



### III

## CURRENT EFFORTS TO PROTECT BIODIVERSITY

#### A. Legislation

1. The 1945 Indonesian Constitution (UUD 1945) stresses the need to use Indonesia's natural resource base wisely and sustainably for economic and social development to improve the prosperity and welfare of the people.
2. The legal framework through which Ministry of Forestry addresses the issues of forest protection and wildlife conservation is primarily the Basic Forestry Law of 1967. This law specifies the responsibility of the government towards all aspects of conservation as well as the relationships between the people and State regarding forest ownership and use. This law provides for protection of conservation areas but needs revision to recognise *adat* common property uses and to be compatible with the objective of *in-situ* conservation outside protected areas.
3. New legislation on Conservation of Natural Resources and Ecosystems came into

effect on August 10, 1990. The new laws stress the need for conservation of biological resources so that these can be utilised sustainably to increase the prosperity of the people. The D-G PHPA and other Forestry agencies are now in the process of writing the implementing regulations. It is essential that these regulations stress conservation rather than simply endorse exploitation and extraction. These regulations should be widely reviewed by other concerned agencies prior to discussion in the House of Representatives (DPR).

**4.** The Basic Law on Environmental Management (UU 4 of 1982) provides for the assessment of environmental impacts of development projects. Under the associated Government Regulation No. 29 of 1986 every ministry is expected to draw up lists of projects which might have adverse environmental impacts. D-G PHPA within MoF has the responsibility of assessing the EIAs (AMDAL) for ongoing and proposed logging concessions.

**5.** Legislation in many other sectors affects resource use and biodiversity. An urgent review is required of legislation pertaining to issues such as coastal zone management, land rights and land tenure; benefits from traditional knowledge; private investment in conservation areas; utilisation of biological resources by the private sector and protection of local crop varieties. The present legislation related to many of these issues is complex, cumbersome and difficult to implement because of confusion over sectoral responsibilities, lack of resources and lack of understanding of existing legislation. For instance, establishment of marine conservation areas must conform to international treaties as well as Indonesian national legislation, local government regulations and community rights. Coastal zone management comes under the jurisdiction of the Navy, Fisheries (Ministry of Agriculture), PHPA and local government (*bupati*) but utilization is often regulated according to *adat* and customary use.

## B. Institutions

**1.** The government agency with direct responsibility for protection of natural habitats and conservation of nature is the Directorate General of Forest Protection and Nature Conservation (PHPA) within Ministry of Forestry. PHPA is responsible for protection and management of all terrestrial and marine conservation areas and for management of protection forests.

**2.** The Ministry of Population and Environment (KLH) has direct responsibility for environmental policy and regulation. KLH has played a key role in the development of a Biodiversity Strategy for Indonesia, linking conservation of biodiversity with economic development.

**3.** Other institutions with responsibility for managing biological resources include Ministries of Forestry, Agriculture, Dalam Negeri [Home Affairs], D-G Fisheries, BKLH, LIPI. The activities of many other sectors e.g. Ministries of Mining, Transmigration and Public Works have considerable impact on biodiversity. BAPPENAS as the national planning body and the provincial BAPPEDA also have key responsibilities for biodiversity conservation.

**4.** The Indonesian NGOs have played an active role in stimulating public interest in biodiversity issues, urging government to strengthen conservation and environmental issues in na-

Table 3:  
Management Costs for Parks and Protected Areas  
[1987-1988]

Park	Area	Annual operating Budget [US\$]	Annual costs per km <sup>2</sup>
Gunung Leuser	10,946	232,357	21
Baluran	279	187,172	671
Bali Barat	772	159,527	207
Dumoga Bone	2,780	136,874	49
Gede Pangrango	152	120,714	794
Komodo	407	111,817	275
Ujung Kulon	786	90,274	115
Kerinci Seblat	14,846	79,606	5
Tanjung Puting	3,552	68,639	19

Source: *pers comm.* PHPA

tional legislation, policy documents and development activities. The NGOs such as MPHI, WALHI and SKEPHI, participated in the TFAP review process and in preparation of this Plan. Indonesia has more than 400 NGOs throughout the archipelago working with local communities to resist and counter destruction and simplification of habitats e.g. replanting mangroves, soil conservation and sustainable agriculture. Appendix 11 lists some NGO activities.

**5.** A serious constraint to the effectiveness of conservation programmes to date has been that many of the agencies directly responsible for biodiversity protection are under-funded. The total budget available to PHPA in the 1988/89 and 1990/91 fiscal years, for instance, was only Rp10,150,899,000 (ca.\$5,640,000), and 30 percent less for 1989/1990.

**6.** Shortage of trained staff is another major constraint. PHPA employs a total staff of 4742 (3210 or approximately two-thirds are *pegawai*

*negeri*/civil servants). 28 percent (904 PNS) of the staff are assigned to headquarters and Balai III (West Java and West Kalimantan). Overall staff numbers are high but there is a lack of skilled technical and management professionals in the field, even though several national parks appear over-staffed. PHPA has almost no trained marine biologists even though it is the agency charged with management of coastal and marine conservation.

Most of these resources go to headquarters and national parks. Even so the budget per park is still very low, an estimated Rp 47 per hectare for Kutai in 1987/1988, with most of this going to pay staff salaries. Other government agencies, institutes and NGOs also suffer from lack of funds e.g. at LON 60 percent of annual funding is allocated to salaries and only 40 percent to technical activities.

**7.** Institutional reform and strengthening must be a prerequisite for effective conservation of biodiversity. Many government agencies

would benefit from redistribution of manpower and resources, better training and a more rational employment policy to streamline conservation agencies into more effective institutions.

Policies of staff transfer also need review. Trained staff are often transferred to positions where their training and expertise are redundant.

### *C. International Conventions and Programmes*

1. Indonesia supports and implements international conventions and international programmes which are relevant to conservation of biodiversity. Indonesia is already a party to CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), the World Heritage Convention and the ASEAN Heritage Convention.

2. For active participation in CITES the relevant management authorities (PHPA) must collect and collate up-to-date information on status, abundance and population trends of populations of traded species. PHPA is collaborating with WWF to establish a database to monitor trade in parrots and other wildlife.

3. Indonesia has already nominated three national parks as World Heritage Sites - Komodo, Lore Lindu and Ujung Kulon. The Governor of Irian Jaya has proposed the nomination of Gunung Lorentz reserve as a World Heritage site.

4. Indonesia participates in the UNESCO Man and the Biosphere programme (MAB) involving research projects and training. Indonesia has seven MAB reserves: Gn. Leuser, Siberut-Taitai Batti (Sumatra), Cibodas/Gn. Gede-Pangrango (Java), Tanjung Puting (Kalimantan), Komodo (NTT), Lore Lindu and Bunaken (Sulawesi).

5. Indonesia has expressed an intention to join the Ramsar Convention and participate in

international collaboration for conservation and management of wetlands.

6. PHPA is involved in discussions within ASEAN concerning the establishment of trans-frontier reserves. The Kayan-Mentarang and Bentuang-Karimun reserves in Kalimantan have increased conservation importance because they border the proposed Pulong Tau and Lanjak Entimau reserves in Sarawak. Wasur N.P. in Irian Jaya is also a border park, abutting the Tondou Wildlife Management Area in Papua New Guinea.

7. Indonesia is participating in development of the Global Biodiversity Conservation Strategy, sponsored by the United Nations Environment Programme (UNEP), the World Conservation Union (IUCN) and the World Resources Institute (WRI). Activities include participation by WALHI on the Programmes International Coordinating Group, co-sponsorship by KLH and WALHI of the Southeast Asia Regional Consultation on the Strategy and IUCN and WRI input to developing the Indonesia Biodiversity Action Plan.

8. Indonesia, through KLH, is assisting in the development of the Global Conservation Convention and preparing papers on biodiversity to be presented at the UNCED conference in Rio de Janeiro, Brazil in June 1992.

## D. Existing Programmes to Conserve Biodiversity

### 1. National system of parks, reserves and protection forests

1.1. Since species live and evolve in complex natural habitats within even larger ecosystems, the primary means of conserving biodiversity is conserving ecosystems, both terrestrial and marine. Unlike many other tropical countries, Indonesia already has a system plan for parks and protected areas. Terrestrial and wetland sites of highest conservation value in each of the seven major biogeographic regions were identified according to criteria of species richness, endemism, range of habitats and management viability as well as for socio-economic benefits. Conservation priorities are identified in the National Conservation Plan (FAO/MacKinnon and Artha, 1981/82); IUCN Indomalayan Review (MacKinnon and MacKinnon, 1986) Irian Jaya Conservation Plan (Petocz and Raspado 1989) in agreement with PHPA central authorities. These priority areas were designated in TGHK by provincial authorities, refined by RePPPProT and reaffirmed in the TFAP and this action plan - appendix 7.

1.2. The Indonesian government has already gazetted or designated 348 terrestrial conservation areas covering a total of 16.2 million ha. or 8.2 percent of Indonesia's land area. A further 2.7 million hectares (1.4 percent of total land area) are proposed as reserves (MoF/FAO, 1991). Conservation areas have been established or designated on all major islands and island groups to cover all major habitat types. The official goal is to have at least 10 percent of Indonesia's land within reserves by the end of Repelita VI (MoF/FAO, 1991). Another 30 million ha of forests are designated as protection forest. In total 49 million hectares of forest lands are included within protected areas.

1.3. The Marine Conservation Data Atlas (Salm and Halim, 1984) identified marine and coastal

areas of greatest importance for conservation of biodiversity. Top priority areas are identified in appendix 8. The plan identifies areas requiring protection and management and indicates the whereabouts of sensitive habitats and important biological resources which may be threatened by poorly planned developments. 10 million hectares of marine and littoral habitats are targeted for inclusion in conservation areas by the end of Repelita V with the intention of expanding this total to 20 million hectares by the year 2000.

1.4. Indonesia has 366 established conservation areas including 24 national parks and several marine parks. 80 terrestrial areas and 49 marine areas are of top conservation priority (MacKinnon and MacKinnon, 1986; Salm and Halim, 1984) - Appendices 7,8, maps Annex A. These conservation areas are managed by the Department of Forest Protection and Nature Conservation (PHPA) within the Ministry of Forestry. At present many parks and reserves exist on paper only and have little or no effective management - Table 4.

1.5. In planning the national system it was assumed that protecting ecosystems will protect most of the native flora and fauna and this does indeed seem to be the case. All Indonesian birds are recorded from at least one designated reserve and many are represented in several (MacKinnon and Wind, 1980). The same is true for the most conspicuous mammals, e.g. primates (MacKinnon, 1987). Although data is incomplete, most endemic birds and mammals are known to occur in one or more reserves - Appendix 9. Most of the endangered species listed in the IUCN Red Data Books are also recorded from at least one reserve.

1.6. Unfortunately the protected area network may still be inadequate to conserve all of Indonesia's rich biodiversity in the long term.





*The Toraut River in Dumoga-Bone National Park, Sulawesi, provides water for irrigation schemes in the valley below*

The percentage of terrestrial and marine habitats included in the protected area design varies between biogeographic regions and for different habitat types - appendix 2, 8. While some habitat types such as montane forests are well-represented within the protected area network other habitats are still poorly represented,

especially lowland rain forests, mangroves and marine habitats (MacKinnon and Artha, 1981; Salm and Halim, 1984). Between 1977 and 1984 there was a remarkable growth in areas legally gazetted as conservation areas (RePPPProT, 1990) but since 1984 there have been almost no new areas gazetted - fig 1.

1.7. Gazetting parks and other conservation areas is only the first step in protecting biodiversity. Species survival in the long-term will depend on effective protection and management. Many reserves, especially on the Outer Islands, have no staff, no budgets and no effective protection. Even in the better-funded national parks there is often a lack of resources and trained personnel. Protection and management can only be improved with an increase in funds, manpower and training, including relevant on-the-job training for field staff. Marine parks, in particular, suffer from lack of marine biologists and other trained personnel.

1.8. Several conservation programmes to strengthen national park and reserve management are in progress or scheduled to begin in 1991 with funding and technical assistance from the World Bank, bilateral agencies (ODA, USAID, JICA, DGIS, New Zealand government) and international conservation agencies e.g. WWF, AWB - Appendix 7, 12, Table 4. Many of these programmes are focusing on community involvement and participation in reserve management and on buffer zone projects to relieve pressure on park boundaries.

1.9. Thirty million hectares of protection forests protect watersheds and steep slopes throughout the archipelago. Management of these forests is part of the mandate of PHPA but is usually left to provincial forestry offices or neglected because of lack of resources. Illegal logging and pioneer agriculture erodes the protection forests. If properly managed, protection forests could form a valuable part of the conservation estate, as extensions and corridors between conservation areas.

1.10. Although they cannot be a substitute for conservation areas, production forests, if well-managed and selectively logged in accordance with forestry regulations, can be valuable for conservation. Many species of mature rain forests will survive in logged-over areas whereas they cannot maintain viable popula-

tions in small isolated reserves. Production forests can, therefore, serve as valuable reserve buffers if logged lightly and protected from further encroachment so that forests can regenerate.

## 2. Tropical Forestry Action Plan

2.1. The Tropical Forestry Action Plan is the policy document prepared by Ministry of Forestry to guide forestry programmes and investment during Repelita V and VI. Many of the policies and activities listed are relevant to sustainability of forest resources and slowing loss of biodiversity. Conservation actions outlined in the TFAP complement the Biodiversity Action Plan - Appendix 13, 15.

2.2. The draft TFAP recommends:

- forest management based on detailed land use planning and appropriate forest land allocation and guided by sound silvicultural practices and multiple use concepts;
- review of the Basic Forestry Law to recognise *Hukum Adat* and to include local communities in development of forest resources;
- development of forest plantations, wood from non-forest sources, fuel wood and charcoal supplies and rattan plantations to relieve pressure on natural forests;
- strengthening of programmes to rehabilitate forest and critical lands, with special emphasis to soil and water conservation;
- extension of social and community programmes, emphasising the participation of people living in and around forests in forestry development activities;
- developing programmes to assess the socio-economic values of non-timber forest products to local and national economics and improving utilisation and marketing of these products;

Table 4 National Parks - Management and Technical Assistance

Reserve	Prov./ Islands	Alt. (m)	Habitats	Total area (Km <sup>2</sup> )	Mgt. Plan	Donor assistance
<b>Sumatra</b>						
Barisan Selatan	BL	0-1811	LR MF	3650	*	WB2
Kerinci Seblat	WBJS	20-2447	FS LR MF PS	14846 [9144]	*	TSSD/WB WWF
Way Kambas	L	0-50	FS LR Mn	1235	*	WB2 WWF
Gn. Leuser	A	0-3419	FL LR MF	8080	*	WB1
<b>2. Java and Bali</b>						
Gede/Pangrango	W	600-3079	LR MF	150	*	WB2
Ujung Kulon	W	0-623	FS LR Mn	761	*	NZ WWF
Baluran	E	0-1250	MSF Mn	250	*	WB1
Bromo Tengger/Ijen	E	200-2000	LR MF	576	*	WB1
Meru Betiri	C	0-1223	MF SER	580	*	
Alas Purwo	E	0-360	MSF SER	620	*	WB1
Bali Barat	B	0-1414	MSF MF SER	570	*	WB1
<b>3. Kalimantan</b>						
Gunung Palung	W	0-1160	FS LR MF P	900	*	USAID
Tanjung Puting	C	0-100	FS HF LR Mn PS	3050	*	WB2
Kutai	E	0-398	FS IF LR	2000	*	Private sector WB2

(1944) Kerinci - Saablat proposed at 14846 sq. km but area reduced after TGHK revisions. 1986



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Reserve	Prov./ Islands	Alt. (m)	Habitats	Total area (Km2)	Mgt. Plan	Donor assistance
<b>4. Nusa Tenggara</b>						
Gn. Rinjani complex	L	500-3276	MF SER	1170		WWF
Komodo	K	0-735	FL Mn Sav.	340	*	
<b>5. Sulawesi</b>						
Lore Lindu	C	200-2356	LR MF	2310	*	WB2
Rawa Aopa	SE	100-1006	FS MSF PS UF	1500		TSSD/WB?
Dumoga Bone	N	100-1970	FL MF SER	3000	*	WB1
<b>6. Maluku</b>						
Manusela	S	0-3027	LRF MF FL Mn	1890	*	WB2
<b>7. Irian Jaya</b>						
Wasu		0-10	MSF Sav FS	4262	prep	WWF/ DGIS
Marine P. Seribu	Java	sea level	coral marine	1100	*	WB2, WWF
Karimun Jawa	Java	sea level	coral marine	1116		
Bunaken Teluk Cenderawasih	Sulawesi Irian Jaya	0 - 30 sea level	coral coral marine	890 14500	prep *	USAID WB2

**Sumatra**

A = Aceh  
N = North Sumatra  
W = West Sumatra  
R = Riau  
L = Lampung

**Java and Bali**

W = West Java  
C = Central Java  
E = East Java  
B = Bali

**Kalimantan**

W = West Kalimantan  
C = Central Kalimantan  
S = South Kalimantan  
E = East Kalimantan

**Nusa Tenggara**

L = Lombok  
K = Komodo

**Maluku**

S = Seram

**Sulawesi**

SE = South-East Sulawesi  
N = North Sulawesi

C = Central Sulawesi

- upgrading of protection and management in protection forests; - extension of the protected area network in all biogeographic regions;
- improved management and staffing of priority conservation areas and development of selected sites for ecotourism;
- buffer zone development around national parks, involving local community participation;
- clear demarcation of forest boundaries to avoid conflicting use e.g. concessions overlapping conservation areas;
- rationalisation of shifting agriculture;
- conservation of mangroves and coastal forests;
- strengthening of forestry institutions, policy and research;
- improved manpower, training and investment planning;
- involvement of youth in tree planting campaigns; and
- forestry in transmigration programmes (tenure and land rights, transmigrants and HTI).

2.3. TFAP proposes investments in excess of US\$10,000 million, two-thirds from the private sector, during Repelita VI (1994 - 1999) in the forestry sector. Many TFAP programmes, if carefully planned, have considerable potential for slowing biodiversity loss outside the protected area network - Appendices 13 and 15.

### 3. *Ex-situ* conservation

#### 3.1. A series of botanical gardens and arboreta

are being maintained by government and private institutions for ex situ conservation of plant biodiversity. Arboreta (Sibolangit near Medan, Haurbentes and Darmaga near Bogor) and TAHURA or public forest parks (Tahura Juanda in Bandung, Tahura Hatta near Padang and Tahura Bukit Suharto in East Kalimantan) are run by the Ministry of Forestry. Germplasm collections-cum-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). Botanical gardens at Bogor, Cibodas, Purwodadi and Bali are managed by the Indonesian Institute of Sciences (LIPI). Educational botanical gardens have been established by the Ministry of Education and Culture (University of Gadjah Mada in Yogyakarta and University of Indonesia in Depok). There are several other specialized botanical gardens throughout Indonesia, such as the medicinal plant garden (Tawangmangu in Central Java and Lido in West Java) operated by the Ministry of Health and the orchid palace Telanaipura (Jambi) owned by the Jambi Provincial Government.

3.2. The Ministry of Agriculture maintains a series of germplasm gardens: for coconuts (Bone-Bone and Mapanget in Sulawesi), spices (Bacan Island), mango (Grati, East Java), rubber (Sungai Putih, North Sumatra) and other crops. Cenderawasih University and Pertanian and Perkebunan maintain a collection of tubers, fruits and plants for estate and forestry plantations in Irian Jaya.

3.3. The private sector runs specialised botanical gardens such as the Taman Bunga Keong Mas of Taman Mini Indonesia Indah and the Wiladatika Flower Garden of the Scout Movement (Pramuka) in Cibubur near Jakarta. The Ragunan Zoo in Jakarta and the Gembira Loka Zoo in Yogyakarta also maintain their grounds as botanical gardens. Newly-created *kebun raya* are being developed by district and provincial governments for regional plant specialities.

3.4. The research institutions of Ministry of Agriculture maintain a series of cold storage facilities for medium term germplasm conservation through the preservation of seeds, spores or tissue cultures. At present no institution in Indonesia has a long term germplasm storage facility.

3.5. Throughout Indonesia local communities have set up community seed banks of native plant species. The NGOs PAN-Indonesia and WALHI have established database recording community seed banks.

3.6. Local communities have maintained species diversity by cultivating wild-collected fruit trees e.g. mango, rambutan, durians. The mango *Mangifera casturi* is now recorded only from village gardens in South Kalimantan. Farming practices which simulate or modify natural forest conditions e.g. Dayak forest gardens, also serve to maintain greater diversity than do more intensive forms of agriculture.

3.7. There are already a number of zoological gardens in Indonesia. Apart from Jakarta (Ragunan), Bandung, Surabaya and Yogyakarta, most zoos in Indonesia are suffering from lack of financial, scientific, public and managerial support. The Ancol Marine Aquarium and the Taman Burung of Taman Mini Indonesia Indah (both in Jakarta) and Taman Safari are specialized zoos designed for special purposes.

3.8. Zoos can play a very useful role through education and awareness programmes to help urban populations appreciate the values of biodiversity.

3.9. Captive breeding programmes can be a useful supplement to *in-situ* conservation for some easy-to-breed species and a source of animals for stocking other zoological gardens. The value of zoo efforts to captive breed endangered species for reintroductions to the wild is more doubtful. For many, indeed most, endangered animal species captive breeding

programmes may not be realistic because of the expense, limited space, difficulties in encouraging animals to breed in captivity and even greater difficulties in reintroducing captive-bred young to the wild.

3.10. Current zoo captive breeding programmes focus on the Sumatran rhino (Surabaya, Ragunan-Jakarta, Taman Safari-Bogor); Komodo dragon (Ragunan) and Bali starling (Surabaya). Taman Safari and Taman Burung (TMII) are both engaged in programmes attempting to breed parrots and birds of paradise.

3.11. Captive breeding programmes for traded species such as crocodiles, macaques *Macaca fascicularis* and arowana fish *Scleropages formosus* have been established and could provide young for restocking wild populations.

#### 4. Activities in natural resource sectors

4.1. Present policy with regard to plant resources *emphasises exploitation* through agronomic or silvicultural approaches. There have been concentrated efforts to produce high-yielding cultivars of rice, corn, soybean and peanuts but little attention has been paid to other crop plants cultivated by Indonesian farmers.

4.2. The National Committee for Germplasm Conservation has encouraged the establishment of germplasm collections in many institutions to conserve the genetic diversity of many crop plants, but so far these valuable resources are not being utilized for plant breeding. In the past fifty years no new cultivars of mango, durian, rambutan, salak, duku, minor grain legumes or local vegetables have been released by government institutions. The improved cultivars of tomato, water spinach, and chili pepper made available to farmers by Puslitbang Hortikultura in recent years and bearing Indonesian cultivar names were produced outside the country and successfully tested for adaptation in Indonesia. The only recent cultivars of industrial crops

raised are rubber (by Balai Penelitian Perkebunan Sungai Putih) and sugar cane (by Puslitbang Gula Pasuruan). In extending coconut plantations the government seems to prefer imported cultivars instead of using those produced locally by Puslitbang Tanaman Industri.

4.3. In cattle, poultry and fish farming imported breeds have been important. Very little work has been done in Indonesia on conserving animal genetic resources. Recently Puslitbang Peternakan has made some attempts to preserve the purity of the breeds of Madurese cattle, Garut goat, Kedu fowl and Alabio ducks. Banteng *Bos javanicus* have already been domesticated to breed Bali cattle. Freshwater fish reservations are being identified by Balitbang Ikan Air Tawar to protect important breeding grounds.

## 5. Research and training

5.1. Indonesian scientists are currently engaged in several research programmes on topics relevant to biodiversity. Scientists from LIPI, LON, national institutes and local universities conduct their own research programmes as well as collaborating with foreign scientists on topics as diverse as taxonomy, ecology, fisheries production, plant and animal husbandry, soil science, silviculture and germ plasm research. While there is excellent local expertise in many fields, there are numerous research and training needs still to be addressed.

5.2. Ministry of Forestry through Litbang Kehutanan have a large number of research projects covering forest regeneration, forest management and utilisation, productivity of tropical forests, sustainable development, rehabilitation, soil and water conservation, tree improvement and timber estates. The number of active research staff increased from 87 in 1989 to 118 in 1990. Litbang have cooperative programmes with foreign and national institutions, among others IDRC (rattan) TROPENBOS (dip-

terocarp growth and yield), ITTO (forest fire), University of Cambridge (plant-animal interactions), ODA (forest ecology and botany), USAID (natural resources management), UNMUL (forest utilisation), Gajah Mada (standardisation of research) and LIPI. Major research constraints are limited manpower and funding and duplication of efforts in regional forestry institutions (MoF/FAO, 1991).

5.3. The PROSEA project (Plant Resources of South-East Asia) based at Herbarium Bogoriense is collating information on useful native and introduced plant species and their uses, including medicinal plants. The National Institute of Health (NIH, U.S.A.) is collaborating with Indonesian scientists to collect medicinal plants and assess their pharmaceutical values.

5.4. Strategies for increasing food production have so far relied on importing technologies from abroad and adapting and developing them to suit the Indonesian environment. Using such methods Indonesia has been self-sufficient in rice production since 1984. Development of technologies to become self-sufficient in other commodities, such as sugar and soybean, have so far lagged behind countries such as Thailand or Taiwan, whose cultivars have been flooding the Indonesian markets. Development of new technologies has been handicapped by inadequate research programmes and a shortage of trained plant breeders. The lack of trained personnel in these fields may result from inappropriate course work at university level or the apparent lack of job opportunities for young graduates.

5.5. Mechanisms for monitoring key biodiversity indicators include inventory of specific localities, and monitoring of species richness and distribution over time. Current monitoring projects of habitats and species include forest plots at Wanariset and ITCI, East Kalimantan, forest ecology projects in Gn Leuser (Ketambe, N. Sumatra), Tanjung Puting (C. Kalimantan) and Gn. Palung (W. Kalimantan). New forest

research projects involving long-term monitoring in primary and production forests will be established under the ODA Forest Management project and the Natural Resources Management project (USAID). Coastal habitats are being monitored at Segara Anakan (south Java). The Snellius expeditions provide some monitoring of marine biodiversity. Other suitable research sites for long term monitoring are Dumoga-Bone (Sulawesi) and Manusela (Seram), both sites where intensive research and collection have provided excellent baseline data.

5.6. Current curricula at schools and university already include some biodiversity issues, although these topics are usually presented under other names. Better presentation and coverage of biology and its relevance to society and development may encourage a greater understanding of biodiversity issues among Indonesian science graduates.

5.7. Many Indonesian universities have faculties of Forestry, Agriculture and Fisheries. A few such as UI and UNAS (Jakarta), IPB (Bogor), Padjajaran (Bandung) and Gajahmada (Yogyakarta) offer courses with greater emphasis on biology, ecology and conservation of natural resources. 42 universities throughout Indonesia have environmental study centres (PSLs). Many of these run AMDAL courses for government agencies and university staff and conduct EIAs on new development programmes in the provinces.

5.8. The School of Environmental Conservation Management (SECM) at Bogor has been operating for 12 years providing courses in park and reserve management to PHPA staff. In 1991 the School extended its syllabus to include a one month course in marine conservation.

## E. Availability of Information on Biodiversity

### 1. Biodiversity information

1.1. The Herbarium Bogoriense and Zoological Museum, Bogor, are repositories for major collections of plant and animal material collected throughout Indonesia. These identified collections are a major resource in providing information on species richness and distribution. The Herbarium has 1.6 million plant specimens, a collection at least three times larger than any other herbarium in Southeast Asia. It houses the most complete collections of all plant material collected in Indonesia with many type specimens. Much of this material is now under threat because of lack of adequate storage facilities, trained personnel and budgets to carry out required restoration work. Immediate attention needs to be paid to further inventory work, restoring and cataloguing the herbarium and museum collections and to establishing a

computer database to make information more accessible to users. Projects such as the Flora Malesiana, Fauna Malesiana and PROSEA will enhance collection and collation of data on biodiversity.

1.2. There is considerable information available within Indonesia and in published English and Dutch literature on biodiversity within the archipelago. Unfortunately this information is not always readily available to interested parties. Major constraints are the lack of tree flora, field guides and simple identification keys for major plant and animal groups. There is an urgent need to produce such materials, drawing on local expertise. In recent years there has been some attempt to collate this information in a more accessible form, e.g. the publication in





Indonesian of standard works such as Heyne's volume on Economic Plants and the Ecology of Indonesia book series published in Indonesian and English.

1.3. Further constraints are limited publication of information within Indonesia, few Indonesian journals and limited access to international publications because of their expense. Although there are many libraries with collections relevant to biodiversity within Indonesia (Herbarium Bogoriense, Zoological Museum,

BIOTROP, Puslitbang Kehutanan) they are severely constrained by budgets in their abilities to purchase reference books and relevant journals. Libraries generally require greater funding and more trained personnel.

1.4. There is considerable 'grey' literature available on biodiversity e.g. field reports and management plans from MoF, PHPA, LIPI, LON, FAO and WWF. The recent publication of the RePPPProT maps (1990) provides a standard set of maps for the whole archipelago showing land use and habitat extent. These maps will prove an invaluable baseline for further conservation planning and rationalisation of reserve boundaries.

1.5. Several computerised databases relevant to biodiversity have already been established: WWF-PHPA (Species, reserves, habitat); AWB-PHPA (Wetlands); WWF-Irian/PHPA (Wildlife Trade); UNESCO - PHPA database on MAB reserves; PROSEA/Herbarium (Useful plants); KLH/EMDI (Land use and environmental planning). There are also plans to establish a National Biodiversity Database with GIS at LIPI in collaboration with The Nature Conservancy.

## 2. Public access to information

2.1. Public access to information is very limited at present. Even information exchange between government agencies and scientific institutes is poor. There need to be closer institutional links and greater information exchange between all agencies concerned with biodiversity issues within the government and public domain.

2.2. Specifically government agencies and donors must develop guidelines and procedures to make full information available in a timely manner to local communities and NGOs about planned development activities that will affect biological resources.