003, UNESCO 2002, Turek pers. comm. 2003).

Protected Area Coverage

The large protected areas for Papua, from the Biodiversity Action Plan for Indonesia (1993), are Tamrau Utara, Tamrau Selatan, Arfak, Weyland, Memberamo, Jayawijaya, Kimaam and Lorentz and Wasur areas. Teluk Cendrawasih National Park (1,453,500 ha) was added in 1997; it is the largest marine national park in Indonesia and has extensive coral reefs and over 209 species of fish. Four species of marine turtle are frequently seen there, along with Dugongs, and Blue Whales (*Balaenoptera musculus*). Lorentz National Park (2,450,000 ha) was designated in 1997. It is the most complete ecosystem for biodiversity in Southeast Asia or the Pacific, ranging from the coast to the glazier on the Mt. Puncak Jaya, and has 630 species of bird. It has been declared by UNESCO as a World Heritage Site and by ASEAN countries as an ASEAN Heritage Site. Wasur National Park (413,810 ha) is the largest relatively undisturbed wetland in Papua. It has a vast open waterway Rawa Biru, which along with its coastal beaches, attracts palaearctic migrant waders. It directly borders upon Papua New Guinea (MFI/UNESCO/CIFOR, 2003).

Conservation International (1999) suggests that the current protected areas system contains a “significant percentage of the province’s most important ecosystems, and was relatively well designed”. That report stated that additional biologically critical areas (i.e., those containing numerous endemic species, high species richness, and/or unique natural features), should be added to the current system. These include: The karst areas of the Bird’s Neck, the lowland terra firme forests at the southern base of central mountains, and the Tami River valley on the north coast adjacent to Papua New Guinea. They recommended extensions to the borders of several protected areas, including the Tamrau Mountains and Mamberano lowlands to include adjacent biologically important habitat. The World Bank (2001) also recommends Mamberano-Foja be added as a protected area and that management capacity for protected areas needs to be considerable upgraded.

Some conservation management practices in Indonesia have been contentious, including Integrated Conservation Development Projects (ICDPs). However, some of the most successful ICDPs in Indonesia have been in Papua. For example, empowered local communities have taken an active role in demarcation, protection and stewardship of Arafak and Wasur National Parks (World Bank 2001).

Forestry

The rate of deforestation in Papua has not been dramatic, with most logging being restricted to coastal lowland forests and Mangrove Forests. The World Bank (2001) reports that between the mid 1980s and 1993, Papua mangroves decreased by 13% (382,000 ha to 201,300 ha).

Summary

Papua is the most spectacular center of endemicity for plants and animals in Indonesia. Its high mountainous terrain has protected much of its fauna and flora, although, almost nothing remains of its lowland forests. It has the most extensive system of lakes in Indonesia as well as the largest forests on ultrabasic substrates in the world. It is one of the foremost two or three places globally as a center for marine biodiversity. While Papua has on paper extensive protected areas, some additions are required, and planning is needed to integrate these protected areas into a system that conserves representative landscapes and their functions.

There is a profound absence of biological information about Papua. Consequently, there is a priority need for an ecoregional planning process, based on available information, including that of Conservation International (1999), to identify the major ecological systems requiring conservation actions, both for protected area planning but also to indicate priority areas for ground surveys.

High country habitats in many of the existing protected areas are considerably less threatened by hunting, logging, and land conversion compared to the lowlands. For this reason, priority activities to conserve biodiversity in these protected areas needs to be focused on the coastal mangroves, lowland forests and savanna.

The south coast of Papua, in Wasur National Park, is an important stop over place for palaearctic migrant wader birds on their way to the northern coast of Australia. It has been designated as a wetland of international importance. These resting areas for migrants are of immense importance to the global survival of a number of migrant bird species. There is a priority in establishing the importance of this part of the Papuan coastline for migrant birds and to establish a management process to protect them from hunters, and to conserve the habitats that they utilize.

The recently discovered biological importance of the Raja Ampat islands indicates that this group of islands and their surrounding marine environments are of the highest priority for support to conserve their biodiversity.

3.7 Nusa Tenggara and Maluku

Introduction

Nusa Tenggara comprises the smallest islands in Indonesia and is divided into two provinces, Nusa Tenggara Barat (NTB) and Nusa Tenggara Timur (NTT). The largest island in NTB is Sumbawa (15,255 ha) and in NTT is West Timor (14,395). Nusa Tenggara, Maluku make up about 8% of the land area of Indonesia. Most of these islands are young, ranging from 1 to 15 million years old (Audley Charles 1987). The Nusa Tenggara islands fall into the western half of the Inner and Outer Banda arcs. The inner Banda islands tend to be mostly volcanic; some have been combined during the glacial maxima up to 10,000 years ago, into larger dry land masses (such as Komodo and Flores). These past larger island groupings have left an imprint on the faunal assemblages and the nature of intra-specific morphological and genetic variation found in the higher vertebrates that currently inhabit these modern islands (Kitchener and Suyanto 1996).

Eastern Indonesia is at the junction of four main geological plates (Indo-Australian, Pacific, Eurasian and Philippine Sea). It is the interaction between these plates that produces the complex geology and tectonic activity in Nusa Tenggara (Monk et al. 1997). Consequently, these islands are a mixture of volcanic islands, coral reef islands, continental crust fragments and composite islands formed from different sources.

The oceanic volcanic islands of the Inner Banda Arc are geologically the simplest. These include Lombok, Sumbawa, and Flores. Solor, Adonara, Pantar. Komodo is the exception amongst the Inner Banda Arc Tertiary volcanic islands as it was formed in part during the Mesozoic. Flores is a particularly unstable part of the NTT inner islands. This instability is influenced by the Banda Arc-continent collision at the Timor Trench to the south of the Flores. Flores now has 14 active volcanoes. Volcanoes further to the east of the Banda arc are increasingly younger in age (Carlile and Mitchell 1994).

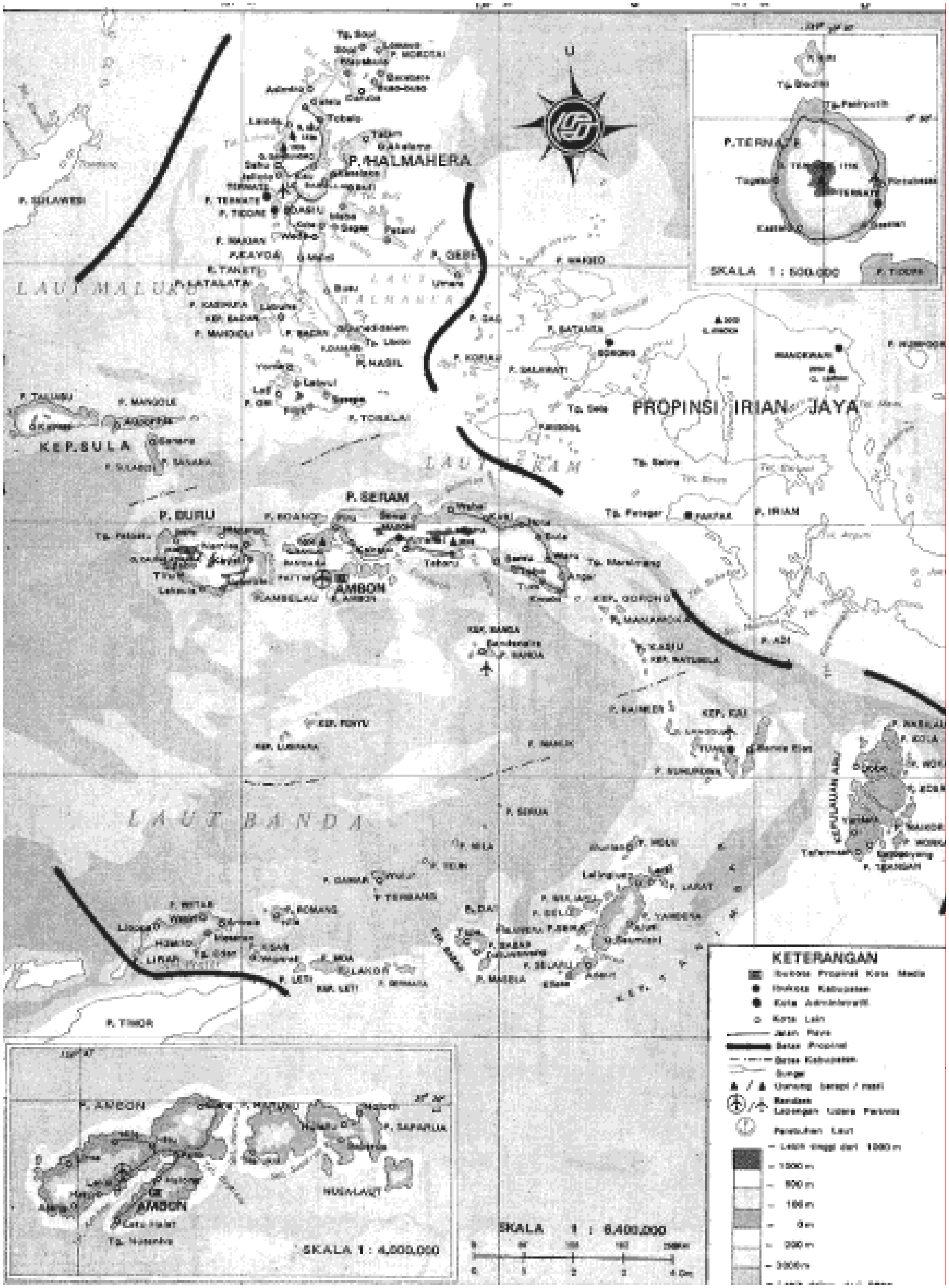


Fig. 3.9: Map of Nusa Tenggara and Maluku

The non-volcanic islands in the Outer Banda Arc are derived from the basement rocks of the Australian continental margin (Audley Charles 1993), most emerged from the sea only about 4 million years ago. These include the islands of Sumba, Raijua, Sawu, Roti, Semau and possibly Timor (Harris 1991). Whatever their origins, islands in the Banda Arc are now mainly composed of raised shallow- and deep-marine sediments, and they are characteristically limestone, with karts formations (Monk et al. 1997).

Maluku islands are generally small, like those in Nusa Tenggara. The largest islands are Halmahera (20,000 ha) and Seram (17, 429 ha); no other island is larger than 8,000 ha. Many of the islands in the southern Maluku are also part of the Banda Arc of islands. Although many of the islands in the southern Maluku were influenced and formed by geological process related to the Banda Arc, that formed the Banda Islands, much of the northern Maluku islands, including the larger islands, were formed by the contact zone between the Indo-Australian Plate and the westward movement of the Pacific Plate during the Miocene. (Hamilton 1979).

Southern Maluku volcanic islands that are part of the Inner Banda Arc include Wetar, Romang, Damar, Teun, Nila Serua, Manuk and the Banda Islands. They are all young and almost all are active and surrounded by fringing reefs of some 75 m in width (Pannell 1991). The northern part of the Inner Banda arc (part of the Buru-Seram-Ambon complex) is not active and is composed of old, eroded volcanic rocks.

Outer Banda Arc islands in the Maluku include, Kisar, Leti, Moa, Lakor, Sermata Islands, Luang, Babar Islands, Tanimbar Islands, Kai Islands, Watubela Islands, Gorong Islands and Seram Laut. They are characterized by a complex mix of sedimentary and metamorphic rocks. This mix is detailed in Monk et al. (1997:40), who states that whatever their origins, these islands are now composed primarily of raised shallow and deep marine sediments and are consequently limestone with karst formations.

A number of islands in northern Maluku are believed to have broken away from the continental crust and rifted to their present location several hundred km away. Obi, southern Bacan and the Buru-Seram-Ambon complex are believed to have formed in this manner and to have reached their present position in the late Pliocene. They are believed to have strong geological affinities with crustal fragments in Nusa Tenggara (Sumba and Timor Islands) (Burrett et al. (1991).

North Maluku is believed to be the most complex geologically in the region, with many islands being composites of other islands. Halmahera Island is the product of inner volcanic arc islands outer arc islands, raised coral reefs and continental crustal fragments. Further, Haymaker, Moratai, and the small islands between the southeast arm of Halmahera and Weigo Island have a different derivation from the rest of the Maluku (and Nusa Tenggara).

The Aru Islands, 125 km from the Papuan coast, are the only true continental islands in the Maluku. They are surrounded by the shallow Arafuru Sea which has a maximum depth of only 20 m.

The rural population comprises 85% of the total population of Nusa Tenggara. While most of them are agriculturalists, little of the land is under permanent cultivation. The Ministry of Forestry has jurisdiction over most of the land area of Nusa Tenggara and Maluku, and therefore forestry and reforestation policies affect virtually the whole population (Monk et al. 1997).

Smaller islands have many of the same ecological and environmental problems as those of the larger islands already discussed in this Report. But small islands also have problems that are unique to them because of their reduced landmass. Environmental threats tend to be more profound on smaller islands because they have fewer resources, both natural and human, and ecosystem collapse happens more rapidly. A geometric fact of small islands is that they have relatively larger coastlines in proportion to area than do larger islands. Consequently, they are frequently more exposed to outside pressures. For these reasons, forested lands are extremely important to prevent erosion of small water catchment areas and subsequent sediment flows to the surrounding seas that can so rapidly degrade surrounding reefs and animal and plant communities.

Terrestrial

The plant diversity in the Inner and Outer Banda Arc islands is essentially the same. A total of 407 endemic species and five genera of plants are known from Nusa Tenggara and Maluku, of which only eight species are shared between Nusa Tenggara and Maluku. The endemic genera are Septogarcuinia (Sumbawa), *Sautiera* and *Sinthraoblastes* (Timor), *Parakibara* (Halmahera) and *Pseudsmelia* (Halmahera and Moratai). The highest number of endemic species is on Lombok and Timor Islands, with 10% and 10.3

%, respectively. Western and eastern floral elements within these islands have no obvious demarcation boundary and Wallace's line has no significance for plants between Bali and Lombok Islands. Both Indo-west Malesian and eastern genera and species are moderately represented in Nusa Tenggara, the former being mainly rainforest plants and the latter being a mix of rainforest and seasonal species. All families of west and east Malesia are found in Nusa Tenggara, except for minor rare families (van Steenis 1979).

Most of the vegetation structural types found in other major islands reported in this report also occur in Nusa Tenggara and Maluku.

Lowland Evergreeen Rainforests are common throughout Nusa Tenggara and Maluku, generally on the drier slopes of Nusa Tenggara and Maluku. In the more arid parts of the region, pockets of lowland forest and gallery forest are often restricted to ravines. The most important expanses of tropical Lowland Evergreeen Rainforest are in central and north Maluku. These have a high proportion of dipterocarps, similar to densities found in Malaysia (Jones and Darsidi 1976)

One form of this forest is the structurally complex tropical Semi-Evergreen Rainforest, which is transitional between the Lowland Evergreeen Rainforest and Monsoon Forest. The Semi-Evergreen Rainforest is characterized by having low, pure stands so that the diversity of plants is less than in Lowland Evergreen Forests. Deciduous trees may be up to a third of all the taller species. The dipterocarp, *Dipterocarpus retusus,* is the only species in this family that occurs in Nusa Tenggara, where it is restricted to the western areas. On Sumbawa this species is replaced on drier slopes by the Sumbawan endemic, *Heritiera gigantean*. Eight species of dipterocarp are known from the Maluku. Many of the remaining dipterocarp forest are dominated by the endemic species *Shorea selanica*.

Tropical Montane Forests occur in several places in Seram, Mt Rinjani, Lombok, Bacan, Halmahera, Moratai, Buru and Obi, and on other island, but published information on them is extremely scarce. Little aseasonal Montane Forest survives in Nusa Tenggara and Maluku (just 1.9% of north Maluku and 0.2% of southern Maluku); it survives on Ambon Seram and Flores. Seasonal Montane Forests occur above Monsoon Forests. It is more prevalent in Nusa Tenggara and southern Maluku (1.2%) than in Central and Northern Maluku (0.2%). Most of the mountainous areas of Nusa Tenggara must have originally been covered with seasonal Montane Forest (Collins et al. 1991). In some areas the gum tree (*Eucalyptus urophylla*) dominates these forests and many such forests are being cleared, but some fragments still exist on Timor (van Steenis 1972) .Timor Mountains are the driest in the region, if not the whole of Malesia; they are continuously burnt and almost all are degraded to some extent up to their summits.

Heath Forests are rare and un-described in Nusa Tenggara and Maluku, with small patches in East Timor, Sula Islands and Trangan Island, Aru (Monk et al. 1997). Forests on ultra basic rocks occur on Timor, Leti, Ambon, Seram, Obi, Bacan, Halmahera and Gebe Islands. The only descriptions of the fauna and flora on ultra basic rocks in Indonesia are from Kitchener, Ed. (1997) for Gag Island. Forest on limestone rocks in Nusa Tenggara and Maluku occur in both everwet and aseasonal areas are similar in structure to those reported from other islands in this Report. In Maluku they occur on Buru and Seram Islands.

The recorded species of mammals, birds, reptiles and frogs in Nusa Tenggara and Maluku have recently been dramatically revised. Surveys between 1987 and 1996 by the Western Australian Museum and LIPI of some 32 islands in these regions have described numerous new species (Kitchener and Suyanto, eds 1996; Kitchener pers. comm.). Possibly the most surprising result was that these surveys almost doubled the known species of frogs in the region and mammal species recorded from most islands. Synoptic accounts for most of these recently surveyed vertebrate faunal groups have not been produced save for the bats. As is the case with plant species, these faunal surveys revealed that for the vertebrate groups, except for birds, Wallace's Line was not the most significant biogeographic boundary. In fact the brief survey of Lombok Island increased the known mammal fauna there from 22 to 54 species- with all the additional species being of Asian origin. The survey of the other entire island in Nusa Tenggara similarly added large numbers of mammal species of Asian origin to their inventories. It was only when the Tanimbar Islands were reached that a significant Australasian mammal element appeared, including several un-described species of Mosaic-tailed Rats. The Tanimbar Island group, and not the boundary between Bali and Lombok, appears to be the major interface between the Oriental and Australasian regions for mammals, and other terrestrial vertebrate groups (D. Kitchener pers. comm). Thus, for many invertebrates, and birds and butterflies, this interface is better represented by Weber's Line than Wallace's Line (see also MacKinnon and MacKinnon 1986; Vane Wright and Peggie 1994; Whitmore 1981b).

Monk et al. (1997) review the recent literature and conclude that in the general area of Wallacea, Nusa Tenggara, except for Tanimbar, which has a mixture of Indo-Malay and Australian elements, is dominated by Indo-Malay forms to the west. The Sula islands are part of Sulawesi; Central and South Maluku, including Seram and Buru, are more closely related to Australia than to Papua; and North Maluku centered on Halmahera, including Bacan, the Sula Islands and Obi have greater affinities with Papua.

The bat fauna of the Inner Banda arc is greatly influenced by the Sundaic elements which diminish evenly from the Javan sources area. But there is a rapid increase in the proportion of endemics in the inner Banda Arc from west to east for bats but no such trend for the Outer Banda Arc islands. For bats, the islands of the Inner and Outer Banda Arcs are not clearly characterized as either continental or oceanic islands. Perhaps this is because these islands straddle the region between two large source areas to the west (Sunda) and east Sahul). There has, however, been considerable speciation in this region and endemic bat species have become widely distributed in both Banda Arcs. These bat endemics are presumably adapted to insular environments which may explain their ability to persist on even small Outer Banda Arc islands. Frequent volcanic eruptions in the inner Banda Arc islands (which have among others included in the 20th century Gunung Agung, Bali; Gunung Rinjani, Lombok; Gunung Ranaka, Flores; and Gunung Api, Banda Neira) may have offered opportunities for invasion of both Sundaic and Lesser Sunda elements into the Banda Islands, a situation presumably to the competitive advantage of the endemics that may be expected to be adapted to small island ecosystems. Other eruptions in this region have included the largest volcanic eruption in recorded history, namely, Mt. Tamora on Sumbawa in 1815. Moyo Island, only 3 km from the foothill of Tambora, was directly in the path of the eruption column and was covered to a depth of some 0.9 m of ash (Self et al. 1984). Despite this, Moyo Island now has a richer bat fauna than would be predicted from either its area or distance from the Java source area. Moyo also has a relatively rich non migratory passerine bird, snake and frog fauna in relation to its area. Clearly recovery and re-invasion by vertebrate of areas in Nusa Tenggara and Maluku devastated by these volcanic explosions fauna can be relatively rapid and complete. Of the various biogeographic hypothesis, the ‘constant perturbations’ model seems to best fit the dynamics of bat species richness in the Inner and Banda Arc islands (Kitchener 1998).

Mammals of the Maluku include marsupials (six species of Cuscus, Phalangeridae, including endemic species *Strigocuscus pelengensis* in the Sulu islands; *Phalanger* *ornatus* in the Halmahera group; *Phalanger rothschildi* in the Obi Islands and *Phalanger* sp on Gebe Island (an undescribed Cuscus is also recorded from Timor Island far to the south-fideõ D. Kitchener; Sugar Glider, *Petaurus breviceps,* and the Seram Bandicoot (*Rhynchomeles prattorum*)). The bats are the most common mammals encountered in the Maluku but there appears to be no endemic genera there, although there are a few endemic species (Corbet and Hill 1992).

Pattern of bird colonization in the region are complex and far from being understood. The large number of endemic species (144 species or 39%), high overall species richness (672 species) results from the fact that most of the islands with birds are oceanic and that these have been variably colonized from the Sunda and Sahul regions. The region is characterized by high levels of endemism at subspecies and species levels but not at generic levels (seven genera). The Central and Northern Maluku have patchy distribution of many birds. For example, Verditer Flycatcher (*Eumyias panayensis*) on Seram and Obi; Mountain tailorbird (*Orthotomus cuculatus*) on Buru; Seram and Bacan; Tyto owls (Tytonidae) on Taliabu and Buru; and the Black-eared Oriole (Oriolidae) on Buru and Tanimbar (P. Jepson in Monk et al. 1997)

The most commonly accepted biogeographic boundaries for birds in Nusa Tenggara are those of MacKinnon and Wind (1980) (see fig. 3.10). Although there remains contention as to whether the island of Obi should be included with north or central Maluku (Monk et al. 1998). Monk et al. (1997) note that the butterflies of north and central Maluku have the same boundaries (Vane –Wright and Peggie 1994) as the birds of MacKinnon and Artha (1981).

Amphibians and reptiles of Nusa Tenggara and Maluku total at least 45 species of frog species, mostly *Rana, Litoria* and *Rhacophorus* (L. Smith pers. comm.), which is about twice the number generally reported from the region.

Freshwater fish are largely unrecorded and unreported in Nusa Tenggara and Maluku (Kottelat 1994), except for Komodo Island where some 14 species are known (R. Lillee in Monk et al. 1997).

The fauna in caves is generally unreported in Nusa Tenggara and Maluku. However, Batu Tering cave on Sumbawa have an extremely large bat fauna involving large fruit eating species (*Pteropus, Dobsonia* and *Eonycteris*) and a representative of local insect eating bats including Miniopterus, *Myotis*, *Hipposideros* and *Rhinolophus* (Kitchener pers. comm.).

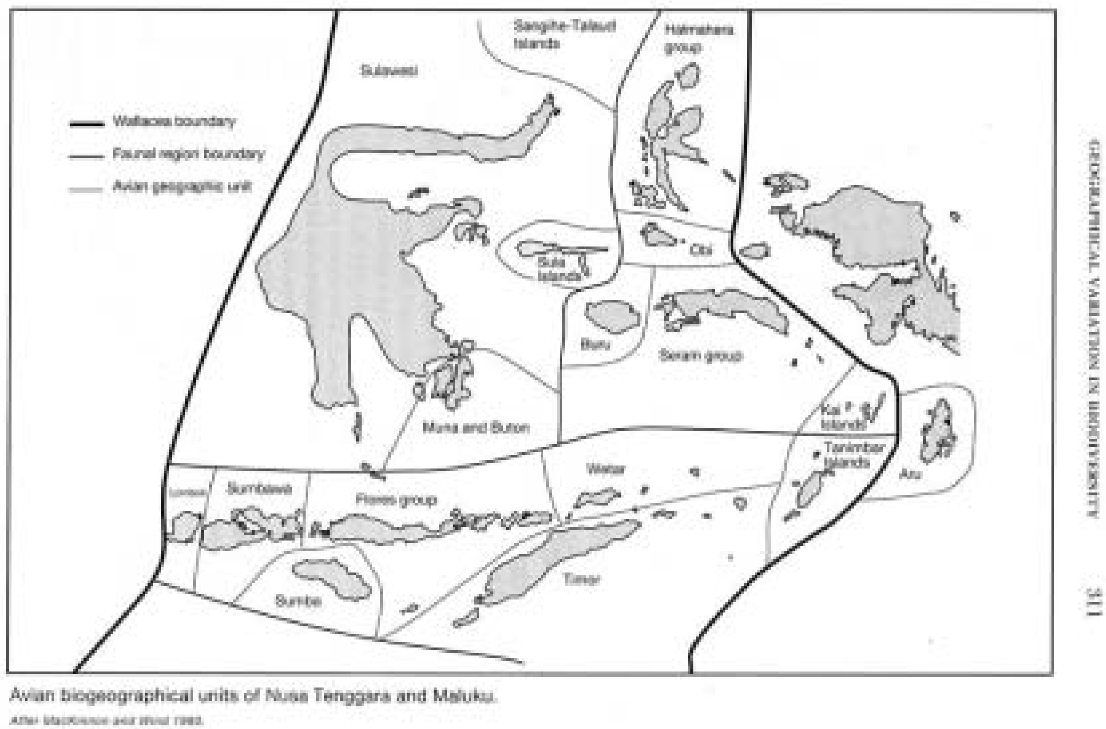


Fig. 3.10 Avian Biogeographical Units of Nusa Tenggara and Maluku

(Source: Monk, et.al. Ecology of Nusatenggara and Maluku. 1996)

There is a good deal of information on the butterflies of Nusa Tenggara and Maluku (Monk et al. 1997). Information from Seram Island, Maluku, indicates that moth diversity peaks at about 600-1000 m above sea level in the upper levels of the lowland forests; it is lowest in disturbed habitats. Species diversity is lower than for Sulawesi but higher than for similar sized Pacific islands (Holloway 1993).

Coastal and Marine

Nusa Tenggara is situated on the border of the Indian Ocean and the Banda Sea. It consists of several thousand islands, stretching east to west, with coastlines dominated by rugged, rocky shores sloping relatively steeply into the sea. Reef flats are mostly narrow, with the slope varying from gentle to steep down to 30-50 m. The southern coasts are exposed to oceanic swell throughout the year and the corals are dominated by encrusting or low-branching morphologies. In some places there are fairly sheltered bays with mangroves, and there are also several places with strong tidal currents flowing through the straits. Coral development is greatest on the western and northern coasts of the islands, and the coral diversity is extremely high. The underwater topography is rugged and known as a refuge area for coral species (Suharsono 1998).

The coral areas of western Nusa Tenggara are approximately 25,000 ha (BAPPENAS, 2003). Three small islands of (Gili Trawanga, Gili Meno, and Gili Air) are popular diving and tourism areas due to their coral reefs in excellent condition (more than 40% coral cover) and beaches.

Komodo Island is a National Park with a large marine area. It is certified as a Natural World Heritage Site, primarily for the protection of the Komodo Dragon, but now, increasingly, for its diverse and lush marine life.

Nusa Tenggara has a relative small area of mangroves compared to the other islands of Indonesia (38,000 ha), most of which are still intact (25,000 ha or 65%) (BAPPENAS, 2003). All sixteen species of mangrove found in Indonesia are reported from Lombok and the Gili Islands.

The 1983 world coral bleaching event caused large scale coral mortality in Lombok (and Bali and Karimunjawa). Coral reef ecosystems adjacent to rapidly growing cities such as Ambon have collapsed or deteriorated drastically due to pollution (Suharsono 1998).

The Maluku has numerous large and small volcanic islands. Generally these are situated in areas of high earthquakes activity. Maluku is surrounded by deep seas and is located between the Sunda shelf in the west and the Sahul shelf in the east. Several volcanic islands with fringing reefs are found in Banda and Halmahera. The coastlines are usually rugged with narrow and steep beaches. Reef flats are narrow and gently sloping seaward to about 2-5 m, followed by a drop off at an angle of about 80-90° to depths greater than 100 m. The shallow sub-tidal reefs are dominated by smaller corals while the walls are densely covered by massive and encrusting corals, soft corals and gorgonians (Suharsono 1998).

Three areas in the Maluku have been identified as conservation priorities to conserve bird migratory areas and for the marine life. These are Manusela, G. Kapalat Mada and Yamdena (BAPPENAS 2003).

Freshwater

Although limited data on watershed sub-catchment areas and length of river systems is available, it is not particularly useful to assess the extent of water systems. This is because the smaller and more rugged islands tend to identify more and smaller tributaries as separate catchments. For example, Nusa Tenggara claims to have more river catchments than Sumatra and Kalimantan combined, and nearly as much total river length. Because of these issues of scale and definition, it is difficult to compare the extent of water systems in Nusa Tenggara and Maluku with the other islands. However, the concept of 'critical lands' and the national land rehabilitation program provide some insight into land and watershed management needs as defined by the GoI.

Nusa Tenggara and Bali have a combined land area of 7.3 million ha, which is the smallest in the country. This island chain has seven major river basins comprising 7.2 million ha of watershed area and over 18,000 km of river length. State forest land covers 3.2 million ha, about 44% of the archipelago's total land area. Of this "forest area," about 39% is in protection forests, designated to preserve watershed and ecosystem functions; 16% is in protected areas (parks and nature preserves); and 45% is in production forests under varying levels of exploitation, including conversion to other land uses. The island has over 1.7 million ha of "Critical Land" which represents 7% of Indonesia's total and 23% of the island's area. This is twice the national average for critical lands, indicating a high concentration of degradation in a relatively small area. Most (78%) of this critical land is outside the state forest area and the remaining 0.4 million hectares is state forest land. The national land and forest rehabilitation program will target only 100,000 ha in Bali and NTT, 7% of the area's critical land and 4% of the area affected by the program FWI/GFW 2002 (Director General for Water Resources, Department of Kimpraswil, 2002).

Maluku has a land area of 7.8 million ha, 4% of Indonesia's total. The island has three major river basins with 3,500 km of river length. State forest land dominates 90% of the island's area, covering 7.0 million ha. Only about 53% is still good quality natural forest. Another 45% is degraded forest and 2% is entirely deforested. Of this "forest area," about

26% is in protection forests, designated to preserve watershed and ecosystem functions; 6% is in protected areas (parks and nature preserves); and 68% is in production forests under varying levels of exploitation, including conversion to other land uses. The island has over 0.7 million ha of "critical land," which represents 3% of Indonesia's total and 9% of the island's area. Most of this critical land (74%) is outside the state forest area and the remaining 0.2 million ha is state forest land. The national land and forest rehabilitation program provides no data on program activities in Maluku (BPS Statistik Indonesia 2002; Ministry of Forestry 2002).

Biodiversity Centers

The 10 biounits in Nusa Tenggara and Maluku combined are biodiversity centers. However, within these units there are habitats and biotic assemblages that are of special interest as follows:

All the national parks (see list immediately below)

The Yamdena Island group. This assemblage of islands is at the interface of the Australasian and Oriental faunal Bioregions. It has a unique assemblage of terrestrial and marine island faunas that offer in microsm the opportunity to explore a major contact zone and gain an understanding of the morphological and genetic factors that determine the distribution of animal and influence their distributional boundaries.

Gunung Ranaka and associate mountain areas in Manggarai Province in Flores for its Montane Forests that retain some of the unique rodent fauna and avifauna of the Flores biounit.

The island of Halmahera retains a particularly important assemblage of birds and likely also of all other biotic groups.

Komodo National Park for its viable population of Komodo Dragons and for the reefs and their biota that surround Komodo and its associated islands.

Protected Area Coverage

Although Nusa Tenggara and Maluku have numerous and extensive protected areas, more than half of these remain ungazetted. Few reserves have been gazetted in the most endangered habitats, the Lowland Rainforests, which are the richest habitats for biodiversity in these regions. For example, 31 endemic birds and almost all mammals are associated with lowland forests in Sumbawa (Jepson and Monk 1995).

In Nusa Tenggara, three biounits have been proposed (see earlier sections of this Report). These include Sumba only; Flores (Lombok, Sumbawa through to Alor) and Timor (Wetar and surrounding islands). Maluku has seven biounits: Halmahera (Moratai, Halmahera, Bacan, Obi, and smaller islands)- it is the richest group for biodiversity – Sula islands; Buru; Seram/Ambon group; Kai Islands; Aru Islands and Banda group (MacKinnon and Artha 1981). It is important that each of these biounits individually is well represented by protected areas.

The national parks in the region are as follows:

Gunung Rinjani National Park (41,330 ha) a landscape scale area from the Montane Forests through to lowland forests and savanna.

Komodo National Park (173,300 ha) for its reefs and associated biota. It is both a UNESCO Natural World Heritage Site and a Biosphere Reserve.

Manupeu – Tanah Daru National Park (87,984 ha). It is some of the last remaining Monsoon Forests in Sumba. Mostly it is sharply rising hills from sea level to 600 m. It contains 118 species of plant, 87 species of bird and 57 species of butterfly.

Laiwangi – Wanggameti National Park (47,014 ha), represents all forest types in Sumba. It is particularly important for the bird assemblage that it contains.

Kelimutu National Park (5,000 ha) provides habitat for 19 restricted range bird species and four endemic species of mammal.

Manusela National Park (189,000 ha) is a landscape scale park that comprises Coastal Forest (including mangroves), swamp forest, Lowland Rainforest, Montane Rainforest and Sub-alpine Forests. It is the quintessentially important protected area in the Maluku as exemplified by its 117 species of bird (14 endemic).

Many of the proposed reserves are located at lower altitudes. However, the main purpose of most of the is recreational, except for reserves in the Aru islands and the Banda Sea which are mainly strict nature reserves and wildlife sanctuary reserves. For the Flores biounit, many of the reserves are purely recreational parks, and many at lower altitudes have been promoted to attract tourism and so offer less protection than previously. Consequently, it is concluded that there is inadequate protected areas, both by designation, location, purpose to adequately represent the biodiversity in each of Nusa Tenggara and Maluku biounits.

Forestry

The Duabanga forests of Mt. Rinjani were first logged in 1922. Currently, production forest in the region is mainly mixed lowland forest and Hill forest up to 1,300 m above sea level.

"State forest land" (classed as conservation, protection, production, and conversion forests) are a key element of landscapes and watersheds in Nusa Tenggara and Maluku. The amount of production forest in Nusa Tenggara and Bali is 1,248,402 ha and this comprises protected areas (515,649 ha); limited production forest (538,378 ha); production forest (556,543 ha); conversion forest (345,889 ha). The comparable figures for Maluku are 1,809,634 ha; 443,345 ha; 1,653,625 ha; 1,053,171 ha; and 2,034,932 ha, respectively.

East Nusa Tenggara and Bali, stand out in Indonesia as having 23% of their land in critical condition, namely land with a high level of degradation and decreased functions, which is twice the national average. The smaller islands of the eastern archipelago generally have steeper slopes and lower rainfall than the larger islands, leading to higher rates of land classed as critical. In NTT and Bali, 32% of non forest land is critical, in Maluku it is 65%. NTT and Bali are well above the national average in terms of the critical lands inside the forest estate, whereas Maluku is well below the national average (BPS Statistik Indonesia 2002). The National Land Rehabilitation Program to restore critical lands (Press Release No. S.14/II/PIK-1/2004, *Enam Menteri Hadiri Pra*

Pencanangan Gerakan Nasional Rehabilitasi Hutan Dan Lahan (GN RHL), 8 *Januari* 2004) plans only minimal effort in Maluku and none in NTT.

Summary

Despite the reduced species richness and number of endemic species, this region must not be thought of simply as an area of transition between the Sahul and Sunda source areas to the east and west, respectively. It is in fact a complex mix of different island types that have provided the substrate for some 10 clearly recognizable biounits. Indeed, the oceanic nature of most of its island has been responsible for the evolution of some interesting species in the region.

It has a series of excellent national parks that represent the Flores, Sumba and Seram biounits. However, Flores itself, with its fascinating rodent and bird assemblage is poorly represented, as is the Timor unit. Most of the seven Maluku biounits are also not well represented by gazetted protected areas. The standout island requiring a better protected area *system* is Halmahera Island.

In selecting priorities for conservation interventions in this region, consideration should be given to support areas which are extremely important to represent the biota within each of the biounits, giving extra weight to those areas that are most threatened and which currently receive little donor support or attention. Unfortunately, threats to current protected areas or proposed protected areas are intense throughout the region. But perhaps threats to Manusela National Park, in part because it is relatively inaccessible, are less than those on the island of Halmahera, which is covered with forestry concessions and experiences illegal logging, extraction of non-forest products and intense hunting. Much of the area of Manggarai on Flores Island is also severely degraded by illegal logging, but the area focused on Gunung Ranaka and its associated high mountain ranges are relatively protected by their rugged topography, although they also experience extensive illegal logging, hunting and removal of non-forest products. Sumba Island has been seriously degraded by removal of the Sandalwood forests over much of the island and their replacement by *Alang alang* grasslands. The national parks on Sumba are few of the remaining refuges for the biota of this unique biounit. The ecology of the low lying Tanimbar Islands are an extremely threatened by the wholesale removal of their vegetation cover by both legal and illegal logging, and also by intensive hunting.

Destruction of this vegetation cover is leading to extensive sediment run off onto the surrounding fringing reefs, which is causing damage to corals and reef biota.

For the above reasons, the priority areas requiring support for the conservation of their biodiversity in the region are, first, Halmahera, then in order, Tanimbar islands, Manupeu – Tanah Daru National Park and Laiwangi-Wanggameti National Park (Sumba Island), Manggarai District (Flores Island) and Manusela National Park (Seram).

4. Protected Areas Policy, Status and Management

While the previous Chapter looks at biodiversity patterns and conservation of biodiversity in specific protected areas, this Chapter focuses on broad, national-level protected areas policy, status and management. This is important in terms of understanding opportunities and constraints for working in specific individual protected areas. Further, it is important for identifying entry-points to leverage best practices in conservation management in one site to the broader national protected area system.

Indonesia has established a network of 379 terrestrial protected areas covering 18,398 million hectares and 35 marine PAs covering 4,723 million ha. Established mostly during the 1980s, Indonesia's protected area system is founded on a habitat and biodiversity representation approach.

Table 4.1: Structure and Extent of Indonesia's Protected Areas System

Classification	No. of units	Area (Hectares)	Area (%)
1. Terrestrial Areas			
1.1 National Parks	35	11,291,754.03	61%
1.2 Strict Nature Reserves	173	2,718,565.63	15%
1.3 Nature Recreation Parks	87	283,873.39	2%
1.4 Wildlife Reserves	53	3,548,018.01	19%
1.5 Grand Forest Parks	17	334,336.30	2%
1.6 Hunting Parks	14	222,410.85	1%
Sub-Total	**379**	**18,398,958.21**	**100%**
2. Marine Areas			
2.1 National Parks	6	3,680,936.30	78%
2.2 Strict Nature Reserves	8	211,555.45	4%
2.3 Nature Recreation Parks	18	765,762.00	16%
2.4 Wildlife Reserves	3	65,220.00	1%
Sub-Total	**35**	**4,723,473.75**	**100%**
Combined Totals:			
3.1 National Parks	41	14,972,690.33	65%
3.2 Strict Nature Reserves	181	495,428.84	2%
3.3 Nature Recreation Parks	105	1,049,635.39	5%
3.4 Wildlife Reserves	56	3,613,238.01	16%
3.5 Grand Forest Parks	17	334,336.30	1%
3.6 Hunting Parks	14	222,410.85	1%
Total	**414**	**23,122,431.96**	**100%**

Source: PHKA 2002

Indonesia has allocated 10% its land area as Protected Areas. While Indonesia has a long history of Protected Areas management, rapid growth of the national system occurred most significantly in the 1980s. Based on the efforts of a number of international and Indonesian conservationists, Indonesian's Protected Areas system was designed primarily to provide representation of significant habitat and biodiversity of Indonesia. While such a strategy makes sense in terms of the preservation of Indonesia's rich natural heritage, this approach often comes into conflict with economic development agendas espoused by various levels of government, local communities and the private sector. A successful Protected Areas system in Indonesia requires effective balancing of conservation of Protected Areas with sustainable development in the broader landscape. Spatial planning provides an excellent tool for achieving this.

Appendix VII of this report contains a complete list of terrestrial and marine Protected Areas sorted by categories stipulated in GoI legislation. The appendix includes name, category, IUCN class, size, location, type of ecosystem, level of threat, management authority and associated urban areas. Due to the sheer number of Protected Areas in Indonesia, we have not inserted the PA table into the body of the report. Additionally, please see Appendix X for a country map of the location of protected areas.

4.1 Terrestrial Protected Areas

4.1.1. A Brief History of Indonesian Protected Area Policy

Protected Area Networks. Since its inception, protected area policy in Indonesia adopted concepts largely from the west, often before these had been ratified in international policy. Indonesia has been at the forefront of experimentation for emerging international policy ideas on protected areas.

The late colonial era (1900-1940) was characterized by two influential citizens' movements formed in response to public shock over extinctions and the speed of human-induced landscape change. The first movement (1900-1910) was rooted in European natural history and forestry traditions and motivated by the belief that natural monuments were part of a cultural heritage and should be protected from ruin. The second movement (1920s) originated from within the international fraternity of big-game hunters who promoted the ideal that human conquest of nature carries with it a moral duty to ensure the survival of threatened species. Together these movements established the principles that the study and appreciation nature (e.g., of wildlife, scenic landscapes, unusual features etc.) were a legitimate and economically viable land use and that state land and funds should be allocated for this purpose.

In response to the first movement, the Dutch administration passed the 1916 nature monument ordinance and subsequently designated 110 sites, mostly on Java. The 1932 ordinance on wildlife reservations was a response to the second movement and was linked with the 1933 London Convention on African Wildlife that formalized national parks, wildlife refuges and strict nature reserves in international (colonial) law. As a result, 17 wildlife refuges, mostly in Sumatra and Kalimantan, were designated (Dammerman 1929).

In the atmosphere of post-WWII internationalism, leaders of these citizens' movements collaborated with leading scientists and resource mangers to form the IUCN within the United Nations. Subsequently, a key policy focus of the IUCN (1974-1982) was the establishment of a worldwide network of PAs that represented the spectrum of ecosystems, habitats and species living on Earth (Dammerman 1929; Holdgate 1999). This 'representative' principle was expressed in the 1980 World Conservation Strategy (IUCN/UNEP/WWF 1980) and re-affirmed in the 1992 Convention on Biological Diversity (CBD). The CBD, guided by the results of an eight-year (1974-82) national park development project, managed under the auspices of FAO/UNDP and which produced a National Conservation Plan (NCP) for Indonesia, confirmed the location of virtually all new reserves designated under the New Order (1967-98). The NCP (MacKinnon & Artha 1982) proposed the establishment of a major ecosystem reserve (MER) in each bio-geographic region of Indonesia to include continuous habitat types and, if possible, the richest examples of those habitats, augmented with smaller reserves to protect special or unique habitat types and regional variations. A national land use plan was a key target of Indonesia's third five-year development plan and, to varying degrees, NCP reserves proposals were included in the *Tata Guna Hutan Kesepakatan* or national Forest Land-Use Plan (TGHK) (Jepson *et al.* 2002). The influential Regional Physical Planning Programme for Transmigration (RePPProT) (RePPProT 1990b) version of the TGHK settled on a 'minimum set' of 80 MERs. Designation and management of these were the backbone of the 1993 Indonesian Biodiversity Action Plan, and all but seven had been designated by 1997.

In policy terms the NCP signified a shift to more and larger reserves distributed throughout the archipelago. Since 1950, the average size of a protected area has increased by a factor of 2 and the average size of a *cagar alam* (strict nature reserve) has increased 15 times. Whereas the largest reserve in the Dutch Indies has 416,000 ha, Indonesia now has 8 reserves over 500,000 ha and the largest (Gunung Leuser) is 2,505,600ha.

At first sight, a reserve expansion policy seems at odds with the resource management ethos of the Suharto regime, which exploited forests to increase GNP and consolidate power through awarding lucrative concessions to cronies. However, the New Order's protected area policy provided an effective means to reign in the 'concession culture' that had gotten out of hand, while at the same time bringing international kudos to the Suharto presidency. National Parks appear relatively late in Indonesia's PA history. The first Indonesian national parks were declared at the 1982 Bali World Park's Congress but were not enacted until Law 5 of 1990.

Protected Area Management Models. After the 1982 Bali Parks Congress, the focus of international assistance moved from PA network planning and designation to park management. The Dutch government funded a School of Environmental Management to train a new generation of government park managers. It was operational from 1984-1993 and 400 people graduated from its intensive 9-month course. The school's faculty taught a model of park-management located within a wilderness worldview of conservation and based on the African game reserve, i.e., a park director reporting to the center and leading a cadre of rangers and supporting staff. Indonesia lacked adequate human resources so these personnel were allocated from the existing forest police.

The mid 1980s saw the emergence of an indigenous Indonesian environmental movement led by a returning generation of western-educated Indonesians. This 'new' environmentalism was deeply concerned with justice, and 'environment' became an umbrella under which the broader issues of social justice could be debated. The sub-discipline of social forestry embraced social justice and attracted some of the best critical thinkers in natural resource management. Its teaching at western universities meant that Indonesia's young environmental leaders and a new generation of natural resource management professionals in development agencies were part of the same extended academic peer group. Defining national park management in term of community-based (co-) management was not difficult because a) national parks in Indonesia lack a preexisting ideology and b) the development aid-NGO nexus was already established in Jakarta-based resource management.

The vastly increased international resources for conservation following the 1992 Rio Earth Summit allowed experimentation with community-based management in Indonesia on a grand scale. The most widely adopted model was the Integrated Conservation and Development Project (ICDP) model, of which Kerinci Seblat National Park ICDP was the flagship World Bank project with a US$35 million budget over 5 years (1996-2001). Confidence in this model waned following a 1998 World Bank assessment (Wells et al. 1999) of 18 Indonesian ICDPs, which concluded that "very few ICDPs in Indonesia can realistically claim that biodiversity conservation has or is likely to be significantly enhanced by past or future activities."

Table 4.2: Major Investments in Indonesian Protected Area Management During the 1990s

Site	Status	Area (1,000ha)	Annual budget (S1,000) GoI budget	Annual budget (S1,000) Total	Total external investment (S1,000)	Duration	Source of external financing	Lead agency/TA providers
Sumatra								
Gunung Leuser	TN	900	767	6,051	42,356	1996 - 2002	European Union	Yayasan Leuser
Kerinci-Seblat	TN	1,368	467	5,691	34,145	1996 - 2001	World Bank/GEF	Kerinci ICDP; WWF, Warsi
Siberut	TN	190	241	1,400	9,800	1993 - 1999	ADB	IPAS
Bukit Tiga puluh	TN	128	0	178	713	1994 - 1997		WWF
Java								
Ujung Kulon	TN	123	617	4	17	1992 - 1995		WWF
Gede Pangrango	TN	15	717	-	-	-		PHKA
Halimun	TN	40	174	138	415	1995 - 1997	USAID/ JICA	BCN/JICA
Kalimantan								
Bukit Baka/Raya	TN	70	85	138	688	1992 - 1996	USAID	NRMP
Kutai	TN	199	311	482	964	1996 - 1997	UNESCO, FrOK	
Kayan Mentarang	TN	1,360	0	420	2,100	1992 - 1996		WWF
Danau Sentarum	TN	130	0	400	2,000	1993 - 1997	DFID	Wetlands Intl
Sulawesi								
Bunaken	TNL	89	237	185	923	1993 - 2004	USAID	NRM
Taka Bone Rata	TNL	530	140	104	313	1994 - 1996		WWF
Togian Islands								CI
Lore Lindu	TN	229	149	325	1,624	1991-1995		TNC

Tangkoko Dua Sudara	CA					1991-1997		WCS
NTT								
Komodo	TN/L	88	500	574	287	1994-1995		TNC
Ruteng	TW	32	0	2100	14,700	1993-1999	ADB	IPAS
Wangameti/	TN		0				DANIDA	BirdLife
Irian Jaya								
Wasur	TN	308	0	175	876	1992-1996		WWF
Lorentz	CA	2,150	0	277	553	1996-1997		WWF
Arfak	CA	68	0	45	180	1994-1997		WWF
Cyclops	C	22	0	31	248	1990-1997		WWF

Note: Adapted with additions from Wells (1997). Please note that the government agency managing each of these protected areas is the Directorate General of Forest Protection and Nature Conservation (PHKA) of the Ministry of Forestry.

Many PA advisors, both inside and outside government, saw the limited capacity of MoF (and in some cases the implementing agencies) as a major contributor to the poor performance of protected area management projects. Further, it was recognized that the short-term nature of funding for ICDPs, the lack of local government support and the absence of a fully effective legal system contributed to the perceived failure of ICDPs in Indonesia. Rectification of these deficiencies may still make ICDPs an effective vehicle for conservation activities in Indonesia.

Moreover, some groups have suggested that conservation outcomes would be enhanced if management control were given over to specially constituted bodies. In response, the government allocated a park management concession for Gunung Leuser National Park to a specially constituted foundation financed by a 7-year, US$37.4 million European Union project grant. MoF has also developed pilot management approaches with a business-NGO partnership (Komodo) and quasi-governmental multi-stakeholder board (Bunaken, North Sulawesi). The latest model, currently under development, is “conservation concessions,” where an NGO acquires a former logging concession to manage in effect as a protected area, but does not partner an existing government park management unit.

4.1.2 Management and Control of Protected Area Lands

The Basic Forestry Law of 1967 classified forestlands as state lands under the authority and management jurisdiction of MoF. Protected areas are a sub-category of national forest placed under the jurisdiction of the Directorate General of Nature Conservation

(PHPA). During the Suharto regime all protected area categories, except Grand Forest Parks, were managed under the "regional office" system, whereby a hierarchy of agencies and officials reporting directly to the central government in Jakarta operated in parallel to the *Dinas* system comprising local government agencies reporting to the district or province governments. National Parks were administered by a Technical Management Unit (UPT) reporting jointly to the *Kanwil* (representative of the central government at the province level) and Director of National Parks in Jakarta. By 1998, 39 of the 41 national parks had UPTs with staffs of between 25 and 274. All other protected areas were managed by the district sub-offices of a provincial Office of Conservation of Natural Resources (BKSDA), which were understaffed, under-resourced and lacking in direction.

This regulatory and management framework for PAs was overlaid on the complex web of patron-client relationships that constitute the *de facto* institutional arrangement governing the management of forest lands in Indonesia. Moreover, the move towards larger reserves and adoption of the MER concept increased the area of protected areas overlaid on the income generating territories of these local governing elites.

From the late 1980s onwards the MoF Directorate of Nature Conservation developed partnerships with international conservation NGOs (INGOs) and bilateral development agencies to strengthen their management capacity. In 1990, MoF had joint programs with WWF (est. 1962) and the Asian Wetland Bureau (est. 1987). Subsequently, five more international NGOs established programs and representative offices and by 2003 all but two of these had converted to Indonesian 'franchise' NGOs (Table 3.2). The majority of MoF-INGO programs focused on two or more national park 'projects,' and some INGOs became contractors for components of park management mega-projects managed under MoF-aid agency partnerships. In addition, development projects such as USAID's NRM and the Biodiversity Conservation Network (BCN) provided policy development support and invested in the development of local civil society partners and community groups.

Table 4.3: International NGOs (INGOs) Supporting Protected Area Management in Indonesia

Organisation	Date established rep. office/ signed MOU	1990s protected area focus	Current organisation status	Staff – directly employed	Turnover FY2002 ($)
World Wildlife Fund (International)	1962/62	Kayan Mentrang NP (92-P) Betung Kerihun NP (96-P) Kerinci-Seblat NP (95-01) Leuser NP (95-97) Bukit Tigapuluh NP (95-99) Ujung Kulon NP (95-P) Lorentz (92-P) Wasur (92-00) Mutis-Timau NR (95-P)	Foundation: Yayasan WWF Indonesia (1998)	274	2,355,000
Wetlands International (Asian Wetland Bureau)	1987/1988	Danau Senterum (89-93) Berbak/Sembiling (89-P)	INGO Representative office	16 (core) 40(project)	700,000
BirdLife International (International Council for Bird Preservation)	1991/1992	Sumba 92-P	Association BirdLife Indonesia (2003)	22 (core) 23 (project)	633,000
The Nature Conservancy	1991/1991	Lore Lindu Komodo	INGO Representative office	191	5,000,000
Wildlife Conservation Society	1996/1997	Tangkoko (91-96) Bukit Barisan (97-P)	INGO Representative office	111	297,000
Conservation International		Togian Islands	INGO Representative office	24 (core) x (project)	
Fauna & Flora International	2002 1996 with LIPI	Halimun Kerinci-Seblat (93-P) Aceh	Representative Office	4 (core) 30 (project)	450,000
International Rhino Fund	1993/1994	Way Kambas, Bukit Barisan Selatan, Kerinci Seblat, Ujung Kulon	Representative Office	1 (core) 111 (project)	550,000

Partnerships with INGOs were needed for MoF for a range of reasons, including the need to: a) develop knowledge of the natural resources of lands in the protected area 'estate'; b) enhance the agency's limited human, technical and financial resources; c) demonstrate commitment to biodiversity and PA ideals to the international community; d) bolster the standing and legitimacy of park management units to local government; and e) establish a line of communication with communities living in protected areas. With one or two exceptions (e.g., Bunaken Marine National Park), the last two of these needs have proved difficult to establish and sustain. To date, almost half of MoF-INGO partnership projects have closed within eight years, and the majority of PA management projects managed by development agencies have been unable to sustain activities beyond five years. Protected areas were difficult to integrate into the political economy of the Suharto era because, unlike logging or plantation concessions, they did not generate local revenue. Gazettement of a reserve signifies the acceptance of a PA's existence by local government and leaders because it gives PA officials recourse to local courts to deal with instances of land encroachment, resource extraction and poaching. To date, only the Kerinci-Seblat National Park has been gazetted and this only after significant amounts of donor aid.

The relationship between MoF and INGOs and the role of the latter in PA management has entered a period of flux. This is a result of international trends in civil society-government relations, regional autonomy and decentralization of management of certain functions of forestlands. There are indications that two alternative paradigms of park management are forming. The first is a social forestry approach whereby local government actors and communities together protect and manage forest resources for their direct socio-economic benefits. This approach will involve local and national NGOs, international and national research institutions and local government actors with a focus on those national parks that have a track record of community-based management and social forestry research. This approach is likely to attract funds from international donor government sources.

The second strand is more protectionist and is concerned with managing and protecting attributes of nature, such as mega-fauna, species diversity and wilderness, whose benefits to society accrue at large spatial and temporal scales. This approach will involve land coming under the direct management control of international conservation NGOs or international research groups who sub-contract parts of the management to local civil society groups, government departments and/or business management. Many of these quasi-private wildlife sanctuaries and strict-nature reserves will be established on ex-forest concession land.

4.1.3 Protected Area Financing

In the mid 1990s, government budgets for protected areas were high by international standards. For the three-year period 1994-97, the Directorate of Nature Conservation received 19% of the overall MoF Budget (equating to $34.7 million annually) and National Parks received nearly 27% of this allocation ($10.2 million in 1996/97). Nearly 70% of this budget came from two sources, the MoF development budget and the Reforestation Fund, both of which were financed by tax revenues from logging and concession fees (MacAndrews & Saunders 1998). These sources of funding disappeared following the economic and political changes of 1997, and the real value of the routine budget was eroded. The amount of international assistance in dollar terms remained consistent or increased up until 2001 because in 1997 the EU-financed Leuser and World Bank/GEF financed Kerinci-Seblat projects were just getting under-way. The significance of these projects in terms of the overall PHPA budgets increased.

International development aid is an important source of funding for PA management in Indonesia because it accounts for 40-55% of the annual operating budgets of the eight international conservation NGOs with Indonesia programs. These organizations together are the largest employer of protected area management specialists, yet, with the exception of WWF, they receive less than 20% of their operating budgets from 'parent' organizations. Any reduction in development aid flows to these organizations could have serious repercussions for the human resource base in protected area policy and management.

Table 4.4: Sources of PHPA financing and the average budget for the three-year period 1994-1997

Sources	Proportion (%)	Amount (US$,000)
DIK (routine budget),	30.6	10,618
DIP (Development Budget)	20.0	6,937
DR (Reforestation fund)	37.6	13,041
BLN (International assistance, excluding INGOs)	7.7	2,667
IHH/LHK (fees from forest products and log auctions)	4.0	1,403
Total	**100**	**34,666**

Calculated from data in MacAndrews & Saunders 1998

A number of policy studies have considered options to replace the anticipated decline in revenues from logging, which financed PA management in Indonesia before 1997. Ideas for alternative financing can be divided into two types: a) those that could generate revenues at a scale to finance PA management through the government (MoF) budget and b) those which reduce the cost of park management by building local buy-in through improving the livelihoods of rural peoples. The first category includes debt-for-nature swaps and carbon credits and the second low-impact resources extraction and community-ecotourism.

All of the above ideas, however, come with their own set of challenges. Debt-for-nature swaps will require a stronger legal and institutional basis for PA management than is currently the case. The carbon-credit idea has yet to flourish because of disagreement over the Kyoto protocol and difficulties in creating an international mechanism for transferring and auditing such credits. Further, it is uncertain whether Indonesia's terrestrial protected areas can attract international tourists on a significant scale. In terms of dive tourism, Indonesia's reefs, sea mounts and currents are of international standard, but building an economically significant marine tourism industry would require major investments in transport infrastructure as well as major reforms in licensing and organizing the tourism industry. From the MoF/PHKA perspective, the only realistic forms of new financing currently available are the US$ 10 million allocation for Sumatra from the Critical Ecosystems Partnership Fund's interest of BirdLife International, CI and TNC in taking on conservation concessions.

A number of political, economic, and technical problems have so far thwarted financing mechanisms that seek to promote co-management of protected areas through providing new income sources for communities and/or local government. Decentralization means that local leaders need forests (timber and land) to consolidate their authority, and for many communities the immediate returns from "wild logging" exceed those from low impact resource extraction (McCarthy 2001). While Indonesia's protected areas contain many high value resources (e.g., resins and medicinal plants) or could be the location for *in situ* propagation of high value products (e.g., birds and garden plants), capturing the economic potential of these resources is severely constrained by a) the absence of existing commodity chains, b) the lack of business skills and entrepreneurship within the NGO sector, and c) the high levels of corruption that community entrepreneurs face from local government or security officials.

The quality of the major financial investments in PA management during the 1990s was not fully subject to rigorous and independent study. In part this is because donors and implementation agencies act as partners in project delivery. As a result, performance and impact measures are agreed jointly and assessed by project supervision missions undertaken by staff of the donor and government agencies and consultants. In the context of PA management, reliance on internal stakeholder forms of performance evaluation is not fully objective because the organizational survival and well-being of the institutions concerned is linked to the amounts of funds disbursed. Internationally, the sub-optimal performance of conservation and protected area investments is leading to calls for conservation audits. The Nature Conservancy has tested a conservation audit methodology on its Komodo National Park project. This represents an important development over the supervision mission approach.

4.1.4 Assessment of Indonesia Terrestrial Protected Area Policy and Management

The 90-year old Indonesian protected areas initiative can claim many successes that represent foundation stones for success in the 21st century. These include:

- A policy history that represents major trends in thinking since the internationalization of the PA movement at the beginning of the 20th century.
- A science-based PA design that almost represented the macro-scale bio-geographic diversity of Indonesia in a system of designated protected areas.
- A huge area of land and sea designated as PA, at least in the policy and planning documents of the international community and national government.
- An extensive international network of senior professionals who at some time in their careers have worked on an Indonesian PA initiative.
- A large body of Indonesian government officials trained in conservation, although admittedly now this body is fragmented and demoralized.
- A large number of Indonesian professionals with on-the-ground work experience in PAs
- A policy discourse that has aligned PAs with macro-economic policy and social justice agendas.

The Indonesian PA effort does however lack certain dimensions that characterize countries with effective PA policy and management. These include:

- Linking of PA policy with broader social policy relating to health, recreation, well-being and identity.
- A national PA vision rooted in the public sphere, including a portfolio of PA categories that represent the main strands of this vision and the relationship with landscape.
- Household name foundations and charities that purchase land and/or lobby for government acquisition to support this national vision.
- A ‘landscape wing’ to the PA movement, comprising writers, artists, photographers etc. who generate public wonder and appreciation of nature and a popular meaning for PAs.

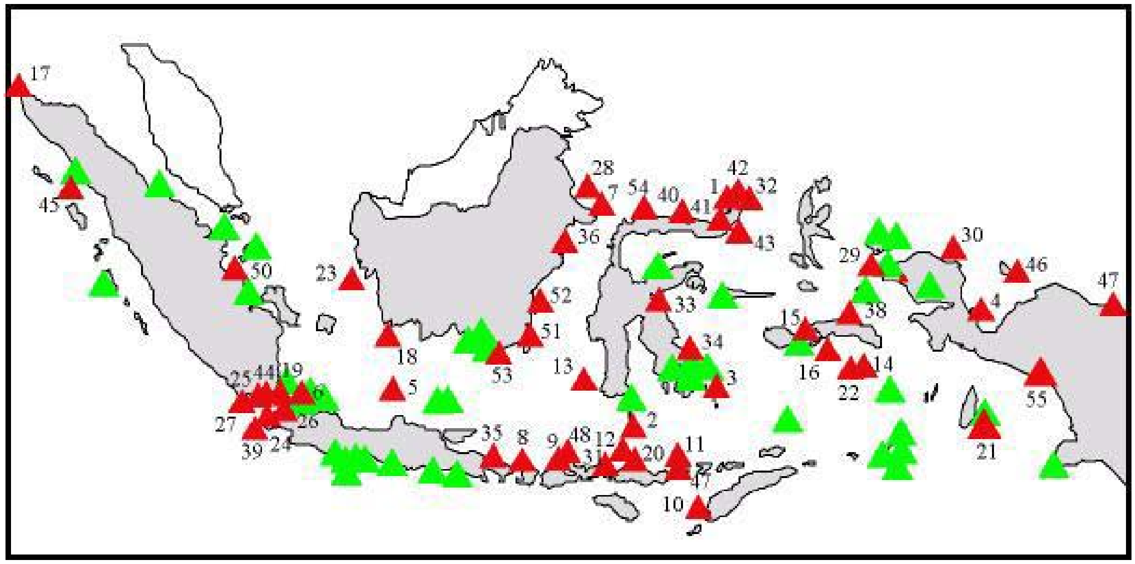
- Integration of PAs with popular culture and the presence of social practices relating to recreational, aesthetic and intellectual pursuits.
- Generating flows of capital and entrepreneurship between cities and their rural hinterlands through domestic recreation (weekending etc).
- Business sector marketing products (excursions, retreats, food-products, crafts, etc.) on the basis of PA brands and the public association of these with desirable 'qualities' such as authenticity, escape, adventure and purity.
- A size and configuration for PAs that is compatible with the implementation capacity and mandate of the management agency (as perceived by local actors) taking into account the landscape context.
- A professional and empowered PA management service possessing its own vision, heroes, values and principles.
- A government and university scientific service able to deliver international standard research, monitoring, advice and comment.

4.2 A Note on Marine Protected Areas in Indonesia

Marine protected areas (MPAs) are a more recent phenomenon in Indonesia relative to terrestrial PAs. Indeed, it was the work of Rodney Salm in the 1980s that raised MPAs as an important policy issue for biodiversity conservation and management in Indonesia. This chapter primarily concerns terrestrial protected areas.

Currently, there are six marine parks included in the Indonesian PA system, which still fall under the authority of MoF. The new Ministry of Fisheries and Marine Affairs has initiated talks with MoF to have the parks reassigned from MoF to their ministry. Presently, there is a Memorandum of Understanding between the two ministries and they are "co-managing" the system. There are also a number of other mainly terrestrial protected areas that have marine components.

Figure 4.1: Map of Indonesian MPA's. Approximate locations are marked with red triangle; numbers correspond to those in above 6 tables. Possible MPA sites are marked with green triangles.



<u>**Note**</u>: Green highlighted entries indicate possible MPAs (based upon map examination); verification still required.

5. Status and Protection of Endangered Species

This section of the report discusses the status and protection of endangered species in Indonesia. It discusses the threats to endangered species in Indonesia, the extent to which the government's recognition of endangered species matches the IUCN's identification through its Red List, the attempts to protect these species and the opportunities and challenges for future action plans.

5.1 Introduction

Indonesia, India, Brazil and China are among the countries with the most threatened mammals and birds (www.iucnredlist.org). This statement is confirmed for Indonesia by the 164 and 117 species of endangered mammals and birds, respectively, on the IUCN Red List. However, the number of endangered bird species recognized by GoI is much higher than these above figures, namely, 390 endangered bird species or 25% of the known Indonesian bird species.

Other sections of this report indicate that numerous proximal factors impact biological diversity and endangered species, such as encroachment of protected areas, expansive removal of habitat of endangered species by logging (both legal and illegal), introduction of exotic species, agricultural expansion, wild fires, reef damage and hunting. But the underlying factors threatening endangered species, also detailed in this report, tend to be a widespread lack of a conservation culture, obscure land tenure rights, poor or absent multi-use spatial plans and a corrupt judiciary. Thus, although the National Development Planning Body, Bappenas, (2003) recently updated Indonesia's Biodiversity Strategic Action Plan (IBSAP), implementation of this one and its predecessor has been poor due to the aforementioned constraints.

Several examples that most dramatically capture the dimension of the threat to endangered species are as follows: First, a million birds a year (including many endangered species) are trapped and taken from forests, wetlands and coastal habitats, principally to sell through the Javanese and Bali domestic markets, with fruit doves and parrots among others also being exported. Second, over the last decade, some 20,000 to 25,000 tons of fish were taken annually from Indonesian waters to supply the Chinese live fish trade, which operates mainly through Hong Kong. These fish mainly come from plundering coral reefs, usually through the use of extremely detrimental methods, such as cyanide poisoning (which only stuns the target fish, but kills many smaller fish and crustaceans), bombing reefs, and collecting fish during spawning aggregations. This has led to a number of reef fish becoming endangered (World Bank 2001).

5.2 The Indonesian Endangered Species Lists

GoI does not automatically place on the Indonesian endangered species lists those species that are on the current IUCN list. Consequently, there are differences between the GoI and IUCN lists. Appendix VIII provides a list of protected species according to GoI legislation as well as the IUCN red lists for mammals, birds, and reptiles. It is evident from this list that there is not full harmonization with the IUCN list. The IUCN red list for Indonesia contains the following species of mammals, birds and reptiles:

IUCN MAMMAL RED LIST

Scientific Name	IUCN Category
Zaglossus bruijnii	Endangered
Antechinus habbema	Data deficient
Antechinus naso	Data deficient
Antechinus wilhelmina	Data deficient
Dasyurus albopunctatus	Vulnerable
Dasyurus spartacus	Vulnerable
Phascolosorex doriae	Data deficient
Planigale novaeguineae	Vulnerable
Echymipera clara	Data deficient
Microperoryctes murina	Data deficient
Rhynchomeles prattorum	Data deficient
Ailurops ursinus	Data deficient
Phalanger alexandrae	Data deficient
Phalanger gymnotis	Data deficient
Phalanger rothschildi	Vulnerable
Phalanger vestitus	Vulnerable
Spilocuscus papuensis	Data deficient
Spilocuscus rufoniger	Endangered
Strigocuscus celebensis	Data deficient
Dendrolagus dorianus	Vulnerable
Dendrolagus goodfellowi	Endangered
Dendrolagus inustus	Data deficient
Dendrolagus mbaiso	Vulnerable
Dendrolagus ursinus	Data deficient
Thylogale brownii	Vulnerable
Thylogale brunii	Vulnerable
Pseudocheirus canescens	Data deficient

IUCN MAMMAL RED LIST (Cont.)

Scientific Name	IUCN Category
Pseudocheirus schlegeli	Data deficient
Pseudochirops albertisii	Vulnerable
Pseudochirops corinnae	Vulnerable
Pseudochirulus caroli	Data deficient
Dactylopsila megalura	Vulnerable
Manis javanica	Lower risk: near threatened
Hylomys parvus	Critically endangered
Chimarrogale sumatrana	Critically endangered
Crocidura beccarii	Endangered
Crocidura minuta	Data deficient
Crocidura orientalis	Vulnerable
Crocidura paradoxura	Endangered
Crocidura tenuis	Vulnerable
Suncus mertensi	Critically endangered
Tupaia chrysogaster	Vulnerable
Tupaia longipes	Endangered
Acerodon celebensis	Lower risk: near threatened
Acerodon humilis	Vulnerable
Aethalops aequalis	Lower risk: near threatened
Aethalops alecto	Lower risk: near threatened
Aproteles bulmerae	Critically endangered
Cynopterus nusatenggara	Lower risk: near threatened
Dobsonia beauforti	Endangered
Dobsonia emersa	Vulnerable
Dobsonia exoleta	Lower risk: near threatened

IUCN MAMMAL RED LIST (Cont.)

Scientific Name	IUCN Category
Dobsonia minor	Lower risk: near threatened
Dobsonia peronii	Vulnerable
Dyacopterus spadiceus	Lower risk: near threatened
Megaerops kusnotoi	Vulnerable
Neopteryx frosti	Vulnerable
Nyctimene aello	Lower risk: near threatened
Nyctimene celaeno	Vulnerable
Nyctimene certans	Lower risk: near threatened
Nyctimene cyclotis	Lower risk: near threatened
Nyctimene draconilla	Vulnerable
Nyctimene minutus	Vulnerable
Paranyctimene raptor	Lower risk: near threatened
Pteropus argentatus	Data deficient
Pteropus chrysoproctus	Lower risk: near threatened
Pteropus ocularis	Vulnerable
Pteropus pohlei	Vulnerable
Pteropus pumilus	Vulnerable
Pteropus speciosus	Vulnerable
Pteropus temmincki	Lower risk: near threatened
Rousettus bidens	Lower risk: near threatened
Rousettus spinalatus	Vulnerable
Styloctenium wallacei	Lower risk: near threatened
Syconycteris carolinae	Vulnerable
Syconycteris hobbit	Vulnerable
Thoopterus nigrescens	Lower risk: near threatened
Emballonura furax	Vulnerable
Emballonura raffrayana	Lower risk: near threatened
Taphozous achates	Vulnerable
Nycteris javanica	Vulnerable
Coelops robinsoni	Lower risk: near threatened
Hipposideros breviceps	Vulnerable
Hipposideros corynophyllus	Vulnerable
Hipposideros coxi	Vulnerable

IUCN MAMMAL RED LIST (Cont.)

Scientific Name	IUCN Category
Hipposideros dinops	Lower risk: near threatened
Hipposideros inexpectatus	Vulnerable
Hipposideros macrobullatus	Lower risk: near threatened
Hipposideros madurae	Lower risk: near threatened
Hipposideros muscinus	Vulnerable
Hipposideros papua	Vulnerable
Hipposideros sorenseni	Lower risk: near threatened
Hipposideros sumbae	Lower risk: near threatened
Hipposideros wollastoni	Lower risk: near threatened
Rhinolophus canuti	Lower risk: near threatened
Rhinolophus celebensis	Lower risk: near threatened
Rhinolophus creaghi	Lower risk: near threatened
Rhinolophus keyensis	Endangered
Rhinolophus nereis	Lower risk: near threatened
Rhinolophus philippinensis	Lower risk: near threatened
Rhinolophus simplex	Endangered
Glischropus javanus	Endangered
Hesperoptenus gaskelli	Vulnerable
Kerivoula myrella	Vulnerable
Miniopterus schreibersii	Lower risk: near threatened
Myotis hermani	Data deficient
Myotis ridleyi	Lower risk: near threatened
Myotis stalkeri	Endangered
Nyctophilus heran	Endangered
Nyctophilus timoriensis	Vulnerable
Pipistrellus kitcheneri	Lower risk: near threatened
Pipistrellus macrotis	Lower risk: near threatened
Pipistrellus minahassae	Data deficient
Pipistrellus mordax	Lower risk: near threatened
Pipistrellus papuanus	Lower risk: near threatened
Scotophilus celebensis	Data deficient

IUCN MAMMAL RED LIST (Cont.)

Scientific Name	IUCN Category
Chaerephon johorensis	Lower risk: near threatened
Cheiromeles parvidens	Lower risk: near threatened
Cheiromeles torquatus	Lower risk: near threatened
Mops sarasinorum	Lower risk: near threatened
Mormopterus doriae	Vulnerable
Otomops formosus	Vulnerable
Otomops johnstonei	Vulnerable
Tadarida australis	Lower risk: near threatened
Tarsius bancanus borneanus	Data deficient
Tarsius bancanus natunensis	Data deficient
Tarsius bancanus saltator	Data deficient
Tarsius dianae	Lower risk: conservation dependent
Tarsius pelengensis	Data deficient
Tarsius pumilus	Data deficient
Tarsius sangirensis	Data deficient
Tarsius spectrum	Lower risk: near threatened
Macaca fascicularis fascicularis	Lower risk: near threatened
Macaca fascicularis fusca	Data deficient
Macaca fascicularis karimondjawae	Data deficient
Macaca fascicularis lasiae	Data deficient
Macaca fascicularis tua	Data deficient
Macaca hecki	Lower risk: near threatened
Macaca maura	Endangered
Macaca nemestrina	Vulnerable
Macaca nigra	Endangered
Macaca nigrescens	Lower risk: conservation dependant
Macaca ochreata ochreata	Data deficient
Macaca ochreata brunnescens	Vulnerable
Macaca pagensis pagensis	Critically endangered
Macaca pagensis siberu	Critically endangered

IUCN MAMMAL RED LIST (Cont.)

Scientific Name	IUCN Category
Macaca tonkeana	Lower risk: near threatened
Nasalis larvatus	Endangered
Presbytis comata	Endangered
Presbytis femoralis batuana	Data deficient
Presbytis femoralis chrysomelas	Data deficient
Presbytis femoralis cruciger	Data deficient
Presbytis femoralis percura	Data deficient
Presbytis fredericae	Data deficient
Presbytis frontata	Data deficient
Presbytis hosei canicrus	Data deficient
Presbytis hosei everetti	Data deficient
Presbytis melalophos melalophos	Lower risk: near threatened
Presbytis potenziani potenziani	Vulnerable
Presbytis potenziani siberu	Vulnerable
Presbytis thomasi	Lower risk: near threatened
Simias concolor concolor	Endangered
Simias concolor siberu	Endangered
Trachypithecus auratus auratus	Endangered
Trachypithecus auratus mauritius	Endangered
Trachypithecus cristatus	Lower risk: near threatened
Pongo abelii	Critically Endangered
Pongo pygmaeus pygmaeus	Endangered
Pongo pygmaeus wurmbii	Endangered
Hylobates agilis agilis	Lower risk: near threatened
Hylobates agilis albibarbis	Lower risk: near threatened
Hylobates agilis unko	Lower risk: near threatened
Hylobates klossii	Vulnerable
Hylobates lar vestitus	Lower risk: near threatened
Hylobates moloch moloch	Critically endangered
Hylobates moloch pongoalsoni	Critically endangered

IUCN MAMMAL RED LIST (Cont.)

Scientific Name	IUCN Category
Hylobates muelleri abbotti	Lower risk: near threatened
Hylobates muelleri funereus	Lower risk: near threatened
Hylobates muelleri muelleri	Lower risk: near threatened
Symphalangus syndactylus syndactylus	Lower risk: near threatened
Nycticebus coucang menagensis	Data deficient
Nycticebus javanicus	Data deficient
Cuon alpinus	Vulnerable
Catopuma badia	Vulnerable
Catopuma temminckii	Lower risk: near threatened
Neofelis nebulosa	Vulnerable
Panthera pardus melas	Endangered
Panthera tigris sumatrae	Critically endangered
Pardofelis marmorata	Data deficient
Prionailurus planiceps	Vulnerable
Prionailurus viverrinus	Lower risk: near threatened
Amblonyx cinereus	Lower risk: near threatened
Lutra lutra	Vulnerable
Lutra sumatrana	Data deficient
Lutrogale perspicillata	Vulnerable
Martes flavigula robinsoni	Endangered
Melogale personata orientalis	Lower risk: near threatened
Mustela lutreolina	Endangered
Helarctos malayanus	Data deficient
Arctogalidia trivirgata trilineata	Endangered
Cynogale bennettii	Endangered
Diplogale hosei	Vulnerable
Macrogalidia musschenbroekii	Vulnerable
Paradoxurus hermaphroditus lignicolor	Vulnerable
Balaenoptera acutorostrata	Lower risk: near threatened
Balaenoptera borealis	Endangered
Balaenoptera edeni	Data deficient

IUCN MAMMAL RED LIST (Cont.)

Scientific Name	IUCN Category
Balaenoptera musculus	Endangered
Balaenoptera physalus	Endangered
Megaptera novaeangliae	Vulnerable
Feresa attenuata	Data deficient
Globicephala macrorhynchus	Lower risk: conservation dependent
Grampus griseus	Data deficient
Lagenodelphis hosei	Data deficient
Lissodelphis peronii	Data deficient
Orcaella brevirostris	Data deficient
Orcaella brevirostris [Mahakam subpopulation]	Critically Endangered
Orcinus orca	Lower risk: conservation dependent
Sousa chinensis	Data deficient
Stenella attenuata	Lower risk: conservation dependent
Stenella coeruleoalba	Lower risk: conservation dependent
Stenella longirostris	Lower risk: conservation dependent
Steno bredanensis	Data deficient
Tursiops truncatus	Data deficient
Neophocaena phocaenoides	Data deficient
Physeter catodon	Vulnerable
Indopacetus pacificus	Data deficient
Mesoplodon ginkgodens	Data deficient
Ziphius cavirostris	Data deficient
Dugong dugon	Vulnerable
Elephas maximus	Endangered
Tapirus indicus	Vulnerable
Dicerorhinus sumatrensis harrissoni	Critically endangered
Dicerorhinus sumatrensis sumatrensis	Critically endangered
Rhinoceros sondaicus sondaicus	Critically endangered

IUCN MAMMAL RED LIST (Cont.)

Scientific Name	IUCN Category
Babyrousa babyrussa	Vulnerable
Sus barbatus oi	Lower risk: near threatened
Sus verrucosus	Endangered
Axis kuhlii	Endangered
Bos javanicus	Endangered
Bubalus depressicornis	Endangered
Bubalus quarlesi	Endangered
Capricornis sumatraensis sumatraensis	Endangered
Hystrix brachyura	Vulnerable
Hystrix crassispinis	Lower risk: near threatened
Bunomys coelestis	Endangered
Bunomys fratrorum	Lower risk: near threatened
Bunomys heinrichi	Lower risk: near threatened
Bunomys prolatus	Endangered
Chiropodomys karlkoopmani	Endangered
Chiropodomys muroides	Lower risk: near threatened
Coccymys albidens	Endangered
Crunomys celebensis	Endangered
Eropeplus canus	Endangered
Haeromys margarettae	Vulnerable
Haeromys pusillus	Vulnerable
Hydromys habbema	Lower risk: near threatened
Hydromys hussoni	Lower risk: near threatened
Kadarsanomys sodyi	Lower risk: near threatened
Komodomys rintjanus	Vulnerable
Leptomys elegans	Critically Endangered
Leopoldamys siporanus	Vulnerable
Macruromys elegans	Critically endangered
Macruromys major	Endangered
Mallomys gunung	Critically endangered
Mallomys istapantap	Lower risk: near threatened
Margaretamys elegans	Vulnerable

IUCN MAMMAL RED LIST (Cont.)

Scientific Name	IUCN Category
Margaretamys parvus	Vulnerable
Mayermys ellermani	Vulnerable
Maxomys baeodon	Endangered
Maxomys dollmani	Vulnerable
Maxomys hylomyoides	Lower risk: near threatened
Maxomys pagensis	Lower risk: near threatened
Maxomys wattsi	Endangered
Melasmothrix naso	Endangered
Melomys aerosus	Lower risk: near threatened
Melomys fraterculus	Lower risk: near threatened
Melomys obiensis	Lower risk: near threatened
Microhydromys richardsoni	Lower risk: near threatened
Mus vulcani	Lower risk: near threatened
Papagomys armandvillei	Vulnerable
Paraleptomys wilhelmina	Vulnerable
Paruromys ursinus	Endangered
Paulamys naso	Extinct
Pithecheir melanurus	Lower risk: near threatened
Pogonomelomys bruijni	Critically endangered
Pseudohydromys occidentalis	Vulnerable
Pseudomys delicatulus	Lower risk: near threatened
Rattus adustus	Vulnerable
Rattus bontanus	Vulnerable
Rattus elaphinus	Vulnerable
Rattus enganus	Critically endangered
Rattus feliceus	Vulnerable
Rattus foramineus	Lower risk: near threatened
Rattus hainaldi	Lower risk: near threatened
Rattus hoogerwerfi	Vulnerable
Rattus jobiensis	Lower risk: near threatened

IUCN MAMMAL RED LIST (Cont.)

Scientific Name	IUCN Category
Rattus koopmani	Lower risk: near threatened
Rattus mollicomulus	Vulnerable
Rattus pelurus	Vulnerable
Rattus sordidus	Lower risk: near threatened
Rattus timorensis	Data deficient
Sundamys maxi	Endangered
Taeromys arcuatus	Vulnerable
Taeromys hamatus	Vulnerable
Taeromys punicans	Lower risk: near threatened
Tateomys macrocercus	Vulnerable
Tateomys rhinogradoides	Vulnerable
Uromys anak	Lower risk: near threatened
Xenuromys barbatus	Lower risk: near threatened
Hylopetes bartelsi	Lower risk: near threatened
Hylopetes sipora	Endangered
Hylopetes winstoni	Critically endangered
Hyosciurus heinrichi	Vulnerable
Hyosciurus ileile	Vulnerable
Iomys sipora	Vulnerable
Lariscus hosei	Vulnerable
Lariscus niobe	Lower risk: near threatened
Lariscus obscurus	Lower risk: near threatened
Petinomys lugens	Lower risk: near threatened
Prosciurillus abstrusus	Vulnerable
Prosciurillus weberi	Lower risk: near threatened
Pteromyscus pulverulentus	Lower risk: near threatened
Sundasciurus brookei	Lower risk: near threatened
Sundasciurus jentinki	Vulnerable
Nesolagus netscheri	Critically endangered

IUCN BIRD RED LIST

Scientific Name	IUCN Category
Casuariidae - Cassowaries and Allies	
Casuarius bennetti	Lower risk: near threatened
Casuarius casuarius	Vulnerable
Casuarius unappendiculatus	Vulnerable
Megapodiidae - Megapodes	
Aepypodius bruijnii	Vulnerable
Macrocephalon maleo	Vulnerable
Megapodius bernsteinii	Lower risk: near threatened
Megapodius geelvinkianus	Lower risk: near threatened
Eulipoa wallacei	Vulnerable
Phasianidae - Grouse and Allies	
Anurophasis monorthonyx	Lower risk: near threatened
Arborophila charltonii	Lower risk: near threatened
Argusianus argus	Lower risk: near threatened
Caloperdix oculea	Lower risk: near threatened
Lophura bulweri	Vulnerable
Lophura erythrophthalma	Vulnerable
Lophura hoogerwerfi	Vulnerable
Lophura ignita	Lower risk: near threatened
Lophura inornata	Vulnerable
Melanoperdix nigra	Vulnerable
Pavo muticus	Vulnerable
Polyplectron schleiermacheri	Endangered
Rhizothera longirostris	Lower risk: near threatened
Rollulus rouloul	Lower risk: near threatened
Anatidae - Ducks and Allies	
Cairina scutulata	Endangered
Salvadorina waigiuensis	Vulnerable
Turnicidae - Buttonquails	
Turnix everetti	Endangered

IUCN BIRD RED LIST (Cont.)

Scientific Name	IUCN Category
Indicatoridae - Honeyguides	
Indicator archipelagicus	Lower risk: near threatened
Picidae - Woodpeckers	
Dinopium rafflesii	Lower risk: near threatened
Meiglyptes tukki	Lower risk: near threatened
Megalaimidae - Asian Barbets	
Megalaima henricii	Lower risk: near threatened
Megalaima javensis	Lower risk: near threatened
Megalaima mystacophanos	Lower risk: near threatened
Megalaima rafflesii	Lower risk: near threatened
Bucerotidae - Typical Hornbills	
Aceros corrugatus	Lower risk: near threatened
Aceros everetti	Vulnerable
Aceros subruficollis	Vulnerable
Anthracoceros malayanus	Lower risk: near threatened
Buceros bicornis	Lower risk: near threatened
Buceros rhinoceros	Lower risk: near threatened
Buceros vigil	Lower risk: near threatened
Trogonidae - Trogons	
Harpactes diardii	Lower risk: near threatened
Harpactes duvaucelii	Lower risk: near threatened
Harpactes kasumba	Lower risk: near threatened
Harpactes orrhophaeus	Lower risk: near threatened
Harpactes whiteheadi	Lower risk: near threatened
Coraciidae - Typical Rollers	
Eurystomus azureus	Vulnerable
Alcedinidae - Alcedinid Kingfishers	
Alcedo euryzona	Lower risk: near threatened
Ceyx fallax	Lower risk: near threatened

IUCN BIRD RED LIST (Cont.)

Scientific Name	IUCN Category
Halcyonidae - Halcyonid Kingfishers	
Actenoides concretus	Lower risk: near threatened
Actenoides monachus	Lower risk: near threatened
Cittura cyanotis	Lower risk: near threatened
Tanysiptera carolinae	Lower risk: near threatened
Tanysiptera ellioti	Lower risk: near threatened
Tanysiptera hydrocharis	Data deficient
Tanysiptera riedelii	Lower risk: near threatened
Todirhamphus australasia	Lower risk: near threatened
Todirhamphus enigma	Lower risk: near threatened
Todirhamphus funebris	Vulnerable
Todirhamphus lazuli	Lower risk: near threatened
Todirhamphus nigrocyaneus	Data deficient
Cuculidae - Old World Cuckoos	
Cacomantis heinrichi	Lower risk: near threatened
Carpococcyx radiatus	Lower risk: near threatened
Carpococcyx viridis	Critically endangered
Cuculus vagans	Lower risk: near threatened
Phaenicophaeus diardi	Lower risk: near threatened
Phaenicophaeus sumatranus	Lower risk: near threatened
Centropidae - Coucals	
Centropus chalybeus	Lower risk: near threatened
Centropus nigrorufus	Vulnerable
Centropus rectunguis	Vulnerable
Cacatuidae - Cockatoos and Allies	
Cacatua alba	Vulnerable
Cacatua goffini	Lower risk: near threatened
Cacatua moluccensis	Vulnerable
Cacatua sulphurea	Critically endangered

IUCN BIRD RED LIST (Cont.)

Scientific Name	IUCN Category
Psittacidae – Parrots	
Aprosmictus jonquillaceus	Lower risk: near threatened
Charmosyna multistriata	Lower risk: near threatened
Charmosyna toxopei	Critically endangered
Eos cyanogenia	Vulnerable
Eos histrio	Endangered
Eos reticulata	Lower risk: near threatened
Loriculus catamene	Endangered
Loriculus exilis	Lower risk: near threatened
Loriculus flosculus	Endangered
Loriculus pusillus	Lower risk: near threatened
Lorius domicella	Vulnerable
Lorius garrulus	Endangered
Micropsitta geelvinkiana	Lower risk: near threatened
Prioniturus flavicans	Lower risk: near threatened
Psittacula longicauda	Lower risk: near threatened
Psittaculirostris salvadorii	Vulnerable
Psitteuteles iris	Lower risk: near threatened
Psittinus cyanurus	Lower risk: near threatened
Psittrichas fulgidus	Vulnerable
Tanygnathus gramineus	Vulnerable
Tanygnathus lucionensis	Lower risk: near threatened
Apodidae – Typical Swifts	
Collocalia vulcanorum	Lower risk: near threatened
Collocalia papuensis	Lower risk: near threatened
Hydrochrous gigas	Lower risk: near threatened
Tytonidae – Barn and Grass Owls	
Tyto inexspectata	Vulnerable
Tyto nigrobrunnea	Endangered
Tyto sororcula	Data deficient

IUCN BIRD RED LIST (Cont.)

Scientific Name	IUCN Category
Strigidae – Typical Owls	
Ninox ios	Vulnerable
Ninox ochracea	Lower risk: near threatened
Ninox rudolfi	Lower risk: near threatened
Otus alfredi	Endangered
Otus angelinae	Vulnerable
Otus beccarii	Endangered
Otus enganensis	Lower risk: near threatened
Otus mentawi	Lower risk: near threatened
Otus rufescens	Lower risk: near threatened
Otus sagittatus	Vulnerable
Otus siaoensis	Critically endangered
Otus silvicola	Lower risk: near threatened
Otus umbra	Lower risk: near threatened
Uroglaux dimorpha	Data deficient
Aegothelidae – Owlet-Nightjars	
Aegotheles wallacii	Data deficient
Batrachostomidae – Asian Frogmouths	
Batrachostomus auritus	Lower risk: near threatened
Batrachostomus harterti	Lower risk: near threatened
Batrachostomus mixtus	Lower risk: near threatened
Batrachostomus stellatus	Lower risk: near threatened
Batrachostomus poliolophus	Lower risk: near threatened
Eurostopidae – Eared-Nightjars	
Eurostopodus diabolicus	Vulnerable
Caprimulgidae – Nightjars and Allies	
Caprimulgus concretus	Vulnerable
Caprimulgus pulchellus	Lower risk: near threatened

IUCN BIRD RED LIST (Cont.)

Scientific Name	IUCN Category
Columbidae – Pigeons	
Caloenas nicobarica	Lower risk: near threatened
Columba argentina	Critically endangered
Ducula cineracea	Endangered
Ducula pickeringii	Vulnerable
Ducula rosacea	Lower risk: near threatened
Gallicolumba hoedtii	Endangered
Goura cristata	Vulnerable
Goura scheepmakeri	Vulnerable
Goura victoria	Vulnerable
Ptilinopus dohertyi	Vulnerable
Ptilinopus granulifrons	Vulnerable
Ptilinopus jambu	Lower risk: near threatened
Ptilinopus monacha	Lower risk: near threatened
Ptilinopus subgularis	Lower risk: near threatened
Treron capellei	Vulnerable
Treron floris	Vulnerable
Treron fulvicollis	Lower risk: near threatened
Treron oxyura	Lower risk: near threatened
Treron psittacea	Endangered
Treron teysmannii	Lower risk: near threatened
Turacoena modesta	Vulnerable
Heliornithidae - Sungrebes	
Heliopais personata	Vulnerable
Rallidae - Rails	
Aramidopsis plateni	Vulnerable
Gymnocrex rosenbergii	Vulnerable
Gymnocrex talaudensis	Endangered
Habroptila wallacii	Vulnerable
Megacrex inepta	Lower risk: near threatened
Porzana paykullii	Lower risk: near threatened
Rallina leucospila	Lower risk: near threatened
Rallina mayri	Data deficient

IUCN BIRD RED LIST (Cont.)

Scientific Name	IUCN Category
Scolopacidae – Snipes and Allies	
Limnodromus semipalmatus	Lower risk: near threatened
Numenius madagascariensis	Lower risk: near threatened
Scolopax celebensis	Lower risk: near threatened
Scolopax rochussenii	Endangered
Tringa guttifer	Endangered
Burhinidae – Thick-knees	
Esacus magnirostris	Lower risk: near threatened
Charadriidae – Plovers and Allies	
Charadrius javanicus	Lower risk: near threatened
Charadrius peronii	Lower risk: near threatened
Vanellus macropterus	Critically endangered
Laridae – Gulls and Allies	
Sterna bernsteini	Critically endangered
Accipitridae – Hawks and Allies	
Accipiter nanus	Lower risk: near threatened
Aquila clanga	Vulnerable
Aquila gurneyi	Lower risk: near threatened
Erythrotriorchis buergersi	Data deficient
Harpyopsis novaeguineae	Vulnerable
Ichthyophaga humilis	Lower risk: near threatened
Ichthyophaga ichthyaetus	Lower risk: near threatened
Megatriorchis doriae	Lower risk: near threatened
Spilornis kinabaluensis	Vulnerable
Spizaetus bartelsi	Endangered
Spizaetus nanus	Vulnerable
Falconidae – Falcons	
Microhierax latifrons	Lower risk: near threatened
Sulidae	
Papasula abbotti	Critically endangered
Anhingidae	
Anhinga melanogaster	Lower risk: near threatened

IUCN BIRD RED LIST (Cont.)

Scientific Name	IUCN Category
Ardeidae - Herons	
Egretta eulophotes	Vulnerable
Gorsachius goisagi	Endangered
Zonerodius heliosylus	Lower risk: near threatened
Threskiornithidae - Ibises	
Pseudibis davisoni	Critically endangered
Threskiornis melanocephalus	Lower risk: near threatened
Pelecanidae - Pelicans	
Pelecanus philippensis	Vulnerable
Ciconiidae - Storks and Allies	
Ciconia stormi	Endangered
Ephippiorhynchus asiaticus	Lower risk: near threatened
Leptoptilos javanicus	Vulnerable
Mycteria cinerea	Vulnerable
Fregatidae - Frigatebirds	
Fregata andrewsi	Critically endangered
Procellariidae - Petrels and Allies	
Pterodroma phaeopygia	Critically endangered
Oceanodroma monorhis	Lower risk: near threatened
Pittidae - Pittas	
Pitta baudii	Vulnerable
Pitta caerulea	Lower risk: near threatened
Pitta dohertyi	Lower risk: near threatened
Pitta granatina	Lower risk: near threatened
Pitta megarhyncha	Lower risk: near threatened
Pitta nympha	Vulnerable
Pitta schneideri	Vulnerable
Pitta venusta	Vulnerable
Eurylaimidae - Broadbills	
Calyptomena hosii	Lower risk: near threatened
Calyptomena viridis	Lower risk: near threatened
Eurylaimus ochromalus	Lower risk: near threatened
Ptilonorhynchidae - Bowerbirds	
Archboldia papuensis	Lower risk: near threatened

IUCN BIRD RED LIST (Cont.)

Scientific Name	IUCN Category
Meliphagidae - Honeyeaters	
Lichmera notabilis	Lower risk: near threatened
Melidectes princeps	Vulnerable
Myzomela kuehni	Lower risk: near threatened
Philemon brassi	Lower risk: near threatened
Philemon fuscicapillus	Vulnerable
Pardalotidae - Pardalotes and Allies	
Gerygone hypoxantha	Endangered
Petroicidae - Australo-Papuan Robins	
Microeca hemixantha	Lower risk: near threatened
Petroica archboldi	Data deficient
Poecilodryas placens	Lower risk: near threatened
Irenidae - Fairy-Bluebirds	
Chloropsis cyanopogon	Lower risk: near threatened
Chloropsis venusta	Lower risk: near threatened
Corvidae - Cinclosomatinae	
Androphobus viridis	Data deficient
Eupetes macrocerus	Lower risk: near threatened
Corvidae - Pachycephalinae	
Colluricincla sanghirensis	Critically endangered
Pitohui incertus	Lower risk: near threatened
Corvidae - Corvinae	
Cicinnurus respublica	Lower risk: near threatened
Coracina bicolor	Lower risk: near threatened
Coracina dispar	Lower risk: near threatened
Coracina fortis	Lower risk: near threatened
Corvus florensis	Endangered
Corvus fuscicapillus	Lower risk: near threatened
Corvus unicolor	Endangered
Epimachus bruijnii	Lower risk: near threatened
Epimachus fastuosus	Vulnerable
Loboparadisea sericea	Lower risk: near threatened

IUCN BIRD RED LIST (Cont.)

Scientific Name	IUCN Category
Macgregoria pulchra	Vulnerable
Oriolus hosii	Lower risk: near threatened
Oriolus xanthonotus	Lower risk: near threatened
Paradigalla carunculata	Lower risk: near threatened
Paradisaea rubra	Lower risk: near threatened
Pericrocotus igneus	Lower risk: near threatened
Pityriasis gymnocephala	Lower risk: near threatened
Platysmurus galericulatus	Lower risk: near threatened
Platysmurus leucopterus	Lower risk: near threatened
Sphecotheres hypoleucus	Lower risk: near threatened
Corvidae - Dicrurinae	
Dicrurus sumatranus	Lower risk: near threatened
Eutrichomyias rowleyi	Critically endangered
Monarcha boanensis	Critically endangered
Monarcha brehmii	Endangered
Monarcha everetti	Endangered
Monarcha julianae	Data deficient
Monarcha leucurus	Lower risk: near threatened
Monarcha sacerdotum	Endangered
Myiagra atra	Lower risk: near threatened
Rhipidura fuscorufa	Lower risk: near threatened
Rhipidura opistherythra	Lower risk: near threatened
Terpsiphone atrocaudata	Lower risk: near threatened
Corvidae - Aegithininae	
Aegithina viridissima	Lower risk: near threatened
Corvidae - Malacotoninae	
Philentoma velatum	Lower risk: near threatened
Muscicapidae - Old World Flycatchers and Allies	
Cochoa azurea	Vulnerable
Cochoa beccarii	Vulnerable
Cyornis caerulatus	Vulnerable
Cyornis ruckii	Critically endangered

IUCN BIRD RED LIST (Cont.)

Scientific Name	IUCN Category
Cyornis sanfordi	Endangered
Cyornis turcosus	Lower risk: near threatened
Enicurus ruficapillus	Lower risk: near threatened
Ficedula bonthaina	Endangered
Ficedula dumetoria	Lower risk: near threatened
Ficedula henrici	Vulnerable
Ficedula rufigula	Lower risk: near threatened
Ficedula timorensis	Lower risk: near threatened
Geomalia heinrichi	Lower risk: near threatened
Muscicapa segregata	Lower risk: near threatened
Rhinomyias addita	Lower risk: near threatened
Rhinomyias colonus	Lower risk: near threatened
Rhinomyias umbratilis	Lower risk: near threatened
Saxicola gutturalis	Lower risk: near threatened
Trichixos pyrropyga	Lower risk: near threatened
Zoothera dumasi	Lower risk: near threatened
Zoothera dohertyi	Lower risk: near threatened
Zoothera erythronota	Lower risk: near threatened
Zoothera everetti	Lower risk: near threatened
Zoothera machiki	Lower risk: near threatened
Zoothera peronii	Lower risk: near threatened
Zoothera schistacea	Lower risk: near threatened
Sturnidae – Starlings and Allies	
Aplonis crassa	Lower risk: near threatened
Aplonis mystacea	Lower risk: near threatened
Basilornis galeatus	Lower risk: near threatened
Leucopsar rothschildi	Critically endangered
Streptocitta albertinae	Lower risk: near threatened
Sturnus melanopterus	Endangered

IUCN BIRD RED LIST (Cont.)

Scientific Name	IUCN Category
Pycnonotidae - Bulbuls	
Alophoixus finschii	Lower risk: near threatened
Iole olivacea	Lower risk: near threatened
Ixos malaccensis	Lower risk: near threatened
Pycnonotus cyaniventris	Lower risk: near threatened
Pycnonotus eutilotus	Lower risk: near threatened
Pycnonotus melanoleucos	Lower risk: near threatened
Pycnonotus squamatus	Lower risk: near threatened
Pycnonotus tympanistrigus	Lower risk: near threatened
Pycnonotus zeylanicus	Vulnerable
Setornis criniger	Vulnerable
Zosteropidae - White-eyes	
Heleia muelleri	Lower risk: near threatened
Madanga ruficollis	Endangered
Zosterops flavus	Lower risk: near threatened
Zosterops grayi	Lower risk: near threatened
Zosterops kuehni	Lower risk: near threatened
Zosterops mysorensis	Lower risk: near threatened
Zosterops nehrkorni	Critically Endangered
Zosterops uropygialis	Lower risk: near threatened
Sylviidae - Old World Warblers and Allies	
Alcippe brunneicauda	Lower risk: near threatened
Cettia carolinae	Lower risk: near threatened
Crocias albonotatus	Lower risk: near threatened
Garrulax rufifrons	Lower risk: near threatened
Kenopia striata	Lower risk: near threatened
Macronous ptilosus	Lower risk: near threatened
Malacocincla malaccensis	Lower risk: near threatened
Malacocincla perspicillata	Vulnerable
Malacopteron affine	Lower risk: near threatened

IUCN BIRD RED LIST (Cont.)

Scientific Name	IUCN Category
Malacopteron albogulare	Lower risk: near threatened
Malacopteron magnum	Lower risk: near threatened
Megalurus albolimbatus	Vulnerable
Napothera atrigularis	Lower risk: near threatened
Napothera macrodactyla	Lower risk: near threatened
Ptilocichla leucogrammica	Vulnerable
Stachyris grammiceps	Lower risk: near threatened
Stachyris leucotis	Lower risk: near threatened
Stachyris maculata	Lower risk: near threatened
Stachyris nigricollis	Lower risk: near threatened
Trichastoma rostratum	Lower risk: near threatened
Nectariniidae - Sunbirds and Allies	
Aethopyga duyvenbodei	Endangered
Anthreptes rhodolaema	Lower risk: near threatened
Dicaeum everetti	Lower risk: near threatened
Prionochilus thoracicus	Lower risk: near threatened
Melanocharitidae - Berrypeckers and Longbills	
Melanocharis arfakiana	Data deficient
Passeridae - Sparrows and Allies	
Lonchura stygia	Lower risk: near threatened
Lonchura vana	Vulnerable
Padda fuscata	Vulnerable
Padda oryzivora	Vulnerable
Ploceus hypoxanthus	Lower risk: near threatened

IUCN REPTILE RED LIST

Scientific Name	IUCN Category
Chelidae - Side-necked Turtles	
Chelodina mccordi	Critically endangered
Chelodina parkeri	Vulnerable
Chelodina reimanni	Lower risk: near threatened
Chelodina siebenrocki	Lower risk: near threatened
Elseya branderhorsti	Vulnerable
Trionychidae - Softshell Turtles	
Amyda cartilaginea	Vulnerable
Chitra chitra	Critically endangered
Pelochelys bibroni	Vulnerable
Pelochelys cantorii	Endangered
Carettochelyidae - Pig-nose Turtles	
Carettochelys insculpta	Vulnerable
Cheloniidae - Marine Turtles	
Caretta caretta	Endangered
Chelonia mydas	Endangered
Eretmochelys imbricata	Critically endangered
Lepidochelys olivacea	Endangered
Dermochelyidae - Leatherback Turtles	
Dermochelys coriacea	Critically endangered
Bataguridae - River Terrapins	
Batagur baska	Critically endangered
Callagur borneoensis	Critically endangered
Cuora amboinensis	Vulnerable
Cyclemys dentata	Lower risk: near threatened
Cyclemys oldhamii	Lower risk: near threatened as *Cyclemys dentata*
Heosemys spinosa	Endangered
Leucocephalon yuwonoi	Critically endangered as *Geoemyda yuwonoi*
Malayemys subtrijuga	Vulnerable
Notochelys platynota	Vulnerable
Orlitia borneensis	Endangered
Siebenrockiella crassicollis	Vulnerable
Testudinidae - Tortoises	
Indotestudo forstenii	Endangered
Manouria emys	Endangered

IUCN REPTILE RED LIST (Cont.)

Scientific Name	IUCN Category
Sauria - Lizards	
Varanus komodoensis	Vulnerable
Serpentes - Snakes	
Anomochilus leonardi	Data deficient
Python molurus	Lower risk: near threatened
Iguanognathus werneri	Vulnerable
Crocodylia - Crocodiles	
Crocodylus siamensis	Critically endangered
Tomistoma schlegelii	Endangered

Endangered species referred to in this report are principally those on the official Indonesian endangered lists. The reason for this is that GoI lists are those that will be adhered to by GoI when conservation initiatives are being planned in Indonesia. Until now, there is no evidence that the placement of animals or plants on GoI endangered species lists automatically infers increased protection to a species. The export of species on GoI and CITES lists is restricted by custom and quarantine inspectors through the normal ports, but ways are usually found to circumvent such restrictions by traffickers of endangered species (World Bank 2001).

The Indonesian endangered animal and plant lists have been compiled and presented in the 2001 publication *Jenis – jenis Hayati yang Dilindungi Perundang-undangan Indonesia* (eds M. Noerdjito & M. Maryanto). Species in that publication are officially recognized as endangered in that their endangered status is supported by a Ministerial decision or *Surat Keputusan Menteri*. A more recent publication for plants *Tumbuh-tumbuhan Langka di Indonesia* by H. Wiriadinata et al. (2001) has further information and also includes some proposed additions to the list of endangered plants. A list of endangered species presented in the Statistics Report of MoF presents much lower figures for numbers of endangered species than Noerdjito & Maryanto (2001). Perhaps species categorized as 'vulnerable' are not included in the MoF's statistics, but this could not be confirmed.

Of interest is that the 2001 listings show many additions to those in the 1993 Biodiversity Action Plan for Indonesia coordinated by Bappenas. These additions in large part result from better knowledge of the status of wildlife, but also in no small part to the continued degradation of the Indonesian environment in the 1990s.

Table 5.1: Numbers of Indonesian Critically Endangered, Endangered & Vulnerable Species (spp) and Total Number of Species in Each Group in Indonesia

Taxonomic Group	No. Endangered spp (Noerdjito & Maryanto Nov. 2001	No. Endangered Spp (GoI Biodiversity Action Plan 1993)	No. Endangered spp (IUCN Redlist 2001 & 2003)	Total No. spp 2001
Mammals	**131**	27	128(164)	457
Birds	**390**	9 (126)*	104 (117)	1530
Reptiles	**48**	12	19 (27)	514
Fish	**8**	3	60 (NA)	1400
Insects	**19**	4	- -	250,000?
Molluscs	**12**	2	-	20,000?
Crustaceans	**9**	0	-	?
Plants	**110**	0	184 (NA)	29,375

** More complete list of Collar & Andrew (1988). Interim third edition of IUCN Red Data Book.*

Within the listing of endangered animals and plants in *Peraturan Pemerintah Republik Indonesia* No.7 and 8 (1999) (www.dephut.go.id), a group of 11 endangered charismatic species receives extra protection from a Presidential Decree (KepPres). They are as follows:

- Anoa *(Anoa depressicornis, Anoa quarlesi)*;
- Babirusa *(Babyrousa babyrussa)*;
- Javanese Rhinoceros (*Rhinoceros sondaicus*);
- Sumatran Rhinoceros (*Dicerorhinus sumatrensis*);
- Komodo Dragon (*Varanus komodoensis*);
- Bird of Paradise (all species in the family *Paradiseidae*);
- Javanese Eagle (*Spizaetus bartelsi*);
- Sumatran Tiger (*Phantera tigris sumatrae)*;
- Leaf Monkey (*Presbytis potenziani*);
- Orangutan (*Pongo pygmaeus*);
- Javanese Gibbon (*Hylobates moloch*)

The formulation of GoI endangered plant and animal species lists is somewhat *ad hoc*. While senior staff from LIPI are always invited to meet with the MoF's Directorate of Nature Conservation staff when forming and reviewing such lists, criteria for the selection and categorization of endangered species are unclear. For example, LIPI scientists consider that the IUCN 2003 red lists for Indonesia (www.iucnredlist.org, tables 5 & 6) are not complex enough for many faunal species, but are overly complex for many plant species. However, a LIPI/MoF workshop to review the IUCN's 2003 red list recommended that most or all of the mammal and plant species on the IUCN list should also be added to the Indonesian endangered species list.

LIPI is the national custodian of the excellent Indonesian computerized plant and animal database (developed by the GEF supported Biodiversity Collection Project). This has the capacity to produce distribution maps of endangered species provided sufficient data is available. LIPI is also the final arbiter of the taxonomic status of endangered species. This is sensible, as LIPI is the national repository of taxonomic expertise and is well equipped to make global changes of taxonomic synonyms on their national biological databases.

However, the level of ecological information appended to their databases is inadequate to provide information on the current status of populations of endangered species. PHKA considers that monitoring species on the GoI endangered species list is the preserve of LIPI. However, LIPI considers itself ill-equipped to carry out such monitoring activities. Thus, there is a major inter-institutional gap in roles and responsibilities.

5.3 The Extent of Endangered Species in Indonesia

There was a dramatic increase in all groups of species recognized as endangered in Indonesia between 1993 and 2001. For example, mammals and birds increased by 104 and 264 species, respectively. It is important to note that this reflects effort in identifying threatened species and not necessarily an increase in the actual number of species endangered. Interestingly, the Noerdjito & Maryanto (2001) endangered list has fewer fish and plants than the IUCN 2001 red list, and fewer mammals than are on the IUCN 2003 red list.[1] However, it has almost four times as many birds listed than the IUCN 2003 red list (greatly influenced by the 67 raptors species on the Noerdjito & Maryanto (2001) endangered list).

For a discussion on the extent of endangered species by region, please see the section on Biodiversity Patterns in Indonesia.

[1] The difference in these mammals lists in large part relates to the inclusion of a large number of bats categorized as vulnerable on the IUCN list.

5.4 Conservation of Endangered Species

Information obtained from MoF and from NGOs indicates that GoI has no ratified action plans for any Indonesian endangered animal or plant species[2].

No action plans are currently in preparation for plants. For animals, a GoI survival plan is currently being produced but only for the Javanese Eagle -- one of the 11 charismatic species on the most highly protected GoI lists (PP7 and PP8). GoI has been involved with several international NGOs in the preparation of action plans for the Sumatran Tiger (*Phantera tigris sumatrae*), Javanese Rhinoceros (*Rhinoceros sondaicus*), Komodo Dragon (*Varanus komodoensis*) and Bali Mynah (*Leucospar rothschildi*).

WWF Indonesia has produced survival plans for the Orangutan, Sumatran Tiger, and Javanese Rhinoceros, which they have presented to MoF's Directorate of Nature Conservation, but to date there has been no response from the government. WWF is also preparing an action plan for Indonesian sea turtles. Additionally, the IUCN has sponsored an orangutan survival action plan as well as. Further, in the 1990s PHPA and the IUCN Conservation Breeding Specialists group conducted population viability analyses for a number of species including the Sumatran Rhinoceros, Bali Starling and Javan Hawk Eagle. The reports arising from PVA workshops included conservation action points. As with other natural resource issues, the aforementioned plans and strategies have suffered in their implementation due to broader, crosscutting issues discussed in other portions of this report.

Most of the funding of ecological research on Indonesian endangered species has come from international sources (bilateral, multilateral, universities and private) and has been channeled through both local and international NGOs, bilateral agencies and zoos. Most of this information has found its way into privately produced survival plans for several of the 11 flagship endangered Indonesian species, as well as the Bali Mynah.

Management of endangered species is still retained by GoI because endangered species and other conservation activities are exempt from decentralization under Act No. 22 of 1999 (see earlier sections). GoI continues to implement a strict preservation model for

[2] That being said, in 1995 PHPA and Bird Life together developed a format for species recovery plans and produced three, for the Bali Starling, Yellow Crested Cockatoo and Javan Hawk Eagle. The last of these stimulated a wide range of local NGO-led conservation activities across Java (pers. comm. P. Jepson 2004).

endangered species (Category 1, IUCN). However, many other current decentralization policies, including aspects of the forest estate, tend to move implementation of conservation of endangered species to co-management scenarios with districts and provinces. For example, many NGOs advocate that land set aside for endangered and other species without the consent of local communities should be returned to those communities (Kompas, 26 January 2001). Introduction of Integrated Conservation and Development programs (ICDPs), social forestry and protected areas as means to conserve endangered and other species have been difficult to fully actualize because of the contentious issues of land tenure (FWI/GFW 2002; please see earlier section on legislation and institutions). This has resulted in local communities and local governments, down to the village level, reclaiming their perceived rights in the form of intensified illegal logging and land encroachment, with devastating impact on endangered species. Official GoI action plans for priority endangered animals and plants are urgently required. These plans need to be mainstreamed into district, province and GoI multi land-use spatial plans.

Given the lack of official GoI action plans for any endangered species, we conclude that there is a general absence of integrated planning for endangered species involving protected areas, other conservation domains and corridors linking populations. Further, since decentralization, spatial planning has mainly devolved to provinces and districts (please see section on legislation and institutions), which are generally ill-equipped to both design the process and technically carry out the work (Brown and Jarvie 1999).

In summary, the lack of available meaningful multi-use land and spatial planning that incorporates the requirements of endangered species, coupled with a general neglect of such plans where they exist, continue to result in a dramatic increase in Indonesian species that are endangered. Degradation of lowland forests, wetlands and coastal marine environments, encroachment of habitats in protected areas and other areas, pollution and hunting will continue to threaten Indonesian animals and plants in the near and long-term.

5.5 Endangered Species Habitats

Many of the critically endangered species, especially the 11 species protected by presidential decree, are large animals that require extensive tracts of land (or ocean) to maintain viable populations. This is particularly the case with predators, such as the species of cats (*Felis spp*), Kubung (*Cynocephalus*), Musang air (*Cynogale*), and Raptors (e.g., *Falconidae, Pandionidae*), all of which are species that range widely and are endangered.

A large majority of the animals and plants that are endangered are those from the mid to lowland rainforests of Indonesia, including species that inhabit the forest canopy (Primates (*Hylobatidae, Macaca, Pongo, Presbytis, Simias, Nasalis Tarsius*), the Tree Kangaroo (*Dendrolagus*), and Squirrels (*Petaurista, Phalanger, Ratufa*)) and under-story (*Cervus spp, Muntiacus, Tapirus, Iomys, Lariscus, Lutra*). The endangered bird species are also disproportionately from these forests (MacKinnon et al. 2000), as are the species of endangered plants, particularly *Dipterocarpaceae, Rafflessiacea, Orchidacea* and *Palmae*. A key challenge to protecting these endangered species is that their habitats lie in the same location as commercially valuable timber resources, viz., mid and lowland forests.

Pollution and degradation of wetlands, fresh water and coastal environments has also endangered a number of species. The Mahakam River Dolphin is reduced to about 70 individuals. Many species of water birds or birds that breed in wetlands are endangered, as are both freshwater and sea turtles, three species of crocodile, and a much wider range of fish than are listed, e.g., in Central Sulawesi (Whitten et al. 1987).

Summary. Indonesia is among the countries with the most threatened flora and fauna and has recognized this through legislation that recognizes their need for protection. Yet the challenges to protecting endangered species are many: Proximate causes include encroachment of protected areas, logging, introduction of exotic species, agricultural expansion, wildfires, reef damage and hunting. More tenacious challenges are institutional, such as obscure land tenure, poor or absent spatial planning, unclear roles and responsibilities of government agencies at all levels, and a corrupt judiciary. Further, there is a lack of harmonization between internationally recognized endangered species, viz., those on the IUCN Red List, and the species that Indonesia recognizes. Moreover, there is a lack of coordination among the government institutions involved in identification and protection of endangered species. Indonesia lacks any official action plans for endangered species, and there is a general absence of integrated planning for endangered species involving protected areas, other conservation domains and corridors linking populations. The lack of available meaningful multi-use land and spatial planning that incorporates the requirements of endangered species, coupled with a general neglect of such plans where they exist, continues to result in a dramatic increase in Indonesian species that are endangered. Degradation of lowland forests, wetlands and coastal marine environments, encroachment of habitats in protected areas and other areas, pollution and hunting will continue to threaten Indonesian animals and plants in the near and long-term.

6. Conservation Outside of Protected Areas

This section addresses issues of conservation and management in natural systems beyond the protected areas reserve. Important conservation values may be captured in managed natural systems, including forests, coastal areas, wetlands, and agricultural areas. Beyond natural areas, this section discusses threats posed by development projects as well as opportunities for conservation through zoos and seed banks.

6.1 Managed Natural Systems

This section describes the major managed ecosystems of Indonesia and analyzes their present conservation status. For each system, ecological and social importance is discussed. Economic and ownership issues are raised where these are an essential component of the threat, as in the forestry sector. All of these managed natural systems play a vital role in providing environmental services. This includes but is not limited to ensuring air and water quality, regulating erosion, managing water flows, and maintaining productive soils. All of these are essential components of healthy ecosystems that can contribute to biodiversity conservation. A country map of vegetation types is included in Appendix XI of this report.

6.1.1 Forest Resources

6.1.1.1 Overview of Indonesia's Forests

Indonesia's forests are among the most extensive, complex, diverse, and valuable in the world. Indonesia's forests account for about 10% of the world's remaining forests and are important to the survival of Indonesia's biodiversity: home to 25% of all fish species, 17% of birds, 16% of reptiles and amphibians, 12% of mammals and 10% of plants (Lele 2000). Globally, Indonesia's forests represent a treasure trove of unique biodiversity and endemic species. Indonesia's forests are a globally important climatic resource, both as an atmospheric filter and as a sink for carbon that would otherwise contribute to global warming. Tens of millions of poor and indigenous peoples depend on the forests for their livelihoods. Tens of millions of others benefit from commercial use of forests, which contributes important shares of Indonesia's trade earnings, GDP, tax revenue and employment.

Indonesia’s forest estate is also vast, covering about two thirds of the nation’s land – 120 million hectares encompassing not only actual forested areas, but also millions of hectares of agricultural land, mining operations, upstream villages and downstream towns (Bennett and Walton 2003). The forests are also diverse with links to the national economy and local incomes, export earnings and domestic trade, small scale livelihoods and vast industrial enterprises, foreign and domestic investment, private and state management, and security and conflict issues (Bennett and Walton 2003). The wealth of forest resources, both products and environmental services, also results in extensive conflict over control of these resources. These are reflected in horizontal conflicts between local communities and timber concession holders, as well as vertical conflicts between different levels of government. (Bennett and Walton 2003). Besides forested land within the designated state forest area, millions of hectares of additional land are forested or are managed agroforestry systems that contribute to conservation of forest biodiversity and environmental services.

6.1.1.2 Current Status of Indonesia’s Forests

While Indonesia has some of the world’s largest and most biologically diverse forests in the world, these forests have undergone significant change in recent years. GoI policy to boost forest production through the timber concession and plantation systems has generated significant revenues for development, but has also resulted in significant forest degradation. Since 1995, more than 20 million hectares of forest have been cleared, thus resulting in one of the highest rates of tropical forest loss in the world. Additionally, millions of hectares of forest have been degraded to some degree, thus putting growing pressure on the maintenance of environmental services and biodiversity conservation.

Since the mid-1990s, rates of forest degradation appear to be on the rise. While data remains unreliable, estimates for forest degradation from such institutions as the World Bank and the Ministry of Forestry range from 2.4 to 3.6 million hectares per year. This significant increase in forest degradation is attributed to a range of often inter-related problems including illegal logging, and a gap between wood-based based industry capacity and a legal, sustainable supply of timber. The GoI is aware of this problem, and is under mounting international pressure from donor countries as well as international NGOs to reverse this trend. (FWI/GFW, 2002). This requires effective and equitable law enforcement, rationalizing and down-sizing of the wood-based industry, and managing forests for integrated environmental services and resource benefits rather than only for timber production.

6.1.1.3 Forest Land Use Types

The GoI categorizes State Forest land into four major components (Bennett and Walton 2003). This includes:

- Conservation areas or *Kawasan Konservasi* (20 million ha)
- Protection forests or *Hutan Lindung* (34 million ha) intended to prevent erosion and safeguard water resources
- Production forests or *Hutan Produksi* (58 million ha) managed primarily for timber exploitation by forest concessions, and
- Conversion Forests or *Hutan Konversi* (8 million ha) designated for release from the state domain for agricultural utilization, mostly plantation systems, in particular oil palm (GoI, Law 41 of 1999).

It is important to note that up to 10 million hectares of State Forest land are currently not covered with trees. Additionally, millions of hectares of land outside of State Forest land are forested and/or are managed as agroforestry systems. (Bennett and Walton 2003).

Conservation Areas. Conservation areas comprise Indonesia's protected areas system, described in great detail earlier in this report. With the objective of conserving Indonesia's rich biodiversity for Indonesians and the global community, Indonesia's conservation area is sub-categorized into national parks, strict nature reserves, nature recreation parks, wildlife reserves, grand forest parks and hunting parks. All sub-categories follow international IUCN standards, and fall into IUCN categories I through IV. Indonesia's conservation area comprises both terrestrial and marine protected areas.

Protection Forest. Protection forests are designated to safeguard essential environmental services, particularly hydrology and erosion control. It consists of riparian areas, steep slopes, or watershed areas that preserve ecosystem functions or provide important environmental services. As the second-largest categorization of forest land, protection forests contribute significantly to the biodiversity and forest conservation landscape. By law and practice, protection forest lacks the same legal and institutional support for protection compared to conservation areas. The protection forests are not patrolled or policed for the most part, and often occur within local government boundaries and within active timber concessions.

Production Forest. Most commercial forestry takes place in Production Forest. Companies are provided forest concession rights, or *Hak Pengusahaan Hutan* (HPH), for a period of thirty-five years to harvest forests under Indonesia's selective harvesting guidelines. Typical forest concessions range in size from 50,000 to 200,000 hectares. As of December 2001, there were 351 forest concession holders managing a total area of 36.56 million hectares of forest. Concession holders include private companies, as well as parastatals under the control of the Ministry of Forestry.

Since Indonesia's decentralization initiative was launched in 1999, there has been a surge in the issuing of small scale forest concession permits, primarily at the district level. The legal status of such permits remains unclear, and the right to authorize forest concession permits remains a source of contention between central and local level government agencies. (Bennett and Walton 2003).

Conversion Forest. As noted above, a substantial area of land has been allocated to be converted from forest to other uses, mainly agriculture, but also other activities such as transmigration and other development projects. In terms of agriculture development, forest land is typically converted to oil palm for the production of crude palm oil, or timber plantations to provide fiber to Indonesia's growing pulp and paper industry. Similar to the forest concession rights system described above, conversion forest licensing is oriented toward large-scale investments. Two key licenses associated with conversion forest are the permits for forest clear cuts, or *Izin Pemanfaatan Kayu* (IPK) for the clearing of forest for development activities, and the permit for Industrial Timber Plantations, or *Hutan Tanaman Industri* (HTI). (Bennett and Walton 2003: 51). Since 1999, there has been a moratorium on the provision of new licenses for forest conversion. This moratorium does not affect activities of existing permit holders.

6.1.1.4 Commercial Forestry

Indonesia's forest-based industries contribute significantly to the national economy, though long-term sustainability hinges on a significant increase in supply of timber and fiber. This can not come from sustainable management of natural forests, and, instead, will need to come from a variety of plantation systems that could be developed on existing degraded forest land.

Wood-processing Industry. Indonesia's wood-based industry is ranked third in overall non-gas and oil export value, after electronics and textiles. In 2001, wood-based exports were valued at more than $4.23 billion, and accounted for almost 10% of Indonesia's non-gas and oil revenues. (Bennett and Walton 2003:52). While wood-based exports were led by plywood through the 1980s and 90s, pulp and paper exports have been gradually replacing plywood as the primary export product. Indonesia's pulp capacity rose from 606,000 metric tons in 1988 to 4.9 million metric tons in 2000. Paper production capacity rose from 1.2 million to 4.3 million metric tons during the same time period. Operating at current capacity, Indonesia's pulp and paper mills would consume some 24 million cubic meters of timber, more than four times the current Annual Allowable Cut (Barr 2000).

Log Production. Annual round wood consumption by the wood-processing industry is generally regarded to be around 60 million m^3 (Bennett and Walton 2003). With annual allowable cut (AAC) from Indonesia's forests in 2002 at 12 million m^3, this means that legal, authorized consumption is only a fifth of actual demand. As the AAC has been reduced in recent years to 6.3 M m^3 in 2003 and further to 5.7 M m^3 in 2004, there has not been a noticeable decline in wood processing activity and industrial timber demand, meaning a larger and larger share is coming from illegal and unsustainable sources (Ministry of Forestry, Press Release, Jan. 2003). Official statistics indicate that wood supply comes from a variety of sources, including timber concession (HPHs), forest clear-cutting for plantations (IPKs) and industrial timber plantations (HTIs). Additionally, teak plantations on Java contribute to overall log production, but are a minor share of the total.

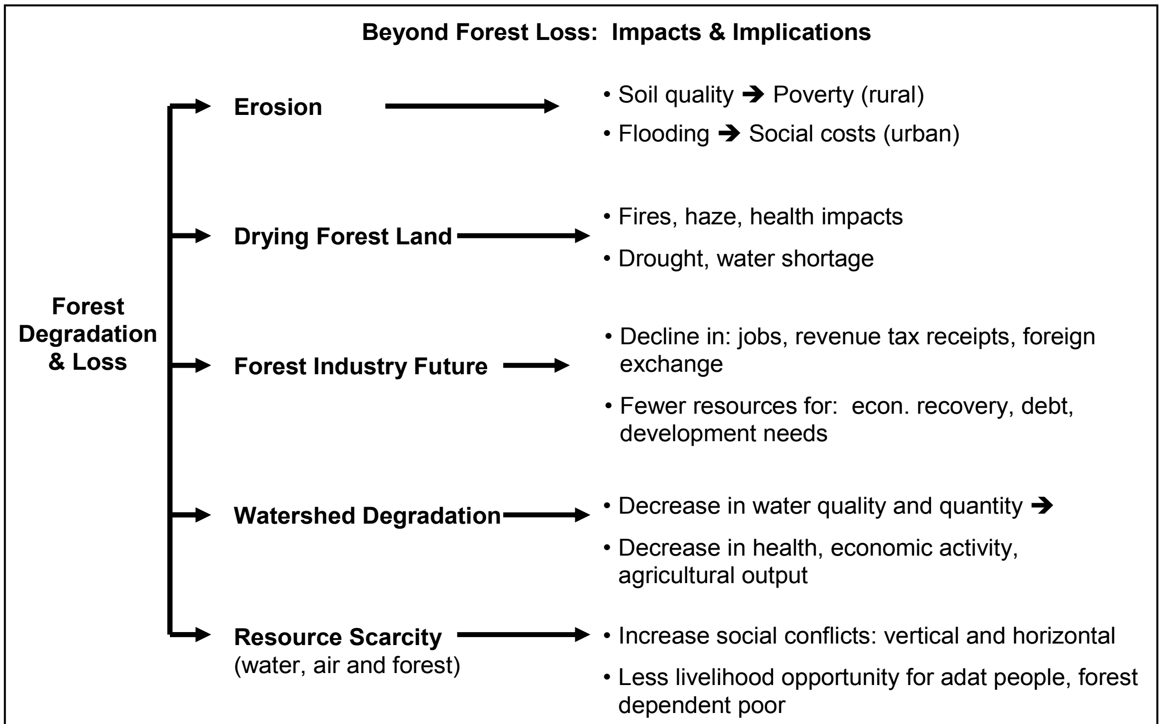
Timber Certification. Responding to growing international market demand for certified timber, particularly from North America and Europe, there has been increased interest on behalf of the GoI, international and national NGOs and some business leaders to develop certified eco-friendly timber from Indonesia. The Indonesian Ecolabeling Institute (LEI) was established in 1998 to facilitate the development of timber certification, combining international standards as set by the Forest Stewardship Council (FSC) with Indonesian forestry regulations. While there has been extensive training in timber and forest product certification, to date there have been only two concessions that have received and maintained certification standards. Ecolabeling and certification could enhance market value of Indonesia's forest product outputs if there were a greater focus on North American and European finished product markets, but the current focus is on products and markets currently not as interested in ecolabeling and certification. Further, forest tenure in Indonesia is problematic to international ecolabel standards as forest tenure is currently granted to the State rather than local communities or private holders.

Non-Timber Forest Products (NTFPs) Although timber extraction has long dominated commercial forestry in Indonesia, the country's forests also produce a diversity of non-timber forest products (NTFPs), some of high commercial or local value such as rattan, resins, fruits, and medicinal plants (Bennett and Walton 2003). Rattan contributes to an export market for furniture, handicrafts and mats. While cultivated in local agroforestry systems in Central and East Kalimantan, a highly sought-after large diameter rattan cane is harvested directly from natural forests in Sulawesi. Production of this cane has dropped in recent years primarily due to loss of natural forest habitat for the more sought-after large-diameter canes (Bennett and Walton 2003: 53).

Bird's nests, *gaharu* wood, various resins, honey, mushrooms and medicinal plants are also important NTFPs gathered from natural forests, typically by individual harvesters, and contributing significantly to rural livelihoods as well as domestic and export markets. Sago, as well as various fruits, roots, leaves and wild animals are also collected for local consumption. *Damar* resin is collected from smallholder-cultivated agroforests in southern Sumatra. Industrial-scale production systems from plantations produce turpentine and *gondorukem* from Pine resin as well as eucalyptus oil (Bennett and Walton 2003: 53).

6.1.1.5 Environmental Implications of Forest Loss.

As mentioned earlier in this Chapter, Indonesia's forests have suffered significant degradation since the 1980s and this has been exacerbated since the late 1990s. This has significant impact on Indonesia's economy, as indicated by the growing gap in timber supply for wood-based industry and reduced export earnings from the sector's exports. Additionally, this has had a significant impact on Indonesian society, as forest degradation has led to loss of livelihoods for many forest dependent communities, horizontal and social conflict over remaining forest resources, and increased incidences natural disasters precipitated by forest degradation. Finally, this has had significant impacts on biodiversity conservation and environmental services management. This is captured in the figure below, which demonstrates the broad impacts of forest loss in Indonesia.



[*Forest Loss Implications; Source: USAID NRM III Program Presentation to Bappenas, 2003*]

Figure 6.1: Forest Loss Implications

Forest Fires. Fires have been the preferred method for clearing land for agricultural development for thousands of years in Indonesia. The scale of use of fire for land clearing has grown dramatically in direct correlation to the expansion on oil palm and timber plantations. While the least expensive method for clearing land for a plantation manager, the environmental cost for Indonesia is significant. The on-going use of fire for land clearing has resulted in yearly fires that cover Indonesia and its neighbors in a thick smoke and haze. This disrupts economic activities and creates health hazards, and threatens biodiversity. Besides direct impact from fire, plant growth and photosynthesis is affected. Further, migratory routes of various species of animals are altered and destroyed. An economic resource valuation of Indonesia's 1997-98 forest fires indicates the cost for Indonesia at $7 billion and its neighbors at $2 billion. (ICG 2001:4, Applegate 2001).

Illegal Logging. Illegal logging is considered by the GoI, national and international NGOs and the donor community to be a leading cause of forest degradation in Indonesia (see GoI, DFF and NGO statements to the Consultative Group on Indonesia meetings, 2000-2003). The substantial gap between legal timber supply and wood-based industry capacity is met largely through illegal logging, and these activities have a detrimental effect on the environment. Among other things, illegal logging activities within forest concessions include over-harvesting beyond the legal and sustainable quota, as well as harvesting trees from steep slopes and riparian habitat designated as protection forest. It includes timber harvesting and land encroachment in conservation areas and protection forest. Illegal logging includes the falsification of relevant logging and travel documents that inhibit adequate regulation of logging activities to ensure sustainable forest management. It includes exercising the use forest clearance permits without following-up on the development of plantations. In all these cases, illegal logging threatens biodiversity conservation and damages the environmental services of forests by going beyond or circumventing existing policies that regulate sustainable forest management.

Debt, Restructuring and Overcapacity. Indonesia's wood-based industry has installed capacity to consume seven to ten times the Ministry of Forestry's Annual Allowable Cut. Additionally, this wood-based industry is in serious debt and in many cases totally bankrupt. A recent study showed that the Indonesian Bank Restructuring Agency (IBRA), which is charged with restructuring and then selling corporate debt, holds approximately US$ 1.734 billion debt and a sizable share of wood processing capacity from Indonesia's wood-based industries (Simangungsong and Setiono 2003). Restructuring and selling this debt in order for wood-based industries to continue poses a significant threat to biodiversity and conservation of forest resources, as it encourages unhealthy firms to exploit forests in a non-sustainable manner in order to keep in business. Debt restructuring could provide a unique opportunity for rationalizing Indonesia's wood-based industry overcapacity with sustainable forest management if debt restructuring were clearly linked to the demonstration of legal and sustainable supplies of timber and fiber. Additionally, the GoI has recently labeled Indonesia's pulp and paper industry as a 'strategic industry' in terms of its capacity to generate export revenues and create jobs. This threatens biodiversity and environmental services management of forests, since pulp and paper capacity outstrips current sustainable levels of timber and fiber production. Unless industrial capacity is rationalized with sustainable production levels, wood-based industry will continue to threaten biodiversity and forest conservation in Indonesia.

6.1.1.6 Conflict and Forest Resources

A key threat to Indonesia's forest resources is conflict. While conflict over forest resources in Indonesia and around the world has been prevalent for decades, Indonesia has witnessed a recent surge in the scope and depth of conflict over forest resources. These conflicts can be broadly categorized as horizontal and vertical in nature. Horizontal conflict includes conflict among local communities as well as between local communities and concessions (timber extraction and/or plantation development) over management and or extraction rights to forest resources. Vertical conflict includes conflict between different levels of government over authority over the licensing and regulation of timber extraction and/or forest conversion. A powerful incentive driving interest in and conflict over control of forest resources is their relative liquidity into cash. Very low level investments in equipment, labor and operating rents can quickly be converted into significant cash flows. Virtually wherever commercially-viable stocks of timber are present, powerful individuals and institutions including but not limited to the Indonesian military, are involved in forest extraction activities (Jarvie et al. 2003).

Factors contributing to conflict over Indonesia's forest resources are numerous. First, natural wealth of Indonesia's forest estate, in terms of timber, non-timber forest products and conversion to plantations, is enormous. Indonesia's forests have and continue to attract entrepreneurs trying to make money, as low levels of investment can reap huge financial rewards. Second, over-exploitation of Indonesia's rich forest resources lead to increased competition among entrepreneurs and local communities to maintain control of remaining forest resources. Third, large-scale forest resource allocation in Indonesia has been top-down and elitist. Large-scale logging commenced in the 1970s, with all licensing and permits coming from the center. Jakarta's political elite benefited from this policy, leading to disenfranchisement and anger in and around forested areas in the Outer Islands. Fourth, industrial development policy resulted in over-capacity in wood-based industry such that natural forests could no longer sustainably supply industry. This put more pressure on available forest resources, and led to increased conflict in forest areas. Fifth, forest resource tenure rights are controlled by the State and tend to be allocated for large-scale commercial operations including timber extraction and conversion to plantations. Farmers and communities living in or adjacent to state forests – often for many generations – have no clear way to establish management rights over their forest resources. Especially when confronted with a commercial operation, this leads to conflict. At the very least, the lack of mechanisms for individual and/or community tenure perpetuates a policy of forest exploitation rather than one of sustainable forest management and conservation. Sixth, the Indonesian military generates a significant portion of their budget through the exploitation of forest resources, including timber as well as endangered wildlife (ICG 2001). Forest resource exploitation is perpetuated through the military's territorial command structure and contributes significant revenues to the military budget. Seventh, laws and regulations established to regulate sustainable forest management are neither regularly nor equitably enforced. Indonesia's laws and regulations place steep fines and jail terms for forest crimes, but are rarely implemented. Arrests are often made, but few cases work their way through the legal system to completion. Finally, the recent decentralization and regional autonomy process has led to conflict among different levels of government over control to allocate and regulate forest resources.

The scope and depth of conflict over forest resources is widespread. As Jarvie et al. note in their recent study, "No group in Indonesian society is innocent of involvement in conflict. Within each group of stakeholders, some elements promote illegal activities that lead to conflict, while other group members suffer directly or indirectly from these actions. This includes police and military officials, some of whom have, in the course of their duties, suffered serious injury or even died defending the written law, while others have benefited enormously. This same observation applies to communities. International companies buying forest products, or providing logging tools, are also directly or indirectly complicit in engendering conflict. Whereas timber-related conflict is based in rivalry for ownership of resources among political elites, security forces and different elements of civil society and patterns of conflict vary by forest type and industrial exploitation. Those directly responsible for conflict are local gangs or syndicates, except in West Papua, where state-societal conflict prevails. Criminal syndicates constitute alliances among new and local political elites, business interests and security forces." (Jarvie et al. 2003: 9)

Eradicating conflict over Indonesia's forest resources involve a number of issues grounded in the principles of good governance. This includes regular and equitable enforcement of existing laws and regulations; provision of adequate forest management tenure mechanisms for individuals and community groups; clarification of roles and responsibilities over forest resource licensing and regulation between different levels of government; and reduction in the military's generate budget revenues through forest resource exploitation.

6.1.2. Coastal and Marine Resources

Indonesia's coastal and marine resources are described in Chapter Three of this report. The rich biodiversity of these resources contribute significantly to Indonesia's national economy and support the livelihoods of tens of millions of Indonesians. This section looks at the environmental threats to major coastal and marine ecosystems outside of protected areas.

Like its forests, Indonesia's coastal and marine resources are being exploited at an unsustainable rate. On-going degradation of coral reefs and mangrove forests, over-fishing of both reef and pelagic fish species, and pollution of coastal and marine resources is leading to a dramatic reduction of the productive value of these resources. As a result, coastal communities are among the poorest in Indonesia, with many living in subsistence conditions, lacking basic facilities including access to clean water, public health and education facilities. Trapped in a vicious cycle of debt – often intergenerational – coastal fishing communities often succumb to dangerous, destructive and illegal fishing practices to increase their catch.

Degradation of Indonesia's coral reefs occurs through over-fishing and illegal fishing practices, sedimentation and pollution-related problems. Over-fishing and illegal fishing activities include blast and poison fishing, as well as damage from nets. Destruction of coral reefs due to these practices quickly results in reduced fish-catch, thus leading to over-fishing on existing reefs, and then expansion of illegal fishing activities to more distant coral reefs.

Coral reef damage caused by sedimentation and pollution-related problems tends to be concentrated on fringing reefs located at the base of major watersheds. Poor development planning can lead to increased erosion and sedimentation during and after construction of roads and other infrastructure development. Poor land-use management by farmers can result in agriculture activities leading to increased erosion and sedimentation. Poorly planned land clearing and logging can further exacerbate erosion and sedimentation. Similarly, pollution stems from up-stream discharge of industrial waste as well as agricultural runoff of residues from fertilizers and pesticides. Reducing the threats to coral reefs from sedimentation and pollution-related problems requires an integrated approach of working with both coastal communities as well as upstream stakeholders through effective integrated watershed management initiatives.

Destruction of Indonesia's mangrove forests stems from rapid logging of mangrove forests, primarily to feed the country's growing pulp and paper sector, as well as through conversion to aquaculture. Of the country's 4.25 million hectares of mangrove forest, more than 1 million hectares have been designated for logging. The rate of mangrove forest degradation, especially along coastal areas of Sumatra, Kalimantan, Java and Papua, is unsustainable. Besides contributing to reduced stock of economically-viable fish species, loss of the protective mangrove forest habitat is resulting in increased flooding during high tides in the rainy season, as destroyed mangrove forests can no longer play their crucial role of buffering the coast from stormy seas.

While Indonesia's coastal and marine resources are in peril, there are signs of hope. In 2000, the Government of Indonesia established the Ministry of Fisheries and Marine Affairs. Previously a Director General position in the Ministry of Agriculture, raising Fisheries and Marine Affairs to a cabinet-level ministerial position provided the necessary political support to ensure Indonesia established policy enabling conditions and institutional capacity for more sustainable coastal and marine resources management. With the support of USAID, the Ministry of Fisheries and Marine Affairs has launched a national law on sustainable marine resources management. Further, the Ministry of Fisheries and Marine Affairs is establishing effective programs that support Indonesia's trend toward decentralization and regional autonomy.

Yet there is still a great deal of work to be done to ensure more sustainable marine and coastal resources management. This includes policy development and capacity building for sustainable marine resources management through establishment of a vibrant marine protected areas network that focuses on increased fisheries production; developing models for decentralized coastal and marine resources management; and integrating coastal and marine resources management into larger, integrated watershed management projects.

6.1.3 Inland Waters and Wetlands

Inland waters and wetlands are increasingly affected by flooding, sedimentation, urbanization, industrialization, and accompanying pollution. More generalized environmental destruction in forested uplands affects both water quality and water quantity in more heavily populated downstream regions. Both agriculture runoff and industrial discharges contribute to a worsening of water quality. Land conversion (forests to agriculture or settlements) and land filling (for development projects and settlements) affect both watersheds and wetlands, with increasing evidence of imbalanced hydrologic regimes seen in seasonal drought and flooding. Freshwater systems, both natural and man-made, are important sources of fish protein for Indonesians and their degradation will result in negative nutritional impacts.

In some areas near major population centers on Java, competition for water between housing, industry, and agriculture (primarily for irrigated rice) is becoming acute and will only intensify in coming years. Recent promulgation of a new water resources regulatory framework has generated serious, and often contentious, public debate especially linked to the possibilities of private sector involvement and possible fee structures for irrigation water ('user fees').

On a larger, more visible scale, Indonesian development projects have created vast areas of degradation in important wetlands and peat areas. Destructive logging and land clearing practices have affected water regimes and moisture retention to the extent that seasonal fires (caused by land clearing, etc) have affected peat lands, with attendant health impacts due to haze. The "million hectare rice project" has destabilized a vast area of fragile swamp forest habitat in central Kalimantan, home to orangutans and other endemic species.

6.1.4 Agro-ecosystems

The core of Indonesian agriculture is irrigated rice. Each year, 10 million hectares are planted in rice, much of this in double-cropped systems. Indonesia's yield of nearly 4.5 tons/hectare is the highest among tropical rice systems. Well over half of Indonesia's rice is produced on Java, and the Java provinces plus South Sulawesi and North Sumatra account for over 70% of national rice production (Fakih, Rahardjo et al, 2003). Rice cultivation is also the largest single occupation in the nation (and indeed in the world). In terms of biodiversity, tropical wet rice 'monoculture' is in fact a rich aquatic system due to 3,000 years of co-evolution of rice plants and insect complexes. Studies (Settle et al. 1996) have identified more than 700 species of arthropods in a single hectare of rice field on Java.

Throughout the 1990's it is estimated that nearly 50,000 hectares per year of highly productive irrigated rice on Java were lost to the development of housing and industry around burgeoning urban centers (Wahono, 1999). From areas surrounding metropolitan areas like Jakarta down to the environs of *kota kecamatan* (sub-distict capitals) the loss of agricultural land is quite visible. As little as 15 years ago, Bekasi District bordering Jakarta, now an industrial area, was one of the largest rice producing districts in the nation. This has caused many to eye the less densely populated outer islands as alternative agricultural production areas, often with disastrous results. In the mid-1990's political schemes like Suharto's dream of the 'Million Hectare Rice Estate' in Central Kalimantan resulted in unmitigated disasters (Barber and Schweithelm 2000, Hayes 1997, Kartodihardjo 1999). The only ones benefiting were the companies and associated GoI bodies, which cleared over 500,000 hectares of forest. The lessons have not been fully internalized as there is still talk of 'rice estates,' either publicly or privately organized, being established in Sumatra and even Papua. Fortunately, these schemes require huge infrastructural investments not currently available. Just as in the case of massive crude palm oil plantations, development of large scale 'industrial agriculture' puts pressure on forests and often ends up leaving behind areas of degraded, erosion prone, land (ANGOC, 1999).

Besides rice, Indonesia has perhaps 250,000 hectare in highland and lowland vegetables. Lowland vegetable production comprises chili, shallots, grain legumes (soybean, mungbean), and corn, often grown in rotation with rice as dry season crops (*palawija).* Upland vegetable production mostly involves areas dedicated to exogenous vegetables (cabbage, beans, carrots, tomatoes, etc.) where most of the produce is destined for urban areas(Pertanian dalam Angka, BPS, 2002).

In highland and lowland vegetable as well as in rice production, the pollution load introduced to the environment from the overuse of chemical fertilizers and pesticides presents a serious problem affecting not only fauna and flora, but public health as well. Vegetable crops such as cabbage are sprayed up to 30 times a season with 'cocktails' of toxic chemicals (Eveleens et al, 1996). Epidemiological studies conducted under the auspices of a USAID supported Integrated Pest Management Project (BAPPENAS-FAO) in the 1990's showed that besides obliterating life in soil and water, 20% of pesticide 'spray events' resulted in mild to moderate poisoning for the human sprayer, as defined by three or more signs and symptoms of neurobehavioral toxicity (Kishi, Hirshhorn, Dilts, et al 1996; Murphy et al 1999), hence constituting a major public health problem on top of environmental damage. When farmers are taught good agro-ecosystem management methods, poisonous pesticide use can be reduced up to 90% in vegetables, and removed entirely from most rice systems. Similar approaches are now being applied to chemical fertilizers, which besides being increasingly expensive to farmers are also causing soil fertility problems through overuse while contributing to pollution of water resources.

A number of studies have been commissioned over the last decade to produce erosion maps with the view to restricting agricultural practices in areas with a high risk of erosion. However, these local maps and their recommendations are seldom rigorously followed. Partial shifting agriculture systems in many places, for example along steep slopes of the upper Mahakam River, East Kalimantan, contributes greatly to land erosion[1]. Government programs, albeit not usually on the scale of the 'Million Hectare Rice Estate,' also contribute to erosion and degraded land. In a recent preliminary study for an ADB project on degraded land (Pontius, et al, 2003), a survey team found that in a majority of field sites visited degraded land was caused by government programmatic interventions: failed citrus plantations in Sulawesi, abandoned teak and tea plantations in Java, neglected rubber estates in Sumatra. Local communities seldom have the resources, or the knowledge, to rehabilitate such degraded resources.

Shifting and pioneer agriculture has been estimated to affect some 38.9 million hectares in Indonesia (RePPProt 1990). Partial systems of this sort can encourage the spread of the fire disclimax, *alang alang* grass (*Imperata cylindrica*), which dramatically alters the ecology and biodiversity of massive areas of Indonesia. RePPProt (1990) estimates that 10 million hectares have been converted to *alang alang*. In addition to improving agricultural practices in the outer islands of Indonesia, monitoring and regulating the plantation industry is essential to stop the ever increasing expanse of the *alang alang* grasslands since often these industries often clear forests for timber but do not fulfill their obligations to plant (FWI/GFW 2002, Telapak 2001).

Farming of prawns and fish in *tambak* ponds along the entire coastline of many Indonesian islands degrades the coastline and eliminates the protective sheath of mangroves. This is having a destructive effect on populations of local coastal and marine fish and crustaceans, and is seriously damaging biodiversity. Studies on comparable *tambak* in Thailand indicate that *tambak* ponds with an open connection to the sea are not

[1] "Partial shifting agriculture" systems is differentiated here from "integral shifting agriculture systems," the latter of which has been demonstrated to be a productive and sustainable form of agriculture and would not be considered a significant cause of land erosion (Conklin 1957, Dove 1981).

viable for many years and that economic returns from such practices in the mid-term are less rewarding than the traditional coastal fisheries that they have replaced. Hamilton and Snedaker (1984) note that the fisheries and coastal protection functions of mangroves may far outweigh the value of any other form of land-use.

Almost all freshwater lakes in Indonesia, except for Papua where many are protected by their remoteness, are severely impacted by surrounding farming practices, which dramatically alters their biological diversity. Upland lakes and watersheds surrounded by agricultural land are highly vulnerable to fertilizer and pesticide runoffs. Most of this run-off results from highly wasteful, large-scale overuse of chemical inputs and is avoidable as both technologies and training methodologies exist to remedy this problem. There is a need to continue to monitor and restrict the effluent (industrial and fertilizer) and sediment run off into these water bodies. This is particularly important as many of these water bodies have endemic species (e.g., Poso and Lore Lindu in Sulawesi). Probably nowhere in Indonesia is the impact of such farming practices on both biological diversity and people more pronounced than in the middle Mahakam region, East Kalimantan. There is a growing awareness downstream of the effect of damaging these water bodies. This includes greater turbidity in waters, flash floods, alteration of watercourses and shifts in the brackish/sea water boundaries, which so dramatically effect the distribution of the riparian vegetation, particularly the freshwater forests and mangroves. These lakes themselves are also very important commercially. For example, the Kapuas lakes produce 75% of all freshwater fish consumed in West Kalimantan. The Mahakam Lakes of East Kalimantan supply most of the local market in east Kalimantan for freshwater fish and also 30% of all dried freshwater fish consumed in Java (Bappenas 1993, MacKinnnon et al. 1996).

Agricultural policy and land use practices in Indonesia have had serious impacts on biodiversity in Indonesia. A glaring example of this is the oil palm plantations in Sumatra and Kalimantan. These monoculture plantations exclude most of the original biodiversity and frequently also are sited on the best agricultural land for mixed crops.

6.1.5 Ecosystems and Watershed Management

Many analysts and experts believe that an ecosystem approach[2] is the most effective way in the long run to maintain and maximize biodiversity. Major international conservation organizations and academics have promoted concepts of landscape management, bioregional planning, or other broad scale planning efforts as a way to deal with the increasing threats to biodiversity and environmental resources. As summarized in a report by the World Bank (2001), ecosystem level planning and management "embraces a continuum of different land uses from strict protected areas to production landscapes. It also means:

- Retaining a permanent forest estate including natural lowland forests as well as hill and montane forests;
- Creating new PAs to maintain remaining fragments of natural forest and protecting forest corridors that link remaining forest blocks;
- Managing production forests for sustained forest production and as buffer zones around, and corridors between, PAs to maintain as large an area of forest as possible, thereby effectively increasing the conservation value; and
- Seeking new options for managing forests after logging, rather than allowing conversion to inappropriate forms of agriculture. Such forest management could involve various management systems e.g. agroforestry, community management of production forests, and afforestation of degraded lands but should be designed to encourage natural regeneration, maintain native species and maximize biodiversity benefits."

The World Bank recommends that biodiversity conservation in Indonesia needs to be mainstreamed into traditional development. This means the incorporation of biodiversity issues, options and objectives into sectoral policies, sustainable national and regional development programs, and project impact assessment and mitigation/management plans in order to promote conservation management within the production landscape. In effect, projects in traditional sectors such as water, urban, agriculture, infrastructure, industry, energy, rural development and tourism need to balance environmental priorities in order to ensure sustainable development (World Bank, 2001).

[2] The ecosystem approach "insists upon the rigorous definition of an ecosystem by linking various ecosystem concepts and their interactions at different scales. This method is not limited to the application of a single ecosystem model for all cases. Instead, this approach depends upon viewing the ecosystem from a range of perspectives and using different system models to capture the complete picture…One ecosystem perspective consists of abiotic and biotic components" (www.fes.uwaterloo.ca/u/jjkay/HNA/c_ecosystem.html).

As discussed in later sections of this chapter, Indonesia's environmental and natural resource management approaches are mainly sectoral in nature and not particularly effective in their implementation. There is significant opportunity to design stronger, better integrated environmental management systems at the national to regional levels.

Watershed Management. Watershed management[3] provides an effective base for strengthening landscape management and mainstreaming sustainable forest and environmental services management. Watersheds provide an example of a manageable environmental system where conservation and development can be bought together in a practical, concrete, and timely manner. Indeed, the watershed is a concept that clearly and concretely demonstrates the short-term and long-term socio-economic benefits of forest and biodiversity conservation and management.

Field initiatives focusing on watershed management in East Kalimantan, North Sulawesi, and Papua demonstrate this. For example, in East Kalimantan multiple stakeholders in and around the province's key commercial hub of Balikpapan work together to sustainably manage the two watersheds – Sungai Wain and Manggar – that supply the city of approximately 500,000 people with its water, while also preserving the high level of biodiversity in the area, most notably the sun bear, red leaf monkeys, and several endemic species of birds, etc. (SKA-LORIES nd). Political will, awareness and action were cultivated and demonstrated all levels: a multi-stakeholder board oversees watershed management, the city government has invested US$ 200,000 per year and alternative livelihoods have been developed for those previously engaged in illegal logging and encroachment. Moreover, the success of Balikpapan's watershed management has drawn the attention of others in East Kalimantan, with the approach being replicated in East Kutai and Bontang. Keen interest is also being shown by other cities and districts. Integral to the success of watershed management is a multistakeholder approach that builds awareness and turns it into action that demonstrates the socio-economic benefits of biodiversity conservation through watershed management.

Further, watershed management holds the promise of locally derived protected areas that fit IUCN categories V and VI. These initiatives can take the form of conservation concessions for protecting high value critical habitats that lay outside the existing protected area system. Indeed the Balikpapan watershed management initiative could fit

[3] "Watershed management" is used in its broadest sense to refer to the watershed and its impacts on it from beyond defined boundaries. It is the unit of pragmatic intervention and is a component of an ecosystem.

this schema, and CIFOR in northern East Kalimantan will shortly begin monitoring a community-based conservation concession of a watershed funded by the IUCN. Integral to bolstering these local management and conservation initiatives is the development of a supportive policy framework at the national level.

The consequences of not managing watersheds and conserving their environmental services and resources, particularly in the upper catchment areas, also demonstrate the multiple benefits of their appropriate management. The recent (November 2003) floods in northern Sumatra that took the lives of at least 180 people are a tragedy that attests to the need for effective watershed conservation and management. The Sumatra disaster is only the latest in a long series of flooding and landslide events due to watershed degradation in Indonesia. WALHI, the Indonesian forum on environment, has identified numerous cases of natural disasters related to resource degradation in recent years. Landslides in Java and Sulawesi have kept this issue in the public eye during the second half of 2003 and into 2004. The increasingly severe and frequent flooding of Jakarta due to the development of weekend estates and resorts for Jakarta's affluent in the city's catchment also demonstrates strong evidence for the need for watershed conservation and management. Other cities, notably Bontang and Medan have also experienced increased flooding in recent years.

Land and Watershed Areas. The rationale for GoI and donor focus on watershed management to conserve and manage environmental services and contribute to biodiversity and forest conservation in Indonesia arises from the country's particular landscape characteristics and the mapping of certain administrative categories and demographics on to those attributes. Indonesia encompasses 189 million hectares of land area, much of which is steep and mountainous. Sumatra and Kalimantan account for 55% of this area; Papua accounts for 19% and Sulawesi 10%. The smaller islands of Java, Bali, Nusa Tenggara and Maluku make up the remaining 15% of land area. Notably, Java with only 7% of Indonesia's land area is home to 60% of Indonesia's people.

Table 6.1: Distribution of Indonesia's Land, Forest Land, and Watersheds

Major Island	Land Area (ha)	% Distrib	Watershed Area (ha)	% Distrib	State Forest Land (ha)	% Distrib	"Forest Land" as % of All Land
SUMATERA	48,084,700	25%	40,861,940	27%	23,049,656	19%	48%
JAVA	12,756,900	7%	10,873,538	7%	3,093,929	3%	24%
BALI & NTT	7,313,700	4%	7,228,800	5%	3,204,861	3%	44%
KALIMANTAN	57,419,400	30%	52,031,860	35%	36,190,596	30%	63%
SULAWESI	19,167,100	10%	14,978,090	10%	12,410,631	10%	65%
MALUKU	7,787,000	4%	0	0%	6,994,707	6%	90%
PAPUA	36,546,600	19%	24,767,300	16%	35,408,724	29%	97%
TOTAL	**189,075,400**	**100%**	**150,741,528**	**100%**	**120,353,104**	**100%**	**64%**

Source: Statistik Indonesia, 2002. Watershed data from Department of Settlements and Regional Infrastructure

Watershed areas and sizes follow in proportion to land area of the major islands. Although limited data on watershed sub-catchment areas and length of river systems is available, it is not particularly useful as an assessment tool. This is because the smaller and more rugged islands tend to identify more and smaller tributaries as separate catchments, with the result that Nusa Tenggara claims to have more river catchments than Sumatra and Kalimantan combined, and nearly as much total river length. Because of these issues of scale and definition, it is difficult to provide an overall analysis of watershed management issues and needs by island group, though some specific cases are used illustratively in section 3. The concept of "critical lands" and the national land rehabilitation program provide some insight into land and watershed management needs as defined by the GoI.

Table 6.2: Distribution of Watersheds and River Systems in Indonesia

Major Island	Watershed Area (ha)	% of total	No. of Major River Basins	Total Length of River (km)
SUMATERA	40,861,940	27%	30	21,235
JAWA	10,873,538	7%	15	14,821
NUSA TENGGARA	7,228,800	5%	7	18,447
KALIMANTAN	52,031,860	35%	14	16,460
SULAWESI	14,978,090	10%	17	17,127
MALUKU (*na)	0	0%	3	3,449
PAPUA	24,767,300	16%	4	7,210
Grand Total	150,741,528	100%	90	98,749

Source: Director General for Water Resources, Department of Settlements and Regional Infrastructure, 2002.

Forest Lands. "State forest land" accounts for two-thirds of the land area in Indonesia. As discussed in section 6.1.2 of this chapter, this is an administrative definition and some of this area is not covered by forests. It is clear, however, that forest lands (categorized as conservation, protection, production, and conversion forests) are a key element of landscapes and watersheds in Indonesia. Like the population, forest land is not evenly distributed across Indonesia. Over 90% of the land is categorized as state forest in the eastern, less-developed islands of Papua and Maluku. In the larger western islands of Sumatra and Kalimantan, state forest land represents about half to 60% of their total area. Java, the most populous island, is only 24% state forest, much of this categorized as teak plantations and national parks.

While much of this vast estate was once land with forests on it, currently nearly half is not. Forest Watch Indonesia's 2002 assessment reveals that 56% of the "state forest land" can still be described as natural forest, 37% is degraded, and 8% is entirely deforested. This is an indication that the biodiversity represented in the forest is likely similarly threatened or reduced from its prior extent.

Table 6.3: Distribution of State Forest Lands

	Protection Forest	Protected Areas	Limited Production Forest	Production Forest	Conversion Forest	Total
SUMATERA	6,695,628	4,878,520	1,910,271	8,005,654	1,559,583	23,049,656
JAVA	632,917	441,939	387,597	1,631,476	0	3,093,929
BALI & NTT	1,248,402	515,649	538,378	556,543	345,889	3,204,861
KALIMANTAN	6,858,792	4,458,887	11,925,715	12,099,244	847,958	36,190,596
SULAWESI	4,821,237	2,223,348	3,276,388	1,471,239	618,419	12,410,631
MALUKU	1,809,634	443,345	1,653,625	1,053,171	2,034,932	6,994,707
PAPUA	11,452,990	7,539,300	3,365,475	10,379,684	2,671,275	35,408,724
TOTAL	33,519,600	20,500,988	23,057,449	35,197,011	8,078,056	120,353,104
% OF TOTAL	28%	17%	19%	29%	7%	100%

Source: Ministry of Forestry, "Statistics of Production Forest Management," 2002

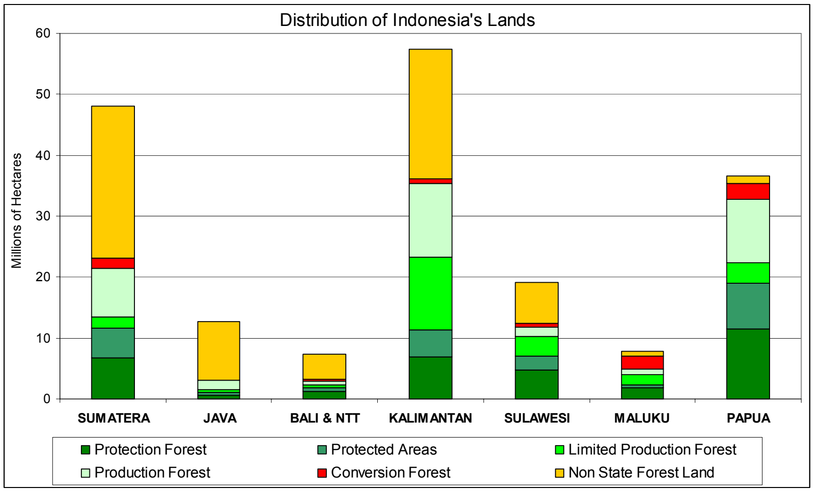


Figure 6.2: Distribution of Indonesia's Lands

Of the 120 million ha of state forest, more than half (55%) is allocated to production and conversion uses. Only 17% is in formal protected areas (parks, nature reserves). Another 28% is "protection forest."

"Critical Lands." Twenty three million hectares, or 12%, of Indonesia's lands are classified by the Ministry of Forestry as "critical." Based on documentation from the Ministry of Forestry, determination of critical lands is based on the level of degradation and the decrease of ecological functions. Assessment of critical lands depends on the function of the land: for example, in protection forests, assessments are based on land cover, crown density, slope, erosion and land management; in agricultural areas assessments are based on land productivity. (MoF 2003b)
The distribution of critical lands mainly follows the distribution of land in Indonesia, with some important exceptions. The western, more populous and more intensively used islands tend to have a higher concentration of critical land. Bali and NTT, however, stand out as having 23% of lands in critical condition, twice the national average. The smaller islands of the eastern archipelago generally have steeper slopes and lower rainfall than the larger islands, leading to higher rates of land classed as critical.

The distribution of critical lands does not necessarily follow the distribution of state forest land. About a third of this critical land is inside the national forest estate and two thirds is outside. In other words, non state forest land represents only a third of all land, but includes two thirds of the land in critical condition. Only about 7% of all forest land is in critical condition, while 22% of non forest land is critical, three times higher. In Bali and NTT, 32% of non forest land is critical, in Maluku it is 65%, and in Papua, nearly all. Java, Bali, NTT, and Sumatra are well above the national average in terms of the critical lands inside the forest estate, whereas Maluku and Papua are well below the national average.

Table 6.4: Distribution of Critical Lands Inside and Outside State Forest Area

MAJOR ISLAND	Non State Forest Land	All State Forest Land	Critical Land Outside Forest Area	Critical as % of Non Forest Land	Critical Land in Forest Area	Critical as % of Forest Land
SUMATERA	25,035,044	23,049,656	4,352,999	17%	1,988,869	9%
JAVA	9,662,971	3,093,929	1,699,682	18%	366,985	12%
BALI & NTT	4,108,839	3,204,861	1,305,116	32%	363,764	11%
KALIMANTAN	21,228,804	36,190,596	4,565,755	22%	2,612,971	7%
SULAWESI	6,756,469	12,410,631	948,213	14%	974,713	8%
MALUKU	792,293	6,994,707	514,875	65%	180,036	3%
PAPUA	1,137,876	35,408,724	1,719,594	>100%	1,649,309	5%
TOTAL	**68,722,296**	**120,353,104**	**15,106,234**	22%	**8,136,647**	7%

Source: BPS, Statistik Indonesia 2002, Ministry of Forestry, 2002

Given gaps in official data sources on forest and land use issues, caution is needed in drawing sweeping conclusions. These findings suggest, however, that the matrix of lands and habitats that support biodiversity is most heavily affected, degraded and/or disturbed outside the forest estate in the lands held by local governments, communities, small holders, and the private sector. This distribution can influence thinking about priorities for intervention.

National Land Rehabilitation Program ("Movement"). To protect forest and land from further degradation and recover its critical functions, the GoI recognizes that serious rehabilitation efforts are needed. Reforestation programs in Indonesia date back to 1976. More recently, the Minister of Forestry issued a decree (No. 20/Kpts-II/2001) dated 31 January 2003, concerning criteria and standards on rehabilitation of forests and lands as guidance for implementing integrated and sustainable forests and lands rehabilitation. From the GoI perspective, the purpose of forests and land rehabilitation is to "recover the degraded natural forest and land resources in order to achieve optimal function and maximum benefit for all parties, to ensure environmental balance and water scheme in watershed areas, and to support sustainable forestry development."

The main activity in rehabilitation efforts is planting tree species that provide benefits to the local communities, balancing forest function and people's needs. The Ministry of Forestry has recently launched a National Land Rehabilitation Program ("Movement"). Over a five year period, this movement, known as *GN RHL*, seeks to rehabilitate 3.1 million hectares of forest and critical land in 68 priority watersheds involving 27 provinces and 242 districts and cities.[4] Based on a replanting cost of Rp. 6 million (about $700) per hectare, the GoI has allocated Rp. 18.5 Trillion ($2.2 Billion) for this effort. The program will involve the planting of 169 million tree seedlings. (Cite: Press Release No. S.14/II/PIK-1/2004, "*Enam Menteri Hadiri Pra Pencanangan (Soft Opening) Gerakan Nasional Rehabilitasi Hutan Dan Lahan* (GN RHL), 8 Januari 2004.)

The distribution of land in this rehabilitation program does not mirror the distribution of land or critical land across Indonesia; 60% of the effort is focused on Sumatra and another 20% on Kalimantan. The program plans only minimal effort in Maluku and none in Papua. Java, Bali, and NTT, which have a larger concentration of critical lands, will receive a small share of rehabilitation efforts.

Table 6.5: Areas Affected by National Land and Forest Rehabilitation Program

Major Island	Total Rehabilitation Program Area (Ha)	% distrib.	Rehab. In State Forest (Ha)	% distrib.	Rehab. In non State Forest (ha)	% distrib.
SUMATERA	1,832,258	59%	772,124	51%	1,060,134	66%
JAVA	186,221	6%	21,505	1%	164,717	10%
BALI & NTT	119,552	4%	50,107	3%	69,445	4%
KALIMANTAN	577,070	19%	436,851	29%	140,219	9%
SULAWESI	393,425	13%	228,432	15%	164,993	10%
MALUKU	824	0%	332	0%	492	0%
PAPUA	0	0%	0	0%	0	0%
TOTAL	**3,109,350**	**100%**	**1,509,350**	**100%**	**1,600,000**	**100%**

Source: Ministry of Forestry, 2003. Materials accompanying GNRHL, "Lampiran 4c: Luas Sasaran Dan Perkiraan Kebutuhan Biaya Rencana Rehabilitasi Hutan Dan Lahan Lima Tahunan Pada Das Prioritas I Kelompok Penutupan Lahan I Dan II Per Propinsi Di Seluruh Indonesia"

Although the scale and budget for this activity is large, it will affect only a fraction of the vast area assessed as "critical." Though it aims to affect 13% of the critical land area, the distribution of program efforts is far from uniform. Relative to critical lands, the rehabilitation scheme targets more resources and effort in Sumatra and Sulawesi (rehabilitation area is 20 to 30 percent of critical area). The program focuses little or no

[4] Critics of this approach (e.g., J.Post editorial, Jan. 23, 2004) point out that planting 600,000 ha per year, even if successful, will not help much if deforestation continues as 2 million ha per year.

attention in Maluku and Papua, where critical land areas are a smaller portion of the total. If need is a criterion for resource allocation, however, it would appear that Java, Bali, NTT, and Kalimantan are under-represented in the rehabilitation program. Java, Bali, and NTT have concentrations of critical lands much higher than the national average, but they stand to receive lower than average shares of rehabilitation program effort.

Table 6.6: Rehabilitation Areas Compared to Critical Areas

Major Island	Total "Critical" Land Area (ha)	"Critical" as % of Total Land	Rehabilitation Program Area (ha)	Rehab as % Critical Land
SUMATERA	6,341,868	13%	1,832,258	29%
JAVA	2,066,667	16%	186,221	9%
BALI & NTT	1,668,880	23%	119,552	7%
KALIMANTAN	7,178,726	13%	577,070	8%
SULAWESI	1,922,926	10%	393,425	20%
MALUKU	694,911	9%	824	0%
PAPUA	3,368,903	9%	0	0%
TOTAL	23,242,881	12%	3,109,350	13%

Source: Combined from sources above.

In addition, the land rehabilitation program is focused on the most severely degraded lands. Two thirds of the program is located on areas with "small trees and undergrowth, open land, dry land agriculture mixed with undergrowth" (Land Cover Classification I). The other third of the program is focused on dry secondary forest, secondary swamp forest, and secondary mangrove forest (Land Cover Classification II). This reflects the focus of the program on restoring watershed and ecosystem services and supplying commercial timber in the future. When evaluating additional intervention needs, biodiversity and forest conservation planners must consider whether to focus more effort on relatively in tact forest areas, rather than on severely degraded lands.

Rehabilitation efforts are unevenly distributed inside and outside the State Forest area. Though two thirds of critical lands are outside the forest estate, nearly half the rehabilitation program area is inside the state forests. Relative to the critical lands, the program plans nearly twice the effort inside the forest estate (19% of area affected) as outside (11% of area affected). Looking at individual regions, this imbalance is even greater (e.g., in Bali/NTT and Kalimantan). Effort within the forest estate, again, is unevenly distributed. Sixty percent of the effort is located in production forest areas (limited, production, or conversion). Another 30% of the effort is located in protection forests (i.e., areas that protect watershed and ecosystem functions). Ten percent of the effort is located in conservation forests (protected areas). This allocation is consistent with an emphasis on production and service provision from the national forests. A biodiversity-oriented approach would yield a different distribution of rehabilitation resources, more focused on conservation areas and protection forests as key habitat.

Table 6.7: Rehabilitation Efforts and Critical Lands Inside and Outside State Forest

	CRITICAL LAND DISTRIBUTION				REHABILITATION PROGRAM DISTRIBUTION			
	Total "Critical" Land (ha)	State Forest % of Critical Land	Non State Forest % of Critical Land		Rehab in State Forest Land (Ha)	Rehab area as % of Critical Land in Forest Area	Rehab in Non State Forest (Ha)	Rehab area as % of Critical Land in Non Forest Area
A	B	C	D		E	E/(B*C)	G	G/(B*D)
SUMATERA	6,341,868	31%	69%		772,124	39%	1,060,134	24%
JAVA	2,066,667	18%	82%		21,505	6%	164,717	10%
BALI & NTT	1,668,880	22%	78%		50,107	14%	69,445	5%
KALIMANTAN	7,178,726	36%	64%		436,851	17%	140,219	3%
SULAWESI	1,922,926	51%	49%		228,432	23%	164,993	17%
MALUKU	694,911	26%	74%		332	0%	492	0%
PAPUA	3,368,903	49%	51%		0	0%	0	0%
TOTAL	23,242,881	35%	65%		1,509,350	19%	1,600,000	11%

Summary. The GoI's forest and watershed rehabilitation program is a major effort, but is not focused on producing biodiversity protection and benefits. By focusing on critically degraded forest areas, especially uplands and watershed areas, the program will help toward restoring some habitat areas and ecosystem functions, with some positive influence on biodiversity conservation. However, the program is limited in its reach and is not targeted toward biodiversity conservation objectives. Additional efforts could be designed to complement the national program in areas where it is working, or to supplement it in areas where it is lacking. Relatively less effort is planned for Eastern Indonesia and the smaller islands. Also, relatively more of the program's resources are focused inside the forest estate, while most of the critical lands are outside the forest estate.

6. 2 Impacts of Development Projects

The section reviews the impacts of the internationally and locally funded major development projects on biological diversity and tropical forest resources. Indonesia's framework for evaluating and managing the impacts of development project is discussed. The section also covers environmental review and permitting requirements as they concern major projects.

6.2.1 Key Types of Development Projects

Indonesia's on-going development process has significant impacts on the conservation of biodiversity and forests. Population pressure has led to opening of large tracts of forest land for settlements and agriculture development. Economic development has led to increased urbanization and the expansion of numerous urban areas into once rural environments. Increased and intensified industrial and agriculture production has led to increased pollution in river systems and groundwater tables. This section focuses specifically on the impact of large-scale development projects on biodiversity and forests. It includes the impacts of mining and petroleum as well as road and infrastructure development. Land conversion is discussed briefly, as this has been addressed in greater detail in the previous section of this report. This section ends with a brief discussion on Indonesia's policy framework for regulating the environmental impact of major development projects.

It is important to note that public spending on general infrastructure for development services, including but not limited to roads, ports, power generation and distribution, clean water supplies and waste water treatment systems, has dropped markedly since the start of the Asia economic crisis in 1997. As Indonesia emerges into a more stable economic recovery, investments for maintenance and development of such infrastructure is on the rise. This includes both GoI and donor supported development financing for infrastructure.

6.2.1.1 Mining

Mining has been taking place in Indonesia for thousands of years, though large-scale commercial mining operations began relatively recently, in the late 1960s. Presently, Indonesia is a world leader in the production and exporting of key mineral resources including copper, gold, nickel, silver, and coal. While mining contributes significantly to the national economy, mining is also one of the most environmentally damaging. It leads to habitat destruction, produces large quantities of waste in the form of slag heaps, overburden and tailing. Mines and their processing units are also a source of water contamination from ore tailings and chemicals. Open pits are a hazard to both people and wildlife, and ponds formed in open pits can become a breeding ground for mosquitos and other vectors of various tropical diseases (MacKinnon 1996:581). Environmental impacts of mining activities are regulated through the Ministry of Environment's Environmental Impact Management Agency (Bapedal), primarily through preparation and then monitoring of Indonesia's Environmental Impact Assessment process (AMDAL). Additional regulations are administered by the Ministry of Minerals and Energy.

Large scale commercial mining activities occur across Indonesia. Significant operations include Freeport, in Papua province; Newmont, on Sumbawa Island, Nusa Tenggara; and Kaltim Prima Coal in East Kalimantan. There are literally hundreds of other commercial mining activities in Indonesia, and data of site location and scope of activities is incomplete.

Artisanal and small–scale mines (ASM) are also scattered across Indonesia, with notable aggregations of coal and gold ASMs in Sumatra, Kalimantan, Sulawesi, Java, Maluku and Papua. There has been a surge in ASM activities since 1998, and this is leading to significant environmental and public health threats. ASM gold operations are releasing untreated mercury, which results in severe and irreversible health damage to both adults and children. Mercury also enters river systems, polluting water resources as well as poisoning fish and river habitats (World Bank 2001: vi-vii). Unlike large-scale, commercial mining, ASM activities are unregulated and there is thus no clear legal framework to manage the increasingly negative impacts of ASM on the environment.

Of special note in the field of ASM, OSM brought specialists to the Dimembe Gold Mining District east of Manado where significant small scale mining is taking place. The bulk of the ore beneficiation was being carried out by mercury amalgamation, perhaps the world's most environmentally destructive form of ore processing. Each of the several hundred processing units loses about 1 liter of mercury each month causing tons of mercury to be discharged into the environment annually. Alternatives to mercury amalgamation are limited, and can carry their own set of environmental and human health risks. OSM provided technical assistance to BAPEDALDA of North Sulawesi, including site visits, to help reduce the mercury processing. A conversion to cyanide vat leach processing was suggested as being much more environmentally friendly and efficient in recovering gold from the local ore. In 2002 there was one pilot vat leach system in the district now there are 34. The deployment of this technology will almost certainly reduce the current level of mercury impacts to the surrounding watershed.

Coal Seam Fire Suppression.

Indonesia's fire and haze problem is increasingly being ascribed to large-scale forest conversion and land clearing activities making way for pulpwood, rubber and oil palm plantations. Fire is the cheapest tool available to small holders and plantation owners to reduce vegetation cover and prepare and fertilize extremely poor soils. Fires that escaped from agricultural burns have ravaged East Kalimantan forests on the island of Borneo during extreme drought periods in 1982-83, 1987, 1991, 1994 and 1997-98. Not only were the economic losses and ecological damage from these surface fires enormous, they ignited coal seams exposed at the ground surface along their outcrops.

Coal fires now threaten Indonesia's shrinking ecological resources in Kutai National Park and Sungai Wain Nature Reserve. Sungai Wain has one of the last areas of unburned primary rainforest in the Balikpapan-Samarinda area with an extremely rich biodiversity. Although fires in 1997/98 damaged nearly 50% of this Reserve and ignited 76 coal fires, it remains the most valuable water catchment area in the region and it has been used as a reintroduction site for the endangered orangutan and a study site for the endangered Asian Sun Bear.

OSM provided Indonesia with the capability to take quick action on coal fires that presented threats to public health and safety, infrastructure or the environment. Technical assistance and training transferred skills in coal fire management through MEMR's Training Agency to the regional offices; giving the regions the long-term capability to manage coal fires. Funding was also included to extinguish 107 coal fires as demonstrations to the Indonesian Government and training exercises. Successful demonstrations obtained visible benefits for a large number of local interests and received overwhelmingly favorable public response. This built the public and political support needed to continue this work.

These successes encouraged MEMR to officially assume the responsibility for coal fire management by Decree 1539/20/MPE/1999. The Ministry reallocated internal funds to support portions of the immediate suppression projects and committed a portion of the Coal Royalty Fund to provide long-term support for coal fire suppression activities. Coal fires continue to present a serious risk to Indonesia's ecosystems, population and forest resources. The Ministry and local governments in East Kalimantan are still working on the coal fire inventory. It presently contains 164 coal fires, but it is far from complete. Unless these coal fires are managed or extinguished, they will add to the already catastrophic cycle of anthropogenic forest fires that further reduce Indonesia's forest resources and endangered species while contributing unnecessarily to global carbon emissions.

Protecting Critical Resources - Building Linkages Between Forestry And Mining

There has recently been conflict between the two Ministries over mining in protection forests. MEMR issued mining concessions to 152 companies to explore and exploit minerals in areas that were later declared protection forests by the Ministry of Forestry (MoF). The two Ministries were unable to resolve the issue so DPR is now involved. The sentiment in the DPR seems to be to issue permits for exploitation to companies who have discovered deposits thus honoring original commitments. OSM provided MoF some basic mining information they could use in meetings with the DPR and MEMR. Additional working papers were provided to MoF on the impacts of mining on watersheds, water quality and quantity, the very values protection forests were set aside to protect.

MoF and the Min. of Environment (MOE) have no in-house expertise on mining or geology. This lack of expertise puts them at severe disadvantage when trying to make any case against mining practices and MEMR. The strategy in developing linkages between MEMR, MoF and MOE is to help the agencies develop more rational positions in consultation with others and then better defend those positions when overlapping interests collide.

6.2.1.2 Petroleum

Indonesia is the second largest exporter of petroleum products east of the Persian Gulf, with extensive production of gas and oil in upper Tertiary basin beds located primarily in coastal and marine areas of Sumatra, East Kalimantan, the north coast of Java and the southern coast of Papua. Major oil refineries are located in East Kalimantan, and produce diesel oil, gasoline, kerosene, fuel oil and gas oil (Burbridge, et al. 1988). There are LNG plants in Aceh, East Kalimantan and Java. BP is currently constructing a new LNG plant in Bintuni Bay, Papua.

Oil and gas exploration and development areas cover large tracts of land, primarily consisting of coastal and marine habitat, but permanent facilities including pipelines and refineries are relatively small. There is significant negative environmental impact associated with oil and gas production. Construction work, discharge of refineries, oil spills and leaks can change nearby habitat. Local fish stocks may decline as a result of increased water temperatures from discharge of cooling water from processing plants (MacKinnon. 1996: 584).

Large scale oil pollution is harmful to marine and coastal habitats as well as their associated fauna. It leads to a dramatic increase in water temperature and decrease in oxygen. Mangrove forest ecosystems are especially vulnerable. This was demonstrated by the Showa Maru oil tanker accident in the Malacca Straights in 1975 (Soegiarto and Polunin 1980; Baker 1982). Oil slicks at sea seriously affect marine animal life by disrupting the food chain (phytoplankton and zooplankton) as well as directly poisoning birds, fish and marine mammals.

Similar to large-scale, commercial mining, the environmental impact of gas and oil production is regulated through the Ministry of Environment’s Environmental Impact Management Agency (Bapedal), primarily through preparation and then monitoring of Indonesia’s Environmental Impact Assessment process (AMDAL), and additional regulations administered by the Ministry of Minerals and Energy.

6.2.1.3 Land Conversion

Large-scale land conversion is for development of plantations (primarily oil palm and timber) as well as for the country’s transmigration program. Forest conversion for plantations is discussed in the previous section. Forest conversion for plantations is regulated though a number of licensing requirements authorized by the Ministry of Forestry. This includes the forest clearance license (IPK) and industrial timber plantation license (HTI).

Indonesia's transmigration program has moved more than 2.5 million people from relatively densely populated areas in Java and Bali to relatively sparsely populated areas in Sumatra, Kalimantan, Sulawesi, and Papua. Transmigration camps are typically cleared from forested area, and provide areas for homes as well as an average two hectares agriculture land per family. There have been transmigration programs in Indonesia since the early 1900s, peaking during the New Order regime of 1965 through 1998. Since 1999, there has been little expansion of transmigration activities.
Clearing for transmigration sites results in the loss of biodiversity and forest resources when forest land is cleared for site establishment. Success of a transmigration site rests in the care given to land clearing. Often, land clearing results in significant loss of top soil, thus resulting in low agriculture productivity for transmigrant farmers. This often leads to encroachment into nearby forest land, thus resulting in additional forest and biodiversity loss (MacKinnon, 1996:392).

6.2.1.4 Roads and Infrastructure

Transportation systems, roads and infrastructure are major type of development projects with significant impact on biodiversity and forest conservation, especially where they occur in rural and/or forested areas[5]. Environmental impacts of roads are rarely considered during the planning process for public transportation in Indonesia. Instead, road design and placement is based on opening access to new land for economic development. Especially in forested or recently forested areas, routes for roads are often aligned along former logging roads. When former forest concession and forestry plantation roads are converted to public roads (lower cost to local government), most primary environmental impacts have already taken place, so less priority is placed on environmental review. While design and construction of new roads is regulated under Indonesia's environmental impact assessment system (AMDAL), the upgrading of roads is not. Thus, many public roads passing through forest and upgraded from logging concession roads, are basically unregulated in terms of environmental impact.

Without this stage of environmental review the significant secondary environmental impacts of roads are not well documented. Data on secondary impacts of roads such as encroachment, illegal logging, and forest fires are not commonly available for transportation planning and therefore are not formally considered by planning authorities. However, there is an awareness of these issues among regional planning officials.

[5] This section draws on Huttche (1999).

Road planning and building takes place from the scale of trans-province highways to the scale of local district or village roads. Many see roads as a key infrastructure element that can stimulate or facilitate development by lowering transport costs and improving market access. Local governments find transport projects an easy, visible symbol of development and progress for citizens seeking results from their newly empowered local governments.

Managing proper design and construction of roads and infrastructure can result in increased opportunities for social and economic development, while mitigating harmful environmental impacts including loss of biodiversity and forest resources. A key tool for proper design is the spatial planning process. Spatial planning offers a key to balancing economic growth with sustainable environmental management and can ensure a more integrated approach towards sustainable development.

6.2.2 Regulatory Framework for Environmental Management

The main regulatory tool for managing environmental impact in Indonesia is an environmental assessment process called the AMDAL. The AMDAL was legislated initially through the Environmental Management Act of 1982 and Government Regulation No. 29/1986 regarding Environmental Impact Assessment (EIA). The Ministry of Mines and Energy enacted an updated regulation regarding prevention and mitigation of environmental damage and pollution in 1995. The Environmental Management Law was revised in 1997, and the AMDAL regulation was updated in 1999 (WB 2001: 72).

6.2.2.1 Environmental Impact Assessment and Management

A comprehensive set of environmental laws, regulations, and decrees govern Indonesia's AMDAL process. The key element of AMDAL is an environmental impact assessment that aims to identify and describe potential significant environmental impacts of a planned activity or business prior to commencement of the activity or business. The assessment measures impact, then recommends a menu of alternatives including a no-action option. Additionally, Environmental Management Plans (RKL) and Environmental Monitoring Plans (RPL) describe abatement and mitigation measures as well as control measures regarding the implementation of environmental management practices.

While Indonesia's AMDAL process is consistent with international standards, its implementation often limits its effectiveness in influencing project planning, design, and implementation. Many AMDALs do not focus on relevant aspects of the affected environment in sufficient detail. Second, key issues unique to each particular sector are not adequately addressed. For example, there is rarely any attempt to reconcile potential mining activities and potential future land use at the site. Third, AMDAL findings and recommendations are often not necessarily taken into account in the decision to approve a permit application or in the specifications for environment-related design or operating requirements for the proposed project. Fourth, there is little follow-up on the implementation of the environmental management and monitoring recommendations submitted with the AMDAL. Finally, the AMDAL process is designed to address project-level environmental impacts, and thus often misses landscape-level impacts such as impacts related to the overall scale of development in a region and its rate of expansion (World Bank 2001: 73).

6.2.2.2 Spatial Planning Process[6]

Spatial use planning and management are regulated through Law 24 of 1992. This law stipulates that spatial planning must be environmentally sound, and must strive to overcome negative environmental impacts. Spatial use plans should specify patterns of land, water, and air use, and other natural resources, in compliance with the law's principles. The Spatial Planning Law (1992) also provides for incentive and disincentive instruments, respecting the rights of citizens. Also, sustainable development should be incorporated into the spatial use management plan. Key agencies involved in the planning process include the Ministry of Home Affairs, Bappenas, and the Ministry of Environment at the central level, and their regional counterparts the regional planning (BAPPEDA) and environmental agencies (BAPEDALDA). The spatial use plan becomes the basis for issuing location permits for proposed development projects.

As in other areas of Indonesian environmental management, the legal theory does not always translate into practical reality. From a management perspective, the spatial planning process could be improved by managing the process of planning, including public participation and consultation at key points in the process, rather than focusing only on specific technical inputs. All technical inputs could be provided in a more coordinated and integrated manner. More effort is needed in using transparent, objective

[6] This section draws upon Brown and Jarvie (1998).

criteria to evaluate alternatives and providing the results of these decisions to the affected public. In this way, the spatial planning process could contribute to the process of conflict prevention and provide avenues for resolution of differences during the planning of a project, rather than after ground breaking.

From an environmental perspective, spatial planning and land use decisions are not always well supported, environmental and social implications of alternatives are not fully analyzed, and conservation and protection of natural areas are not emphasized. Focus tends to be on economic development. Data are always an important gap in Indonesia. Planners do not always understand the types of data and analyses they need, those that are available, and how to access them to improve the basis and rationale for plans. This is especially true for socioeconomic data and indicators that are difficult to "map." Even if better physical, spatial and biological data were available, values of environmental resources and community resource use patterns are poorly understood, especially near undeveloped (potential conservation) areas. Consequently, land use decisions specified in plans are not always well supported and the environmental and social implications of development decisions are not analyzed or documented.

In both regional spatial planning and environmental management, coordination is weak among the various agencies that implement these processes, both at the national and the local level. Sectoral agencies promoting projects can often dominate the process, which should be managed by the planning and environmental agencies, which are sometimes weaker in technical capacity or political influence. This can lead to gaps both in plans and in implementation, where the advocating agency presses forward with insufficient review from agencies that could build upon or mitigate the impacts of planned projects. After the planning process, implementation is often inconsistent. Plans are not always enforced and even good plans can be changed easily through political intervention.

6.2.2.3 Monitoring and Enforcement for Environmental Management

Although some agencies have training and expertise in technical procedures and aspects of environmental inspection, significant gaps remain in the inspection process, standards used, and responses to violations. Gaps include the lack of performance-based standards for assessing compliance, lack of monitoring, implementation or reclamation plans or requirements, and lack of standardized and practical sanctions, tailored to the severity and frequency of violations by firms or project proponents (World Bank 2001). Finally, in most sectors and situations, especially in forestry and mining, the regulatory sanctions are either too little to be meaningful or too large to be practical. For example, mine or mill closure may be a legal sanction, but it is nearly never implemented due to administrative complexity or political resistance. More regular monitoring and enforcement of environmental management regulations is the key to ensuring that these legally-sound laws and implementing regulations result in a policy that balances sustainable development with adequate conservation of biodiversity and forest resources.

6.3. Ex-situ Conservation

Indonesia has a large number of zoos, rehabilitation centers, and botanical gardens. Unfortunately, there are no GoI specific requirements or policies that regulate the overall objectives and practices of these organizations, or set specific professional standards to ensure that they adhere to modern practices, including animal husbandry, housing and staff training. There is also a lack of GoI coordination or maintenance standards for seed banks. Please see Appendix IX for a list of zoos, herbariums and botanical gardens managed by GoI and their contact information.

The Indonesian National Museum and Herbarium play a key role in developing and maintaining the national biodiversity databases, including, presumably, those involved in all ex- situ conservation. However, there are no regulations to ensure that ex-situ conservation organizations lodge a duplicate set of their biological data with either the National Museum or Herbarium.

Ex-situ conservation of fauna within Indonesia is limited to several efforts by GoI that are both poorly funded and largely uncoordinated. For example, the 12 Elephant Conservation Centers in Sumatra, which house some 400 captive elephants removed from the wild population to reduce human elephant conflicts, have been criticized, both for being poorly run and providing inadequate veterinary care (www.elephantfamily.org). Zoos (22 listed in http://sea.nus.ed.sg/). Those criticized included the 10 largest zoos, all of which are members of the South East Asian Zoos Association,, none of which currently has a real role in the conservation of Indonesian biodiversity (The World Society for the Protection of Animals 2000 Report). The most successful past conservation program by an Indonesian zoo was the development of techniques to breed Komodo Dragons by the Gembira Loka Private Zoo. Other private zoos (*Taman Safari* and *Taman Burung*) are attempting to breed birds of paradise and parrots.

Wanariset Orangutan Center, East Kalimantan has 330 Orangutan in captivity. It focuses on rehabilitation, re-introduction, policing, education and outreach. It has a very professional staff that has done much to raise public awareness of the endangered status of Orangutan and improve the husbandry of Orangutan in captivity. It currently has a program of limited re-introduction of captive Orangutan into the wild in sites where Orangutans were once common but are now absent. This reduces or eliminates the possibility that released orangutans will transfer to native populations of Orangutan a wide range of infections contracted from humans, including, hepatitis, tuberculosis and influenza.

Ex-situ conservation of flora within Indonesia is maintained by GoI and private institutions through a series of botanical gardens and arboreta.

Arboreta. The key arboreta are Sibolangit, Medan; Haurbentes and Darmaga, Bogor; and the Tahura public parks run by the Ministry of Forestry, which comprise Tahura Juanda; Bandung; Tahura Hatta; Padang; and Tahura Bukit Suharto, East Kalimantan. These Tahura parks serve mainly a recreational role. The latter was severely devastated by the bushfires of the 1980's and 1990's. However, it serves as a valuable center from which to monitor the cycle of recovery of vegetation after severe fires.

Germplasm. Collections and botanical gardens are managed by the Ministry of State for Research and Technology (Kebun PUSPITEK, Serpong) and the Ministry of Agriculture (Kebun Paseh, near Subang). The Ministry of Agriculture maintains a series of *germplasm* gardens for coconuts, spices, mango, rubber and other crops. They also have a series of cold storage facilities for medium-term *germplasm* storage of seeds, spores and tissue culture. No institutions have facilities for long-term storage. Cendrawasih University and the departments of agriculture and estate crops also maintain collections of tubers, fruits and plants for plantations in West Papua.

Cultivars. Several species of global importance originated in Indonesia, including black pepper, nutmeg, cloves, sugar cane, citrus fruits and many other tropical fruits. More than 6000 species of plants and animals are utilized on a daily basis by Indonesians, either harvested from the wild or cultivated (Bappenas 1993). Numerous wild plants and animals are harvested for domestic and or commercial consumption as food, handicrafts, medicines, fuel and building materials.

Botanical gardens are in Bogor (*Kebun Raya*) Cibodas, Purwodadi and Bali; they are well managed by LIPI. These are the Indonesian centers for the conservation of plants, but they are principally educational and recreational botanical gardens and enact little *ex-situ* conservation; they lack determined conservation action plans. Other specialized botanical gardens are the medicinal plant gardens of Tawangmangu, Central Java and Lido, West Java, which are operated by the Minister of Health; and the Orchid Palace Telanaipura, Jambi, operated by the Jambi Government.

Educational botanical gardens have been established by the Minister of Education and Culture at the University of Gadjah Mada, Jogyakarta, and the University of Indonesia, Depok. Large privately owned botanical gardens include Taman Bunga Keong Mas, Taman Mini Indonesia; Wiladatika Flower Garden, Cibubur; and Ragunan Zoo, Jakarta.

Ex-situ conservation outside Indonesia. There have been several international breeding programs for endangered Indonesian animals. Examples are Silvery Gibbons (Perth, Western Australia, Howlett, UK and Santa Clarita, USA); Bali Mynah (Brookfield Zoo, USA and Riverbanks Zoo, USA); Komodo Dragon (Smithsonian National Zoo, USA, Memphis Zoo, USA and Parken Zoo, Sweden); and Sumatran Tiger (Minnesota Zoo, USA). Most of these breeding programs have been very successful. For example, while there are estimates of only 400-500 Sumatran Tigers in the wild (most in five National Parks and two game reserves), there are now some 235 individuals in zoos elsewhere in the World. The Indonesian Zoological Parks Association has played an important part in the success of these programs. There are some 33 Silvery Gibbons held in zoos outside Indonesia, some breeding successfully, while the wild population in Java dwindles to about 2000 individuals (www.tiho-hannover.de/gibbons). The largest zoo colonies of Orangutan is in Singapore, but large colonies are also found in America where 175 Orangutan are in captivity. These North American zoos participate in a breeding program as part of the Orangutan Survival Plan (www. Brookfieldzoo.com) Estimates place the population of wild Komodo Dragons at about 1000 individuals, but it is estimated that World wide there are some 5000 individuals - with 95 bred successfully in eight North American zoos. Although there may be as few as 60 Balinese Mynah birds in the wild, some 750 individuals are held captive in zoos throughout the World, including 230 in North America (www.brookfieldzoo.org). A consortium of North American zoos has also developed a Bali Mynah species survival plan through which they intend to re-introduce these birds to West Bali.

Plant seed banks exist in a number of institutions in the Ministry of Forestry and several universities, but lack of funds and coordination has hampered the maintenance of these collections and resulted in a general decline in the value of these banks to conservation. Information on these seed banks was sought from a number of senior staff at the National Herbarium and Kebun Raya Botanical Garden (the Indonesian center for plant conservation) without success. It may be concluded, then, that there is not an active program to develop such seed banks for the propagation and conservation of endangered plant species.

6.4 Conservation of Economically Important Species and Germplasm

Indonesia is the richest country in the world for native species that have become cultivars. These include cultivars of the fruits: mango, durian, rambutan, salak, duku; minor grain legumes or local vegetables, tomato, water spinach, chili peppers, ananas, rice, Madurese Cattle, Garut Goat, Kedu Fowl and Alabio Ducks and Banteng Cattle. The Bogor Agricultural Institute also has fish breeding and fish production programs that also utilize Indonesian freshwater endemics (Bappenas 1993),

Initiatives to conserve economically important species and *germplasm* in Indonesia have focused on plant breeding of rice, emphasizing seed banks, seed improvement and seed breeding. Such efforts on economically important species such as oil palm, rubber and cacao, are dominated by the private sector. Presently there is a move towards revitalizing local varieties and to this end the national biology institute maintains a *genebank*.

Research and development centers for food and vegetables (*Puslitbang Tanaman Sayuran* and *Puslitbang Tanaman Pangan)* maintain cultivars. However, while there have been concentrated efforts to produce cultivars of rice, corn, soybean and peanuts, little attention has been given to other plants cultivated by Indonesian farmers. In the past 50 years, no new cultivars of the fruits mango, durian, rambutan, salak, duku, or the minor grains, legumes or vegetables have been released by government institutions. The only recent production of crop cultivars are of rubber and sugar cane (Bappenas 1993). The decline in genetic stocks is not well documented or monitored. As an example, of the 1,500 cultivars of wild Indonesian rice, only one cultivar has been propagated for the whole of Indonesia. Importation of many fruits into the Indonesian markets is also severely undercutting the development and retention of Indonesian cultivars (Ministry of Environment 2003).

7. Major Issues and Recommendations for Biodiversity and Forest Conservation

This section outlines a number of major issues facing biodiversity and forest conservation in Indonesia, both currently and in coming years. They are condensed from the body of the report. Following each major issue is a set of recommendations to address the aforementioned issues. We have divided the discussion of major issues and their respective recommendations into two complementary sections: the first is a geographic focus that provides an island-by-island synopsis, and the second is a "cross-cutting themes" perspective that provides a synopsis of the major issues found across the archipelago as they relate to biodiversity and forest conservation and management.

7.1 Major Issues and Recommendations According to Geographic Focus

7.1.1 Kalimantan

Among Indonesian islands, Kalimantan, the Indonesian portion of the island of Borneo, is second only to Papua in terms of species richness for plants, mammals, birds and reptiles. It also has high levels of endemism. Consequently, Kalimantan (and Borneo) is a priority area for conservation in Indonesia. Species richness and diversity in Kalimantan are richest in its lowland rainforests. The greatest threats to biodiversity are also in the lowland rainforest, as well as freshwater systems, coastal communities and fringing reefs.

Important areas for conservation action in Kalimantan have not altered much since the 1993 Biodiversity Action Plan for Indonesia, although the extent of degradation to many of these areas has changed dramatically. Momberg et al. (1998) have suggested some additional areas for East Kalimantan, such as the complex forested area of Sebuku/ Sembakung and the various limestone forests on the Sangkulirang/ Mangkaliat Peninsula.

This report considers that the most important areas for conservation action in Kalimantan are those with both the highest biodiversity and greatest threats. These are the three major lowland/coastal National Parks (Gunung Palung, Tanjung Puting and Kutai). Further, the most important ecological systems for such action are the major river systems, especially their water catchments, lakes, swamps and deltas. These include the Mahakam, Kapuas and Barito River systems.

Many other areas are important to the conservation of overall biodiversity in Kalimantan. However, their biodiversity is less threatened than the above mentioned areas, either because of their large size and location in mountainous terrain (e.g., Bentuang–Karimun, Kayan Menterang and Bukit Baka Bukit Raya), or because they are on rugged limestone terrain that is largely inaccessible for exploitation (and which mostly avoided large scale burning by wild fires in the 1980s and 1990s). The river systems mentioned above are selected as priority systems because their trajectory of flow largely defines the major landscapes and determines in large part the ecological functions of these landscapes. Consequently, management of the entire river system is fundamental to the health of all biotic (and human) communities downstream.

Recommendations

The conservation foci and priorities in Kalimantan are:

1. The recovery of the three key lowland National Parks (Kutai, Gunung Palung and Tanjung Puting), the mangrove and coastal communities of Sebuku and the Mahakam River deltas. For the three National Parks, this would initially require development of strategies to rehabilitate their degraded lands, consolidate existing boundaries, bolster the capacity of their PA management, and provide alternative livelihoods for local villagers.

2. The protection of the upper catchments of the major river systems (at least the Kapuas, Barito and Mahakam) and a conservation strategy for the multiple use and sustainable management of natural resources in their water basins. This would require in some case the identification of the catchment areas and associated water basins, the strict enforcement of existing logging regulations on steep slope lands, possible removal of shifting agriculture from these catchments and integrated and transparent spatial planning with downstream stakeholders. A test case could be the Mahakam River because it involves land management scenarios to be adopted along the length of this river system by a number of districts and for coordination by the province. There is already a clear indication of interest by the East Kalimantan provincial government and at least four district governments in the management of the Mahakam River system (Kitchener pers. comm.). This interest stems from the economic cost to the constituencies of the various concerned governments arising from the lack of an effective management plan for the Mahakam River. The

Mahakam system is an immensely important conservation target because its lake and delta system support an important assemblage of water birds and waders, including north Asian migrants, and constitute the last habitat of some remaining 50 Irrawaddy Dolphins in Kalimantan. The lakes and river are also extremely important commercially for the supply of freshwater fish in East Kalimantan and as dried fish for Java. The delta also had the largest expanse of Nipa palm in Kalimantan -- one of the largest in the world – as well as a huge area of crucial mangrove habitat that needs to be rehabilitated to protect the coastline and local fisheries.

3. The development of multiple-use spatial plans at provincial and district levels for the entirety of Kalimantan that would serve to "mainstream" conservation requirements into all development sectors. The matrix of habitats in which protected areas are embedded is absolutely necessary to conserve the biodiversity of Kalimantan, particularly for many of the endangered species, such as the orangutan. For this reason, better natural resource management in land outside protected areas is imperative to conserve many species that are currently endangered or vulnerable to becoming endangered. A test case could be conducted in a district that has not been extensively developed and has relatively fewer spatial planning conflicts, such as the Berau district of East Kalimantan.

4. A review of the cutting strategy for forest concessions. Many logged concessions retain impressive assemblages of plants and animals (a population of some 1000 orangutans was recently located in a logged over forest in the district of Berau. While it may not be possible at this period in the development of Indonesia to prevent an initial cull of timber in concessions deemed important as biodiversity centers, governments may be convinced of the need to alter cutting schedules in the longer term in important conservation areas. This would provide a greater amount of time and greater opportunities for a more developed conservation culture to form in Indonesia. In doing so, re-growth forest may incur dramatically altered cutting schedules that would be more protective of their biodiversity.

5. Focused attention on the protection and conservation of the biodiversity in and around fringing coral reefs and atolls, particularly in the Berau islands. These islands have a unique role to play as rookeries for a number of endangered species of sea turtles, and their reefs support a high diversity of fish and marine invertebrates.

6. Support for the addition of a protected area in the Sangkulirang Peninsula to conserve the limestone plant and animal communities that are unique to Kalimantan and are currently not represented in the existing Indonesian protected area system.

7. Support for conservation of the Kalimantan coastline through a program to rehabilitate mangrove forests, once widely distributed around the island. This would require a review of development policies regarding fish and shrimp ponds (*tambak*), the presence of which is a major factor in the degradation of mangrove communities. Rehabilitating mangrove forests would also require the regulation of cutting of mangroves for firewood, construction purposes and making of charcoal.

7.1.2 Sumatra

Sumatra has a rich biodiversity similar to that of other Sunda Islands but slightly impoverished for most groups when compared to Borneo. It has a number of unique and endemic fauna not found elsewhere and retains a higher representation of the Asian mainland fauna and flora than elsewhere in Indonesia. Most of the broad habitat types on Sumatra and Borneo are fairly similar and most of the threats to their degradation are also similar. Both islands had extensive lowland forests, which are the most biodiverse habitats on both islands. However, the continued degradation of Sumatra's lowland rainforests and their associated faunas is advanced over that of Borneo/Kalimantan, such that the World Bank predicts that almost all these forests on Sumatra will have a significantly damaged vegetation canopy cover by 2005.

Support for activities to conserve the biodiversity of national parks in Sumatra that contain lowland rainforest (Gunung Leuser, Siberut, Kerinci Seblat, Bukit Tigapuluh, Berbak, and Bukit Barisan Selatan) is, as with those in Kalimantan, of the highest priority. Indeed, it can be argued that because proportionately more of the Sumtran lowland rainforests are degraded than is the case in Kalimantan, the Sumatran national parks are of a higher priority than those in Kalimantan.

Of the six Sumatran national parks with lowland rainforest, those of a landscape scale that also include mountain forests, particularly low montane rainforest (also inhabited by many species from the lowland rainforest) should be singled out for urgent conservation support. This is particularly true because with the degradation of the Sumatran lowland forests, it is predicted that loggers will move to the peat swamp forests and to the hilly and lower mountains to obtain timber. Thus, among the above group of six parks, Gunung Leuser, Kerinci Seblat and Bukit Barisan Selatan are of the highest priority. However, Siberut National Park, because of its unique endemic animal assemblage, should also be elevated to the highest priority for support.

Priority support is also required for the Tesso Nilo area, gazetted as a key protected area, to conserve its landscape array of habitats and representative assemblage of plants and animals. Most importantly, it will provide wildlife corridors to link other protected areas in Sumatra and allow greater movement to larger mammals, such as elephants and tigers and vagile birds. Urgent assistance is required because the area is threatened by illegal logging, wildfires and extraction of non-forest products.

The largest and most important national parks in Sumatra, Leuser and Kerinci Seblat, are trans-provincial parks. Their successful management necessitates the collaboration of a number of informed governments at provincial and more local levels as well as civil society. As a consequence, considerable support needs to be provided to inform all stakeholders of the value to them of the ecosystem services provided by these parks.

Recommendations

The conservation foci and priorities in Sumatra are:

1. Recovery, especially of the lowland rainforest habitat in the following National Parks (Leuser, Siberut, Kerinci Seblat, Bukit Duabelas, Bukit Tigapuluh, Bukit Barisan Selatan, Way Kambas), and a refocus on protecting Berbak and Sembilang National Parks, because their peat swamp forests and fresh water swamp forests, which will likely become a target of illegal logging and encroachment after 2005.

2. Employment of different strategies for the implementation of conservation activities in the largest National Parks, which have been the focus of previous initiatives. Initially, this will require a review of the reasons for the lack of success of donor support to achieve conservation success in, for example, Leuser and Kerinci Seblat and for the failure of conservation groups to successfully defend Bukit Tiga Puluh from encroachment and illegal logging. Among other aspects, this review should explore the Integrated Conservation and Development Projects (ICDPs) that were successful in Indonesia or that could have been successful given different foci, e.g.,

longer time frames, different administrative structures and different funding channels for project implementation.

3. Support for the gazettment of the Tesso Nilo forest, Riau Province, as a National Park embedded in the Tesso Nilo Conservation Landscape. This landscape could include a special conservation management area that integrates Tesso Nilo forests with those of Kerumutan, Rimbang Baling and Bukit Bungkuk Wildlife Reserve and Bukit Tiga Puluh National Park. In particular, it would be helpful to support the rehabilitation of forests and the re-design of existing A*cacia* and oil palm plantations to allow for the establishment of wildlife corridors, which would to allow elephants and other mobile animals to move freely between forest patches.

4. Preparation of an island wide management plan for Siberut Island. This island is one of the largest jewels in the Indonesian biodiversity crown. If the island's biological diversity is to be conserved and the current exploitation of its fauna and flora is to cease, a multi-use spatial plan developed with local communities in a collaborative and transparent manner is required. This process would begin by a targeted outreach program to educate villagers and decision-makers of the value of ecosystem services to the island's communities.

5. Protection of the upper catchments of the major river systems and a conservation strategy for the multiple use and sustainable management of natural resources in their water basins. This would require in some cases the identification of the catchment areas and associated water basins, the strict enforcement of existing logging regulations on steep slope lands, possible removal of shifting agriculture from these catchments and an integrated and transparent spatial planning with downstream stakeholders.

6. Development of multiple-use spatial plans at provincial and district levels for all of Sumatra that would serve to "mainstream" conservation requirements into all development sectors. This is required for the same reasons noted earlier for Kalimantan.

7. A review of the future cutting strategy for forest concessions for the same reasons noted earlier for Kalimantan.

8. Support for the conservation of the Sumatran coastline through a program to rehabilitate mangrove forests, once widely distributed around the island. This would require a review of development policies regarding fish and shrimp ponds (*tambak*), the presence of which are a major factor in the destruction of mangrove communities in Sumatra, as well as regulation of the cutting of mangroves for firewood, construction purposes and making of charcoal.

7.1.3 Java

Radical land use patterns over the last 150 years have left only small, scattered remnants of Java's natural ecosystems, especially in the lowlands. For this reason, the existing low lying national parks in Java are essentially "habitat islands" embedded in an agricultural landscape. This makes the national parks containing biologically rich lowland forests (Ujung Kulon, Meru Betiri, Baluran and Alas Purwo) the top priority for conservation efforts in Java. Additionally, Meru Betiri is perhaps the most important marine turtle rookery in the entire Java and Nusa Tenggara region, which confirms further its position as a high priority for conservation. All these low-lying parks are currently being degraded by human activities, including the extraction of non-forest products and limited trees for construction purposes. This damage is greatest in Baluran National Park, which recently has been severely encroached. Moreover, hunting of its wildlife has increased dramatically. Both Baluran and Alas Purwo National Parks represent the drier lowlands. Both require support for the management of their biodiversity values. However, of these two parks, Alas Purwo National Park has the more intact ecosystems and Java's biodiversity would benefit more by focusing efforts to manage the threats to Alas Purwo National Park, rather than Baluran National Park. Ujung Kulon National Park retains an impressive assemblage of Java's lowland rainforest fauna, including the flagship conservation species, the Javanese Rhinoceros.

Of the lowland national parks in Java, Ujung Kulon is considered the most important to support to conserve its biodiversity, followed in order by Meru Betiri, Alas Purwo and Baluran.

Sub-alpine and montane forests are significant for the conservation of biodiversity of Java because they are among the most intact areas of forest remaining in Java. Further, they contain a number of endemic species, and many lowland species are also able to live in their lower montane zones. For this reason, Gunung Halimun, Gunung Gede-

Pangerango and Bromo Tengger Semeru National Parks are also of a high priority. However, all these Parks receive considerable management support from GoI. Further, Gunung Gede-Pangerango is particularly well staffed relative to other parks in Java. While all the mountain parks are threatened by human activities, these threats are not as severe as those experienced by the national parks in the lowland areas. Consequently, the need for support to manage their biodiversity is less than is the case for the lowland parks.

The marine national parks, Kepulauan Seribu and Karimunjawa, both suffer greatly from over fishing and damage to their reefs, particularly from physical damage caused by anchoring boats, pollution and general tourism. Of these two parks, Kepulauan Seribu National Park is much more threatened and degraded because of its proximity to Jakarta. It is in the direct path of huge off-shore water plumes that carry pollutants onto its reefs. Karimunjawa is much more protected and retains a fairly intact assemblage of small reef fishes. Karimunjawa is the priority choice for marine conservation effort in the waters around Java.

All extensive remaining patches of natural vegetation on Java, even if secondary, are of the highest conservation significance. Initiatives to conserve the remnant biodiversity of Java require exploration of new approaches to management, particularly outside protected areas. A wealth of biodiversity exists in village gardens, and their associated fields, throughout Java. Strategies need to be explored to maintain and increase the variety of plants and animals in village gardens and plantations and to educate villagers of their vital role in conserving this important element of their biodiversity.

Recommendations

The conservation foci and priorities in Java are:

1. The conservation of more remnant lowland rainforests and mangroves in existing protected areas. For example, Gunung Halimun has more lowland rainforests surrounding it than it has inside its boundaries. And Nusa Kambangan, on the south coast of central Java, urgently needs protection to prevent recent illegal logging activities that threaten to degrade this relatively undisturbed relict of lowland forests.

2. Support for the implementation of initiatives in Java that strive to identify larger landscape scale areas for conservation of biodiversity and management of these landscapes, through better integration of the existing protected areas, and improved spatial planning and conservation practice in land outside the existing protected areas.

3. Encouragement of the diversification of plants in village gardens and the conservation of their associated wildlife. A wealth of biodiversity exists in village gardens and associated fields throughout the island. Strategies need to be developed to maintain and increase the variety of plants and animal in these gardens and to educate villagers of their vital role in conserving this important element of biodiversity.

7.1.4 Sulawesi

Sulawesi is the most spectacular center of endemicity for plants and animals in Indonesia. Its high, mountainous terrain has protected much of its fauna and flora, although almost nothing remains of its lowland forests. It has the most extensive system of lakes in Indonesia, as well as the largest forests on ultrabasic substrates in the world. It is one of the foremost two or three places globally as a center for marine biodiversity. While Sulawesi has extensive protected areas on paper, some additions are required, and planning is needed to integrate these protected areas into a system that conserves representative landscapes and their functions.

The terrestrial priority on Sulawesi should be to connect the existing protected areas with protected forests (*hutan lindung*) to form a more integrated system of protected areas, particularly to link protected areas in both the southern and southwestern arms of the island to those in North Sulawesi through the "hub' protected area in Central Sulawesi -- Lore Lindu National Park. Conservation of biological values in Lore Lindu National Park, which is a landscape scale park, through community participation in the management of the park is the top terrestrial priority. Other terrestrial protected areas in Sulawesi are extremely important for conserving important plants and animals, but none other is as geographically important or has the same variety of topography and diversity of habitats. There is urgency in all of Sulawesi's terrestrial protected areas to avert and ameliorate threats to these parks caused by encroachment, hunting and illegal logging. Lore Lindu National Park faces all these threats, and there is steady attrition of its biological values and the value of its ecosystem services to the large community in the city of Palu and its surrounds.

Conservation of the biota of Sangihe and Talaud islands is also a high priority. These islands have a unique endemic community of animals and plants.

Support for the Bogani-Nani Wartabone National Park, North Sulawesi, to abate threats to this center of biodiversity in this region is also of the highest priority.

Freshwater lakes have been severely degraded and their biota despoiled in Sulawesi. The Malali lake system may be one of the few remaining Sulawesi freshwater systems that can be conserved. There is a priority to survey this system and evaluate its biological importance.

South Sulawesi is poorly served by protected areas, despite the fact that its biota is among the most degraded and threatened in Sulawesi. An initial study to determine priorities for biodiversity action in the Maros-Pangkajene area in South Sulawesi (Allard et al. 2000) should be considered a priority as well.

Bunaken National Park and Taka Bonerate National Marine Park both are nationally and globally important centers of marine diversity, which are heavily impacted by a range of threats. They are top priority areas for conservation activities. Wakatobi is also an immensely important center for marine biodiversity, but it is not as threatened, nor does it require the intensive management needed in Bunaken and Taka Bonerate.

Recommendations

The conservation foci and priorities in Sulawesi are:

1. The continuation of efforts to conserve the habitats and biota of Lore Lindu National Park, Central Sulawesi. This Park is the hub connecting the star-shaped peninsulas of Sulawesi that form different biounits. Lore Lindu has a pivotal role in providing connectivity between these various biounits of faunas and floras. It currently suffers threats from encroachment, particularly in the northeastern part, but this can be contained by conflict resolution and long-term engagement of local resident communities surrounding the Park through collaborative management of the Park.

2. Support for decentralized conservation management of Bunaken National Park to ensure institutional and financial sustainability of Bunaken Advisory Board and

Concerned Citizens Forum. A particular focus should be raised capacity in solid waste management. This solid waste originates from Manado and the North Sulawesi mainland, and its effective management can be part of a broader strategy linking environmental management issues and development planning that demonstrates ‘ridges to reef’ management.

3. Establishment of a system of protected areas in the south peninsula biounit by coalescing some of its existing 26 protected areas. A particular focus should be the Maros karst country that was the subject of a planning assessment by Allard et al. (2000).

4. Support for the reclassification of Tangkoko – Duasudara Nature Reserve to the status of a National Park to complement the conservation values in Bogani Nani Wartabone National Park.

5. Preparation of a protected area strategic plan for the Luwuk peninsula to assess possibilities of coalescing some of the existing protected areas to form a system of reserves that would represent and conserve landscapes and their functions in the eastern part of the central biounit.

6. Preparation of an island wide management plan for Sangihe and Talaud Islands. These islands have an interesting endemic community that warrants conservation attention. It requires the development of a multi-use spatial plan in close collaboration with local communities. This plan should include an integrated protected area system. This process would begin by a targeted outreach program to educate villagers and decision-makers of the value of ecosystem services to the island’s communities.

7. Preparation of a management plan for the Malili lake system in the southeast biounit. The entire system is connected by rivers and contains three large lakes (Matano, Mahalona and Towuti) and two smaller lakes (Masapi and Wawantoa). The preparation of a management plan would also enable a needed evaluation of the predicted (Whitten et al. 2002) importance of this system as a repository of species and would provide information about the origins of Sulawesi freshwater fauna.

8. Protection of the upper catchments of the major river systems and a conservation strategy for the multiple use and sustainable management of natural resources in their

water basins. This would require, in many cases, the identification of the catchment areas and associated water basins, the strict enforcement of existing logging regulations on steep slope lands and integrated and transparent spatial planning with downstream stakeholders.

9. The development of multiple-use spatial plans at provincial and district levels for all of Sulawesi that would serve to “mainstream” conservation requirements into all development sectors. This is required for the same reasons given earlier for other islands.

10. Development of the northern part of Sulawesi as an integrated eco-tourism zone with World Heritage Site status. This would encourage sustainable, conservative, integrated and holistic management of the region, which is now undergoing major development activities.

11. Assistance in the management of Wakatobi and Taka Bonarate National Marine Parks to prepare the scientific and social research and documentation needed to join with Bunaken National Park as Indonesia’s Marine Cluster World Heritage Site in 2005-7.

12. The identification and management of key watersheds and coastal urban centers that most significantly threaten coral areas, particularly those in marine parks. The eco-regional planning process to be carried out by the Nature Conservancy in 2004-2005 may assist with this selection.

7.1.5 Papua

Papua is perhaps the biologically richest and most diverse assemblage of ecosystems in the Tropical Pacific region. It contains almost half Indonesia’s total biodiversity and has a significant portion of the World’s remaining tropical forests as well as some of the most pristine coral reefs in the world. It has the largest area of mangroves of any Indonesian island. Freshwater endemic species are found throughout Papua because almost all lakes are unique ecosystem with endemic species. The Raja Ampat Islands, situated along the northwest coast of Papua, is considered to be the single most biodiverse marine site in the world at this time. Clearly because of its rich biodiversity, Papua is both an Indonesian and world priority for conservation activities to conserve its biota.

Unfortunately there is a profound absence of biological information about Papua. Consequently, there is a priority need for an eco-regional planning process based on available information, including that of Conservation International (1999), to identify the major ecological systems requiring conservation actions -- both for protected area planning but also to indicate priority areas for ground surveys.

High country habitats in many of the existing protected areas are considerably less threatened by hunting, logging, and land conversion compared to the lowlands. For this reason, priority activities to conserve biodiversity in these protected areas needs to be focused on the coastal mangroves, and lowland forests and savanna.

The south coast of Papua, in Wasur National Park, is an important stop over place for palaearctic migrant wader birds on their way to the northern coast of Australia. It has been designated as a wetland of international importance. These resting areas for migrants are of immense importance to the global survival of a number of migrant bird species. There is a priority in establishing the importance of this part of the Papuan coastline for migrant birds and to establish a management process to protect them from hunters, and to conserve the habitats that they utilize.

The recently discovered biological importance of the Raja Ampat islands indicates that this group of islands and their surrounding marine environments are of the highest priority for support to conserve their biodiversity.

Recommendations

The conservation focus and priorities in Papua are:

1. Support for the management of lowland habitats (mangroves, lowland rainforest, savanna, swamps) in all existing protected areas, but particularly in the Cyclops, Lorentz and Wasur areas and on Biak Island. Emphasis is on the lowlands because in many of the existing protected areas and elsewhere, the lowlands are considerably more threatened by hunting, logging, and land conversion than are the highlands.

2. Conservation of the habitat of palaearctic migrant wader birds and the birds themselves in the coastal part of Wasur National Park. There is a priority to identify and conserve migrant bird sites and habitats along this part of the Papuan coastline.

3. Conservation of the Raja Ampat Islands. This group of islands has one of the highest diversities of corals in the world. Further, its terrestrial fauna is varied and interesting, but little surveyed or studied. Conservation efforts should focus on the preparation of a management plan in close collaboration with the island's inhabitants.

4. Support for a transparent, collaborative eco-regional planning process, particularly at the provincial and district levels. This should begin as soon as possible without necessarily waiting for more information on Papua's biological resources.

5. Support to produce background geophysical and biological information to "mainstream" conservation of biodiversity into multi-use spatial plans. Information required includes land use maps, vegetation maps, forest cover maps, water catchment maps, erosion potential maps, endangered species action plans, and eco-regional conservation plans. Additionally, capacity -- both human and technical -- needs to be dramatically increased in the spatial planning divisions of all levels of government in Papua. This support is urgently required because of the need to plan for the expected growth in economic development in Papua of 10% per annum (Conservation International 2000).

6. Support is required for detailed organized collections and surveys to provide an adequate baseline of information on which to develop the appropriate conservation strategies for Papua. There is a need for a biological survey plan for Papua. This plan should focus on specific groups and habitats to survey and should not be a continuation of the somewhat random processes that have historically occurred in Papua. Surveys should be designed to maximize the amount of ecological information gained and to be less focused on "taxonomic" collecting. Freshwater lake systems should be an initial focus.

7. Support to develop practices to manage or eradicate the many exotic species that have recently entered Papuan ecosystems. These include the Macaque Monkey (*Macaca fascicularis*), the fishes Tilapia (*Oreochromis mossambica*) and carp (*Cyprinus carpio*), Mimosa (*Mimosa pigra*), and the toad (*Bufo melanostictus*).

8. Support for the writing and distribution of English and Indonesian versions of *The Ecology of Papua*. This is the only missing volume in the Indonesia *Ecology of...* series, and will be an important contribution to better understanding the ecology of

Indonesia in general and Papua more specifically. This is especially important given the rich biodiversity of Papua.

9. Flexibility to respond to changes in conservation priorities as a consequence of new information or changes in status of existing protected areas. For example, Lorentz National Park is of enormous importance to biodiversity in Papua. Several mining leases in that park have been requested and discussed for a number of years. The possible granting of these leases is reason for great concern regarding the biota of the park and would warrant priority attention.

7.1.6 Nusa Tenggara and Maluku

Despite the reduced species richness and number of endemic species, this region must not be thought of simply as an area of transition between the Sahul and Sunda source areas to the east and west, respectively. It is in fact a very complex mix of different island types that have provided the substrate for some 10 clearly recognizable biounits. Indeed, the oceanic nature of most of its islands has been responsible for the evolution of some interesting species.

The region has a series of excellent national parks that represent the Flores, Sumba and Seram biounits. However, Flores itself, with its fascinating rodent and bird assemblage, is poorly represented, as is the Timor unit. Most of the seven Maluku biounits are also not well represented by gazetted protected areas. The standout island requiring a better protected area *system* is Halmahera Island.

In selecting priorities for conservation interventions in this region, consideration should be given to support areas that are extremely important to represent the biota within each of the biounits, giving extra weight to those areas that are most threatened and that currently receive little donor support. Threats to current protected areas or proposed protected areas are intense throughout the region. But perhaps threats to Manusela National Park, in part because it is relatively inaccessible, are less than those on the island of Halmahera, which is covered with forestry concessions. Further, it has been the site of illegal logging, extraction of non-forest products and intense hunting. Much of the area of Manggarai on the island of Flores is also severely degraded by illegal logging, but the area focused on Gunung Ranaka and its associated high mountain ranges are relatively protected by their rugged topography, although they also experience extensive illegal logging, hunting and removal of non-forest products. Sumba Island has been seriously degraded by removal of sandalwood forests and their replacement by *alang alang* grasslands. The national parks on Sumba represent the few remaining refuges for the biota of this unique biounit. The ecology of the low lying Tanimbar Islands are extremely threatened by the wholesale removal of their vegetation cover by both legal and illegal logging, and also by intensive hunting. Destruction of this vegetation cover is leading to extensive sediment run off onto the surrounding fringing reefs, which is causing damage to corals and reef biota.

For the above reasons, the priority areas requiring support for the conservation of their biodiversity in the region are, first, Halmahera, and then in order, Tanimbar islands, Manupeu-Tanah Daru National Park and Laiwangi-Wanggameti National Park.

Recommendations

The conservation foci and priorities in Nusa Tenggara and Maluku are:

1. Support for the establishment of a gazetted protected area system for Halmahera, the Tanimbar group of islands and for the montane forests of the Manggarai district of Flores.

2. Support is urgently required for the management of the biodiversity of the two national parks on Sumba Island.

7.2 Cross-Cutting Themes and Recommendations

In this section, we discuss the major issues found across the archipelago that strongly affect biodiversity and forest conservation and management. Following each major issue is a set of recommendations.

7.2.1 Institutional Development, Governance and Decentralization

There is a need for stronger partnerships between central government and local government agencies, as well as civil society organizations, to create effective conservation programs. Additionally, it is important to continue the process of empowering PA managers so that they are able to coordinate easily with local governments and communities. Most kinds of PAs and conservation efforts can only succeed with local involvement, but management authority for many PAs remains at the central GoI level. There is a need to design conservation strategies that provide for future economic growth and improved welfare of local stakeholders at the provincial and district levels.

Governmental institutions at all levels require budgetary support, public support, and improved human resource capacity to protect natural systems adequately. Management needs are greatest and capacity is most limited at the local level. Similarly, civil society institutions need capacity and skills to engage as useful partners with government agencies charged with conservation and environmental preservation.

Indonesia's decentralization process also requires on-going institutional development support. Competition among different levels of government in managing and allocating forest resource utilization permits puts increased pressure on forest resources and the biodiversity they contain. Institutional development support can help clarify roles and responsibilities of different levels of government in more effectively managing forest resources. Such support can include principles of good governance, on order to ensure government constituents at the national and local level are adequately engaged in the policy- and decision-making process.

One widely-recognized gap in the decentralization framework is the treatment of cross-boundary issues and coordination issues. Nominally, provinces are responsible for issues that affect more than one district. In practice, however, no institutions have been established to take on or facilitate the coordination role among competing districts. Further, the decentralization process has created animosities among the different levels of government that impede wise and considered treatment of cross-boundary issues. This is particularly detrimental for environmental systems, which usually do not conform to human administrative boundaries. Clearly, forests, fish, rivers, ecosystems, coral reefs, and populations of game exist across district boundaries and cannot be managed properly and sustainably based solely on the district-level perspective. Similarly, any environmental or public services that have the nature of "public goods," such as water supply, clean air, communication networks, will be undersupplied, if all management decisions are taken at district level, rather than from the perspective of the overall welfare of the entire society.

Key issues of institutional development that contribute to effective biodiversity and forest conservation are good governance and decentralization. These issues are discussed extensively throughout this report. It is not in the scope of this report to focus specific recommendations on governance and decentralization.

Recommendations

There is a need to continue to build the institutions and capacity for sound conservation strategies and environmental protection, including:

- Development of institutional capacity in provincial and district service offices dealing with spatial planning that incorporates watershed, forest, and coastal zone management.
- Development of institutional capacity in the systems and processes of law enforcement – local police, judges, and prosecutors – to improve the understanding and enforcement of laws regulating protected areas, natural resource use, and environmental management.

7.2.2 Status and Management of Protected Areas

Management of PAs is in a poor state as a consequence of many factors. Encroachment into PAs is rampant, both from commercial/industrial interests and from local communities seeking livelihoods. Legal protection from such encroachment is lacking because of the general disrepair of the legal system -- even where laws are strong, enforcement is weak or non-existent. The situation is worsened by inadequate funds, which are declining in real terms (both from GoI and donors), and a poor capacity for management. These problems have been exacerbated by the decentralization of government, which has confused roles and responsibilities over some aspects of PA management and planning. Together, these factors mean that much of the PA system, which is impressive on paper, has become merely an open access area, where ownership, management, authority, responsibility, and enforcement are largely absent.

Despite this, progress is possible in PAs, especially where PAs or conservation activities offer demonstrable benefits that can be shared among local stakeholder groups. Examples include areas where nature-based tourism provides substantial earnings relative to local potential (e.g., Komodo NP and Bunaken NP) or where environmental services contribute substantially and visibly to the local economy, such as water supply in Java, Balikpapan, and other areas. Approaches that emphasize shared benefits, livelihood improvements, and visible results to local communities and stakeholders are likely to have greater positive impact than approaches that emphasize conservation for its own sake or preservation without multiple-use options.

Overall, this report endorses approaches that expect communities to respond to economic and prudence-based arguments for conservation by adopting wiser planning and encouraging better practices for resource use. A complementary protectionist approach, however, will also be needed to balance the risks for Indonesia's mega-fauna and localized mega-diverse habitats.

Although Indonesia's PA system is large and complex, there are some remaining areas and habitat types that are underrepresented. There remains the need for a comprehensive review of the adequacy of the existing PAs to represent, and where possible duplicate, important habitats, communities, ecosystems and landscapes. Further, there is a need to consider the integration of the PAs with the surrounding habitat matrix to ensure that an integrated system of conservation areas is achieved. In particular, wildlife and habitat corridors that link biological communities in PAs are important for the preservation of species and ecosystems. Identification of such linkage areas and their restoration through appropriate agro- and forest management practices can contribute positively to the status of PAs and individual species.

Expanding the area under "protected" status does not currently confer protection or improved conservation in practice. The challenge is to ensure that the conservation environment improves so that PAs are better protected in the future, along with the habitat matrix in which they are embedded. Many of these issues are addressed in other sections and particularly below in the sections on conservation management outside of PAs, such as conservation of forest resources.

From a broader perspective, Indonesia's protected areas program lacks an overall vision and popular mandate. This is partly due to the history of development of the PA system, the limited number of experts involved in the process, and the top down manner of GoI decisions before 1998. To last through times of change and hardship, however, PAs need the support of a strong popular will and mandate for their continued existence. Sellars (1997) and Carruthers (1995) suggest that protected area policy works when conservation values are imbedded in the values and beliefs that people associate with their national or regional identities. This indicates that utilitarian (use/benefit) arguments for protected areas need to be balanced with and supplemented by moral-aesthetic-value arguments. The interaction between nationalism, heritage, local pride and wise use together create the social and economic benefits that have established national parks and protected areas as key elements of the social infra-structure of developed nations.

Recommendations

There are opportunities to invest in the improvement of Indonesian protected area policy in a manner that will support broader social and economic goals relating to decentralization, democracy and good governance. These include:

- Support for the conservation of entire landscapes, such as geographic gradients from mountain tops to coastal areas. Priority should be given to freshwater systems, from their upper catchments to the river mouth, which provide crucial ecosystem functions, such as wildlife corridors and habitats for endemic, vagile or migratory species. Fresh water systems that also provide important services, such as the Kapuas and Mahakam River systems, should be given priority attention.
- Support for recognition and conservation of important habitat types that are currently not represented, or are poorly represented, in existing PAs. These would include, for example, limestone/*karst* areas and some coastal/marine systems.

7.2.3 Ecosystems and Watersheds

Ecosystems and watersheds provide a useful and manageable scale for project interventions with potential to improve conservation and environmental management. In many cases, watersheds provide visible, locally-relevant areas where improved management practices can give rise to tangible benefits in the mid term. These benefits provide evidence and create incentives for continued investment and improvement.

Environmental services that produce clear economic benefits and win-win solutions provide a natural entrée for wider involvement of local governments and stakeholders. Water supply is a good example. Where improved natural resource management produces – or simply assures – access to improved water quality and quantity, local people and institutions can see the benefits and approve of the governance decisions and management practices that have been employed. Other areas where people's livelihoods

are clearly dependent on the quality of the environment include agroforestry practices, coastal zone activities, and tourism activities, among others.
As noted earlier, the administrative boundaries of local governments are not designed to address ecosystem level impacts and watershed management needs. These cross-boundary issues have been exacerbated by the decentralization process, which has created dozens of new local governments, but no new regional level institutions for environmental management.

Upstream and downstream issues, needs, benefits, and losses can be quite different, raising different concerns for stakeholder groups and creating different opportunities for appropriate interventions. One area that combines opportunities in governance, management, and communities, is the idea of compensation across boundaries for the production of environmental services or the mitigation of environmental losses. Although there have been some local experiments, the continuing power struggle over authority and responsibility among levels of government has impeded the widespread adoption of these kinds of approaches.

There is a long history of watershed management activities and a large literature on which to draw in designing interventions in this area. The recommendations below are informed by lessons learned derived from this literature and experience. In general, there is a need to support activities that develop skills, models, and institutions for integrated watershed management.

Recommendations

- Strengthening networks of communities and stakeholders focused on broader watershed management issues. In larger areas, one successful approach has been to develop stakeholder networks in upper- and lower-watersheds separately, then bring them together for wider level planning and implementation of activities.
- Working with local governments to develop and test innovative financing mechanisms that address the fact that often the natural resource management practices employed by upland groups have a profound effect on the quality of life in downstream communities. Some local governments in North Sulawesi and East Java have already begun experimenting with "green taxes" and other compensation mechanisms to reward those who augment environmental service delivery or to compensate those who suffer from environmental degradation externalities.

- Exploring opportunities to combine watershed/habitat protection activities with community development and livelihoods enhancement, especially in the areas of agroforestry, community-based planning, water management, community-level forest management activities. Activities in this area can usefully be combined with initiatives to address tenure uncertainty, as discussed in the section on forest resources, below.

7.2.4 Forest Resources

The rapid rate of forest degradation is a key issue for management outside of protected areas, because it negatively affects both biodiversity and environmental services. There are many proximate causes of deforestation, including industrial overcapacity, illegal logging, seasonal drought and fires, uncontrolled licensing and land clearing practices, and confusing or contradictory legal frameworks. However, the underlying causes are governance issues, not technical concerns amenable to specific investments.

Land tenure is another key issue, also a governance issue at its core. The term "tenure" encompasses the issues of access, security, control, rights and responsibilities to use and manage forests specifically, but also land and natural resources more generally. Tenure also touches on fundamental concerns about equity and justice, which complicate the political and policy environment in which solution approaches can be developed and implemented. Uncertainty of tenure creates economic incentives for short-term management practices, rather than long-term investments. Increased certainty would lengthen planning horizons and increase investment in the resource, (e.g., tree planting, agroforestry, less destructive harvesting techniques). These kinds of investments can improve environmental service delivery and may increase biodiversity, at least relative to the current rapid rate of degradation (though perhaps not relative to the prior pristine state).

Forest conversion to agriculture or settlements is part of the issue of forest degradation, but it has special features worth noting. With the rapid rate of forest loss in Indonesia, more attention is needed on future scenarios where there will be much less forest area and much more converted and degraded land. Policy decisions and precedents established in the next few years will largely determine the status of this degraded land, the activities allowed on it, and the people who have access to it.

These large tracts of converted natural forest may become industrial monoculture plantations accruing benefits to a few; agricultural systems of varying ownership patterns and variable productivity; decentralized, small holder agroforestry systems; or some combination of all these. With no management framework and continued conflict over rights and responsibilities under decentralization, however, these converted areas could also simply remain open access areas, lacking management and investment. Some additional research may be needed, but it seems probable that biodiversity conservation and environmental service delivery needs would be better met by mixed agroforestry systems than strict monocultures, conventional agriculture, or open access areas (the practical default option at present). Biodiversity and conservation benefits would be higher if agroforestry systems were interspersed in networks of local and national protected areas, riparian zones, and multiple use recreation areas that provide habitats and corridors for wildlife. There are opportunities now to influence the policies that will affect outcomes on these converted forest lands for many years to come.

Despite rapid rates of forest loss, there are many opportunities for investment in Indonesia's forest sector with the principal long-term aim of improving biodiversity conservation outside the protected areas system. These opportunities are framed as recommendations below.

Recommendations

- Facilitation of forest management and policy dialogue that brings together knowledge and expertise from government, universities and NGOs at the national to local level in order to define a clear vision towards sustainable forest resource management.
- Support for the creation more incentive-based approaches for managing forest lands, both natural and degraded.
- Facilitation of the development and adoption of local level forest management plans and strategies that both involve stakeholders and improve governance. Focus should be on protecting and improving management of remaining natural forests in some key forest-rich districts.

7.2.5 Coastal and Marine Resources

Degradation of coral reefs, mangrove forests, and seagrass beds from conversion, destructive fishing practices, and commercialization are major issues in the coastal and marine sector. These concerns will be aggravated in coming years by rapid growth, urbanization, and industrialization in the coastal zone, as well as intensification of fishing effort based on strategic policies of the GoI. Livelihoods of Indonesia's population, the majority of whom live in the coastal zone, will be affected, positively or negatively, by the policies and approaches adopted today. Already there are livelihood concerns in the fishing sector where bigger boats and catches threaten both the marine resources and the small fishers dependent on them.

Recommendations

- Support for the promotion of sustainable fish management strategies in collaboration with multinational donor projects and international environmental NGOs. A project and literature review should be the basis of an identification of priority conservation and management targets in coastal and marine sectors and approaches to abate primary threats.
- Support for a review of current fishing legislation and policy, including international agreements, to evaluate the extent to which conservation and sustainable use of Indonesian fisheries is protected by law and agreement. Identification of and reporting on the fishing practices that are most inimical to conservation in this sector is also needed.
- Establishment of multi-stakeholder working groups at regional level such that these groups have official input into GoI policy reform in the sector, thereby harmonizing the needs of local stakeholders with national policy and achieving "buy-in" into policy reform and implementation at all levels.

7.2.6 Conflict Management

Conflicts over natural resources are commonplace due to overexploitation of resources, ambiguous transition to decentralization, poor relations between ethnic groups, marginalization of rural communities and attendant resentment, and lack of law enforcement and prosecution of illegal activities. Conflict stems from poor governance, perceptions of historical injustice, inequitable and inconsistent law enforcement, breakdown and shifting of prior power relationships, lack of broadly accepted multiple land-use spatial plans to resolve resource use conflicts, as well as abuse of power.

The International Crisis Group (2001) provides a useful summary of the difficult struggle ahead to reduce the risk of conflict and the negative impacts of destructive extraction: "Indonesia needs to engineer a better balance between the claims of the state, private corporations and ordinary citizens to natural wealth, while ensuring that extraction is environmentally and socially more sustainable. This will take time and requires tradeoffs between economic growth, environmental sustainability and the interests of different stakeholders" (ICG, 2001. p. 2). Again, the crux of the issue is governance and the need for long-term approaches. One good sign is that there are a number of civil society organizations engaged in providing training and capacity building in conflict resolution, as well as a nascent legal framework for a national institutional approach, based on MPR TAP IX/2001.

Thomson et al. (2003), note that conflict is more likely where government agencies are involved, where capacity for oversight is low, where tenure is uncertain, and where the legal system does not provide a path to just recourse. Since all of these conditions are present in Indonesia, donors face a wide array of possibilities for interventions that could help in addressing conflict over resources. However, Jarvie et al. (2003) note that there is no single approach toward resolution, but rather case-by-case responses are needed. The following recommendations, derived from the reports cited here, aim at fundamental governance processes and institutional approaches, rather than conservation or forest policy alone.

Recommendations

- Support for forest management tenure mechanisms for individuals and community groups that constructively engage all levels of government, thereby leading to an acceptable and appropriate resolution of tenure ambiguities and conflicts. Support for these mechanisms would also address the need to clarify the roles and responsibilities of licensing and regulation between different levels of government.
- Strengthening of equitable and consistent enforcement of laws and regulations through support for existing judicial reforms and capacity building of the judiciary, as well as through support of civil society initiatives that focus on legal literacy and monitoring the court system. The successes in legal literacy generally and building capacity of the local judiciary specifically in handling cases concerning illegal wildlife trade, e.g., in southern Sumatra, may provide useful guidance.

- Support for reform of the budgeting process for security forces to increase transparency, improve incentives for applying the rule of law, and reduce the need for "self-financing."

7.2.7 Education, Capacity Building and Training

To deal with the broader governance issues that lie behind the biodiversity and conservation issues identified in this Report, the need for capacity strengthening for government and civil society is nearly boundless. At the level of project interventions and short-term training needs, a variety of courses and curricula have been developed and delivered by a range of development actors. These have not always been well-coordinated and targeted across regions, sectors, and development sponsors. Training programs should recognize that every skill that needs to be developed in regional governments also needs to be developed among civil society organizations, to provide skilled partners and watch dogs in the process of governance. Some of the specific training needs identified, based on the issues addressed in this Report, include: public consultation, participatory planning, environmental policy, resource valuation, environmental impact analysis, public service delivery, law enforcement, conflict prevention, management, and resolution, outreach and communication, constituency development, and planning and management capacity.

With respect to protected area management and biodiversity conservation needs, Sudibyo (2003) notes that technical and institutional capacity among trained and capable practitioners is one of the most urgent challenges. Generally, a lack of appropriate skills and specialization are serious weaknesses in staff of national parks and conservation centers. The World Parks Congress report (WPC 2003) recommended strengthening institutional, societal, individual, and group capacities for PA management.

Improving governance and improving conservation awareness in Indonesia are both long-term change processes. Recognizing the long-term nature of these issues, the level of need, and the depth and breadth of impact required, approaches and strategies that act through the educational system should be considered. Decentralization has opened up new opportunities in the formal education sector to incorporate tailored environmental education into local curricula since local schools now have the authority to determine 20% of their curriculum. Also, as discussed above, resource and environmental issues often provide a useful vehicle for discussing broader governance messages. Moreover, most schools are unprepared to take on this task due to the lack of qualified human resources, so there should be a substantial demand for any curriculum services, technical assistance, or capacity building that can be offered.

Adult education approaches that address both governance and conservation issues should also be considered. Farmer field school models of training are extremely relevant and effective in the context of decentralization. They have proved successful in Indonesia, and tailoring this approach, for example, to an integrated watershed management framework offers robust and productive opportunities.

Recommendations

- Support to provinces and districts in the development of an environmental package to be inserted into school curricula. Begin with pilot projects with local governments, leading to a generic package that can be modified to the topical requirements of individual regions.

7. 2.8 Status and Protection of Endangered Species

In the battle to save endangered species, the generalized threat of habitat loss is more important than any specific threat, such as poaching or pollution. The habitats and ecosystems that endangered species need to survive must be preserved both inside and outside of protected areas. It is instructive to note that the ranges of some of Indonesia's key endangered megafauna – the Javanese eagle and the Birds of Paradise (an entire family) – as well as other threatened but less well-known species, are not confined to parks and protected areas.

Lack of knowledge continues to be a major issue in species conservation. We may not know enough about an endangered species' habitat needs, reproductive cycle, or current threats to develop appropriate and practical conservation interventions. Consider also that there are hundreds of species in Indonesia yet to be described, many of which may be as threatened as the known species. In the past, much conservation investment was focused at the level of science in the field. As Indonesia's crises have grown, along with the need for visible results, many organizations have refocused to the policy level or have emphasized community involvement, to the extent that field-based science is now lacking in many areas and organizations.

Public attitudes – environmental awareness and conservation consciousness – are also important in the quest to save endangered species and to manage protected areas appropriately. Although awareness of environmental issues and conservation needs has increased in recent years, there is still much room for improvement both in the constituency for improved conservation and in the translation of awareness to action at a meaningful scale. People recognize environmental problems, but there is little connection to manageable actions that people can take to correct these problems. There is a common perception that the government should handle these problems better, but there is little connection between people's needs and government decisions.

Recommendations

- Support for activities that contribute to preservation, conservation awareness, and decentralized resource management of endangered species' habitats.
- Support for the gathering of improved biological information on a priority group of endangered species so as to better inform their management.
- Support for the establishment of a multi-stakeholder group to organize conservation efforts for a priority group of endangered species, develop conservation action plans for these species' preservation and implement and monitor the success of these plans. This type of forum and conservation action plan currently exist only for the orangutan and Javan eagle, and even in those cases implementation has not proceeded as expected, thus there is a need to revisit and build upon these initiatives.
- Initiatives to protect Indonesia's critically endangered mega-fauna from poaching, hunting and other forms of persecution. Combating wildlife crime is one of the best performing sectors in Asian conservation with strong networks, a cadre of committed and experience individuals and models that work with appropriate levels of funding. It is an area of conservation with high public interest and brings many conservation issues into sharp relief. Further more it brings profile and standing to the role of the ranger and other field-based staff.

7.2.9 Inland Waters and Wetlands

Inland waters and wetlands are increasingly affected by flooding, sedimentation, urbanization, industrialization, and accompanying pollution. More generalized environmental degradation in forested uplands affects both water quality and water quantity in more heavily populated downstream regions. Both agriculture runoff and industrial discharges contribute to a worsening of water quality. Land conversion of forests to agriculture or settlements and land filling for development projects and settlements affect both watersheds and wetlands, with increasing evidence of imbalanced hydrologic regimes seen in seasonal drought and flooding. Freshwater systems, both natural and man-made, are important sources of fish protein for Indonesians and their degradation will result in negative nutritional impacts.

On a larger, more visible scale, Indonesian development projects have created vast areas of degradation in important wetlands and peat areas. Destructive logging and land clearing practices have affected water regimes and moisture retention to the extent that seasonal fires (caused by land clearing, etc.) have affected peat lands, with attendant health impacts due to haze. The "million hectare rice project" has destabilized a vast area of fragile swamp forest habitat in central Kalimantan, home to orangutans and other endemic species.

Some opportunities in this area have already been addressed in the discussion of ecosystem and watershed level approaches. The need for integrated planning and governance systems is similar for river systems and for wetlands.

Recommendations

- Support for collaboration and coordination among agencies involved in inland water and watershed management to assess their environmental status, conservation needs, and priorities.
- Support for grounded studies that demonstrate the economic benefits of these ecosystems as one means of informing local governments and communities of the value to them of conserving these water bodies.

7.2.10 Impacts of Development

Development initiatives can either positively or negatively affect biodiversity and forest conservation and management, depending on the type of development project and its planning, implementation and monitoring. Indeed, a road project in a heavily forested area that does not consider environmental impacts will more than likely negatively affect the surrounding biodiversity and other natural resources and services. On the other hand, many development projects such as solid waste management and sewage treatment, to which only 1% of the Indonesian population has access, not only improve the health of the human population, but also benefits biological resources and their habitats.

Generally, the impacts of development projects will be exacerbated or mitigated, positively or negatively, by governance processes. Planning systems, environmental impact assessments, and mitigation strategies are presently not well designed, implemented, or monitored. While these processes are all nominally subject to regulation, the rules are routinely ignored and the final plans are seldom enforced. This creates a dynamic of unchecked development, exacerbated by the long-standing growth paradigm that fueled Indonesia's rapid growth in the past two decades. Additionally, there has been a penchant to exploit development projects as rent seeking opportunities, often at the cost of proper planning, implementation and monitoring.

Lack of planning and environmental management systems at the design stage has influenced most kinds of infrastructure investment to date. To facilitate future growth, Indonesia has estimated a need for US$ 78 billion in infrastructure needs in coming years (CGI meeting, Dec. 2003). Based on the inadequacy of regulatory systems, it can be expected that future roads, bridges, and power generation networks will continue to contribute to environmental degradation. Aside from the direct impacts of infrastructure development, there are also the secondary impacts associated with migration, encroachment and land conversion that accompany transport networks, as well as individual investment projects, such as factories or mines.

Mining has been much in the news of late with the controversy over mining in protection forests. In fact, the immediate impacts of mine development are relatively small and localized. The more serious impacts of mining involve the disposal of tailings and waste products, as well as the secondary impacts, such as in-migration of job seekers with their attendant need for facilities and services.

Recommendations

- Building of capacity of stakeholders at the local and regional levels to design, implement and monitor environmental impact assessments (AMDAL). This means strengthening of planning and regulatory systems, decision-making processes and participation of constituents.

- Building of awareness among civil society of the positive and negative environmental impacts of various development initiatives so that they can make informed decisions about whether to support a particular development project.

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