INDONESIA

INTRODUCTION

by Marcel J. Silvius, Asian Wetland Bureau, Indonesia

Area: The land area has been variously estimated at between 1,904,000 and 2,027,000 sq km; figures of 1.904, 1.942, 1.944 and 2.019 million sq km have been reported by various Indonesian government departments. Indonesian territory up to the 12 nautical mile limit is estimated at 5.0 million sq km, of which 2.7 million sq km are enclosed marine waters and 0.4 million sq km are open ocean waters. The continental shelf waters are estimated at 1.5 million sq km and the coastline at 80,791 km.
Population: Approximately 186,000,000 (1986).

Indonesia is an archipelago consisting of about 13,000 islands stretched out between the two continental shelves of Asia and Australia. The archipelago has a great wealth of oil and mineral deposits, forests and fishery resources. It exhibits an enormously varied physical structure of high mountain chains, rows of volcanoes, vast alluvial plains, huge lake and swamp areas, extensive shallow coastal waters, innumerable coral islands and deep oceanic trenches.

The climate ranges from humid to semi-arid tropical at sea level, up through all altitudinal climatic zones to the perpetual snow and glaciers of Gunung Lorenz in Irian Jaya. With its heavy rainfall and often fertile soils (particularly in basic volcanic regions), Indonesia is able to sustain a highly productive tropical agriculture and can support a high density of people at a moderate standard of living.

Of the total land area, about 97% is contributed by 13 land masses. The largest are Kalimantan (539,460 sq km), Sumatra (473,606 sq km), Irian Jaya (421,981 sq km), Sulawesi (189,216 sq km) and Java and Madura (132,817 sq km). Other major islands include Halmahera, Seram, Sumbawa, Timor, Flores, Bali and Lombok.

The country's vast extent, complex shape and wide range of altitudes and climates form the basis of a tremendous natural richness. There are more than 1,500 species of birds, 500 mammals, 3,000 fishes, 10,000 trees and innumerable other life forms. The distribution over islands and isolated mountain ranges has led to a relatively high degree of endemism.

The Indonesian archipelogo spans two major biogeographical regions divided by Wallace's line. West of this line lies the Indo-Malayan Realm, which includes the Greater Sunda Islands of Java, Borneo and Sumatra on the Sunda Shelf; to the east lies the Australasian Realm. During the Pleistocene period some 10,000 years ago, sea-levels were much lower than at present. The Greater Sunda Islands were connected by dry land to the Asian mainland, while New Guinea and the Aru Islands were joined to Australia. Wallacea, comprising the Lesser Sunda Islands (Nusa Tenggara), the Moluccas and Sulawesi, has had no recent land connection to either continent. The distribution of plant and animal species in Indonesia

clearly shows a pattern derived from these ancient linkages and, where no land connection existed, the distribution of species by island-hopping.

Summary of Wetland Situation

The largest wetlands in Indonesia are found in the low-lying alluvial plains and basins, flat-bottomed valleys and mangrove estuaries of Sumatra, Kalimantan and Irian Jaya. The original habitats comprise peat swamps, freshwater swamps and mangrove swamps. An estimated original area of 206,950 sq km of peat swamp has now been reduced to about 169,750 sq km, 16,700 sq km of which are included in existing reserves. The freshwater swamps have been reduced from an original 115,600 sq km to 51,850 sq km, 10,250 sq km of which is included in reserves. Mangrove cover has been reduced from an original 41,850 sq km to 29,000 sq km, 6,700 sq km of which is included in reserves. These estimates are based on FAO reports; other sources give different figures.

Indonesia's 80,790 km of coastline comprise every imaginable tropical coastal habitat ranging from steep sea cliffs supporting large sea-bird colonies to extensive sandy beaches, the nesting habitat of tens of thousands of sea-turtles, or from the diverse coasts of coral atolls to the vast intertidal mudflats which provide feeding areas for hundreds of thousands of resident and migratory water birds.

Indonesia has a wealth of riverine and lacustrine habitats, with huge waterfalls such as the Siguragura falls near Lake Toba in Sumatra, vast riverine swamps and marshes in many lowland areas, and the unique lake depression of the Mamberambo in Irian Jaya. The many active volcanic regions exhibit numerous hot springs and crater lakes which provide some of the country's most impressive scenery.

The estimated total extent of the natural wetland habitats in the main landmasses is shown in Table 1. In addition, Indonesia possesses some of the largest artificial wetlands in the world, including millions of hectares of rice paddies and nearly 200,000 ha of fishponds. A large proportion of these artificial wetlands are on the densely populated island of Java.

Mangroves and mudflats

Mangroves comprise a group of 60 species of salt-tolerant trees which are able to thrive in intertidal zones along sheltered coasts, on sediments that are saline, often anaerobic and sometimes acidic. Mangrove vegetation is believed to have reached its optimal development in the Indo-Malayan region, and here comprises an extremely diverse ecosystem. A total of 92 plant species have been reported (Kartawinata *et al*, 1979) including 38 genuine mangrove tree species. The associated fauna of crustaceans and molluscs is particularly rich.

Indonesia has more mangrove swamps than any other country in the world. Estimates of the total area vary widely, but the generally accepted figure is now about 3.8 million ha. Darsidi (1984) estimated the total area to be 4.25 million ha, and this figure has been repeated by Soemodihardjo (1987) in his recent review of the status and management of the mangrove

ecosystem in Indonesia. Over 75% of mangrove forests occur in Irian Jaya. Other large areas occur on the east coast of Sumatra and the southern and eastern coasts of Kalimantan.

The mammals of the mangrove forest include endemic and rare species such as the Proboscis Monkey, Tiger, Otter Civet, Mentawai Macaque *(Nasalis larvatus, Panthera tigris sumatrana, Cynogale bennettii, Macaca pagensis)* and several species of otters. More than a hundred species of birds are associated with the Indonesian mangroves. These include large water birds such as Spot-billed Pelican, Milky Stork, Black-necked Stork, Lesser Adjutant, Royal Spoonbill and Great-billed Heron *(Pelecanus philippensis, Mycteria cinerea, Ephippiorhynchus asiaticus, Leptoptilos javanicus, Platalea regia* and *Ardea sumatrana)* and also many migratory shorebirds. These latter visit and feed on the extensive mudflats, which fringe the mangrove forests. They include the endangered Nordmann's Greenshank *Tringa guttifer* and the rare Asian Dowitcher *Limnodrornus semipalmatus,* which has its main wintering area on the southeast coast of Sumatra (Silvius, 1986).

Mangrove swamps are highly productive ecosystems with a high potential for sustainable resource utilization. In Indonesia, as in many other countries in the world, over half of the commercial fishery catches consist of estuarine-dependent species. In 1978, the export value of Indonesian fisheries was at least US dollar 194 million, with a recorded harvest of mangrove-linked fisheries of 550,000 tonnes (Salm & Halim, 1984). In areas where clear-felling or bunding have destroyed the mangroves, this productivity has been greatly reduced.

Mangroves constitute a valuable forestry resource; the principal tree species harvested on a commercial basis are *Rhizophora apiculata, R. mucronata* and *Bruguiera* spp. Other products derived directly from mangroves include foodstuffs, paper products, medicines, tannins, alcohol and dyes. In 1978, the combined export (principally charcoal, logs and wood-chips) and domestic value of mangrove forestry products was about US dollar 26 million (Salm & Halim, 1984).

Mangroves also serve a valuable function in the mitigation of flooding and control of coastal erosion. Mangrove forests act as seaward buffer zones against coastal erosion caused by ocean currents and storms, and actively stabilize and extend the coast by accretion.

The combination of diverse forest with interesting features such as stilt-roots and abundant wildlife (monkeys, large colonies of water birds) makes mangrove forest suitable for tourism. Access to such areas is easy by boat or elevated boardwalk. Fishing and boating are possible within the mangrove areas, sea-food restaurants can be established, and crocodile farms may form an additional attraction.

Freshwater swamp forests

The largest extent of freshwater swamp forest occurs in the lowlands of Sumatra, Kalimantan and Irian Jaya, comprising about 95% of the original area of this habitat within Indonesia. Freshwater swamp forests occur on permanently or seasonally flooded mineral soils (over 35% mineral content) on the vast coastal plains and in lowlands in inter-river basins, meander belts

and swales. They often occur as fringes, up to 5 km wide, along rivers; in such situations they are succeeded by peat swamp forests. Several types of freshwater swamp forest can be distinguished: (a) mixed swamp forest, (b) *Melaleuca* forest, (c) *Terminalia* forest, and (d) *Campnosperma* forest.

Freshwater swamp forests are rich in epiphytes, rattans and palms. Common tree genera include *Aistonia, Campnosperma, Terminalia, Shorea, Nauclea, Syzygium, Palaquium, Dyospyros, Barringtonia, Garcinia* and *Melaleuca.* The forest canopy reaches heights of 40 to 50 meters, with some trees up to 60 or 70 meters high. The forests are home to many rare and endangered wildlife species such as the Tiger, Tapir, Asian Elephant, Asian Two-horned Rhinoceros, Lesser One-horned Rhinoceros, Otter-Civet and False Gharial *(Panthera tigris, Tapirus indicus, Elephas maximus, Dicerorhinus sumatrensis, Rhinoceros sondaicus, Cynogale bennettii* and *Tomistoma schlegelii)* and hundreds of bird species, including casuaries, megapodes and hornbills. Large areas of relatively undisturbed habitat are needed to sustain viable populations of these animals.
Freshwater swamp forests are important watershed areas. They are also important as a sustainable forestry resource, with many valuable timber species, such as *Shorea* spp*, Dyospyros* spp*, Gonystylus bancanus* and *Melaleuca* spp*,* and other resources, such as rattans, gums, resins, tannins, bark, oils, medicines and edible fruits. Theoretically, a harvesting cycle of 35 years is attainable, but often the quality of the regenerated forest does not come up to expectations. A rotation of 60 years has been suggested as being more appropriate.

Peat swamp forests

Peat swamp forests occur in Sumatra, Kalimantan and Irian Jaya. Estimates of the total peat area in Sumatra and Kalimantan vary between 16.5 million and 27 million ha (Diemont & Supardi, 1986; Jansen *et al.,* 1985). The differences are partly due to applications of different definitions of peat in relation to depth. Estimates of the total peat area in Irian Jaya vary even more; Driessen and Sudewo (1977) give a figure of 100,000 ha, Euroconsult (1984) a figure of 800,000 ha, and MacKinnon and Artha (1981b) a figure of 8,910,000 ha. Van Steenis (1957) notes that large areas of southern New Guinea are peat swamp.

Peat swamp forest is a further developmental stage of freshwater swamp forest. The leaf litter in this type of forest has accumulated to form a layer of peat, sometimes up to 20m thick. The mineral content of the soils is less than 35%. The peat is acidic and often dome-shaped, so that the only input of water is from precipitation. The vegetation in these basin peats is characteristically zoned in concentration bands around the central dome; the vegetation varies from mixed forest with up to 100 species in the outer zone to virtually monospecies stands of species such as *Shorea* in the inner zones.

Deep peats, more than two meters in depth, are found in Riau and Jambi Provinces of Sumatra, in West Kalimantan and in Central Kalimantan. The peats in South Sumatra are less than two meters deep. In Central Kalimantan, the peat rarely if ever exceeds five meters in depth. Little is known about the peats in East Kalimantan and Irian Jaya (Diemont & Supardi, 1986). The deepest peats in Riau and Jambi exceed 10 meters *(Silvius et al.,* 1984; Anderson, 1976). This

peat is acidic and ombrogenous; the pH can vary from 5.0 in the top-soil to about 3.0 in the sub-soil (Silvius *et al.,* 1984*).*

The peat swamp forest has a relatively high diversity of tree species compared to mangrove forest, with an average of 30 to 55 tree species per ha (Anderson, 1976; Silvius *et al.,* 1984). The wildlife remains rather poorly known; it has many similarities with freshwater swamp forest, but often is poorer in species or has lower population densities.

Peat swamp forests are important as watershed areas. Extensive areas of peat swamp forest and *Melaleuca* swamp forest create natural reservoirs, which can absorb and store excess water and reduce flooding of adjacent areas. Peat swamp forests are also an important sustainable forestry resource with many commercially valuable timber species such as *Gonystylus bancanus (Ramin), Shorea* spp*, Cratoxylum spp and Calophyllum spp,* and locally important products such as rattans, resins, scented woods and fruits (e.g. durians *Durio spp).* Because of the high acidity of the peat and problems encountered in drainage, peat swamp forests are of only limited agricultural use.

Swamp woodlands

Swamp woodlands occur in Irian Jaya in the back swamps of the swamp forests. The canopy of mixed swamp woodland is generally open. Common trees are *Campnospermain* sp*, Nauclea coadunata, Mitragyna ciliata* and *Timonius* sp. Palms and pandans occupy much of the space below the trees, and a dense ground layer is formed of tall sedges and ferns. On sites, which are seasonally dry, the woodland is often low, thin-stemmed and as dense as forest (Paijmans, 1976).

Sago swamp woodland grows in more or less permanently swampy areas. It can occur either as almost pure stands of the sago palm *Metroxylon sagu,* or, as woodland with a rather dense layer of trees and an open tier of sago. In shallow swamps, the sago fronds grow to a height of 14m, and the flowering, starch-producing stems can reach 20m in height. The ground layer of open sago swamps consists of shrub pandans, *Hanguana sp*, sedges or *Phragmites sp.*

Pandan swamp woodlands occupy a habitat similar to that of the sago palm but have a wider range. They form rather open to quite dense, pure stands up to about eight meters in height, in shallow, fresh to brackish, stagnant to frequently flooded swamps.

It has been estimated that there are between six and eight million hectares of sago palm swamps in New Guinea. Yields of up to 25,000 kg of dry starch per ha per annum may be obtained in optimum conditions. At the Lowland Development Symposium in Jakarta in 1986, it was proposed that Indonesia should start a pilot project to gain experience in the economic exploitation of sago.

Herbaceous swamps, grass swamps and savannas

In Irian Jaya, dense stands of swamp grasses cover vast stretches of alluvial plains subject either to frequent severe and deep flooding or to prolong shallow flooding. Grassy swamps are

also prominent in lakes and lagoons with slow-flowing water. In shallow swamps, shrubs and trees appear and form various savanna and woodland communities (Paijmans, 1976). Herbaceous swamps consist of sedges, herbs and ferns. They root in partly floating mats of waterlogged peat and organic debris. There are three types of grassy swamps, their distribution depending mainly on the water regime. *Leersia* swamp occupies permanently swampy parts of riverine floodplains with up to three meters inundation. A *Saccharum/Phragmites* community grows in shallower swamps and may be intermittently dry. *Pseudoraphis* swamp occurs on seasonally dry floodplains, which are shallowly inundated for most of the year.

The deep swamps are important for crocodiles, which have a high economic potential for leather production on a sustainable basis. The shallower and seasonally dry swamps can be important as grazing areas for cattle and, in parts of Irian Jaya, support large populations of deer, which constitute an important source of food.

Lakes

There are four main types of lakes in Indonesia: (a) lakes associated with river systems, such as the extensive oxbow lakes of the Idenburg, Mamberambo and Rouffaer Rivers in Irian Jaya or the Danau Sentarum complex in West Kalimantan; (b) fresh to brackish lakes in mangrove areas; (c) mountain lakes or ancient lakes such as Lake Lindu in Sulawesi; (d) crater lakes such as Danau Meninjau in Sumatra. Most lakes, except for some crater lakes with no contact with river systems, are important fishery resources, and the ancient lakes often have endemic fish species. Many are scenically very attractive and have high economic potential for outdoor recreation and tourism.

Wetland Area Legislation

Reserves were originally established on the basis of the Netherlands Indies "Natuurmonumenten en Wildreservaten Ordonnantie" (Staatsblad 1932, No. 17), but this was replaced by the Nature Protection Ordinance of 1941 (Staatsblad 1941, No. 167) and further supported by the basic Forestry Act of 1967. A new Act on Protection and Conservation of Natural Resources, which will enable the cr

The legal status of mangroves is such that commercial harvest of mangroves is regulated and requires concessionnaires to leave an undisturbed protection zone 50 meters wide along the seaward margin and 10 meters wide along the rivers (Letter of Decision of the Minister of Agriculture No.60/Kpts/Dj/l978). Subsistence use of mangrove is not regulated, although negotiations between Forestry and Fisheries are underway to establish a protected mangrove green belt throughout the country. There are, however, indications that some commercial enterprises do not adhere to the regulations (Saim & Halim, 1984). Thirty-one protected mangrove areas have been declared by various Decrees of the

Minister of Agriculture, and a further nine have been proposed (Saim & Halim, 1984).
In Indonesia, Marine Protected Areas are divided into three categories with different management objectives:

1. Scientific Reserve or Strict Marine Reserve (Cagar Alam Laut): to protect nature and maintain natural processes in order to preserve ecologically representative examples of the natural environment for scientific study, environmental monitoring, education and the maintenance of genetic resources in a dynamic and evolutionary state.

2. Marine Protected Park (Taman Nasional Laut): to protect natural and scenic areas of national or international significance for scientific, educational and recreational use.

3. National Monument Marine Park (Taman Laut): to protect and preserve nationally significant natural features because of their special interest or unique characteristics, while enabling controlled use for recreation and education.

Terrestrial protected areas, many of which contain wetlands, are divided into six categories:
1. Protection Forest (Hutan Lindung). Protection Forests have the lowest level of protection, and can easily be de-gazetted.

2. Wildlife Reserve or Game Reserve (Suaka Margasatwa). No activities that could damage the habitat and cause disturbance to wildlife are permitted. However, some traditional use of the natural resources is allowed, such as fishing and the cutting of timber for local use.

3. Strict Nature Reserve (Cagar Alam). No activities that could damage the habitat and cause disturbance to wildlife are permitted, except scientific research.

4. National Park (Taman Nasional). The level of protection is the same as in Strict Nature Reserves, except that controlled use for recreation and education is permitted.

5. Recreation Park (Taman Wisata).

6. Hunting Park (Taman Buru).

The Government of Indonesia is considering joining the Ramsar Convention in the near future. Berbak Game Reserve in Sumatra would be one of the first areas to be nominated for designation as a Wetland of International Importance under the terms of the Convention.

Wetland Area Administration

Various Indonesian Government bodies are involved with the administration, research, development and conservation of wetlands. Most of these bodies come under the Ministries of Public Works, Agriculture, Forestry and Transmigration. The Ministry of Population and Environment coordinates and controls the integration of environmental policy within these and other ministries. In recent years, most conservation activities have come under the jurisdiction of the

Directorate General of Forest Protection and Nature Conservation (PHPA) in the Department of Forestry. PHPA has a mandate to protect, conserve and manage a system of protected forests, strict nature reserves, game reserves, hunting parks and also marine protected areas

and coastal zones. It has adopted a number of laws and regulations in an effort to control and regulate the exploitation of natural resources (e.g. logging regulations, game laws and protected species laws). The Directorate of Nature Conservation (PA) is responsible for drafting the game laws, making proposals for protecting endangered species, controlling trade in animals (including the issuance of licenses), proposing the establishment and management of protected areas (National Parks, Nature Reserves, Game Reserves, Hunting Parks and Marine Protected Areas), and monitoring and analyzing impacts on natural resources within and surrounding nature conservation areas.

The Department of Agriculture is involved with the National Conservation Plan (1981).

The Centre for Oceanological Research and Development and the Centre for Biological Research and Development, both within the Indonesian Institute for Sciences (LIP!), are the scientific authorities responsible for screening and approving technical decisions relating to terrestrial and marine conservation.

Within each province, there is a regional planning body (BAPPEDA) responsible to the Governor who must approve all plans and integrate them into the context of regional development. Similarly, at national level there is an overall planning body (BAPPENAS), which approves the budgets for all developments.

The Directorate of Nature Conservation is mainly responsible for active conservation and has a programme of action depending on four different Sub-Directorates. The Sub-Directorate of Land Protected Areas is concerned with the proposal, processing and establishment of new reserves and protected forests. It also plans and manages the overall reserve system by making technical guidelines for reserve management, evaluating the condition of protected land and its development, and analyzing and solving the problems occurring in terrestrial conservation areas.

The Sub-Directorate of Marine Protected Areas has been established to consolidate all marine conservation activities, which were formerly divided between the Sub-Directorate of National Parks and the Sub-Directorate of Species Conservation. The Marine Conservation Specialists Team was established in 1982 to coordinate the marine conservation strategy. Proposed developments include the following: (a) the establishment of a network of marine multiple use reserves, resource reserves and strict nature reserves and marine national parks, linked by protected corridors, whose function will be to safeguard breeding stocks of commercial species, examples of different reef communities and areas of value for tourism, research and education; (b) the extension of existing terrestrial reserves and parks to include marine areas; (c) the protection of Dugong habitats and increased protection of turtle nesting beaches; (d) the development of training programmes for staff within FAO and WWF; (e) the development of public education programmes.

The Sub-Directorate of Environmental Assessment prepares plans, programmes and technical guidelines for environmental assessment studies, carries out environmental impact analyses, and subsequently makes recommendations for environment and ecosystem management.

The Sub-Directorate of Species Conservation deals with the revision of lists of protected species, the control of wildlife trade, ex-situ species conservation projects, wildlife breeding projects (e.g. with deer and crocodiles), zoos, and the implementation of the Convention on International Trade in Endangered Species (CITES), to which Indonesia is a signatory.

The four Sub-Directorates operate through the regional structure of the Directorate of Nature Conservation, which consists of eight Regional Offices (Balai Konservasi Sumber Daya Alarn - Nature Resource Conservation Office). These offices (BKSDA) are supported by Sub-Balai (SBKSDA), one per province, with additional SBKSDA for each National Park. BKSDA and SBKSDA are coordinated by the Regional Forest Office. Ultimately, it is hoped that each National Park will be administered by a BKSDA. The SBKSDA staff draws up annual programmes for their field activities and developments which are revised at headquarters before submission to BAPPENAS for budget approval.

In addition to the four Sub-Directorates mentioned above, there is a fifth: the Sub-Directorate of National Parks. This falls under the Directorate of National Parks and Forest Recreation and deals specifically with the development of a system of national parks in Indonesia. The ultimate target is a total of 37 National and Provincial Parks; five parks already exist and another five were to be declared in 1982.

Organizations involved with Wetlands

a) Governmental Organizations

- Directorate General of Forest Protection and Nature Conservation (PHPA), Ministry of Forestry Particularly the Directorate of Nature Conservation.
- Indonesian Institute for Sciences (LIPI)

The Institute includes the Centre for Oceanological Research and Development, the Centre for Biological Research and Development (including the Museum Zoologicum Bogoriense and Herbarium), the Institute of Limnology and the Institute of Biotechnology. The Deputy Director of LIP!, Dr Aprilani Soegiarto, is also the Chairman of the National Mangrove Committee.

- Regional Physical Planning Programme for Transmigration (RePPProT) The Programme has produced land use and land form maps for Irian Jaya, Kalimantan and Sumatra.

- Bakosurtanal, Cibinong, West Java

The national cartographic centre.

- Research Institute for Inland Fisheries, Department of Agriculture

The Institute is concerned almost entirely with aquaculture.

- Directorate of Fisheries Resources Management

The Director, Dr Purwito Martosubroto, is also the Chairman of the National Steering Committee of the ASEAN/USAID Coastal Resources Management Project.

- Public Works Department The Department produces land use maps and has conducted some inventories of wetland resources.

b) Non-governmental Organizations

- World Wide Fund for Nature Indonesia Programme
- Yayasan Indonesia Hijau (Green Indonesia Foundation)

The Foundation is concerned primarily with conservation education.
- Ornithological Society of Indonesia
The Society publishes the journal "Kukila".

- Hunting Technical Services Ltd.
Agricultural consultants to the government.

- Pusat Studi Lingkungan (Environmental Study Centre)
The Centre has produced a report on coastal zone management.

- Institut Pertanian Bogor - Environment

- Asian Wetland Bureau Indonesia

The Bureau (formerly Interwader) has conducted wetland surveys in Sumatra, Java, Bali, Timor and Sulawesi, and in 1987, launched a three-year wetland survey programme throughout the country.

- Foundation for Development of Wild Animal Resources

- ASEAN Research Institute of Tropical Biology (BIOTROP)

- Environmental Manpower Development for Indonesia Programme

- UNESCO/ROSTSEA

The project has a regional programme on wetland research and management.

- EUROCONSULT BY (Netherlands) Euroconsult

- International Center for Living Resources Management (ICLARM)
Particularly the ASEAN/USAID Coastal Resources Management Project.

- Haskoning: Department of Environmental and Sanitory Engineering

The Department has been involved in work on an ecological profile of West Java.

c) Universities

- University of Indonesia (Jakarta & Bogor)

Particularly the Centre for Environmental Studies (PPSML). The University undertakes a considerable amount of research on mangroves.

- Padjadjaran University (Bandung)

Particularly the Department of Ecology.

Table 1: Area of major wetland habitats in Indonesia (in hectares)

Original area (I)		Remaining area (II)	Area within reserves (III)		
SUMATRA					
Mangrove forest	1,365,000		748,000	61,900	Peat swamp
Total	13,548,000		6,458,000	657,000	
JAVA and BALI					
Freshwater swamp	72,000		4,500	1,250	
Mangrove forest	47,000		7,700	2,600	
Total	119,000		12,200	3,850	
NUSA TENGGARA					
Mangrove forest	23,000		12,500	2,500	Freshwater s
Freshwater lakes	5,000		5,000	500	
Beach vegetation	19,000		4,500		
Total	51,000		24,000	3,000	
KALIMANTAN					
Freshwater swamp	3,895,000		1,717,000	362,000	Peat swamp
Freshwater lakes	92,000		92,000	25,000	Total
SULAWESI					
Freshwater swamp	282,000		66,000	2,500	Peat swamp
Mangrove forest	118,000		90,000	6,300	Freshwater la
MOLUCCAS					
Peat swamp	48,000		42,000	1,000	Freshwater s
Total	189,500		125,000	36,700	
IRIAN JAYA					
Freshwater swamp	2,336,000		2,266,000	341,000	
Seasonal freshwater swamp	19,000		19,000	19,000	Peat swamp
Freshwater lakes	115,000		115,000	45,000	Beach vegeta

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WETLANDS

The site descriptions are taken from the Indonesian Wetland Inventory prepared for this Directory and presented in draft form at the IWRB/Interwader Conference on Wetland and Waterfowl Conservation in Asia held in Malacca, Malaysia, on 23-28 February 1987. The Inventory has subsequently been published in full by the Indonesian Directorate General of Forest Protection and Nature Conservation (PHPA) and Asian Wetland Bureau in conjunction with EDWIN *(*Silvius *et al*., 1987). The Indonesian Wetland Inventory describes no less than 231 wetlands of national and international importance in Indonesia. The 137 sites considered to be of international importance are given full treatment below; other sites, possibly of only national importance, are listed at the end of the site descriptions.

The compilation of the Indonesian Wetland Inventory was coordinated by PHPA, and was carried out by Marcel J. Silvius, Eva T. Berczy and Arnoud P.J.M. Steeman of the Asian Wetland Bureau and Edi Djuharsa and Agustinus W. Taufik of PHPA. Derek A. Holmes helped in initiating the inventory and commented on many site descriptions. Much of the information was taken from PHPA files and the reports of WWF, FAO, UNDP and the Asian Wetland Bureau (Interwader Project). Additional information on particular sites was received from K. David Bishop, Ian Craven, C.J. Escott, Derek A. Holmes, Agus Marhardi, Anne and Stephen Nash, Duncan Parish, Crawford Prentice and Alison Skene.

Wetland name: Way Kambas
Country: Indonesia
Coordinates: 4°37'-5°06'S, 105°40'-105°52'E;
Location: 80 km northeast of Telukbetung, Kabupaten Lampung Tengah, Lampung Province, Sumatra.
Area: 123,500 ha.
Altitude: 0-50m.
Biogeographical province: 4.2 1.12.
Wetland type: 06, 07, 11, 18 & 21.
Description of site: A large reserve on the east coast of Lampung Province, representing one of the most extensive reserves in Indonesia and containing one of the largest non-peat freshwater swamp forests in Sumatra. Natural boundaries exist on all sides except along the south for about 30 km. In the past, logging activities have disturbed much of the habitat. Most of the dipterocarp forest within the reserve disappeared between 1968 and 1974. The area is, however, still of considerable conservation interest because of its great richness of wildlife including many endangered species and over 270 species of birds. Over 70% of the reserve has been selectively logged. In some areas, this has created grasslands, which are burned annually. There are several settlements in the coastal areas, with a total of about ten thousand inhabitants. The eastern boundary of the reserve is a 65 km stretch of coast along the Java Sea, with 1,000 ha of coastal forest vegetation, mangrove and dry beach forest. There are several major watercourses in the reserve. The heavy silt load of these rivers has formed extensive intertidal mudflats used by water birds. The swamps are flooded in the wet season from November to March. The tidal amplitude along the coast is about 2.0-2.5m.

Climatic conditions: Humid tropical climate with an average annual rainfall of 2,000 mm; there is a distinct dry season from May to October.
Principal vegetation: The wetland vegetation includes freshwater swamp forest, mangrove forest with *Nypa* palms, and Nibung swamps with *Pandanus* formations.

Land tenure: The wetland is owned by PHPA; surrounding areas are owned by local farmers and fishermen.
Conservation measures taken: Established as a Game Reserve by a Government Decree in 1937.
Conservation measures proposed: There is a proposal to upgrade the reserve to a National Park. It has also been proposed that the reserve be divided into three management zones: (a) Sanctuary, (b) Wilderness Zone, and (c) Intensive Use Zone. There are plans to create facilities for tourism and recreation in the proposed intensive use and wilderness zones.
Land use: Game reserve; some areas in the coastal zone have been reclaimed for agriculture and housing.
Disturbances and threats: Logging; already 75% of the forest has been selectively logged. Also poaching, fires and agricultural encroachment.
Economic and social values: The reserve has a high potential for the development of wildlife tourism.
Fauna: The mangrove forests provide breeding and nursery grounds for marine fish and shellfish, many of which are important in the local fishing industry.
Of the 270 species of birds occurring in the reserve, more than 20% are water birds, including many migratory species and several rare or endangered species such as Malayan Night-Heron, Milky Stork, Storm's Stork, Lesser Adjutant, Black-headed Ibis, White-winged Wood-Duck and Asian Dowitcher (Gorsachius *melanolophus, Mycteria cinerea, Ciconia (episcopus) stormi, Leptoptilos javanicus, Threskiornis melanocephalus, Cairina scutulata* and *Limnodromus semipalmatus)* (almost 500 recorded in 1985). Way Kambas is possibly one of the best areas for *C. scutulata in* Sumatra, with an estimated population of five pairs. Other waterfowl known from the reserve include *Anhinga melanogaster, Ixobrychus cinnamomeus, I. flavicollis, Nycticorax nycticorax, Ardeola speciosa, Bubulcus ibis, Butorides striatus, Egretta sacra, E. garzetta, E. intermedia, E. alba, Ardea purpurea, A. cinerea, A. sumatrana, Dendrocygna javanica, Anas gibberifrons, Amaurornis phoenicurus, Gallicrex cinerea* and *Heliopais personata.* The intertidal mudflats are important for a variety of migratory shorebirds during the migration seasons and northern winter; species recorded include *Glareola maldivarum, Pluvialis squatarola, P. dominica, Charadrius dubius C. mongolus, Limosa limosa, Numenius phaeopus, N. arquata, Tringa totanus, T. glareola, Xenus cinereus, Actitis hypoleucos* and Calidris ferruginea. Migratory terns include *Chlidonias hybrida, C. leucoptera, Sterna hirundo* and *S. albifrons.*
Other birds associated with the wetlands include birds of prey such as *Pandion haliaetus, Haliastur indus, Haliaeetus leucogaster, Ichthyophaga nana* and I. *ichthyaetus.* The area is particularly rich in kingfishers, with no less than ten species: *Alcedo atthis, A. meninting, Ceyx erithacus, C. rufidorsus, Pelargopsis capensis, Halcyon coromanda, H. smyrnensis, H. pileata, H. chloris* and *H. concreta.*
The reserve is very rich in mammals, including rare or vulnerable species such as Sumatran Rhinoceros, Asian Elephant, Tiger, Tapir and Asian Wild Dog *(Dicerorhinus sumatrensis, Elephas maximus, Pant hera tigris, Tapirus indicus* and Cuon *alpinus).* Other species include *Lutra lutra, Helarctos malayanus, Felis ternminckii, F. bengalensis, Paguma larvata, Viverricula indica, Macaca fascicularis, M. nemestrina, Presbytis cristata, Hylobates agilis, Symphalangus syndactylus, Sus scrofa, Cervus unicolor, Tragulus javanicus, T. napu* and *Muntiacus muntjak.*
The Estuarine Crocodile *Crocodylus porosus* and False Gharial *Tomistoma schlegelii* also occur in the reserve.
Special floral values: The reserve is of special interest as it contains one of the few areas of lowland dipterocarp forest in Sumatra under protection. It also contains one of the largest areas of freshwater swamp forest within a reserve.
Research and facilities: The reserve has received a relatively large amount of attention from researchers and conservationists, partly because it is considered to be one of the few areas with a

potential for transmigration of part of the Javanese Rhinoceros *(Rhinoceros sondaicus)* population from Ujung Kulon.
References: FAO (1979e); Holmes (1977); IUCN (in prep); Karpowicz (1985); MacKinnon & Artha (1982a); Nash & Nash (1985a); Salm & Halim (1984); Wind (1979).
Criteria for inclusion: l b. 2a, 2b, 3a.
Source: Marcel J. Silvius.

Wetland name: Ogan - Komering Lebaks
Country: Indonesia
Coordinates: 3°1O'-4°OO'S, 104°30'-105°OO'E:
Location: south of Palembang, Seuth Sumatra.
Area: 200,000 ha liable to seasonal flooding.
Altitude: 1O-25m.
Biogeographical province: 4.2 1.12.
Wetland type: 11, 13, 14, 15, 19, 20 & 21.
Description of site: A large expanse of freshwater swamps and seasonally flooded marshes along the Ogan and Komering Rivers, prior to their confluence with the Musi River near Palembang. There are numerous, deeply flooded backswamps, some of which form permanent open-water lakes (e.g. Legak Semandaway and Lebak Datuk). Some of the swamps completely fill tributary valleys.
Climatic conditions: Humid tropical climate with an average annual rainfall of 2,546 mm (Palembang). There is a dry season (100 mm/month) from June to September.
Principal vegetation: No information.
Land tenure: State owned (Government of Indonesia).
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Presumably fishing, with cultivation of swamp rice around the margins. The surrounding areas are densely populated.
Possible changes in Land use: The region has been the subject of many feasibility studies for drainage and irrigation schemes, but the extent of plans implemented or projected is not known.
Disturbances and threats: Possible reclamation for agricultural purposes. There has been severe deforestation in the water catchment area during the past two decades.
Economic and social values: No information.
Fauna: Little information is available. The area is thought to be rich in water birds, and may be important for the endangered White-winged Wood-Duck *Cairina scutulata.*
Special floral values: No information.
Research and facilities: None
References: None
Criteria for inclusion: 0.
Source: Derek A. Holmes.

Wetland name: Padang-Sugihan Wildlife Reserve
Country: Indonesia
Coordinates: 2°43'-3°00'S, 105°00'-105°l5'E;
Location: 45km northeast of Palembang, Sumatra Selatan Province, Sumatra.
Area: 75,000 ha.
Altitude: 5-lOm.
Biogeographical province: 4.2 1.12.

Wetland type: 11 & 21.

Description of site: A large reserve containing a patchwork of peat swamp forest, swampy grassland, riverine swamp forest and drier *Melaleuca* forest. All habitats are periodically flooded to a maximum depth of l.0-l.5m, and the peat swamp forest is flooded for most of the year. Although some 35 km from the coast, the region is still under the influence of a diurnal tide with one high and one low water in a 24 hour period. The tidal range at the coast is about 2.6m. The reserve is transected by five man-made primary canals, with a sixth forming the reserve's northern boundary. Secondary canals some two km in length branch off at right angles, at approximately 400m intervals. In total, there are some 92 km of primary and 670 km of secondary canals in the reserve. These were dug when the area was being prepared for transmigrant settlers, before the establishment of the reserve. The main canals are 15m wide, and the secondary canals are 2-3m wide. The east and west borders of the reserve are the meandering Sugihan and Padang Rivers, respectively; both are large blackwater rivers, very acidic and heavily stained with tannins and dissolved compounds.

Climatic conditions: Humid tropical climate, with a single pronounced dry season of about three months centered around July, and a wet season of five or six months centered around December and January.

Principal vegetation: Riverine swamp *Alstonia, Dyera, Gonostylus* and *Oncosperma.* The understorey is dominated by *Licuala* palms. Riverine swamp forest, peat swamp, rice paddies, other agricultural land and alang-alang scrub occur in surrounding areas.

Land tenure: The reserve is state owned (PHPA). There are some small communities around the reserve, and additional land has been given out to transmigrant settlers, at 2.5 ha per family.

Conservation measures taken: The entire area (75,000 ha) was designated as a Wildlife Reserve (Suaka Margasatwa) by the Ministry of Forestry in April 1983. In theory, the public has no unauthorized access, and no hunting or harvesting of forest products is allowed.

Conservation measures proposed: Nash and Nash have proposed that all unofficial access routes into the reserve (particularly the main canals) be closed off to prevent illegal logging, wood-cutting, hunting and fishing.

Land use: Wildlife reserve; fishing, some logging and agriculture in surrounding areas.

Disturbances and threats: There is a considerable amount of illegal logging in the swamp forest, cutting of *Melaleuca* trees for poles, poaching of Sambar Deer and monitor lizards, and fishing with lines, nets and dynamite within the reserve. The reserve waterways are used as short-cuts for motorboat traffic between the two main rivers, and the resulting disturbance affects the distribution of the shy Hairy-nosed Otter *Lutra sumatrana.* The area around the reserve is either already cleared for settlement, or is categorized as conversion forest, which means that areas still forested will be cleared. This will isolate the reserve, forming an island of forest surrounded by cleared agricultural land.

Economic and social values: The reserve is of considerable value for scientific research. It is the only protected peat swamp area in Sumatra Selatan Province, and one of only two in Sumatra. It has great potential for conservation education, as it is readily accessible from the large city of Palembang.

Fauna: At least six individuals of the endangered White-winged Wood-Duck *Cairina scutulata* were present in the reserve in 1985-86, and the rare Storm's Stork *Ciconia (episcopus) stormi* is resident. Other waterfowl include *Anhinga melanogaster, Ixobrychus sinensis, I. cinnaniomeus, Ardeola speciosa,* several species of *Egretta, Ardea purpurea, A. cinerea, Mycteria cinerea, Leptoptilos javanicus, Dendrocygna* sp, *Amaurornis phoenicurus, Gelochelidon nilotica* and *Sterna hirundo.* Birds of prey include the raptors *Haliastur indus, Haliaeetus leucogaster, Ichthyophaga nana* and *I. ichthyaetus,* and the fish-owl *Ketupa ketupu.* Eleven species of kingfisher have been recorded: *Alcedo atthis, A. meninting, A. euryzoua, Ceyx erithacus, C.*

rufidorsus, Pelargopsis capensis, Halcyon coromanda, H. smyrnensis, H. pileata, H. chioris and H. concreta. The Great Hornbill *Buceros bicornis* is unusually common.
The very rich mammalian fauna includes the Sumatran Tiger (11-17 individuals), Leopard Cat, Fishing Cat, Sumatran Elephant, Malayan Sunbear, Hairy-nosed Otter, Small-clawed Otter, Masked Palm Civet, Otter Civet, Dark-handed Gibbon (two groups), Pig-tailed Macaque, Long-tailed Macaque, Silvered Leaf Monkey, Greater Mouse Deer, Lesser Mouse Deer, Wild Boar, Bearded Pig, Sambar *(Panthera tigris sumatrae, Felis bengalensis, F. viverrina, Elephas maximus sumatranus, Helarctos malayanus, Lutra sumatrana, Aonyx cinerea, Paguma larvata, ynogale bennettii, Hylobates agilis, Macaca nemestrima, Macaca fascicularis, Preshitys cristatus, Tragulus napu, T. javanicus, Sus scrofa, S. barbatus, Cervus unicolor)* and many smaller species such as *Tupara* sp*, Ratufa bicolor, Callosciurus notatus, C. prevosti, Nannosciurus melanotis, Petaurista elegans, Megaderma spasma* and *Pteropus vampyrus.* By December 1982, 232 Asian Elephants had been driven into the area; an elephant translocation of this magnitude had never before been attempted in Indonesia. Present data suggest that the number of elephants has not changed much, if at all, from the original 232 individual's. This is the world's largest single herd of the species, and the highest density in the wild.
Estuarine Crocodiles *Crocodylus porosus* were introduced into the reserve in 1983-84.
Special floral values: The reserve contains a good example of Sumatran peat swamp forest. Ferns and orchids are present in abundance, and good examples of the giant orchid *Grammatophyllum speciosum* have been noted.
Research and facilities: A study of the elephant population, other large mammals and birds of the reserve was carried out by Nash and Nash between September 1984 and October 1985 under WWF/IUCN Project 3133. A small wooden house maintained by PHPA is available for visiting scientists.
References: MacKinnon & Setiono (1983); Nash & Nash (1985a, 1985b, 1985c, 1985d, 1985e, 1985f, 1985g, 1985h & 1986b); Nash & Philp (1985).
Criteria for inclusion: lb, 2a, 2b, 3b.
Source: Marcel J. Silvius and Stephen and Anne Nash.

Wetland name: Pulau Betet
Country: Indonesia
Coordinates: 2°45'S, 104°50'E;
Location: south of Terusan Dalam and north of the Benawang River, Sumatra Selatan Province, Sumatra.
Area: c.1O.000 ha.
Altitude: O-O.5m.
Biogeographical province: 4.2 1,12.
Wetland type: 06 & 07.
Description of site: A large island with a broad fringe of mangrove forests and intertidal mudflats, and peat swamp forests in the interior. According to local fishermen, there are several freshwater lakes in the interior of the island with breeding colonies of large water birds. However, no survey data are available other than observations made from a boat survey in 1984. The tidal amplitude is about 2.0-2.5m.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest dominated by species of *Rhizophora* and *Bruguiera.*
Land tenure: State owned (Government of Indonesia).
Conservation measures taken: None.

Conservation measures proposed: The area should be surveyed as soon as possible and, if necessary, recommendations made for its protection. As the site is an island, it should be easy to implement adequate protective measures.
Land use: Fishing in the mangrove swamps and surrounding sea. Possible changes in Land use: There may be logging operations on the island in the future.
Disturbances and threats: Illegal logging, and the collection of eggs of water birds for local consumption.
Economic and social values: The area is important as a nursery ground for fish and shellfish of commercial importance.
Fauna: An important area for both resident and migratory waterfowl. According to local people, the island supports breeding colonies of large water birds, including the rare Milky Stork *Mycteria cinerea.* Waterfowl recorded during a brief survey in October 1984 included *Anhinga melanogaster, Butorides striatus, Egretta sacra, E. garzetta, E. interniedia, E. alba, Ardea purpurea, A. cinerea, A. sumatrana, Mycteria cinerea, Leptoptilos javanicus, Threskiornis melanocephalus* and *Anas querquedula.* Over 1,500 migratory shorebirds were observed along the east coast of the island. These included small numbers of Nordmann's Greenshank *Tringa guttifer* and Asian Dowitcher *Limnodromus semipalmatus,* along with *Pluvialis squatarola, Charadrius mongolus, C. leschenaultii, Limosa limosa, L. lapponica, Numenius phaeopus, N. arquata, N. madagascariensis, Tringa totanus, T. stagnatilis, T. nebularia, T. glareola, Xenus cinereus, Actitis hypoleucos, Arenaria interpres, Calidris canutus, C. ruficollis, C. ferruginea* and *Limicola falcinellus.* The Estuarine Crocodile *Crocodylus porosus* is known to be present.
Special floral values: No information.
Research and facilities: Silvius *et al. (1986)* carried out a waterfowl survey in October 1984.
References: Silvius *et al.* (1986).
Criteria for inclusion: 1b, le, 2a, 2c, 3b.
Source: Marcel J. Silvius.

Wetland name: Banyuasin Musi River Delta
Country: Indonesia
Coordinates: 2°00'-2°30'S, 104°30'-105°15'E;
Location: the coastal area between the Sembilang River and Kuala Saleh, Sumatra Selatan Province, Sumatra.
Area: 150,000-200,000 ha of mangrove habitat.
Altitude: 0-0.5m.
Biogeographical province: 4.21.12.
Wetland type: 06, 07 & 21.
Description of site: The very large delta system of the Banyuasin and Musi Rivers and numerous smaller rivers and mangrove creeks. The area comprises some of the most extensive mangrove forests in Sumatra, with intact transitions to freshwater and peat swamp forests. There are vast areas of intertidal mudflats along the coast, some of which are more than one km wide at lowest low tide. The area is under heavy pressure from reclamation activities, and a large part of the swamp forest has already been reclaimed. The peninsula between the Sembilang and Banyuasin Rivers is one of the most important areas for waterfowl in Indonesia, with thousands of large water birds and tens of thousands of migratory shorebirds. The many small villages built on poles on the coastal mudflats are very characteristic of this region. There are also a few larger coastal villages. The long term average coastal accretion rate is estimated at about lOOm per year. The soil consists of unripe clays (entisols) and peat; the clays often consist of potential acid sulphate soils. The tidal amplitude is about 2.O-2.5m.

Climatic conditons: Humid tropical climate, with an average annual rainfall of 2,300 mm. The region is influenced by the northwest monsoon from November to February.

Principal vegetation: Mangrove forests. More than 30 species of mangrove are known to occur; the main species are *Rhizophora mucronata, R. apiculata, Avicennia alba, A. marina, Sonneratia alba, S. acida, Ceriops tagal, C. candoleana* and *Xylocarpus* spp. There are also some extensive swamps of *Nypa fruticans.* Inland, the mangroves and nipa swamps give way to freshwater swamp forests, peat swamp forests and grassy marshes where the forest has been burned or logged.

Land tenure: The wetlands are state owned (Government of Indonesia); surrounding areas are owned by the local authorities and local farmers.

Conservation measures taken: None.

Conservation measures proposed: Silvius (1986) has proposed that the area between the Sembilang River and Banyuasin River (the Banyuasin Peninsula) be designated as a Nature Reserve. The administrative procedure to designate the area as reserve was initiated in late 1986. The reserve would cover an area of about 70,000 ha.

Land use: Fisheries and small-scale logging of mangrove poles; fisheries and agriculture in surrounding areas.

Possible changes in Land use: Several areas have been proposed for transmigration projects, including part of the Banyuasin Peninsula. If these plans are carried out, most of the mangrove forest will be lost, including important breeding areas for the Milky Stork *Mycteria cinerea* and many other large water birds. Hardjowigeno and Situmorang (1987) have recently reviewed the impact of the transmigration programme on the mangrove ecosystem in the Banyuasin Musi Delta. Most of the freshwater swamp forests and peat swamp forests in the water catchment area have been or are being reclaimed or logged.

Disturbances and threats: The major threats to the area are reclamation for official transmigration projects, reclamation by spontaneous transmigrants, logging of the mangrove forest, human disturbance at the breeding colonies of large water birds, and forest fires. The population of Estuarine Crocodiles *Crocodylus porosus* has already been almost exterminated by hunting.

Economic and social values: The mangrove forest is extremely important for the local fishing industry which thrives largely on the shrimps and prawns which use the mangrove as nursery and breeding areas. The fishery industry is rapidly increasing in the area. The fishing villages are constructed mainly of timber taken from the mangrove forest and freshwater swamp forest. Tree species commonly used in the construction include Meranti *(Shorea),* Nibung *(Oncosperma)* and Bakau *(Rhizophora).* The mudflats may have a high potential for the cockle industry.

Fauna: The mangrove forests are important breeding and nursery grounds for many species of marine fishes, prawns and shrimps.

The area is one of the most important sites for waterfowl in Indonesia. Eighteen species of large water birds and 20 species of migratory shorebirds have been recorded. The area is presumed to contain the largest breeding colony of the Milky Stork *Mycteria cinerea in* the world. It is the only area in Southeast Asia with a population of Spot-billed Pelicans *Pelecanus philippensis;* an immature observed in 1986 suggests that the birds are breeding in the area. It has the highest population of Lesser Adjutants *Leptoptilos javanicus* known in Indonesia. The endangered White-winged Wood-Duck *Cairina scutulata* occurs in the swamp forests behind the mangroves. The Grey Heron *Ardea cinerea* is known to breed in the area; the Great Egret *Egretta alba* probably breeds along with several other large water birds such as the Black-headed This *Threskiornis melanocephalus.* Because of the difficulties of access, much of the area is still relatively untouched. A few fishermen collected some eggs and young of large water birds in 1982-1984, but the main breeding colonies of herons, egrets, storks and ibises have not as yet been located by biologists. The highest counts of large water birds obtained during surveys of the Banyuasin Peninsula in October 1984, July 1985 and March 1986 were as follows:

Pelecanus philippensis 9

Anhinga melanogaster 7
Egretta garzetta 48
E. sacra 12
E. intermedia 12
E. alba 2,414
Ardea cinerea 90
A.sumatrana 3
Mvcteria cinerea 1,550
Leptoptilos javanicus 620
Threskiornis melanocephalus 607
Dendrocygna javanica 1,000
Counts of shorebirds on the Banyuasin Peninsula in October 1984, July 1985 and March1986 gave totals of 37,900, 35,500 and 14,500, respectively. The highest numbers of each species recorded were as follows:
Pluvialis squatarola 100
P. dominica 6
Charadrius mongolus 9,460
C. leschenaultii 145
Limosa limosa 30,000
L. lapponica 7,000
Numenius phaeopus 700
N. arquata 1,965
N. madagascariensis 372
Tringa totanus 6,000
T. stagnatilis 100
T. nebularia 106
Xenus cinereus 3,500
Actitis hypoleucos 50
Arenaria interpres 500
Limnodromus semipalmatus 1,760-2,260
Calidris canutus 5
C. tenuirostris 66
C. ruficollis 100
C. ferruginea 700
Birds of prey recorded during the survey in July 1985 included 113 *Haliastur indus,* 12 *Haliaeetus leucogaster* and three *Ichthyophaga ichthyaetus.* Mammals known to occur include Tiger, Leopard Cat, Common Otter, Wild Boar, Bearded Pig, Sambar, Long-tailed Macaque, Pig-tailed Macaque, Silvered Leaf Monkey and Otter-Civet *(Panthera tigris, Felis bengalensis, Lutra lutra, Sus scrofa, S. barbatus, Cervus unicolor, Macaca fascicularis, M. nemestrina, Presbytis cristata* and *Cynogale bennettii).* The Estuarine Crocodile *Crocodylus porosus* is still present, although now in greatly reduced numbers as a result of intensive hunting pressure. The turtle *Chitra indica* is known to occur, and several other species such as *Pelochelys bibronii* may occur. The delta is one of the richest areas for crustaceans in Indonesia.

Special floral values: The mangrove forest is very rich in species. The freshwater swamp and peat swamp forests contain many commercially valuable tree species.

Research and facilities: The vegetation has been surveyed by Sukristiyono Sukardjo and others (1979 & 1984), and several waterbird surveys have been carried out by ICBP and Interwader since 1983.

References: Danielson & Skov (1986 & 1987); Hardjowigeno & Situmorang (1987); Karpowicz (1985); Silvius (1986); Silvius *et al.* (1986); Sukardjo (1979); Sukardjo *et al.* (1984).

Criteria for inclusion: 123.
Source: Marcel J. Silvius.

Wetland name: Sungai Lalan
Country: Indonesia
Coordinates: 2°00'-2°22'S, l03°50'-104°35'E;
Location: 100 km northwest of Palembang, Musi-Banyuasin District, Sumatra Selatan Province, Sumatra.
Area: 586,417 ha, including 80,000 ha of swamp forest.
Altitude: 2-5m.
Biogeographical province: 4.2 1.12.
Wetland type: 02, 06, 07 & 21.
Description of site: The extensive mangrove swamps and intertidal mudflats in the estuary of the Sungai Lalan, and a large, low-lying area of freshwater swamp forest and peat swamp forest along the Sungai Lalan and many other smaller rivers. The swamp forests are under heavy pressure from logging and reclamation projects, and several areas are currently being developed for transmigration schemes.
Climatic conditions: Humid tropical climate with an annual rainfall of 1,250-1,550 mm. Temperatures range from 24-32°C.
Principal vegetation: Mangrove forest with species of *Sonneratia, Rhizophora* and *Bruguiera* near the coast; freshwater swamp forest and peat swamp forest with species such as *Oncosperma filamentosa, Pandanus tectorius, Gluta renghas, Melaleuca* sp and *Fagraea fragrans*. Lowland rain forest further inland.
Land tenure: State owned (Local Government of Sumatra Selatan Province).
Conservation measures taken: None.
Conservation measures proposed: The Lalan River has been proposed as a Crocodile Conservation Area.
Land use: Fishing. Part of the area has been reclaimed for agriculture.
Possible changes in Land use: Part of the area will be reclaimed for transmigration schemes, and some other parts have been set aside for logging activities.
Disturbances and threats: Logging, forest clearance for transmigration schemes, crocodile hunting, pollution and disturbance from boat traffic.
Economic and social values: The mangrove forests and swamp forests support an important fishery.
Fauna: Fishes include *Ophiocephalus micropheltes, 0. striatus, Notopterus* sp*, Mastacembelus* sp*, Anus crassochejius, Pluta* sp*, Macrones baramensis, Clarias* sp, *Opronemus* sp*, Apogon* sp*, Trichogaster trichopterus* and *Anabas testudineus.*
Very little information is available on the waterfowl. Species known to be present include *Pelecanus* sp, *Anhinga melanogaster, Egretta intermedia, E. alba* and a variety of kingfishers (Alcedinidae). Mammals include *Tragulus napu, Manis javanica, Macaca* sp*, Cervus unicolor* and *Sus barbatus.*
Both the Estuarine Crocodile *Crocodylus porosus* and False Gharial *Tomistoma schlegelii* occur in the area, along with *Varanus salvator, Python reticulatus* and *Erynix triungis.*
Special floral values: No information.
Research and facilities: None
References: Direktorat Jendral Kehutanan (1976).
Criteria for inclusion: lb. 2a, 2b.
Source: Agustinus W. Taufik and Marcel J. Silvius.

Wetland name: Muara Bulian
Country: Indonesia
Coordinates: l°45S, 103°15'E;
Location: 40 km WSW of Jambi, close to the Batang Han River, Jambi Province, Sumatra.
Area: c.50 ha.
Altitude: c.25m.
Biogeographical province: 4.2 1.12.
Wetland type: 15, 18 & 21.
Description of site: A swamp used for the cultivation of low quality rice each year if water levels permit. The swamp supports a variety of marsh grasses and sedges, and some floating vegetation. There are small areas of open water and some exposed mud. Scattered trees remain, some of them dead. A grove of open woodland and secondary growth covers one part of the swamp.
Climatic conditions: Humid tropical climate.
Principal vegetation: No details available.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Rice cultivation, fishing, and grazing by domestic buffalo.
Disturbances and threats: Agricultural encroachment.
Economic and social values: No information.
Fauna: A pair of the endangered White-winged Wood-Duck *Cairina scutulata* was observed at the site in 1976. No more recent information is available.
Special floral values: No information.
Research and facilities: None
References: Holmes (1976).
Criteria for inclusion: lb. 2a.
Source: Marcel J. Silvius.

Wetland name: Berbak Game Reserve
Country: Indonesia
Coordinates:1°08'-1°40'S, 104°05'-104°28'E;
Location: 60 km ENE of Jambi, on the east coast of Jambi Province, Sumatra.
Area: c.175,000 ha.
Altitude: O-20m.
Biogeographical province: 4.2 1.12.
Wetland type: 05, 06, 07, 11, 18 & 21.
Description of site: One of the largest swamp forest reserves in Indonesia, forming part of the vast alluvial plain of eastern Sumatra. The reserve is unique for its vast area of hitherto undisturbed peat swamp forest (110,000 ha), and has the largest expanse of freshwater swamp forest within any reserve in Sumatra (c.60,000 ha). At its eastern boundary, the reserve is bordered by five villages and a muddy coast with a narrow fringe of mangrove forest (c.1,500 ha). The Air Hitam Laut River flows through the reserve, and the Benu River forms its southern boundary. Along these rivers, there is a fringe of Nypa *fruticans,* 5-50m wide, which gives way to a zone of *Pandanus tectorius* at about eight or ten km upstream from the coast. Behind these palm and pandanus fringes, there is a zone of riverine forest, 50-500m wide, dominated by *Mammea* sp. The maximum tidal range at the coast is 2.O-2.5m; at 10km upstream, the range is still one meter. The forest is inundated for a large part of the year. The peat soil is typically dome-shaped. The rivers are up to

20m deep and contain acidic, peaty water. In the dry season, brackish water penetrates up to 10 km inland.

Climatic conditions: Humid tropical climate with an average annual rainfall of 2,300 mm. There are five or six months with about 200 mm of rainfall, and two months with as little as 100 mm.

Principal vegetation: Peat swamp forest with trees over 40m in height; freshwater swamp forest with a canopy at 50m and emergent up to 70m in height; riverine forest with trees up to 50m in height and many palms, and riverine fringes of *Nypa fruticans* and *Pandanus tectorius.* Over 150 species of trees have been recorded. Species characteristic of the peat swamp forest include *Tetramerista glabra, Gluta* sp, *Dyospyros bantamensis* and *Durio carinatus;* species characteristic of the freshwater swamp forest include *Aistonia pneumatophora, Antidesma montanum, Baccaurea bracteata* and *Blumeodendron tokbrai;* species typical of the riverine forest include *Oncosperma tiggilarium, Callophyllum* sp*, Mammea* sp*, Theysmanniodendron* sp, *Polyalthya* sp and *Licuala valida.* The aquatic flora includes *Susum anthelminticum,* a floating riverine species which grows up to two meters in height and blocks the rivers about 15 km upstream from the coast.

The principal plant communities in adjacent areas are peat swamp forest, freshwater swamp forest, rice paddies and other agricultural land.

Land tenure: The wetland is state owned (PHPA), and is still inhabited by a Kubu tribe which has no contact at all with the outside world. Surrounding areas are privately owned by local people and spontaneous transmigrants from Sulawesi.

Conservation measures taken: Protected as a Game Reserve since October 1935; the boundaries have been revised several times since then. The last revision occurred in 1985, when the coastal villages were excluded from the reserve. The area is regularly patrolled by PHPA (BKSDA Sub-section Nipah Panjang).

Conservation measures proposed: It has been proposed that the sandy beach area excluded from the reserve in 1985 should be re-gazetted as Game Reserve, and that the northwestern boundary of the reserve should be realigned to follow the Air Hitam Dalam River.

Land use: Game reserve. The area is inhabited by about 150 Kubu, an indigenous tribe of hunter-gatherers who may not even know the use of fire.

Possible changes In Land use: There is a possibility that the coastal villages will encroach further into the protected area, unless adequate patrolling measures are taken. Major logging concessions are located to the west of the reserve and partly overlap with the southwestern portion of the reserve (67,500 ha).

Disturbances and threats: The principal threats are drainage of the peat swamp by drainage canals from the coastal villages, illegal logging, human disturbance at the roosts of migratory shorebirds on the sandy beach at Desa Cemara, illegal capture of False Garials *Tomistoma schlegelii,* and capture of freshwater turtles (often accidental). The area fringing the eastern boundary is highly susceptible to forest fires. A fire in 1982 lasted for three months and destroyed at least 3,000 ha of primary forest. The fire was probably caused by uncontrolled burning on nearby cultivated land.

Economic and social values: The Kubu tribe of hunter-gatherers is unique, especially as the tribe exists without any contact with the outside world apart from very occasional long distance approaches. The peat swamp serves as an important natural water storage reservoir in the dry season, providing the coastal villages and reclaimed land with water.

Fauna: At least 34 species of freshwater fishes and brackish water fishes are known from the rivers.

The reserve includes several important sites for water birds, the most important being the sandy beach near the mouth of the River Cemara. At least 24 species of shorebirds have been recorded, including the Asian Dowitcher *Limnodromus semipalmatus* and Nordmann's Greenshank *Tringa guttifer.*

The area is very rich in mammals; species known to occur in the reserve include Tiger, Leopard Cat, Common Porcupine, Yellow-throated Marten, Malay Sunbear, Common Otter, Wild Boar, Bearded Pig, Tapir, Sambar, Lesser Mouse Deer, Greater Mouse Deer, Long-tailed Macaque, Pig-tailed Macaque, Silvered Leaf Monkey, Dark-handed Gibbon, Scaly Anteater, Siamang, Flying Lemur and Binturong *(Panthera tigris, Felis bengalensis, Hystrix brachyura, Martes flavigula, Lutra lutra, Helarctos malayanus, Sus scrofa, S. barbatus, Tapirus indicus, Cervus unicolor, Tragulus javanicus, T. napu, Macaca fascicularis, M. nemestrina, Presbytis cristata, Hylobates agilis, Manis javanica, Symphalangus syndactylus, Cynocephalus variegatus* and *Arctitis binturong).* A species of rhinoceros may still be present; footprints were reported in the mid 1970s, possibly of the Javan Rhinoceros *Rhinoceros sondaicus.*
Both the Estuarine Crocodile *Crocodylus porosus* and False Gharial *Tomistoma schlegelii* still occur in the area. Other reptiles include the turtles *Orlitia borneensis, Cyclemys dent ata, Pelochelys bibronii* and *Chitra indica,* the snakes *Python reticulatus, Bungarius fasciatus, Beiga dendrophila, Cerberus rhynchops* and *Dendrophis pictus,* and the lizards *Draco* sp, *Varanus salvator, Tachydromus sexlineatus* and *Mabouya rudis.* Amphibians include the toad *Bufo subasper.*
Special floral values: No information.
Research and facilities: Various faunal and floral surveys have been carried out in the reserve.
References: IPB (1976b); IUCN (in prep); Karpowicz (1985); Nash & Nash (1985a); Silvius (1986); Silvius *et al.* (1984 & 1986).
Criteria for inclusion: 1b, le, 2a, 2b, 3b.
Source: Marcel J. Silvius.

Wetland name: Tanjung Jabung
Country: Indonesia
Coordinates: 1°01'S, 104°22'E;
Location: between the mouth of the Batang Han River and Sungai Jambat, just northeast of the Berbak Game Reserve, Jambi Province, Sumatra.
Area: c.3,000 ha.
Altitude: 0-0.5m.
Biogeographical province: None
Wetland type: 06 & 07.
Description of site: A coastal fringe of mangrove forest, approximately 200-500m wide, with some soft mudflats. The site lies to the east of the mouth of the Batang Han River. The tidal range is about 2m.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest; *Avicennia marina* dominates where the mangrove fringe is narrowest, and *Rhizophora* sp where the fringe is wide. Coconut plantations and rice paddies in adjacent areas.
Land tenure: The wetland is state owned; surrounding areas are owned by the local villages.
Conservation measures taken: The area was protected until the late 1970s when the boundaries of the Berbak Game Reserve were relocated following large-scale reclamation of land behind the mangrove fringe.
Conservation measures proposed: Silvius (1986) has recommended that the area be protected as a Nature Reserve (Cagar Alam), to link up with the Hutan Bakau Pantai Timor Nature Reserve.
Land use: Some cutting of mangrove poles and inshore fisheries. There are large coconut plantations behind the mangrove fringe.
Disturbances and threats: Illegal logging and spontaneous reclamation schemes.

Economic and social values: The mangrove is an important nursery and breeding area for species of prawns and marine fishes which are important for the inshore fisheries of the region.
Fauna: Many species of prawns and marine fishes use the mangrove swamps as a nursery and breeding area.
The mudflats are used by many thousands of migratory shorebirds of at least 24 species. Some 12,000 shorebirds were present in autumn 1984, 7,500 in summer 1985, and 5,300 in spring 1986**.** The area is particularly important for the rare Asian Dowitcher *Limnodromus sernipalmatus;* 100 were present in autumn 1984, and 474 in spring 1986. The shorebird counts in April 1986 also included:
370 *Charadrius mongolus*
105 *C. leschenaultii*
2,760 *Limosa limosa*
140 *Numenius phaeopus*
110 *N. madagascariensis*
475 *Tringa totanus*
130 *T. stagnatilis*
115 *Xenus cinereus*
50 *Arenaria interpres*
44 *Calidris canutus*
130 *C. ferruginea*
Other water birds present at the same time included 245 *Mycteria cinerea* Milky Storks, thirty-five *Ardea cinerea,* two *A. sumatrana,* twenty-six *Leptoptilos javanicus* and sixty *Anas querquedula.*
Special floral values: No information.
Research and facilities: The area has been surveyed three times: in 1984, 1985 and 1986. The area is readily accessible by speed-boat from the village of *Nipa Panjang.*
References: Danielson & Skov (1986 & 1987); Silvius (1986); Silvius *et al.* (1986).
Criteria for inclusion: lb. 2a, 2c, 3a.
Source: Marcel J. Silvius.

Wetland name: Hutan Bakau Pantai Timor
Country: Indonesia
Coordinates: 0°50'S, 103°30'E to 1°02'S, 104°07'E;
Location: on the coast between Desa Pemusiran and Kuala Tungkal, 70 km north of Jambi, Jambi Province, Sumatra.
Area: c.6,700 ha.
Altitude: 0-lOm.
Biogeographical province: 4.21.12.
Wetland type: 06 & 07.
Description of site: An extensive fringe of mangrove forest 20-500m wide, and adjacent large area of intertidal mudflats, stretching for 70 km along the northeast coast of Jambi Province. The forest contains several breeding colonies of large water birds. It is bisected by nine major mangrove creeks and rivers and numerous small creeks. There are six coastal fishing villages situated at the mouths of creeks. The tidal range is about 2.0-2.5m.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest containing up to 30 species of trees; agricultural land in adjacent areas.
Land tenure: The wetland is state owned (PHPA); adjacent areas are privately owned farmland.

Conservation measures taken: The area has been protected as a Nature Reserve (Cagar Alam) since 1976. The boundaries are currently being marked in the field and are supposed to follow the present division of mangrove forest and arable land.
Conservation measures proposed: The mangrove fringe near Desa Pemusiran, at present unprotected, should be included in the reserve as it contains important breeding colonies of the Grey Heron *Ardea cinerea.*
Land use: Some illegal cutting for firewood and poles for construction purposes. There are rice paddies and coconut plantations inland from the mangroves, and inshore fisheries (with standing nets and small boats) along the coast.
Disturbances and threats: Further encroachment of the coastal villages into the mangrove fringe, illegal logging, and collection of eggs in the breeding colonies of storks, herons and egrets.
Economic and social values: The mangrove forest is a very important nursery and breeding area for many species of prawns and fishes of commercial value.
Fauna: A very important breeding, feeding and roosting area for a wide variety of water birds. The area is particularly important for the rare Milky Stork *Mycteria cinerea,* supporting the largest known breeding colony of this species in the world. At least 74 active nests were located at Kuala Betara in 1985. (The colony at the Banyuasin Musi River Delta may be larger, but has never been adequately surveyed). Other breeding species include several species of *Egretta, Ardea cinerea* (one of the few colonies in Sumatra) and possibly *Threskiornis melanocephalus.* Other waterfowl recorded in the area include *Anhinga melanogaster, Ardea sumatrana, Leptoptilos javanicus* and *Anas querquedula.*
Up to 19,000 shorebirds of 21 species have been recorded, including over 1,500 Asian Dowitchers *Limnodromus semipalmatus* and two Nordmann's Greenshank *Tringa guttifer.* Other species include *Pluvialis squatarola, Charadrius mongolus, C. leschenaultii, Lirnosa limosa, L. lapponica, Numenius phaeopus, N. arquata, N. madagascariensis, Tringa totanus, T. stagnatilis, T. nebularia, T. glareola, Xenus cinereus, Actitis hypoleucos, Arenaria interpres, Calidris canutus, C. ruficollis, C. ferruginea* and *Limicola falcinellus.*
Reptiles include the monitor lizard *Varanus salvator.*
Special floral values: No information.
Research and facilities: Waterfowl surveys have been carried out by Danielson and Skov (1986 & 1987) and Silvius *et al.* (1986).
References: Danielson & Skov (1986 & 1987); Karpowicz (1985); Silvius (1986); Silvius *et al.* (1986).
Criteria for inclusion: lb. 2a, 2b, 2c, 3a.
Source: Marcel J. Silvius.

Wetland name: Tanjung Bakung
Country: Indonesia
Coordinates: 0°13'-0°24'S, 103°35'-103°48'E;
Location: on Pulau Baso, Riau Province, Sumatra.
Area: The proposed reserve covers c.40.000 ha of mangrove forest.
Altitude: 0-0.5m.
Biogeographical province: 4.2 1.12.
Wetland type: 06 & 07.
Description of site: Tanjung Bakung, a promontory of Baso Island, has extensive mudflats and primary mangrove forests. Several small lakes are present. The outermost tip of the promontory is accreting extremely rapidly. The tidal mudflats comprise very unripe clay sediments over 1.5m deep in places.
Climatic conditions: Humid tropical climate.

Principal vegetation: Primary mangrove forest and *Nypa fruticans* swamp.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: Silvius *et al.* (1986) have recommended that the area be protected as a Nature Reserve (Cagar Alam).
Land use: No information.
Disturbances and threats: Small-scale logging and reclamation; possible disturbance of breeding colonies of water birds by egg collectors (for consumption).
Economic and social values: The mangrove forest is important as a nursery and breeding area for commercially important species of fish and shellfish.
Fauna: An important area for migratory shorebirds and resident large water birds; 10,000 shorebirds were present in November 1984, along with 190 *Egretta alba,* over 360 *Mycteria cinerea* and over 60 *Threskiornis melanocephalus.* According to local villagers, there may still be some breeding colonies of egrets and storks around the small lakes in the mangrove forests.
The Estuarine Crocodile *Crocodylus porosus* may still occur in the area.
Special floral values: None known.
Research and facilities: Silvius *et al.* carried out a preliminary waterfowl survey in November 1984.
References: Karpowicz (1985); Silvius *et al.* (1986).
Criteria for inclusion: lb, 2a, 2c, 3a.
Source: Marcel J. Silvius.

Wetland name: Tanjung Datuk
Country: Indonesia
Coordinates: 0°00'N/S**,** 103°45'E;
Location: on the equator, 15 km east of Desa Bekawan and 50 km south of Sungai Guntung, Riau Province, Sumatra.
Area: The proposed reserve covers c.25,000 ha of mangrove forest.
Altitude: O-O.5m.
Biogeographical province: 4.21.12.
Wetland type: 06 & 07.
Description of site: A rich mangrove area consisting of almost untouched *Rhizophora* forest, extensive mudflats and several unspoiled tidal creeks. There are several brackish lakes in the interior of the mangrove forest. The tidal range is about 2.0-2.5m.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest with *Avicennia* as the accreting species and *Rhizophora* dominating further inland.
Land tenure: State owned (Government of Indonesia).
Conservation measures taken: None.
Conservation measures proposed: Silvius *et al.* (1986) have recommended that the entire area be protected as a Nature Reserve (Cagar Alam). Salm and Halim (1984) have proposed the establishment of a Marine Sanctuary of 5,000 ha.
Land use: Fisheries, crocodile hunting and small-scale logging; fisheries and some agriculture in surrounding areas.
Possible changes in Land use: There is a possibility that some of the mangrove forest, especially around the small lakes, will be reclaimed for agriculture by spontaneous transmigrants from local villages. Further reclamation of mangrove forest is likely in adjacent areas.
Disturbances and threats: Crocodile hunting, illegal logging and spontaneous reclamation projects.

Economic and social values: The mangrove forest is very important as a nursery and breeding area for commercially important species of fish and shellfish.
Fauna: An important area for both resident and migratory waterfowl, notably *Mycteria cinerea* and shorebirds. Over 10,000 migratory shorebirds were present on the mudflats in November 1984, along with over 190 *Mycteria cinerea* and smaller numbers of *Egretta sacra, E. alba* and *Leptoptilos javanicus.* The lakes within the mangrove forest may support breeding colonies of large water birds including *M. cinerea.*
The creeks are still inhabited by the Estuarine Crocodile *Crocodylus porosus,* making this area one of the last refuges for this endangered species in Riau Province.
Special floral values: No information.
Research and facilities: The area has been surveyed only once, in November 1984.
References: Karpowicz (1985); Saim & Halim (1984); Silvius *et al.* (1986).
Criteria for inclusion: lb. 2a, 2c, 3a.
Source: Marcel J. Silvius.

Wetland name: Pulau Burung
Country: Indonesia
Coordinates: 0°25'N, 103°34'E;
Location: east of the mouth of the Kampar River, 12 km NNW of the village of Sungai Guntung, Riau Province, Sumatra.
Area: c.200 ha.
Altitude: Sea level.
Biogeographical province: 4.2 1.12.
Wetland type: 06, 07 & 08.
Description of site: A small mangrove island, surrounded by intertidal mudflats and with a shallow, brackish lake in the centre. There are extensive sandy mudflats on the north and southeast coasts of the island, which is separated from the mainland by a channel several hundred meters wide. The lake is probably not more than 50cm deep. Its salinity appears to be dependent on precipitation and varies with the seasons. The lake is linked with the sea at very high tides. The average tidal variation is about 2m.
Climatic conditions: Humid tropical climate. There are five or six months with over 200 mm of rainfall, and two or three months with less than 100 mm.
Principal vegetation: Mangrove forest dominated by *Rhizophora mucronata* and *R. apiculata,* with some *Bruguiera parviflora, B. gymnorhiza, B. cylindrica* and *Avicennia* sp.
Land tenure: State owned (PHPA).
Conservation measures taken: The area is protected as a Nature Reserve (Cagar Alam), established in 1968.
Conservation measures proposed: There is a need for regular patrols in the area.
Land use: Nature reserve.
Disturbances and threats: Some illegal logging of mangrove poles was reported in April 1984.
Economic and social values: The mangrove swamps are important in maintaining the local fishery. The lake is very rich in fish and is likely to be a breeding and nursery area for marine fishes and crustaceans.
Fauna: According to local people, the mangrove forest around the lake is used as a breeding site by large water birds, including the Milky Stork *Mycteria cinerea.* Small numbers of migratory shorebirds were observed on the mudflats in April 1984.
Special floral values: The *Rhizophora* forest is very tall and healthy, and is one of the best examples of primary mangrove forest in the region.
Research and facilities: M.J. Silvius *et al.* carried out a brief survey of the island in April 1984.

References: Silvius *et al.* (1986).
Criteria for inclusion: lb. 2a, 2c.
Source: Marcel J. Silvius.

Wetland name: Bakau Muara Kapuas
Country: Indonesia
Coordinates: 00°30'N, 102°50'E;
Location: north of the Sungai Kampar, Kabupaten Bengkalis and Kampar, Riau Province, Sumatra.
Area: c.70,000 ha.
Altitude: Sea level.
Biogeographical province: 4.2 1.12.
Wetland type: 07 & 21.
Description of site: An excellent complex of mangrove formations backed by peat swamp forests, still in a relatively undisturbed condition.
Climatic conditions: Humid tropical climate.
Principal vegetation: 20,000 ha of mangrove forest and 50,000 ha of peat swamp forest.
Land tenure: State owned (Government of Indonesia).
Conservation measures taken: None.
Conservation measures proposed: The area has been proposed as a Wildlife Reserve (Suaka Margasatwa).
Land use: No information.
Disturbances and threats: There are plans to log the area.
Economic and social values: No information.
Fauna: The wetland is an important breeding area for the Estuarine Crocodile *Crocodylus porosus.* The forests support a rich bird life and some primates.
Special floral values: No information.
Research and facilities: None
References: MacKinnon & Artha (l982a).
Criteria for inclusion: 1b, 2a.
Source: Marcel J. Silvius.

Wetland name: Kerumutan Baru
Country: Indonesia
Coordinates: 0°15'-0°25'S, 102°25'-l02°38'E;
Location: near Rengat, Kabupaten Kampar, Riau Province, Sumatra.
Area: 120,000 ha.
Altitude: 20-lOOm.
Biogeographical province: 4.2 1.12.
Wetland type: 11, 19 & 21.
Description of site: A large reserve incorporating extensive peat swamp forests with a small area of dry-land forest. The southern tip of the reserve has been cleared for rice cultivation, but otherwise the area is fairly undisturbed. The eastern part is permanently flooded. The reserve represents the best example of inland lowland swamp forests in Riau Province, and is the richest in wildlife due to its proximity to extensive dry-land forests. The area has many rivers such as the Kerumutan, Bengkinang, Batang Rengat, Mangkuang and Merbau.

Climatic conditions: Humid tropical climate with an average annual rainfall of 2,009 mm. The mean temperature is 26.1°C (minimum 24.1°C, maximum 31.6°C); the average relative humidity is 84.1%.
Principal vegetation: Peat swamp forest (100,000 ha), with wet lowland forest on alluvium in adjacent areas (5,000 ha).
Land tenure: State owned (PHPA).
Conservation measures taken: The entire area is protected as a Nature Reserve (Cagar Alam).
Conservation measures proposed: It is proposed to extend the boundaries in the northwest to include the 30,000 ha of forest remaining in the old Kerumutan Reserve (Kerumutan Lama).
Land use: Nature reserve with some cultivation; cultivation in surrounding areas.
Disturbances and threats: Agricultural encroachment and illegal hunting in the reserve. There is a possibility that the area will be opened up to logging.
Economic and social values: No information.
Fauna: The area is rich in mammals including *Elephas maximus, Panthera tigris, Tapirus indicus, Helarctos malayanus, Symphalangus syndactylus, Manis javanica* and *Histryx brachyura.* Little is known of the waterfowl except that *Bubulcus ibis* and species of *Egretta* are present.
Special floral values: No information.
Research and facilities: None
References: Direktorat P.P.A. (1977c & 1982a); MacKinnon & Artha (1982a).
Criteria for inclusion: 1b, 2a, 2b.
Source: Marcel J. Silvius and Agustinus W. Taufik.

Wetland name: Danau Bawah and Puiau Besar
Country: Indonesia
Coordinates: 0°40'N, 102°15'E;
Location: 90 km SSE of Bengkalis, Kabupaten Bengkalis, Riau Province, Sumatra.
Area: 23,750 ha.
Altitude: 0-6m.
Biogeographical province: 4.2 1.12.
Wetland type: 14 & 21.
Description of site: An area of peat swamp forests with two freshwater lakes and an island (Pulau Besar) in one of the lakes.
Climatic conditions: Humid tropical climate with an average annual rainfall of 2,400 mm.
Principal vegetation: Peat swamp forest (16,000 ha) and freshwater swamp forest (4,000 ha), dominated by *Shorea* sp and *Gonystylus bancanus.* Forests in adjacent areas are dominated by species of *Shorea* and *Gonystilus, Terminalia gigantea* and *Melaleuca leucodendron.*
Land tenure: State owned (PHPA).
Conservation measures taken: The area has been protected as a Nature Reserve (Cagar Alam) since 1979.
Conservation measures proposed: None
Land use: Nature reserve; logging and transmigration settlements in surrounding areas.
Disturbances and threats: Land clearance for transmigration, logging, oil exploration and the construction of roads.
Economic and social values: The area has high aesthetic values, and is important as a genetic resource.
Fauna: The area is rich in wildlife, including many rare or endangered species such as *Elephas maximus, Panthera tigris, Tapirus indicus* and several primates. The False Gharial *Tomistoma schlegelii* is present. Waterfowl include species of *Egretta* and various kingfishers (Alcedinidae).

Special floral values: The reserve includes an excellent example of extensive *Shorea* and *Gonystylus bancanus* (Ramin) swamp forests in an attractive setting.
Research and facilities: None
References: Direktorat P.P.A. (1980e); MacKinnon & Artha (1982a).
Criteria for inclusion: 1b, 2a, 2b.
Source: Marcel J. Silvius and Edi Djuharsa.

Wetland name: Danau Belat, Besar Sekak and Sarang Burung
Country: Indonesia
Coordinates: 0°20'-0°40'N, 102°00'E;
Location: 90 km south of Bengkalis, Kabupaten Kampar, Riau Province, Sumatra.
Area: c.10,000 ha.
Altitude: c.30m.
Biogeographical province: 4.2 1.12.
Wetland type: 11, 14 & 21.
Description of site: Three neighbouring areas of peat swamp forest with several rivers and small lakes.
Climatic conditions: Humid tropical climate.
Principal vegetation: Peat swamp forest.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: All three areas have been proposed as Wildlife Reserves (Suaka Margasatwa), but since each is rather small and vulnerable, it has been suggested that they be incorporated in a single, much larger reserve, or linked with the existing Danau Bawah-Danau Pulau Besar Reserve.
Land use: No information.
Disturbances and threats: Logging and reclamation of land for agriculture.
Economic and social values: No information.
Fauna: Very little information is available. The area is reported to be rich in water birds, and one of the lakes is used as a breeding area by large numbers of birds. The False Gharial *Tomistoma schlegelii* occurs in the area.
Special floral values: No information.
Research and facilities: None
References: MacKinnin & Artha (1982a).
Criteria for inclusion: lb. 2a, 2b.
Source: Marcel J. Silvius.

Wetland name: Siak Kecil
Country: Indonesia
Coordinates: 0°59'-1°23'N, 101°26'-101°52'E;
Location: 60 km WSW of Bengkalis, Kabupaten Bengkalis, Riau Province, Sumatra.
Area: c.100,000 ha.
Altitude: c.20m.
Biogeographical province: 4.2 1.12.
Wetland type: 14 & 21.
Description of site: A very interesting system of small freshwater lakes in a large area of peat swamp forest (30,000 ha) and freshwater swamp forest (2,000 ha).
Climatic conditions: Humid tropical climate.

Principal vegetation: Peat swamp forest with up to 30 tree species, and freshwater swamp forest.
Land tenure: State owned (Government of Indonesia).
Conservation measures taken: None.
Conservation measures proposed: The area has been proposed as a Hunting Reserve. FAO (1976) has subsequently recommended that the proposed reserve be enlarged from an original 40,000 ha to 100,000 ha, and that it be given the status of Wildlife Reserve(Suaka Margasatwa). Hunting should be forbidden.
Land use: No information.
Disturbances and threats: Logging and disturbance from oil exploitation.
Economic and social values: No information.
Fauna: The area is known to support many waterfowl, but no details are available. The forests are important for a variety of rare or endangered mammals such as Asian Elephant *Elephas maximus*, Tiger *Panthera tigris* and Tapir *Tapirus indicus.* The site is also very important as a breeding area for the False Gharial *Tomistoma schlegelii.*
Special floral values: No information.
Research and facilities: None
References: FAO (1986); MacKinnon & Artha (l982a).
Criteria for inclusion: 1b, 2a, 2b.
Source: Marcel J. Silvius.

Wetland name: Bakau Selat Dumai
Country: Indonesia
Coordinates: l°35'N, l0l°25'E;
Location: on the mainland coast near Pulau Rupat, Kabupaten Bengkalis, Riau Province, Sumatra.
Area: 60,000 ha.
Altitude: Sea level.
Biogeographical province: 4.2 1.12.
Wetland type: 07 & 21.
Description of site: A large area of rich and almost undisturbed mangrove forest (20,000 ha) and peat swamp forest (40,000 ha) on the mainland coast of Sumatra, opposite the island of Pulau Rupat.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest and peat swamp forest.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: The area has been proposed as a Wildlife Reserve (Suaka Margasatwa).
Land use: Fisheries and coastal protection.
Disturbances and threats: There are some new coastal settlements in the area, and plans have been made to exploit the forestry resources.
Economic and social values: The mangroves provide breeding and nursery grounds for economically important marine fishes and crustaceans.
Fauna: The area is known to be rich in water birds and other wildlife, including the Estuarine Crocodile *Crocodylus porosus,* but no details are available.
Special floral values: No information.
Research and facilities: None
References: MacKinnon & Artha (l982a).
Criteria for inclusion: 1b, 2a, 3b.
Source: Marcel J. Silvius.

Wetland name: Danau Toba
Country: Indonesia
Coordinates: 2°20'-2°55'N, 98°3l'-99°09'E;
Location: 80 km south of Medan, North Sumatra.
Area: c.135,000 ha.
Altitude: 900m.
Biogeographical province: 4.2 1.12.
Wetland type: 14.
Description of site: A very large volcanic caldera lake in northern Sumatra, about 90 km long and up to 30 km wide; the largest and deepest lake in Southeast Asia. The lake is surrounded by steep slopes (the old crater walls) and peaks rising to 2,150m. There is a large island, Pulau Samosir (63,000 ha), rising to 1,685m in the centre of the lake. The maximum depth is about 450m. The lake is fed by local run-off; its outlet at the southeast corner flows into the Asahan River which drains northeast into the Strait of Malacca. A 200m high waterfall on the Asahan River, upriver from Balige, is the largest waterfall in Southeast Asia.
Climatic condition: No information
Principal vegetation: No information is available on the aquatic vegetation. The alluvial plain at the edge of the lake is under cultivation for rice, cloves and coconuts. Surrounding slopes are covered in grassland with some coniferous plantations.
Land tenure: State owned.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Outdoor recreation and tourism, particularly around the town of Prapat on the east shore and on Pulau Samosir, and fishing on a very small scale; agriculture and forestry in surrounding areas.
Disturbances and threats: All mountain slopes around the lake have been cleared by burning, and soil erosion may be a problem. There is some pollution and littering near the main towns such as Prapat.
Economic and social values: A very important area for tourism, and the home of the Taba Batak tribe (about one million people). The Taba Batak are possibly the descendants of the first Batak people, a group of wandering neolithic mountain-dwellers from northern Thailand and Burma who settled in the region about 1,500 years ago. Their former animist religion (now Christian), cannibalistic tendencies and interesting artefacts make the Bataks of great interest to anthropologists and the general public alike.
Fauna: Very little information is available. The isolated nature of the lake would suggest that there may be some endemism in the fish fauna. Very few water birds were observed during a brief survey of Pulau Samosir in December 1986. However, the marshes along the southwestern shore of the lake could be of considerable importance for waterfowl.
Special floral values: No information.
Research and facilities: None
References: None
Criteria for inclusion: lb, le.
Source: Duncan Parish.

Wetland name: Belawan (Timur Laut)
Country: Indonesia
Coordinates: 3°45'N, 98°45'E;

Location: north of Medan, Kabupaten Langkat, on the east coast of Sumatra Utara Province, Sumatra.
Area: 15,765 ha.
Altitude: Sea level.
Biogeographical province: 4.21.12.
Wetland type: 05 & 07.
Description of site: A large area of mangrove forest (9,000 ha), with adjacent sandy beaches and remnants of dry beach forest. The terrestrial forests inland from the site have now been cleared for agriculture.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest; some *Casuarina equisetifolia* forest in sandy areas.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: The area has been protected as a Wildlife Reserve since 1980.
Conservation measures proposed: It has been recommended that the wardening of the reserve be improved, and that degraded portions of the reserve be reafforested.
Land use: Fishing for prawns in surrounding areas.
Disturbances and threats: Clearance of mangroves for agriculture.
Economic and social values: The mangrove is important in maintaining the local prawn fishery.
Fauna: No information is available on the waterfowl. Sea-turtles are reported to nest on the sandy beaches.
Special floral values: One of the few surviving large stands of mangrove forest on the east coast of Sumatra Utara Province.
Research and facilities: None
References: MacKinnon & Artha (l982a); Salm & Halim (1984).
Criteria for inclusion: 0.
Source: Marcel J. Silvius.

Wetland name: Pulau Simeulue
Country: Indonesia
Coordinates: 2°35'N, 96°10'E;
Location: 120 km off the mainland coast, Kabupaten Aceh Barat, Aceh Province, Sumatra.
Area: 25,000 ha.
Altitude: Sea level to 332m.
Biogeographical province: 4.2 1.12.
Wetland type: 07 & 14.
Description of site: An island with lowland forests, hill forests and about 1,000 ha of mangrove forests. The site includes a small freshwater lake, Danau Laut Tawar.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: Wind (1980) and Mitchell (1981) have proposed that the island be designated as a Wildlife Reserve (Suaka Margasatwa).
Land use: No information.
Disturbances and threats: Land conversion and hunting. The possible introduction of animals from the mainland is a permanent threat.
Economic and social values: No information.

Fauna: The island fauna is very distinct, showing a high degree of endemism at the subspecies level and possessing some endemic species. Endemic mammals include a curious macaque monkey *Macaca* sp and a dwarf pig *Sus celebensis mimus.*
Special floral values: No information.
Research and facilities: Preliminary surveys have been carried out by Wind (1980) and Mitchell (1981).
References: MacKinnon & Artha (1982a); Mitchell (1981); Wind (1980).
Criteria for inclusion: lb, 2d.
Source: Marcel J. Silvius.

Wetland name: Singkil Barat
Country: Indonesia
Coordinates: 2°l5'-2°50'N, 97°40'-97°52'E;
Location: near the town of Singkil, Kabupaten Aceh Selatan, Aceh Province, Sumatra.
Area: 65,000 ha.
Altitude: Sea level.
Biogeographical province: 4.2 1.12.
Wetland type: 05 & 21.
Description of site: An excellent, relatively undisturbed area of beach forest communities and freshwater swamp forests on soils of low agricultural potential.
Climatic conditions: Humid tropical climate.
Principal vegetation: Beach vegetation (4,000 ha) and fresh water swamp forest (55,000 ha).
Land tenure: State owned (Government of Indonesia).
Conservation measures taken: None.
Conservation measures proposed: The area has been proposed as a Nature Reserve (Cagar Alam).
Land use: No information.
Disturbances and threats: Land conversion.
Economic and social values: No information.
Fauna: No information.
Special floral values: The site contains the best surviving examples of beach vegetation and freshwater swamp forest in Aceh Province.
Research and facilities: Binnie and Partners (Overseas) Ltd and Hunting Technical Services Ltd have carried out a study of the region's water resources and potentially irrigable land.
References: MacKinnon & Artha (1982a).
Criteria for inclusion: lb.
Source: Marcel J. Silvius.

Wetland name: Taitai Batti and Pulau Siberut
Country: Indonesia
Coordinates: 0°55'- 1°50'S, 98°34'-99°20'E;
Location: Kabupaten Padang Pariaman (Pulau Siberut), Sumatra Barat Province, Sumatra.
Area: Area of wetlands unknown; Wildlife Reserve 96,500 ha.
Altitude: Sea level to 385m.
Biogeographical province: 4.2 1.12.
Wetland type: 03, 05 & 21.
Description of site: Pulau Siberut is a sedimentary island of relatively recent origin. The east coast is slowly subsiding, and this is resulting in a very irregular coastline of bays, capes, islets and coral

reefs. By contrast, the west coast is rather straight and is lined with broad sandy beaches and steep cliffs. The vegetation consists of well formed lowland forests including *Dipterocarpus* forest, swampy sago forest (3,000 ha) and freshwater swamp forest. There is some mangrove forest on the east coast, and some *Barringtonia* forest on the west coast.

Climatic conditions: Wet equatorial climate with no pronounced dry season; the average annual rainfall is 3,320 mm.

Principal vegetation: Mangrove forest on the east coast of the island is dominated by *Rhizophora* sp, *Bruguiera* sp and *Nypa fruticans.* The freshwater swamp forest is dominated by *Terminalia phellocarpa. Barringtonia* forest on the west coast is dominated by species of *Barringtonia, Casuarina, Callophyllum, Shorea, Dialium, Dipterocarpus* and *Oncosperma.*

Land tenure: State owned (PHPA).

Conservation measures taken: Some 96,500 ha of the island have been protected as a Wildlife Reserve (Suaka Margasatwa) since 1976.

Conservation measures proposed: It has been proposed to extend the reserve. The extra areas would include the adjacent coastal waters as a Marine Park.

Land use: Wildlife management.

Disturbances and threats: Land conversion, logging activities, transmigration, introduction of exotic species, collection of forest products such as rattans, and the cutting of mangroves.

Economic and social values: The island has high potential for tourism.

Fauna: Many species of reef fish are known to occur in the surrounding waters. A wide variety of sea-birds and waterfowl have been recorded including *Sula sula, Fregata ariel, Egretta sacra, E. alba, Ardea sumatrana, Ciconia episcopus, Dendrocygna javanica, Esacus magnirostris, Limosa lapponica, Tringa totanus, Xenus cinereus, Actitis hypoleucos* and *Sterna bergii.* Other birds associated with the wetlands include the sea-eagle *Haliaeetus leucogaster,* the kingfishers *Alcedo atthis, Halcyon chloris,* and the whistler *Pachycephala cinerea.*

About 60% of the land mammals are endemic at some level. They include *Hylobates klossii, Presbytis potensiani, Simias concolor, Macaca pagensis, Aeromys* sp*, Aonyx* sp and *Paradoxurus hermaphroditus.* Marine mammals in the adjacent seas include *Dugong dugon, Delphinus* sp*, Stenella* sp and *Grampus* sp.

Reptiles and amphibians include the Estuarine Crocodile *Crocodylus porosus,* the sea turtles *Chelonia mydas, Eretmochelys imbricata* and *Dermochelys coriaceae,* and species of *Gekko, Hemidactylus, Mabuya, Rana, Spinella, Philantus, Python, Geomyda* and *Draco.*

Special floral values: No information.

Research and facilities: Some faunal and floral surveys have been carried out.

References: Direktorat P.P.A. (1981b); IUCN (in prep); MacKinnon & Artha (l982a); WWF (1980 & 1982).

Criteria for inclusion: lb. 2a, 2b, 2d, 3b.

Source: Marcel J. Silvius and Agustinus W. Taufik.

Wetland name: Muara Siberut

Country: Indonesia

Coordinates: l°l3'-1°38'S, 99°02'-99°15'E;

Location: on the east coast of Pulau Siberut, Kabupaten Padang Pariaman, Sumatra Barat Province, Sumatra.

Area: 7,500 ha of mangrove swamp, beach vegetation and coral gardens.

Altitude: Sea level.

Biogeographical province: 4.2 1.12.

Wetland type: 01, 02, 05 & 07.

Description of site: An area of mangrove swamps, beach vegetation and 2,000 ha of shallow inshore waters with extensive coral reefs on the east coast of Siberut Island. The site includes the large estuarine system of the Sarabua River, with its bays, capes and small islands, some with and some without mangrove swamp, patches of coral reef and large tracts of submarine limestone terraces. There are few rivers in the area, the main one being Sungai Sarabua which flows into Teluk Sarabua. There is a high rate of erosion and accretion in the area.
Climatic conditions: Rather wet tropical climate with no pronounced dry season. The annual rainfall exceeds 3,000 mm.
Principal vegetation: Mangrove communities with *Rhizopliora mucronala, R. apiculata, R. conjugata, Avicennia* sp*, Bruguiera sp, Sonneratia alba, Nypa fruticans* and *Callophyllum urophyllum.* The dominant vegetation in adjacent areas includes *Baringtonia asiatica, Hibiscus tiliaceus, Pandanus tectorius, Casuarina equisetifolia, Pemphis acidula, Vitex trifolia, Spirifex littoreus* and *Pometia pinnata.*
Land tenure: State owned (Local Government of Siberut).
Conservation measures taken: None.
Conservation measures proposed: The area has been proposed as a Nature Reserve (Cagar Alam). Specific sites within the Sarabua estuary (Teluk Sarabua) have been proposed as Marine Conservation Areas.
Land use: Fisheries, especially traditional fisheries; agriculture and forestry in surrounding areas.
Disturbances and threats: Cutting of mangroves, destruction of coral reefs, logging operations and hunting.
Economic and social values: An important area for its fisheries and for tourism and other outdoor recreation. The site has considerable potential for conservation education and scientific research.
Fauna: The inshore waters and coral reefs support a very rich fish fauna including parrot fish (Scaridae), wrass (Labridae), damsel fish (Paracentridae), butterfly angel fish (Chaetodontidae), snake eel (Ophichthyidae), shark (Carcharihinidae), *Platax* sp (Ephipidae), *Acanthurus* sp (Acanthuridae), *Lutjanus spilurus* (Lutjanidae), *Dasyatis* sp (Dasyatidae), and *Caranx* sp *(*Carangidae*).*
Sea-birds and waterfowl include *Phalacrororax* sp*, Sula sula, Fregata arid, Egretta sacra, Ardea sumatrana, Ciconia episcopus, Plegadis falcinellus, Actitis hypoleucos* and *Sterna* spp. The coastal waters are very heavily utlized by cetaceans. Other mammals include the Dugong *Dugong dugon, Presbytis potenzianni, Macaca pagensis, Sus* sp, *Cervus* sp and *Muntiacus muntjak.* Reptiles include the Estuarine Crocodile *Crocodylus porosus,* the sea-turtles *Chelonia mydas, Dermochelys coriaceae, Maticora* sp and *Cerberus rhynchops.* Invertebrates include *Tridacna sp, Holothuria* sp*, Rynchia laevigata, Anthipates* sp*, Hipocampus* sp and *Nautilus* sp.
Special floral values: No information.
Research and facilities: Some faunal and floral surveys have been carried out.
References: Direktorat P.P.A. (undated); MacKinnon & Artha (l982a).
Criteria for inclusion: 1b, 2a, 2b, 3b.
Source: Marcel J. Silvius and Agustinus W. Taufik.

Wetland name: Lunang
Country: Indonesia
Coordinates: 2°l5'S, l0l°00'E;
Location: Kabupaten Pesisir Selatan, Sumatra Barat Province, approximately 7 km from the border with the Jambi Province, Sumatra.
Area: 17,700 ha.
Altitude: Near sea level.
Biogeographical province: 4.2 1.12.

Wetland type: 21.
Description of site: A flat, swampy area with extensive peat swamp forests, near the coast of Tanjung Batu. The evergreen vegetation grows to a height of about 30m. The soils consist of organosolen and glei-humus.
Climatic conditions: Humid tropical climate with an average annual rainfall of 2,000 mm.
Principal vegetation: Peat swamp forests dominated by *Litsea* sp*, Shorea javanica, Santeria oblongifolia* and *Gluta renghas.*
Land tenure: State owned (PHPA).
Conservation measures taken: The area was established as protection forest by Government Besluit in April 1921.
Conservation measures proposed: The area has been proposed as a Nature Reserve (Cagar Alam).
Land use: Preservation of threatened habitats and their associated fauna and flora.
Disturbances and threats: Drainage of swamps for agriculture, logging and illegal cutting, cultivation and ladang encroachment, and poaching.
Economic and social values: A valuable genetic resource, important for scientific research.
Fauna: The area supports a rich fauna with many protected species. Mammals include *Macaca* sp, *Hylobates* sp, *Sus* sp, *Panthera tigris, Aonyx* sp, *Manis javanica* and *Cuon javanicus.* Little information is available on the waterfowl, but *Egretta garzetta, Ciconia episcopus* and *Dendrocygna* sp are known to occur.
Special floral values: No information.
Research and facilities: None
References: Direktorat P.P.A. (1979d).
Criteria for inclusion: 1b, 2a, 2b.
Source: Marcel J. Silvius and Agustinus W. Taufik.

Wetland name: Wetlands in Kerinci-Sablat Nature Reserve
Country: Indonesia
Coordinates: 1°3O'-2°4O'S, 101°00'-lO1°5O'E;
Location: part of the Bukit Barisan mountain chain, Sumatra Barat, Jambi, Bengkulu and Sumatra Selatan Provinces, Sumatra.
Area: Area of wetlands unknown; Nature Reserve 1,484,600 ha.
Altitude: 50-3,000m (including the highest peak in Sumatra).
Biogeographical province: 4.2 1.12.
Wetland type: 11, 12, 14 & 22.
Description of site: The Kerinci-Sablat Nature Reserve is situated in the Bukit Barisan mountain range between Bengkulu and Padang. It incorporates the undisturbed forests in the main water catchment areas for the extensive settled region of southern Sumatra. The reserve includes some of the most outstanding scenery in Sumatra, including a 3,000m high volcano (Indrapura), numerous rivers, many lakes and extensive montane and lowland forests. It is characterized by alternating high massifs and alluvial plains, producing steep slopes with broad alluvial fans at their base. Many large rivers, including the Batang, Musi and Teba, have their headwaters in this region. The largest lake in the reserve is Kerinci Lake. This lies in a flat-bottomed valley at an elevation of 783m; it is about 9.5 km long by 6 km wide, and 110m deep. The lake lies within the Kerinci Enclave, a cultivated area of 140,000 ha inside the reserve. Gunung Tujuh Lake, a crater lake at 1,996m elevation, is one of the last undisturbed mountain lakes in Sumatra. It is approximately 1,000 ha in area, and 8-40m deep. Other lakes include Danau Lamkat, Danau Sati, Danau Ladeh Panjang, Danau Dua, Danau Kecil, Danau Pauh and Danau Dipatjampat. Danau Bentu (Sangir Hulu), a high altitude forested bog, is of considerable botanical interest.

Climatic conditions: Humid tropical to temperate climate, depending on altitude. In the western part of the reserve, the rainfall reaches a peak in April and again in November. The average temperature in the lowlands is 28°C.

Principal vegetation: The main vegetation types within the reserve are lowland rain forest, sub-montane rain forest, montane rain forest, cloud forest, riverine forest, swamp forest and highland bog forest.

Land tenure: The site is state owned (PHPA); surrounding areas are owned by the local people and the Indonesian Government.

Conservation measures taken: The site has been afforded some protection since 1929, and was designated as a Nature Reserve (Cagar Alam) in 1980.

Conservation measures proposed: A proposal has been made to upgrade the reserve to the status of National Park (Taman Nasional). A buffer zone management plan will be developed for the Kerinci Enclave.

Land use: Nature reserve; rice is cultivated in the Kerinci Enclave. There are numerous small settlements around the perimeter of the reserve.

Disturbances and threats: The most serious threat is continuing expansion of the Kerinci Enclave, as agricultural land encroaches further and further into the forest. There are seven other settlements with a total population of over 1,100 people within the area of the proposed National Park. Logging is a problem in the west coast lowlands, and the present levels of wardening and law enforcement are inadequate. The introduced aquatic weed *Eichhornia crassipes* has become a pest in Kerinci Lake.

Economic and social values: The reserve is of considerable geological, botanical and zoological interest, and has considerable potential for outdoor recreation and tourism. It is extremely important for watershed protection, and constitutes an important gene pool, particularly for commercial timber species and rattans.

Fauna: No information is available on the fishes. The reserve supports an extremely rich avifauna, including six species of kingfishers (Alcedinidae), five species of hornbills (Bucerotidae), and several very rare species such as Salvadori's Pheasant *Lophura inornata* and the scops owl *Otus stresemanni* (known from only one specimen collected in this area). The reserve is, however, of only limited importance for waterfowl; species known to occur include *Egretta intermedia, Gallinula chloropus* and *Gallinago gallinago.*

The mammalian fauna is also very rich. The reserve contains probably the world's largest contiguous population of the Asian Two-horned Rhinoceros *Dicerorhinus sumatrensis,* estimated at between 250 and 500 individuals. Other vulnerable or rare mammals include Tiger,

Asian Elephant, Tapir, Clouded Leopard, Siamang, Dark-handed Gibbon and Serow *(Panthera tigris, Elephas maximus, Tapirus indicus, Neofelis nebulosa, Symphalangus syndactylus, Hylobates agilis* and *Capricornis sumatrensis).* The Sumatran Hare *Nesolagus netscheri* (endemic to Sumatra) may have its last refuge in the reserve.

Reptiles include *Varanus salvator, Python reticulatus* and *Dryophis prasinnus.* Frogs are common everywhere in the reserve.

Special floral values: The forested bog at Danau Bentu (Sangir Hulu) is claimed to be the highest forested marsh in western Indonesia. Unfortunately, much of the bog has been destroyed for rice cultivation during the last decade. The exceptionally rich flora of the Nature Reserve includes the world's largest flower, *Rafflesia arnoldi,* and the world's tallest flower, *Amorphophallus titanum.*

Research and facilities: Various brief faunal and floral surveys have been carried out in the Nature Reserve, e.g. by Frey-Wyssling in 1933, Jacobs in 1958, Borner in 1973, Meyer in 1977, and Ohsawa and Suharto in 1979. The reserve has been selected as a study area for a long term research programme under the "Tropenbos-programme", a joint effort between several Dutch research institutes and universities. The programme was scheduled to begin in 1987.

References: Blouch (1985); IUCN (in prep); MacKinnon & Artha (1982a).

Criteria for inclusion: la, 1b, le, 2a, 2b.
Source: Marcel J. Silvius.

Wetland name: Dusun Besar
Country: Indonesia
Coordinates: c.3°55'S, 102°20'E;
Location: near Bengkulu, Kabupaten Bengkulu Utara, Bengkulu Province, Sumatra.
Area: 441.5 ha.
Altitude: 1.5m.
Biogeographical province: 4.2 1.12.
Wetland type: 14.
Description of site: A small freshwater lake surrounded by *Vanda hookeriana* and *Rafflesia* flowers.
Climatic conditions: Humid tropical climate.
Principal vegetation: *Vanda hookeriana* and *Rafflesia* spp.
Land tenure: State owned (PHPA).
Conservation measures taken: The lake was designated as a Nature Reserve (Cagar Alam) in June 1936 and renotified in 1981.
Conservation measures proposed: None
Land use: No information.
Disturbances and threats: Encroachment of ladangs and the stealing of timber.
Economic and social values: No information.
Fauna: No information.
Special floral values: The wetland supports a variety of rare flowering plants such as *Vanda hookeriana* and *Rafflesia* spp.
Research and facilities: None
References: MacKinnon & Artha (l982a).
Criteria for inclusion: lb, 2a, 2b.
Source: Marcel J. Silvius.

Wetland name: Krakatau
Country: Indonesia
Coordinates: 6°09'S, 100°27'E;
Location: in the Sunda Strait, 40 km off the southern tip of mainland Sumatra, South Lampung District, Lampung Province, Sumatra.
Area: 13,735 ha.
Altitude: Sea level to 813m.
Biogeographical province: 4.2 1.12.
Wetland type: 03, 05 & 07.
Description of site: The Krakatau Islands are situated in the Sunda Strait. The islands (three in total) are geologically unique, and offer a unique possibility for ecological research on colonization by animal and plant species. The vegetation consists of grasslands, beach communities and lowland rain forest with some small patches of mangrove swamp.
Climatic conditions: Humid tropical climate with an annual rainfall of 1,000-2,000 mm. Average temperatures range from 29.9°C to 34.1°C; the relative humidity varies from 70-81%.
Principal vegetation: Mangrove vegetation consisting of species of *Rhizophora, Bruguiera* and *Avicennia.* Other plant communities include grasslands dominated by *Imperata cylindrica and*

Ischaemum sp, dry beach vegetation dominated by *Casuarina equisetifolia* with *Spirifex littoreus, Ipomoea pescaprae, Pandanus tectorius* and *Hibiscus tiliaceus,* and lowland rain forest.
Land tenure: State owned (PHPA).
Conservation measures taken: A Nature Reserve of 2,500 ha was established in 1919. The islands are managed as part of Ujung Kulon National Park. Conservation measure proposed: It has been proposed to extend the protected area seaward.
Conservation measures proposed: None
Land use: Protected area; fishing in the surrounding seas.
Disturbances and threats: Harvesting of turtle eggs, use of explosives for fishing, pollution and illegal visitors.
Economic and social values: The islands have high aesthetic, geological and historial values, and are of outstanding importance for scientific research.
Fauna: Many species of reef fish occur in the waters around the islands. The avifauna includes a variety of sea-birds and waterfowl such as *Fregata ariel, Egretta sacra, Amaurornis phoenicurus, Esacus magnirostris* and *Actitis hypoleucos.* Birds of prey include *Haliastur indus and Jctinaetus malayanus.* Dolphins are common in the surrounding seas and a species of rat *Rattus* is present on the islands. Reptiles include the monitor lizard *Varanus salvator* and the sea-turtles *Chelonia mydas* and *Eretmochelys imbricata.* Invertebrates include *Panulirus* spp and *Lambis lambis.*
Special floral values: No information.
Research and facilities: None
References: BKSDA 11(1983); Direktorat P.P.A. (l983a); Thorton (1986).
Criteria for inclusion: 1b, 2a, 2c.
Source: Marcel J. Silvius and Agustinus W. Taufik.

Wetland name: Pulau Panaitan
Country: Indonesia
Coordinates: 6°32'-6°40'S, 10504'-105°14'E;
Location: off the extreme western tip of Java, north of Ujung Kulon National Park, West Java.
Area: 17,500 ha, including 1,700 ha of mangrove swamp.
Altitude: Sea level to 320m.
Biogeographical province: 4.22.12.
Wetland type: 01, 05, 07 & 21.
Description of site: Panaitan is a relatively large offshore island, some 10 km northwest of Ujung Kulon. It has sandy beaches, a large shallow bay with mangrove swamps, and hills rising to 320m. The terrestrial vegetation consists of dry beach forest and lowland rain forest.
Climatic conditions: Humid tropical maritime climate with an average annual rainfall of 3,140 mm.
Principal vegetation: Mangrove forest with *Sonneratia* spp*, Avicennia* sp and *Nypa fruticans.* Dry beach forest on the coastal sand dunes is dominated by *Pandanus tectorius, Barringlonia asiatica, Hibiscus tiliaceus* and *Terminalia catappa.* The shoreline is often fringed with *Calophyllum inophyllum.* The rain forest is characterized by an abundance of palms, notably species of *Arenga* and *Oncosperma.*
Land tenure: State owned; managed by PHPA.
Conservation measures taken: The island has been protected as a Nature Reserve since 1921, and was declared a National Park in March 1980.
Conservation measures proposed: It has been proposed that the inshore waters surrounding the National Park be designated as a Marine Park.
Land use: Nature conservation and wilderness zone; fishing in the adjacent seas.

Disturbances and threats: Fishing within the park boundaries, oil pollution from passing tankers, the collection of seaweed, and the illegal collection of firewood.
Economic and social values: The island has high scenic values and has considerable potential for outdoor recreation, conservation education and scientific research.
Fauna: Fishes include *Chaetodon* spp, *Balistoides niger, Pomaeanthus* spp, *Platax firmaetus, Asiochus* sp, *Acanthurus* spp*, Seorus* spp and *Ctenochaitus strigonis.*
The island is important for a variety of waterfowl and sea-birds including *Phalacrocorax sulcirostris, Anhinga melanogaster, Fregata ariel, Nycticorax nycticorax, Ardeola speciosa, Egretta sacra, Ardea cinerea, A. sumatrana, Mycteria cinerea, Charadrius mongolus, Numenius phaeopus, Actitis hypoleucos* and *Sterna* spp. Other birds include birds of prey such as *Pandion haliaetus, Haliastur indus, Haliaeetus leucogaster, Jchthyophaga ichthyaetus* and *Falco peregrinus,* and the kingfisher *Halcyon coromanda.*
Mammals known to occur on the island include Sus *scrofa, Tragulus javanicus, Muntiacus munijak, Callosciurus notatis, Paradoxurus herrnaphroditus, Macaca fascicularis, Ratula bicolor, Cuon alpinus* and *Panthera pardus.* Reptiles and amphibians include *Varanus salvator* and species of *Mabouya, Python, Rana.*
Special floral values: No information.
Research and facilities: None
References: Blower & van der Zon (1978); Hoogerwerf (1953).
Criteria for inclusion: lb. 2a, 3b.
Source: Marcel J. Silvius, Edi Djuharsa and Agustinus W. Taufik.

Wetland name: Rawa Danau
Country: Indonesia
Coordinates: 6°11'S, 105°59'E;
Location: 20 km WSW of Serang, West Java.
Area: 2,500 ha.
Altitude: c.90m.
Biogeographical province: 4.22.12.
Wetland type: 12, 14 & 21.
Description of site: A freshwater lake, about 10 km long, and surrounding freshwater swamp forests; one of the few such areas in Java which has not been converted into wet rice cultivation. Fifteen small rivers drain into the lake from the surrounding hills (up to 200m in altitude). There is only one outlet, the Cidana River, which leaves the lake via a 12m waterfall at Curuk Betung, and flows into the Cimanuk. The lake has a maximum depth of about 5m.
Climatic conditions: Humid tropical climate with a dry season between April and October. Temperatures range from 26-33°C.
Principal vegetation: Freshwater swamp forests with a variety of unusual species such as *Alstonia spatulata* and Ficus *retusa. Eichhornia crassipes* is common in the lake.
Land tenure: State owned (PHPA).
Conservation measures taken: The wetland has been protected as a Nature Reserve (Cagar Alarn) since 1921.
Conservation measures proposed: None
Land use: Agriculture and housing in surrounding areas.
Disturbances and threats: Agricultural encroachment. Various development projects, such as the construction of hydro-electric dams, the enlarging of the lake's outlet for rice irrigation, and the piping of water to the steel mills at Cilegon, are likely to have an impact on the wetland in the future.

Economic and social values: The lake constitutes an important water supply for the local steel industry.
Fauna: An important area for a variety of waterfowl including *Phalacrocorax* spp*, Anhinga melanogaster, Ixobrychus sinensis, I. cinnamomeus, Nycticorax nycticorax, Bubulcus ibis, Egretta* spp*, Ardea purpurea, A. cinerea, Gallinula chloropus* and *Porphyrio porphyrio.* Mammals include the leaf monkeys *Presbytis aygula* and *P. cristatus,* and reptiles, the monitor lizard *Varanus salvator.*
Special floral values: The freshwater swamp forest, particularly that found in the southeastern portion of the Nature Reserve, is of great botanical interest in that it includes several tree species, such as *Aistonia spatulata* and *Ficus retusa,* which are rare elsewhere in Java. Other notable species include *Alocasia bantamnensis* and a subspecies of *Coix lachryma-jobi.*
Research and facilities: None
References: Endert (1932); Hoogerwerf (1935); IUCN (in prep); Milton (1984).
Criteria for inclusion: lb. 2b, 3b.
Source: Marcel J. Silvius.

Wetland name: Pulau Dua
Country: Indonesia
Coordinates: 6°01'S**,** l06°12'E;
Location: in Banten Bay on the north coast of Java, 70 km west of Jakarta, West Java.
Area: 30 ha.
Altitude: O-4m.
Biogeographical province: 4.22.12.
Wetland type: 03, 04, 05, 06 & 07.
Description of site: Pulau Dua is a low-lying island of about eight ha, the northern part of which consists mainly of mangrove forest. Parts of the island which were once cultivated are now covered in secondary scrub. Pulau Dua and a small coral island (Pulau Satu) lying approximately 600m to the east are included in a Nature Reserve which also includes a 200m wide buffer zone extending southward into the area of fishponds on the adjacent coast.
Climatic conditions: Humid tropical maritime climate with an annual rainfall of 1,000-2,500 mm, the rain falling throughout the year. Average temperatures range from 18-22°C.
Principal vegetation: Mangrove communities: *Avicennia marina* is dominant in the younger stands of forest; older stands include *Rhizophora* spp*, Lumnitzera racemosa, Aegiceras corniculatum, Sonneratia alba, Bruguiera cylindrica* and *Avicennia marina.* Secondary growth in areas of abandoned cultivation is dominated by *Hibiscus tiliaceus,* with *Sterculia foetida, Allophylus cobbe, Ixora timorensis, Tamarindus indicus* and *Erythrina* sp.
Land tenure: State owned (PHPA).
Conservation measures taken: Pulau Dua (8 ha) has been protected as a Nature Reserve since 1937. In December 1984, the protected area was extended to 30 ha by including the *Avicennia marina* forest.
Conservation measures proposed: None
Land use: Nature conservation; aquaculture, fisheries and recreation in surrounding areas.
Disturbances and threats: Disturbance from fishing activities close to the island, collection of birds' eggs for human consumption, the cutting of firewood, and the conversion of mangrove areas to fishponds. Visiting tourists, scientists and students cause a considerable amount of disturbance to the breeding birds.
Economic and social values: The island has great potential for tourism because of its large waterfowl populations. The area has high scientific value as one of the major waterbird colonies in Java, and has a long history of scientific research.

Fauna: Pulau Dua is one of the two most important breeding sites for colonially nesting cormorants, herons, egrets, storks and ibises in Java. In 1985, there were at least 7,500 nests of 11 species: *Phalacrocorax niger, Ixobrychus cinnamomeus, Nycticorax nycticorax, Butorides striatus, Ardeola speciosa, Bubulcus ibis, Egretta sacra, E. garzetta, E. alba, Ardea sumatrana* and *Plegadis falcinellus.* Five species which formerly bred on the island, *Anhinga melanogaster, Ardea purpurea, Mycteria cinerea, Threskiornis melanocephalus* and *Platalea leucorodia,* have ceased to do so, probably because of excessive disturbance. A sixth species, *E. garzetta* has also ceased to breed in recent years. Other water birds which have been recorded in the reserve include *Fregata andrewsi, Anas gibberifrons, Pandion haliaetus, Haliastur indus, Redlus striatus, Pluvialis dominica, Charadrius mongolus, Numenius phaeopus, Tringa nebularia, T. glareola, Actitis hypoleucos* and *Calidris ruficollis.*
Reptiles include *Varanus salvator* and *Mabouya multifasciata.*
Special floral values: No information.
Research and facilities: Ailport and Wilson (1986) carried out a waterfowl survey in 1985.
References: Allport & Wilson (1986); Direktorat P.P.A. (1978a & 1980f); Milton & Marhardi (1985 & 1986).
Criteria for inclusion: lb. 2b, 2c, 3a.
Source: Marcel J. Silvius.

Wetland name: Pulau Rambut
Country: Indonesia
Coordinates: 5°58'S, 106°42'E;
Location: in the Seribu Islands (Kepulauan Seribu) in Jakarta Bay, 25 km northwest of Jakarta, West Java.
Area: 56 ha island with 18 ha of mangroves.
Altitude: 0-3m.
Biogeographical province: 4.22.12.
Wetland type: 03, 06 & 07.
Description of site: A small low-lying coral atoll with mangrove forests, dense primary forest and large areas of secondary shrub produced by old shifting cultivation in the centre of the island. Most of the island is subject to tidal inundation.
Climatic conditions: Tropical monsoonal climate.
Principal vegetation: Mangrove forest.
Land tenure: State owned.
Conservation measures taken: The island is protected as a Nature Reserve (Cagar Alam), and wardened by a PHPA guard.
Conservation measures proposed: It is recommended that the presence of the PHPA guard on the island be increased, and that all fish wires be removed from within the boundaries of the Nature Reserve. A research programme should be initiated to monitor the levels of heavy metals and organo-chlorines in the eggs of nesting water birds.
Land use: Nature reserve.
Disturbances and threats: Visitors to the island, including fishermen, cause disturbance to the nesting birds. There are still some ten feral house cats of both sexes present on the island. There are high levels of heavy metal and organic pollution in Jakarta Bay.
Economic and social values: No information.
Fauna: The island supports one of the two largest breeding colonies of large water birds in Java. Breeding species include *Phalacrocorax niger, Anhinga melanogaster, Nycticorax nycticorax, Bubulcus ibis, Egretta sacra, E. garzetta, E. intermedia, E. alba, Ardea purpurea, A. cinerea* and *Mycteria cinerea.* Other species which have been recorded on the island include *Fregata andrewsi,*

F. ariel, Butorides striatus, Ardeola speciosa, Ardea sumatrana, Leptoptilos javanicus, Threskiornis melanocephalus, Plegadis falcinellus, Haliastur indus, Haliaeetus leucogaster, Heliopais personata, Pluvialis dominica, Numenius phaeopus, N. arquata and *Actitis hypoleucos.* There is a roost of about 20,000 flying foxes *Pteropus vampyrus* in *Sterculia* trees, and the monitor lizard *Varanus salvator* is very common throughout the island.
Special floral values: No information.
Research and facilities: Several waterfowl surveys have been carried out.
References: Allport & Wilson (1986); Karpowicz (1985); Milton & Marhardi (1984).
Criteria for inclusion: 1b, 2a, 2b, 2c, 3b.
Source: Marcel J. Silvius and Eva T. Berczy.

Wetland name: Muara Gembong
Country: Indonesia
Coordinates: 6°00'-6°05'S, l06°57'-107°02'E;
Location: 25 km northeast of Jakarta, Kabupaten Bekasi, West Java.
Area: 10,481 ha (undisturbed area c.l,000 ha).
Altitude: 0-15m.
Biogeographical province: 4.22.12.
Wetland type: 02, 07, 10, 11 & 21.
Description of site: A large estuarine zone of tidal mudflats, fishponds and degraded mangrove scrub, with a patch of relatively undisturbed mangrove forest and freshwater swamp on the northern shore.
Climatic conditions: Tropical monsoonal climate with the annual rainfall varying from 1,500 to 6,000 mm. The winds are westerly from December to February, and easterly in June and July. The temperature ranges from 23-32°C, the relative humidity from 77-99%.
Principal vegetation: Mangrove communities with species of *Rhizophora, Avicennia, Sonneratia, Bruguiera,* and *Nypa fruticans;* freshwater swamp with *Acanthus sp, Fimbristylis dichotoma* and *Phragmites karka.*
Land tenure: State owned (Forest Management Unit III, West Java).
Conservation measures taken: None.
Conservation measures proposed: The area has been proposed as a Nature Reserve.
Land use: Aquaculture (fishponds) in adjacent areas.
Disturbances and threats: Coastal erosion and pollution by waste from nearby settlements.
Economic and social values: The mangrove forest plays a valuable role in protecting the coastline against erosion.
Fauna: Waterfowl include *Phalocrocorax sp, Nycticorax nycticorax, Bubulcus ibis, Egretta spp*, *Ardea sp, Mycteria cinerea, Leptoptilos javanicus, Plegadis falcinellus* and many migratory shorebirds. Mammals include *Macaca fascicularis, Presbytis cristata, Panthera pardus* and *Sus sp*. Reptiles include *Varanus salvator* and *Mabouya multifasciata.* Invertebrates include *Terebralia sp*, *Telescopium telescopium, Coluta sp, Cerithium sp*, *Neritunis violacea* and *Castidule sp*.
Special floral values: No information.
Research and facilities: None
References: Allport & Wilson (1986).
Criteria for inclusion: 1b, 2a, 3b.
Source: Marcel J. Silvius and Edi Djuharsa.

Wetland name: Tanjung Sedan
Country: Indonesia

Coordinates: 5°55'-6°00'S, 107°00'-107°05'E;
Location: 30 km northeast of Jakarta, Kabupaten Bakasi, West Java.
Area: 8,200 ha.
Altitude: 0-lOm.
Biogeographical province: 4.22.12.
Wetland type: 02, 05, 06 & 07.
Description of site: A mangrove area in the northern part of West Java, influenced by the Citarum River. In recent years, most of the mangrove swamp has been converted to aquaculture ponds. Only one small area (1,000 ha) of healthy mangrove forest remains, near Ujung Karawang in the Litarum Delta.
Climatic conditions: Humid tropical climate with an annual rainfall varying from 1,500 mm to as much as 6,000 mm. The temperature ranges from 23-32°C, the relative humidity from 77-99%.
Principal vegetation: Mangrove communities with species of *Rhizophora, Avicennia, Sonneratia, Excoecaria, Aegiceras, Bruguiera, Acanthus* and *Cerops, Nypa fruticans, Derris trifoliata, Carex* sp and *Hibiscus tiliaceus.*
Land tenure: State owned (Bekasi Government).
Conservation measures taken: None.
Conservation measures proposed: The area has been proposed as a Nature Reserve (Cagar Alam).
Land use: Fishing and aquaculture; agriculture in adjacent areas.
Disturbances and threats: Felling of mangroves, encroachment by aquaculture ponds, and disposal of waste.
Economic and social values: The mangrove swamp is an important breeding and nursery area for marine fishes and shrimps, including the fry used in the aquaculture schemes. The mangrove forest also serves a valuable function in controlling coastal erosion.
Fauna: Economically important fishes include *Panchax panchax, Dermagenys* sp*, Anabas* sp*, Trichogaster* sp*, Prisopthalmus* sp*, Chanos channos* and *Tilapia mossambica.*
The area is rich in water birds, particularly cormorants, herons, egrets and storks. Species known to occur include *Phalacrocorax niger, P. sulcirostris, Anhinga melanogaster, Ixobrychus sinensis, Nycticorax nycticorax, Bubulcus ibis, Butorides striatus, Egretta sacra, E. garzetta, E. alba, Ardea purpurea, A. cinerea, A. sumatrana, Mycteria cinerea* (20-25 individuals), *Leptoptilos javanicus, Plegadis falcinellus, Dendrocygna javanica, Anas gibberifrons, Amaurornis phoenicurus* and *Himantopus himantopus.*
Mammals include *Macaca fascicularis, Presbytis cristata, Fe/is marmorata* and *Sus* sp. Reptile include *Varanus salvator, Boiga dendrophila* and *Mabouya multifasciata.*
Special floral values: No information.
Research and facilities: None
References: BKSDA III (1983).
Criteria for inclusion: 1b, 2a, 2b, 3b.
Source: Marcel J. Silvius, Agus Marhardi and Edi Djuharsa.

Wetland name: Muara Bobos
Country: Indonesia
Coordinates: 6°15'S, 107°45'E;
Location: 100 km east of Jakarta, Kabupaten Subang and Karawang, West Java.
Area: 1,000 ha.
Altitude: O-5m.
Biogeographical province: 4.22.12.
Wetland type: 02, 05, 07, 10 & 11.

Description of site: A coastal area of swamps, fishponds, canals and rivers, with some good patches of mangrove forest. Part of the coastline is eroding, in particular near the mouths of the Cilamayu, Poponcol and Bobos Rivers.
Climatic conditions: Humid tropical climate with an annual rainfall of 2,000-3,000 mm. Average temperatures range from 26°C to 32°C; the average relative humidity is 80%.
Principal vegetation: Mangrove swamps with *Avicennia alba, A. officinalis, Bruguiera gymnorhiza, B. sexangula, B. parviflora, Rhizophora apiculata, R. mucronata, Excoecaria agallocha, Sonneratia acida, Lumnitzera littorea, Ceriops tagal* and *Acanthus illicifolius;* fresh to brackish swamps and marshes with *Pluchea indica, Derris heterophylla, Portulaca aleracea, Scirpus littoralis, S. grossus, Paspalum vaginatum, Fibristylis spathacea, F. polyfrichoides, Dolichandrone spathacea, Acrostichum aureum, Sesuvium portulacastrum* and *Suaeda maritina. Hibiscus tiliacea, Melaleuca* sp and *Pluchea indica* in adjacent areas.
Land tenure: State owned (Indonesian Government); managed by BKPH-Pamanukan, Forest Department Unit II, West Java.
Conservation measures taken: The area was established as protection forest by the former Government of the Netherlands in 1915.
Conservation measures proposed: The wetland has been proposed as a Nature Reserve (Cagar Alain).
Land use: Aquaculture and fisheries; aquaculture, agriculture and fisheries in adjacent areas.
Disturbances and threats: Cutting of trees for firewood.
Economic and social values: The estuarine ecosystem is important as a breeding and nursery area for many marine fishes and crustaceans.
Fauna: The wetland supports a wide variety of fishes and crustaceans of economic importance including *Mugil cephalus, Anabas* sp*, Amblyrochotus* sp*, Periopthalmus* sp*, Ophiocephalus melanopterus, Therapen jarbus, Stolephorus* sp*, Mermogenys* sp*, Ostracion tuberculatus, Epinephalus* sp, *Panchax panchax, Lactoria cornuta, Siganus verniculator, Chanos chanos, Tilapia mossambica, Macrobrachium* s*p, Penaeus brevicornis, P. orientalis, Scylla serrata, Lates calcariforus* and *Neptunus pelagicus.*
The site is important for a wide variety of water birds including *Phalacrocorax* sp*, Nycticorax nyclicorax, Ardeola speciosa, Butorides striatus, Egretta* spp, *Ardea purpurea, A. cinerea, Mycteria cinerea, Leptoptilos javanicus, Plegadis falcinellus, Threskiornis melanocephalus, Dendrocygna arcuata, D. javanica, Numenius phaeopus, Actitis hypoleucos* and *Sterna* spp. The sea-eagle *Haliaeetus leucogaster* and the kingfishers *Alcedo caerulescens* and *Halcyon chloris* also occur in the area.
Mammals include *Felis* sp*, Sus* sp*, Macaca fascicularis* and *Ambyonix cinerea.* Reptiles and amphibians include *Testudo* sp, *Varanus* sp*, Boiga dendrophila, Mabouya multifasciata, Bufo melanostrictus* and *Rana limnocharis.*
Special floral values: None known.
Research and facilities: Several faunal and floral surveys have been carried out. Naamin (1987) has studied the impact of shrimp aquaculture on the mangrove ecosystem in Ciasem Bay.
References: BKSDA III (1982a & l982b); Naamin (1987).
Criteria for inclusion: 1b, 2a, 2b, 2c, 3b.
Source: Marcel J. Silvius, Agus Marhardi and Edi Djuharsa.

Wetland name: Muara Cimanuk
Country: Indonesia
Coordinates: 6°13'-6°20'S, lO8°O9'-lO8°l9'E;
Location: 60 km NNW of Cirebon, Kabupaten Indramayu, West Java.
Area: 7,127 ha.

Altitude: O-8m.
Biogeographical province: 4.22.12.
Wetland type: 02, 05, 07, 10, 1 1 & 21.
Description of site: An estuarine system with extensive mangrove forests, sandy beaches and some adjacent swamp forest. The area represents one of the largest remaining examples of mangrove swamp habitat on the north coast of Java. Large areas have, however, been reclaimed for fishponds and agricultural land, and only 1,000 ha of mangrove forest near the Cimanuk River remain in a healthy condition. The tidal range is O.5-lm.
Climatic conditions: Humid tropical climate with an annual rainfall of 1,000-1,500 mm. The mean temperature is 27°C; the relative humidity varies from 65-78%.
Principal vegetation: Mangrove forest with *Rhizophora mucronata, R. conjugata, Avicennia* sp, *Bruguiera parviflora, B. gymnorhiza, Sonneratia alba, S. acida, Aegiceras corniculatum, Ceriops candoleana, Oncosperma filamentosa* and *Excoecaria agallocha.* Plant communities in adjacent areas include *Hibiscus tiliaceus, Xylocarpus granatum, Acrostichum aureum, Pandanus* sp, *Ficus retusa, Heritiera littoralis, Pluchea indica, Sesuvium portulacastrum, Pararnignya littoralis* and *Acanthus ilicifolius.*
Land tenure: State owned (Forestry Department).
Conservation measures taken: None.
Conservation measures proposed: The site has been proposed as a mangrove conservation area.
Land use: Some illegal exploitation of forest products; wet rice cultivation, fisheries, livestock grazing and forestry in surrounding areas. The hunting of waterfowl for human consumption is widespread in the area.
Disturbances and threats: Illegal felling of mangrove for timber and firewood, high rates of siltation, enhanced natural flooding, expansion of fishponds, and pollution from waste disposal, rubbish tips and sewage. The hunting pressure on water birds is extremely heavy. In a recent study of waterbird hunting in northern Java, it was estimated that about 300,000 birds are trapped for food each year in the Cirebon-Indramayo region alone. Mobile teams of trappers use whistles and horns to attract the birds, which are then trapped in mist-nets. About 100,000 of these are shorebirds, particularly Oriental Pratincoles *Glareola maldivarum.*
Economic and social values: The mangrove forest supports an important fishery resource.
Fauna: The rich fish fauna includes *Mugil cephalus, Ostracion tuberculatus, Chanos chanos, Ephinephalus sp, Tilapia mossambica, Lactoria cernuta, Siganus verniculator, Pletasus anguilaris* and *Periophthalamus* sp.
Water birds include *Phalacrocorax sulcirostris, P. niger, Nycticorax nycticorax, N. caledonicus, Ardeola bacchus, A. speciosa, Egretta sacra, E. garzetta, Ardea purpurea, A. cinerea, Mycteria cinerea, Leptoptilos javanicus, Plegadis falcinellus, Threskiornis melanocephalus, Dendrocygna* sp, *Rostratula benghalensis, Numenius phaeopus, Tringa stagnatilis, Actitis hypoleucos* and the kingfishers *Alcedo caerulescens* and *Halcyon chioris.*
Mammals include *Sus* sp, *Felis* sp*, Panthera pardus* and *Macaca fascicularis.* Reptiles include *Mabouya multifasciata, Varanus salvator, Python* sp*, Vipera russeli, Boiga dendrophylla* and *Trimeresurus albolabris.*
Special floral values: No information.
Research and facilities: Basic faunal and floral surveys have been carried out, and WWF, PHPA and the Asian Wetland Bureau have conducted a joint study of waterfowl hunting in the area.
References: BKSDA III (l982c); Direktorat P.P.A. (1982/83); MacKinnon & Artha (l982b).
Criteria for inclusion: lb. 2a, 3b.
Source: Agustinus W. Taufik, Edi Djuharsa and Agus Marhardi.

Wetland name: Karimun Jawa Archipelago

Country: Indonesia
Coordinates: 5°43'-5°55'S, 110°10'-110°37'E;
Location: 70 km off the north coast of Central Java, Kabupaten Jepara, Central Java.
Area: 7,026 ha.
Altitude: Sea level to 512m.
Biogeographical province: 4.22.12.
Wetland type: 03, 04, 05, 06 & 07.
Description of site: The Karimun Jawa Islands comprise an archipelago of 27 small islets, of which Karimun Jawa is the largest. Only seven of the islands are inhabited. The vegetation consists mainly of mangrove and beach forest, although there is some lowland rain forest on Karimun Jawa. Most of the islands are surrounded by sandy beaches and fringing coral reefs. Fresh water is confined to a few small wells and forest streams on Karimun Jawa. The average tidal range is 92 cm.
Climatic conditions: Humid tropical maritime climate with an average annual rainfall of 2,632 mm. Average temperatures range from 20-30°C.
Principal vegetation: Mangrove forest with species of *Rhizophora, Avicennia* and *Bruguiera;* dry beach forest with *Casuarina fistula, Barringtonia asiatica* and *Hibiscus tiliaceus.*
Land tenure: State owned; managed by PHPA.
Conservation measures taken: The islands have been designated as a Marine Nature Reserve (Cagar Alam Laut).
Conservation measures proposed: None
Land use: Wildlife conservation; there is some agriculture on the inhabited islands and fishing in the surrounding waters.
Possible changes in Land use: There is a project to develop rice cultivation and aquaculture (fishponds) on the islands.
Disturbances and threats: Cutting of mangroves for firewood; the collection of shells, particularly clams; the killing of sea-turtles and harvesting of their eggs; development of fishponds; dynamite fishing on the coral reefs.
Economic and social values: The archipelago has considerable potential for scientific research.
Fauna: The rich fish fauna includes many edible species and a great variety of ornamental fishes.
Many water birds and sea-birds have been recorded including *Phalacrocorax niger, Ixobrychus sinensis, I. eurhythmus, Ardeola speciosa, Egretta sacra, Pandion haliaetus, Esacus magnirostris, Glareola maldivarum, Numenius phaeopus, Gallinago stenura, Actitis hypoleucos, Sterna bergii, Anous stolidus* and the kingfishers *Halcyon sancta* and *H. chloris.*
Mammals include *Felis bengalensis, Cervus timorensis, Muntiacus muntjak, Sus* sp, *Macaca* sp and small cetaceans.
The sandy beaches are important nesting sites for the sea-turtles *Chelonia mydas* and *Eretmochelys imbricata.* Other reptiles include *Varanus salvator* and *Python* sp.
Invertebrates include *Tridacna gigas.*
Special floral values: No information.
Research and facilities: Basic faunal and floral surveys have been carried out.
References: Direktorat P.P.A. (1980g & 1986c).
Criteria for inclusion: lb. 2a, 2c, 3b.
Source: Marcel J. Silvius and Agustinus W. Taufik.

Wetland name: Pulau Bawean
Country: Indonesia
Coordinates: 5°43'-5°52'S, 112°34'-112°48'E;

Location: in the Java Sea, 110 km north of mainland Java (150 km north of Surabaya) and about 250 km south of Kalimantan, East Java.
Area: Island 20,000 ha; Wildlife Reserve 1,220 ha; Telaga Kastoba Lake c.24 ha.
Altitude: Sea level to 655m.
Biogeographical province: 4.22.12.
Wetland type: 05, 07, 14 & 19.
Description of site: The island of Bawean is the remains of an old volcano; it is roughly circular in shape with an average diameter of about 15 km and an area of about 20,000 ha. The oldest, outermost crater is no longer easily distinguishable, but a more recent crater containing the lake Telaga Kastoba is readily identifiable. This lake is about 600m long and 400m wide, and has a maximum depth of 140m. There are many streams and also hot springs in limestone areas at four different elevations on the island. In coastal areas, the soils consist of alluvial river deposits of grey clay; these are used for the cultivation of rice. There are many small patches of mangrove swamp around the coast. Most of the human population is concentrated near the coast and on the south side of the island.
Climatic conditions: A rather dry tropical monsoonal climate. The heaviest rains and strongest winds occur during the northwest monsoon, from December to March (1,000 mm of precipitation). The driest months are July (50 mm) and August (23 mm). The average daily maximum temperature is about 30°C, the average daily minimum 24.5°C.
Principal vegetation: Mangrove forest characterized by species such as *Sonneratia alba, Rhizophora mucronata* and *Bruguiera cylindrica.* Common plants elsewhere on the island include *Barringtonia asiatica, Calophyllum inophyllum, Hibiscus tiliaceus, Vitex* sp, *Canarium asperum Pternandra coerulescens, Ixora* sp*, Ficus* sp, *Symplocos adenophylla* and *Eugenia lepidocarpa.*
Land tenure: State owned (Government of Indonesia).
Conservation measures taken: None.
Conservation measures proposed: An area of 1,220 ha has been proposed as a Wildlife Reserve, and a managment plan has been prepared (WWF, 1979).
Land use: Fishing, agriculture and teak plantations.
Disturbances and threats: Illegal wood-cutting, deliberate burning of vegetation, shifting cultivation and hunting.
Economic and social values: No information.
Fauna: The island is especially important as the home of the threatened Bawean Deer. Other mammals include *Sus verrucusus, Viverricula malaccensis, Paradoxurus hermaphroditus, Hystrix javanica, Macaca fascicularis, Pteropus* sp*, Cynopterus brachyotis* and *Megaderma spasma.* Waterfowl and sea-birds include *Fregata minor, Nycticorax nycticorax, Ardea purpurea, Gelochelidon nilotica, Sterna sumatrana* and *S. anaethetus.* Reptiles and amphibians include the Estuarine Crocodile *Crocodylus porosus, Varanus* sp*, Python reticulatus, Bungarus candidus* and *Bufo* sp.
Special floral values: No information.
Research and facilities: Blouch and Sumaryoto (1978) carried out a preliminary survey of the status of the Bawean Deer.
References: Blouch & Sumaryoto (1978); Blower (1975); WWF (1979).
Criteria for inclusion: lb. 2a.
Source: Agustinus W. Taufik.

Wetland name: Sedayu Mangroves
Country: Indonesia
Coordinates: 7°0O'S, 112°38'E;
Location: near Sedayu, about 30 km NNW of Surabaya, East Java.

Area: c. 10 ha.
Altitude: Sea level.
Biogeographical province: 4.22.12.
Wetland type: 07 & 10.
Description of site: A small patch of mangrove forest, once part of an extensive belt of coastal mangroves. The mangrove forest is backed by a belt of *Nypa* palms about one km wide, but this is now much degraded. There are extensive intertidal mudflats along the seaward edge of the mangroves, and numerous brackish water and freshwater fishponds in adjacent areas.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest consisting of *Avicennia* sp and *Rhizophora,* and *Nypa fruticans.*
Land tenure: No information.
Conservation measures taken: The mangrove forest is protected by the local people. There is one guard to patrol the area.
Conservation measures proposed: None
Land use: Forest protection; aquaculture in adjacent areas.
Disturbances and threats: The mangrove forest at the site and in adjacent areas has been heavily disturbed by logging, reclamation and pollution. This has led to a reduction in income from the inshore fishery.
Economic and social values: No information.
Fauna: The mangrove forest supports a mixed breeding colony of large water birds containing several hundred nests. Breeding species include *Phalacrocorax* spp*, Anhinga melanogaster, Bubulcus ibis, Egrelta* spp, *Ardea purpurea, A. cinerea* and *Threskiornis mekinocephalus.* The Milky Stork *Mycteria cinerea* is present throughout the year but does not breed at the *site. Porphyrio porphyrio* is common. Flocks of up to 100 migratory shorebirds have been recorded in the immediate vicinity of the site during the migration periods.
Special floral values: None known.
Research and facilities: A preliminary survey has been carried out by PHPA.
References: None
Criteria for inclusion: 1b, 2a, 2c, 3b.
Source: Marcel J. Silvius.

Wetland name: Sukolilo
Country: Indonesia
Coordinates: 7°16'S, 112°47'E;
Location: in the Brantas Delta, southeast of Surabaya near Kecamatan Sukolilo, East Java.
Area: c.1 ha.
Altitude: Sea level.
Biogeographical province: 4.22.12.
Wetland type: 07 & 10.
Description of site: A small patch of protected mangrove forest (one ha) situated in a large area of aquaculture ponds. There are extensive intertidal mudflats along the adjacent coast, but other mangrove forest in the area has been heavily disturbed.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest.
Land tenure: No information.
Conservation measures taken: The one hectare patch of forest is protected by the local people, and there has been some replanting of mangroves.

Conservation measures proposed: The site has been proposed as a Strict Nature Reserve (Cagar Alam).
Land use: Protected forest; aquaculture in surrounding areas.
Disturbances and threats: The site lies only three km from the town of Surabaya and is seriously threatened by reclamation for real estate development. Intensive logging has greatly depleted the mangrove zone in adjacent areas, and some of the surrounding mangrove areas have been filled in with stones and boulders to provide a recreational site. Local youths often shoot at the breeding birds when they fly away from the protected forest over the unprotected aquaculture ponds.
Economic and social values: The mangroves formerly supported a major fishery. However, the inshore fishery has declined drastically with the depletion of the mangrove forests, and fishing vessels now have to go much further out to sea.
Fauna: The protected mangrove forest supports a mixed breeding colony of large water birds containing several hundred nests. The breeding species include *Phalacrocorax sulcirostris, P. niger, Anhinga melanogaster, Egretta sacra, E. garzetta, E. intermedia* and *E. alba.* Other species which occasionally visit the colony include *Bubulcus ibis, Ardea purpurea, A. cinerea* and *Threskiornis melanocephalus.* Flocks of up to several hundred migratory shorebirds have been recorded on the nearby mudflats.
Special floral values: None known.
Research and facilities: The area has never been adequately surveyed, and information is very incomplete.
References: None
Criteria for inclusion: lb., 2c, 3b.
Source: Marcel J. Silvius.

Wetland name: Ijen Merapi Ungup (Ungup Crater)
Country: Indonesia
Coordinates: 8°04'S, 114°l5'E;
Location: on the west slope of Merapi Volcano, 50 km ESE of Bondowoso, Bondowoso and Banyawangi Districts, East Java.
Area: Lake c.50 ha; Nature Reserve 2,560 ha.
Altitude: Lake 2,560m; Nature Reserve 1,000-2,800m.
Biogeographical province: 4.22.12.
Wetland type: 14 & 17.
Description of site: A small crater lake (Ijen Lake) with many sulphur fumeroles, on the Ijen Massif in the Ijen Merapi Ungup Nature Reserve. The lake measures approximately 910m from east to west and 600m from north to south. Most of the reserve is hilly with sharp relief (over 30%) except in the eastern and southern parts, which are relatively flat. Much of the area retains climax forest, but the western slope of Ijen Crater is frequently burned and has lost most of its forest. The Ijen Massif is the source of many rivers, which are used to irrigate large areas of rice paddy in the densely populated lowlands.
Climatic conditions: Humid tropical to subtropical climate, depending on altitude, with an average annual rainfall of 1,997 mm. Temperatures on the plateau average about 20°C. There is a pronounced dry season during the southeast monsoon, particularly in northern areas, which lie in the rain shadow of the high mountains. Most of the rain falls during the west monsoon, the rain commencing in the south and moving northwards.
Principal vegetation: The aquatic vegetation includes Ficus spp, *Schleichera oleosa* and *Pternis wallichiana*. Forests at lower elevations are dominated by *Casuarina* sp*;* the higher, montane forest is dominated by *Albizzia montana.* Grasslands in the highlands are dominated by Themida sp, Saccharum spontaneum and *Cymbopogon vardus.*

Land tenure: State owned; managed by PHPA.
Conservation measures taken: The crater lake is protected in a Nature Reserve (2,560 ha) established in October 1920.
Conservation measures proposed: There has been a proposal to link the Nature Reserve with the existing Maelang Reserve and proposed Raung Mountain Reserve for possible future development as a National Park.
Land use: The lake acts as a natural water storage reservoir. The Nature Reserve was established to protect the forested water catchment areas of several rivers. Sulphur is mined in the area, and the surrounding lowlands are under intensive cultivation.
Possible changes in Land use: The sulphur industry may be expanded.
Disturbances and threats: Man-made fires, erosion in sulphur mining areas, shifting cultivation, and illegal logging and wood-cutting.
Economic and social values: The area is of considerable geological and botanical interest, and has high scenic values. The reserve performs a valuable function in protecting forested watersheds and preserving water supplies to the surrounding lowlands.
Fauna: Little information is available. The only water birds known to occur are *Ardeola speciosa, Bubulcus ibis* and several species of kingfishers. Mammals known to occur in the
Nature Reserve include *Sus* sp, *Muntiacus muntjak, Macaca* sp*, Cuon javanicus, Paradoxurus herrnaphroditus* and *Panthera pardus.*
Special floral values: No information.
Research and facilities: None
References: Direktorat P.P.A. (l976b); FAO (1979b & l982a).
Criteria for inclusion: la.
Source: Agustinus W. Taufik.

Wetland name: Wetlands in Bali Barat National Park
Country: Indonesia
Coordinates: 8°05'-8°l5'S, 114°26'-l14°35'E;
Location: at the extreme western tip of the island of Bali, Kabupaten Bulaleng, Bali.
Area: Area of wetlands unknown; Bali Barat National Park 19,600 ha.
Altitude: Sea level to 200m.
Biogeographical province: 4.22.12.
Wetland type: 01, 05 & 07.
Description of site: A rather dry area at the western tip of the island of Bali. The main wetland habitat consists of about 35 km of beach, 300 ha of mangrove forest and scrub, and 40 ha of sea-grass beds. Most of the beaches are sandy. The mangrove has been extensively cut over and is in a rather degraded state. This exploitation still continues in the Cilimanuk area.
Climatic conditions: Tropical climate with an average annual rainfall of about 1,671 mm. Average temperatures range from 22-24°C.
Principal vegetation: Mangrove communities with *Rhizophora stylosa, R. apiculata, Sonneratia alba, Avicennia marina, Bruguiera gymnorhiza, Ceriops tagal, Aegiceras corniculatum, Excoecaria agallocha, Lumnilzera* sp and *Nypa fruticans.* Dry beach vegetation in adjacent areas.
Land tenure: State owned (PHPA).
Conservation measures taken: The area was first protected as a Wildlife Reserve in 1947. In 1978, four islands totaling 175 ha and three islets totaling 18 ha were added to the Reserve. In 1980, the Reserve was given the status of National Park.
Conservation measures proposed: None
Land use: Nature conservation; fishing and brackish water aquaculture in adjacent areas.

Disturbances and threats: Illegal construction of roads within the Park, cutting of mangroves, mining of coral reefs, occasional hunting of sea-turtles, illegal fishing with dynamite and poisons, poaching and illegal settlement. Poaching for the Indonesian domestic pet market is the key factor in the decline of the endemic Bali Starling *Leucopsar rothschildi.*
Economic and social values: The mangroves support a locally important fishery. The National Park has great scenic values and considerable potential for tourism and scientific research.
Fauna: The coral reefs support a very diverse fish fauna. The National Park supports the largest surviving population of the endemic Bali Starling *Leucopsar rothschildi.* The total population of this highly endangered species was estimated at 104 individuals in August 1984 and only 48 individuals in August 1987. Nest-boxes introduced in 1984 and 1986 have so far proved unattractive to the birds, and it is now thought that the population in the wild is no longer viable. Water birds include sea-birds such as *Fregata minor, Sterna dougallii, S. sumatrana, S. bergii* and S. *hirundo,* and a variety of migratory shorebirds such as *Charadrius dubius, Limosa limosa, Numenius phaeopus, N. arquata, Tringa totanus, T. nebularia, Actitis hypoleucos* and *Calidris alba.*
The National Park supports a variety of mammals including Sus *vittatus, Felis bengalensis, Paradoxurus hermaphroditus, Macaca fascicularis, Cervus sp, Muntiacus muntjak, Manis javanica, Hystrix brachyura, Ratufa bicolor, Pteropus edulis* and *Bos javanicus* (wild herds of 30-40 individuals). Reptiles include the sea-turtle *Eretmochelys imbricata,* monitor lizard *Varanus salvator, Python* sp and *Mabouya* sp.
Special floral values: There is a small stand of the uncommon *Manilkara kauri,* much valued for wood-carving.
Research and facilities: A considerable amount of research has been carried out on the Bali Starling.
References: Direktorat P.P.A. (l980i & l982c); IUCN (in prep); Kvalvagnaes *et al.* (1984).
Criteria for inclusion: 1b, 2b, 3b.
Source: Agustinus W. Taufik and Marcel J. Silvius.

Wetland name: Kangean Archipelago **Country:** Indonesia
Coordinates: 6°30'-7°12'S, 115°11'-116°16'E;
Location: in the Bali Sea, 120 km east of Madura Island and 120 km north of Bali, Kabupaten Sumenep, East Java.
Area: 25,252 ha, including 12,910 ha of mangrove swamp.
Altitude: Sea level to 390m.
Biogeographical province: 4.22.12.
Wetland type: 05 & 07.
Description of site: The Kangean Islands are a group of about 30 islands situated 120 km north of Bali and east of Madura. The largest island is Kangean, with a length of 40 km and width of 25 km. The island group consists of coral-lime heaved up by volcanic action. The greater part of Kangean is hilly, although there are some lowland areas at the southern end. A large part of the western half of the north coast is bordered by sandy beaches, while the eastern half and a part of the southern plain are fringed with coral reefs and overgrown with mangroves. A tropical sub-montane forest covers the hill ridge in the central and northern parts of the main island. There are still large areas of undisturbed mangrove forest in the archipelago, mainly at the southern end of Kangean and on some of the smaller islands such as Saubi.
Climatic conditions: Tropical monsoonal climate. The wet monsoon lasts from October to March, and the dry season begins in late April or May. During the dry season, the average daily temperature reaches 31-32°C, while during the wet monsoon, the average daily temperature is 28°C.

Principal vegetation: Mangrove forest with *Rhizophora* sp*, Bruguiera* sp, *Sonneratia acida* and *Calophyllum inophyllum.* The vegetation in the interior of the islands includes *Terrninalia catappa, Aistonia* sp*, Mangifera indica, Lantana* sp and *Tectonia grandis.*
Land tenure: State owned (Local Government of East Java).
Conservation measures taken: None.
Conservation measures proposed: The islands have been proposed as a Nature Reserve and Marine Conservation Area.
Land use: Fishing and agriculture.
Disturbances and threats: Dynamite fishing, over-exploitation of the forestry resources, hunting of dugong and sea-turtles, and increased human settlement.
Economic and social values: The islands have considerable potential for conservation education and scientific research.
Fauna: Fishes include *Decapterus* spp*, Clupea biogaster, Heriramphus* sp, *Eutlzymus* sp, *Scomberomorus commersoni* and *Chanos chanos.*
The islands are important for a wide variety of waterfowl and sea-birds including *Phalacrocorax sulcirostis, Fregata ariel, Nycticorax nycticorax, Ardeola speciosa, Bubulcus ibis, Butorides striatus, Egretta sacra, E. garzetta, Ardea purpurea, A. cinerea, Dendrocygna javanica, Anas superciliosa, Numenius phaeopus, Tringa glareola, Actitis hypoleucos, Sterna sumatrana, S. bergii* and *S. albifrons.* Other birth of note include the raptors *Pandion haliaetus, Haliastur indus, Haliaeetus leucogaster;* the pigeons *Ducula biccior, Caloenas nicobarica;* and the kingfishers *Alcedo meninting, Ceyx rufidorsus* and *Halcyon sancta.* The endangered Dugong *Dugong dugon* still occurs in the shallow seas around the islands. Terrestrial wildlife includes *Felis temmincki, Panthera pardus, Macaca fascicularis, Presbytis cristata, Muntiacus muntjak, Cervus timorensis, Paradoxurus hermaphroditus, Viverricula malaccensis, Rattus rattus, Cynopterus brachyotis, Myotis adversus, Hipposideros lar vatus, Rinolophus madurensis* and *Neofelis nebulosa.*
Reptiles include the Green Sea Turtle *Chelonia mydas,* Hawksbill Turtle *Eretmochelys imbricata* and monitor lizard *Varanus salvator.*
Special floral values: No information.
Research and facilities: Basic faunal and floral surveys have been carried out.
References: Direktorat P.P.A. (1986d); de Iongh *et al. (1982).*
Criteria for inclusion: lb. 2a, 2b, 2c, 3b.
Source: Agustinus W. Taufik and Marcel J. Silvius.

Wetland name: Gunung Jagatamu
Country: Indonesia
Coordinates: c.8°34'S, 1 l4°00'E;
Location: near the southeast tip of Java, 60 km southwest of Banyuwangi, Kabupaten Banyuwangi, East Java.
Area: 1,860 ha.
Altitude: Sea level to 350m.
Biogeographical province: 4.22.12.
Wetland type: 04, 05, 07 & 21.
Description of site: A hilly coastal area with mangrove swamps, beach forest and lowland rain forest.
Climatic conditions: Humid tropical climate with an average annual rainfall of 1,962 mm,
Principal vegetation: Mangrove swamps with *Rhizophora* sp*, Bruguiera* sp, *Avicennia marina, Sonneratia* sp and *Nypa fruticans.*
Land tenure: State owned; managed by BKPH Unit II, Jawa Timur.

Conservation measures taken: The area has been designated as a Protection Forest (Hutan Lindung).
Conservation measures proposed: None
Land use: Forest protection and nature conservation.
Disturbances and threats: Cutting of wood and hunting.
Economic and social values: No information.
Fauna: An important area for several protected animals, including the Banteng *Bos sonaaicus.* Other mammals include *Muntiacus muntjak* and *Felis rnarmorata.* No information is available on the avifauna.
Special floral values: No information.
Research and facilities: None
References: Direktorat P.P.A. (1980h).
Criteria for inclusion: lb. 2b.
Source: Edi Djuharsa.

Wetland name: Nusa Barung
Country: Indonesia
Coordinates: 8°26'-8°30'S, 113°17'-113°26'E;
Location: 5 km off the southeast coast of Java, 45 km southwest of Jember, Jember District, East Java.
Area: 6,100 ha.
Altitude: Sea level to 325m.
Biogeographical province: 422.12.
Wetland type: 03 & 07.
Description of site: Nusa Barung is a limestone island with spectacular cliffs rising to 325m and some coastal mangrove swamps. The island is about six km from north to south, and 16 km from east to west. Most of the island is hilly; there are several deeply indented bays on the northeast coast, which provide sheltered anchorages for visiting fishermen. Because of its limestone substrate, the island is almost completely dry with no rivers and only a few natural ponds where animals may find standing water.
Climatic conditions: Rather dry tropical climate with an average annual rainfall of 1,600 mm. There is only a short rainy season, and the southern shores are often exposed to strong winds. Average temperatures range from 20-32°C.
Principal vegetation: Mangrove swamps with *Rhizophora* sp*, Avicennia* sp, *Sonneratia alba, Lurnnitzera* sp and *Xylocarpus* sp. Swamp vegetation around the small ponds includes *Aistonia spanthulatus, Vatica walichii, Pleiornium* sp and *Dillenia* sp. The coastal scrub is dominated by *Barringtonia sp, Terminalia catappa, Calophyllum inophyllum* and *Sterculia foetida,* and the lowland forest by *Vitex pubescens, Ficus amplas* and *Tamarindus* sp. The northeastern side of the island is covered with Supatorium sp and alang-alang. Botanically, the island is rather poor with *Sterculia foetida* and other drought resistant species predominating.
Land tenure: State owned (PHPA).
Conservation measures taken: The island has been protected as a Nature Reserve since July 1920.
Conservation measures proposed: None
Land use: No information.
Disturbances and threats: The hunting of sea-turtles and collection of their eggs for human consumption.
Economic and social values: No information.

Fauna: Little information is available. Water birds known to occur on the island include *Sula leucogaster, Bubulcus ibis, Egretta sacra, E. alba, Esacus magnirostris* and the kingfishers *Pelargopsis capensis* and *Halcyon chioris.* Mammals include *Ratufa bicolor, Cervus* sp, *Macaca* sp*, Callosciurus notatus, Viverricula malaccensis* and Sus sp. Reptiles include the Green Sea Turtle *Chelonia mydas,* which nests on the beaches, and also *Varanus* sp, *Mabouya* sp*, Python molurus* and *P.* reticulatus.
Special floral values: None known.
Research and facilities: None
References: Direktorat P.P.A. (l981a); IUCN (in prep); Karpowicz (1985); MacKinnon & Artha (1982b).
Criteria for inclusion: lb, 2a, 2c.
Source: Agustinus W. Taufik.

Wetland name: Cilacap and Segara Anakan
Country: Indonesia
Coordinates: 7°35'-7°46'S, l08°45'-109°01'E;
Location: on the south coast of West Java, close to the frontier with Central Java.
Area: 24,000 ha.
Altitude: Sea level.
Biogeographical province: 4.22.12.
Wetland type: 02, 03, 05, 06, 07, 08 & 11.
Description of site: A large, shallow sea bay with two connections to the open sea, one at the southern end of a sandy barrier island and the other to the west of the rocky island of Nusa Kambangan. Fresh water and silt enter the bay via the Citanduy, Cibeureum and Kawunganten Rivers and several smaller streams. The bay contains extensive mangrove swamps dissected by a network of tidal creeks, and there are marshes and mudflats around Segara Anakan. The coastal plain of Cilacap consists of low-lying swampy areas and rice paddies, and higher old dunes and beach ridges, usually occupied by human settlements. There are several oxbow lakes formed as abandoned meanders of the Serayu River. The site contains at least 18,500 ha of mangrove swamp and 200 ha of tidal marsh. Some 8,200 ha of the surrounding swamps have already been converted into rice paddies.
Climatic conditions: Humid tropical maritime climate with a maximum rainfall of 3,720 mm per year. The average temperature is 27°C.
Principal vegetation: Mangrove swamps with a very diverse flora. Tree species include *Rhizophora mucronata, R. conjugata, Bruguiera gymnorhiza, B. parviflora, Ceriops candoleana, C. roxburghiana, Xylocarpus granatum, X. molluccensis, Avicennia officinalis, A. marina, Sonneratia alba, S. ovata, S. acida, Aegiceras corniculatum, A. floridum, LumnItzera racemosa, L. littorea, Scyphiphora hydrophyllaceae, Cynometra ramiflora, Pit hecellobium umbellatum, Heritiera littoralis, Cerbera manghas* and *Nypa fruticans.* Other plants associated with the mangroves include *Acrostichum aureum, Acanthus ilicifolius* and *Derris heterophylla.*
Land tenure: State owned (Indonesian Government).
Conservation measures taken: The number of trawlers permitted to fish in the Cilacap area is limited to 90. This regulation came into effect in July 1978. Trawlers are not allowed to fish in the traditional fishing grounds, which extend three nautical miles offshore.
Conservation measures proposed: Various scientists and conservationists have proposed that the site be given special protection. The Citanduy River Basin Management Project made several proposals to stabilize the lagoon by diverting the Citanduy River, dredging and churning up sediment to facilitate transportation.

Land use: Fishing, cultivation of rice and cutting of mangrove poles; fishing, forestry, agriculture and recreation in adjacent areas.
Disturbances and threats: The rate of sedimentation has increased to such an extent that the surface area of the lagoon will decrease from the current 1,400 ha to about 550 ha by the year 2000 (Guarin & White, 1988). There are not enough patrols to check the implementation of the fishing regulations, and over-fishing has become a problem. Illegal cutting of the mangrove forest has led to severe degradation of the forest, especially in the Karang Anyar area. Reclamation and polderization of the swamps for agricultural purposes continue. At present, there is no serious chemical pollution in the lagoon, although some domestic wastes and increasing pesticide residues may be problems.
Economic and social values: Cilacap is a very important region for its marine fishery resources, and most of the 8,000 people dependent on Segara Anakan are fishermen. The fishery resources have been exploited by traditional methods for a very long time. Modern technology has been used since 1971, mainly for shrimp fishing (trawling). The number of trawling units has been limited to 90 since 1976, to curb over-fishing. In 1977, the production of demersal fish was 18,300 metric tonnes, but by 1979, production was down to 13,500 metric tonnes. The present catch of offshore fisheries is estimated at only 9,050 metric tonnes (7,150 tonnes of finfish and the rest, penaeid shrimps). The lagoon itself produces about 400 metric tonnes of finfish, shrimps and crabs per year. The mangrove forest is of great value to the local people. It provides firewood, timber for construction purposes, and the materials for making fish traps and racks for drying fish and shrimps.
Fauna: The bay supports a very rich fish fauna. Species of commercial importance include *Lutjanus* spp*, Formio niger, Pampus* spp*, Anus* spp, *Trichiurus* spp, *Pniacanthus* spp, *Chorinemus* sp*, Epinephalus* spp*, Pomadacys* spp*, Nemipterus* spp*, Saurida* spp*, Johnius* sp, *Eutherapon* sp*, Upeneus* spp*, Gerres kapas, Leognathus* spp*, Anguilla* spp*, Psettodes* sp, *Cygnoglossus* sp, *Himantura* spp and *Carcharinus* spp. Some of the many species of no commercial importance include *Peniophthalmus koereuteri, Mugil* sp, *Peniophthalmodon scholosseni* and *Acentrogobius virdipunctatus.*
Waterfowl known to occur at the site include *Anhinga melanogaster, Bubulcus ibis, Egretta alba, Ardea purpurea, A. cinerea, Mycteria cinerea, Ciconia episcopus, Dendrocygna arcuata, Amaurornis phoenicurus* and *Porphyrio porphynio.* Small cetaceans occur in the bay, and *Cervus* sp, *Muntiacus muntjak, Macaca* sp and *Hystrix brachyura* occur in the forests. Reptiles include the Green Sea Turtle *Chelonia mydas* and the monitor lizard *Varanus salvator.*
The rich invertebrate fauna includes the economically important crab *Scylla* serrata, other crabs such as *Macrophthalmus bosci, Uca* sp, Neopisesarma taeniolata, *Grapsus* sp and *Pagurus* sp, and a wide variety of molluscs (bivalves, Luciniidae, *Anomia corugata, Pedalion isogunum* and eighteen species of Gastropods).
Special floral values: The site contains a particularly large and diverse stand of mangrove forest.
Research and facilities: The area has been the subject of a considerable amount of research by Indonesian scientists, and is currently being investigated under the ASEAN-US Coastal Resources Management Project.
References: Bird *et al*. (1982); Direktorat P.P.A. (1980g. 1986a & 1986b); FAO (1979a); Guarin & White (1987); Sukardjo (1984).
Criteria for inclusion: lb, le, 2a, 2c, 3b.
Source: Marcel J. Silvius and Eva T. Berczy.

Wetland name: Penanjung Pangandaran
Country: Indonesia
Coordinates: 7°43'S, lO8°4O'E;

Location: approximately 40 km west of Cilacap, Ciamis District (Kabupaten), West Java.
Area: 530 ha.
Altitude: Sea level to 150m.
Biogeographical province: 4.22.12.
Wetland type: 04, 05, 06 & 12.
Description of site: Penanjung Pangandaran is a small peninsula on the south coast of Java, roughly rectangular in shape, with its highest axis lying in a northwest-southeast direction. It is approximately three km long and up to two km wide. The coastline is rugged, with precipitous cliffs and steep, narrow gullies skirting a wooded plateau. Only in the north does the land slope more gently to sandy coves and beaches. The plateau has river valleys radiating outward from the centre, with the largest draining towards the south and northwest. The valleys are separated by narrow, steep-sided ridges, which slope gently towards the coast and then drop steeply to the shoreline, ending abruptly in a cliff. Extensive coral formations are found along the northeast coast. There are also limestone cliffs on the southeast coast. There are some swampy areas in the valleys and several small isolated remnants of primary forest around holy places.
Climatic conditions: Tropical monsoonal climate with an average annual rainfall of 3,196 mm. Average temperatures range from 25-30°C. The northwest monsoon occurs between October and March, and the dry season from July to September.
Principal vegetation: Swampy areas with *Calamus* sp, and *Barringtonia* formations with Barringtonia asiatica, Terminalia catappa and *Calophyllum inophyllum;* primary and secondary forest with *Vitex pinnata, Dillenia exelca, Cratoxylum formosum, Psychotaria malayana, Ficus variegata* and *Tetrastigma lanceolarium.*
Land tenure: State owned (Indonesian Government); managed by PHPA.
Conservation measures taken: The entire peninsula has been designated as a Nature Reserve.
Conservation measures proposed: The boundary of the reserve should be extended 800m seaward from the low tide mark, and this area should be designated as a Marine Park.
Land use: Fishing, grazing of livestock, recreation and agriculture.
Disturbances and threats: Human settlement, extensive planting of coconut palms, felling of timber,, collection of firewood, excessive disturbance from recreation, and illegal hunting.
Economic and social values: The site has high aesthetic, cultural, historical and scientific values, and has considerable potential for outdoor recreation. The surrounding coral reefs support a rich fishery resource.
Fauna: Ornamental fish species occurring around the coral reefs include *Ballistoides niger, Diodon* sp*, Heniochus* sp*, Amphiprion* sp*, Acanthurus* sp, *Docyllus trimaculatus, Ephiadus* sp, *Centropyge bicolor* and many others.
The avifauna includes waterfowl and sea-birds such as *Phalacrocorax niger, Fregata ariel, Egretta sacra, E. intermedia, Actitis hypoleucos* and *Sterna sumatrana,* the fish-eagle *Haliaeetus leucogaster,* and the kingfisher *Halcyon chloris.*
The reserve is rich in mammals including *Muntiacus muntjak, Bos sondaicus, Hystrix javanica, Viverricula malaccensis, Ratufa bicolor, Sus* sp*, Manis javanica, Presbytis cristata, Macaca fascicularis, Felis bengalensis* and *Herpestes javanicus.* Small cetaceans are common in the adjacent seas.
Reptiles include the sea-turtle *Chelonia mydas* and the monitor lizard *Varanus salvator.*
Special floral values: The swampy areas support a rare species of *Rafflesia.*
Research and facilities: Basic faunal and floral surveys have been carried out.
References: Direktorat P.P.A. (1977a & 1979a); FAO (1976); Kvalvagnaes & Halim (l979a).
Criteria for inclusion: 1b, 2a, 2b.
Source: Agustinus W. Taufik.

Wetland name: Rawa Lakbok
Country: Indonesia
Coordinates: c.7°24'S, 108°31'E;
Location: near Banjar, Ciamis, West Java.
Area: 3,000 ha.
Altitude: 6.5-lOm.
Biogeographical province: 4.22.12.
Wetland type: 22.
Description of site: A large area of peat swamp and grassland in the interior of West Java; probably the largest area of peat swamp in Java and possibly the largest topogenous peat marsh in Indonesia. Peat depths of up to six meters have been recorded. The peat deposits originated in a basin bounded to the south, west and northwest by hill ranges. The swamp drains southeast into the Rawa Biuk through a gap in the ridge between the Lakbok and Biuk basins. Reclamation of the swamp was begun as early as 1924. Clearing of the original vegetation has been so drastic that the former impenetrable swamp has been reshaped into an almost treeless plain with cultivated areas and swampy fallow lands.
Climatic conditions: Humid tropical climate with an annual rainfall of 2,940-3,600mm. There is no pronounced dry season, the driest month being July with a rainfall of 72-98 mm.
Principal vegetation: Marsh grasses. The area formerly supported extensive swamp forests with many species that are now rare in Java, such as *Ficus retusa, Elaeocarpus littoralis, Nephralepis radicans, Scirpodendron ghaeri, Flascopa scandens, Stenochlaena palustris* and *Licuala* sp. Whether or not any of this forest remains is uncertain.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: A survey should be conducted as soon as possible to determine the conservation importance of this wetland, which is of a type now rare in Java.
Land use: No information.
Disturbances and threats: Agricultural encroachment, hunting and bird-netting.
Economic and social values: No information.
Fauna: The area is thought to be of importance for water birds, but no information is available.
Special floral values: Natural swampy grasslands of this type are now rare in Java.
Research and facilities: No surveys have as yet been carried out in the area.

References: None
Criteria for inclusion: la.
Source: Marcel J. Silvius, Agus Marhardi and Eva T. Berczy.

Wetland name: Leuwang Sancang
Country: Indonesia
Coordinates: 7°45'S, l07°50'E;
Location: 55 km south of Garut, Kabupaten Garut, in the southeast part of West Java.
Area: 2,157 ha.
Altitude: Sea level to 177m.
Biogeographical province: 4.22.12.
Wetland type: 02, 04, 05, 07, 11 & 21.
Description of site: The estuaries of the Cikaengan and Ciporeang Rivers with extensive coral reefs, mangrove swamps and sandy beaches, and the adjacent undulating lowlands with brackish swamp forest, dry beach forest, freshwater swamp forest and lowland rain forest. Peripheral areas of the site have been severely damaged by illegal tree-felling.

Climatic conditions: Humid tropical climate with an average annual rainfall of 3,226 mm. Average temperatures range from 22.4-30.8°C; the average relative humidity is 84.6%.
Principal vegetation: Mangrove swamps with *Rhizophora* spp*, Sonneratia acida, Aegiceras corniculatum* and *Avicennia* sp; beds of the sea-grasses *Sargassum sp, Gelidium sp* and *Halimeda sp*; swamp forests with *Crinum asiaticum, Nypa fruticans, Pandanus tectorius, Terminalia catappa, Calophyllum inophylum* and *Calotropis gigantea.*
Land tenure: State owned (PHPA).
Conservation measures taken: The site was first protected as a Nature Reserve in 1959**,** and renotified as a Cagar Alam in 1961 and again in 1978.
Conservation measures proposed: A proposal has been made to extend the Nature Reserve towards the sea.
Land use: Nature conservation; agriculture and fisheries in surrounding areas.
Disturbances and threats: Illegal agricultural encroachment, the cutting of timber, poaching, and the collection of sea-grasses, turtle eggs and ornamental fishes.
Economic and social values: The area is of some importance as a source of commercially valuable seaweeds.
Fauna: An important area for a variety of ornamental fishes, birds, large mammals and sea-turtles, with several rare and endangered species. The ornamental fishes include *Amphiprion perideraion, Chaetodon meyeri, Balistoides* sp*, Pomacentrus* sp*, Heniochus* sp*, Lutjanus* sp*, Caranx* sp and *Acanthurus lineatus.* The avifauna includes waterfowl such as *Egretta* spp*, Ardea* spp*, Leptoptilos javanicus* and *Plegadis falcinellus,* and several uncommon land birds such as *Buceros rhinoceros, B. sylvestris* and *Pavo muticus.* The larger mammals include *Sus vittatus, Macaca iris, Panthera pardus, Bos javanicus* and *Muntiacus muntjak.* Three species of sea-turtle have been recorded: *Chelonia mydas, Eretmochelys imbricata* and *Caretta caretta.* Other reptiles include *Varanus salvator, Python* sp and *Tryonix* sp.
Special floral values: The flora includes several rare and endangered species.
Research and facilities: Basic faunal and floral surveys have been carried out.
References: Direktorat P.P.A. (1976a, l979b & l982b); IUCN (in prep); UNAS (1976).
Criteria for inclusion: 1b, 2a, 2b.
Source: Marcel J. Silvius.

Wetland name: Cikepuh
Country: Indonesia
Coordinates: 7°ll'-7°20'S, 106°23'-106°30'E;
Location: between Pelabuhan Ratu and the Ujung Genting Peninsula, Kabupaten Sukabumi, West Java.
Area: 8,127 ha.
Altitude: Sea level to 224m.
Biogeographical province: 4.22.12.
Wetland type: 04, 05, 07 & 21.
Description of site: A partly flat and partly hilly area with lowland tropical rain forest, mangrove forest, dry beach forest, freshwater swamp forest and some secondary forest. The site contains one of the few remaining areas of lowland forest on Java, and incorporates an important turtle-nesting beach.
Climatic conditions: Humid tropical maritime climate with an average annual rainfall of about 2,500 mm (range 1,000-3,500 mm). The average temperature ranges from 25-27°C.
Principal vegetation: Freshwater swamp forest; mangrove communities with *Rhizophora* sp, *Bruguiera* sp*, Sonneratia alba, Avicennia* sp*, Callophyllum inophyllum* and *Nypa fruticans;* dry

beach formations with *Pandanus* sp, *Barringtonia asiatica, Bambusa* sp, *Sterculia foetida* and *Terminalia catappa.* Lowland tropical rain forest and secondary forest in adjacent areas.
Land tenure: State owned (PHPA).
Conservation measures taken: Established as a Wildlife Reserve (Suaka Margasatwa) in 1973 by Agriculture Ministerial Decree.
Conservation measures proposed: There is a proposal to manage the area in conjunction with the Cibanteng Nature Reserve and turtle nesting beach at Pangambalan.
Land use: Fisheries; agricultural settlements in surrounding areas.
Disturbances and threats: Agricultural encroachment, the cutting of trees for timber, poaching, the collection of turtle eggs for human consumption, and lack of effective management.
Economic and social values: Fisheries production.
Fauna: Many ornamental species of fishes occur in the area. Waterfowl include *Phalacrocorax niger, Nycticorax nycticorax, Ardeola speciosa* and *Dendrocygna javanica.* The kite Haliastur indus and the kingfishers *Alcedo atihis* and *Halcyon chloris* are also present. The area supports a variety of large mammals including *Bos javanicus, Muntiacus muntjak, Panthera pardus, Sus* sp, *Hylobates moloch, Hystrix javanica, Viverricula malaccensis, Ratufa bicolor, Pteropus vampyrus* and *Macaca fascicularis.* Reptiles include the sea-turtles *Chelonia mydas, Eretmochelys imbricata, Dermochelys coriaceae,* as well as *Mabouya multifasciata* and *Varanus salvator*.
Special floral values: No information.
Research and facilities: None
References: Direktorat P.P.A. (l979b & 1985); IPB (1975); IUCN (in prep).
Criteria for inclusion: lb, 2a.
Source: Agustinus W. Taufik.

Wetland name: Rawa Gajonggong
Country: Indonesia
Coordinates: 6°43'S, 106°59'E;
Location: between Cibodas and Cibeureum, in Gede-Pangrango National Park, 60 km SSE of Jakarta, West Java.
Area: Unknown.
Altitude: c. 1,500m.
Biogeographical province: 4.22.12.
Wetland type: 18 & 22.
Description of site: A small, high altitude swamp with extensive *Phragmites* reed-beds, areas of open water and floating peat. The peat is about two meters thick.
Climatic condition: None
Principal vegetation: The aquatic vegetation includes *Juncus effusus, Xyris melanocephala, Phragmites karka, Scirpus mucronata, Gunnera macrophylla* and *Eupatorium* sp.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: Protected within the Gede-Pangrango National Park (15,196 ha) established in 1980.
Conservation measures proposed: None
Land use: No information.
Disturbances and threats: No information.
Economic and social values: No information.
Fauna: No information.
Special floral values: A good example of a very rare habitat in Java. The swamp is the westernmost locality for *Juncus effusus* and *Xyris melanocephala* in Java. The very large herb *Gunnera macrophylla* occurs at the site.

Research and facilities: The site does not appear to have been surveyed since 1941.
References: Steenis (1941).
Criteria for inclusion: la, 2b.
Source: Marcel J. Silvius.

Wetland name: Pulau Satonda
Country: Indonesia
Coordinates: 8°06'S, 1 l7°45'E;
Location: off the north coast of Sumbawa Island, Dompu District, Sumbawa, Nusa Tenggara.
Area: 985 ha.
Altitude: Sea level to 335m.
Biogeographical province: 4.23.12.
Wetland type: 05, 08 & 10.
Description of site: Satonda Island is a small circular island some two km in diameter, about two km off the north-central coast of Sumbawa. The entire island consists of the top of an emerging volcano. About half of the island is occupied by a large salt-water lake in the crater of the old volcano. The island has steep slopes, emerging abruptly from the sea and falling steeply again into the lake.
Climatic conditions: Tropical monsoonal climate with the annual rainfall varying from 500 mm to 2,000 mm. The seasonal rainfall pattern is determined by the northwest monsoon.
Principal vegetation: No information is available on the aquatic vegetation. The terrestrial vegetation includes *Duabanga molluccana, Ziziphus mauritania, Murrimia* sp*, Daeryodes costata* and *Casuarina* sp. The south shore of the lake is covered with alang-alang; the slopes of the volcano are mostly covered with dry monsoon forest.
Land tenure: State owned (Sumbawa Local Government).
Conservation measures taken: None.
Conservation measures proposed: The island has been proposed as a Wildlife Reserve.
Land use: Nature conservation; fishing in surrounding areas.
Disturbances and threats: Hunting, accidental or intentional burning, ladang encroachment and cultivation.
Economic and social values: The island has great scenic beauty, and is of considerable geological interest. The surrounding waters support an important fishery.
Fauna: The lake is reported to contain a considerable population of fishes, but no details are available.
The avifauna includes *Anhinga melanogaster, Fregata minor, Egretta sacra, Ardea cinerea, Ciconia episcopus, Haliastur indus, Haliaeetus leucogaster, Falco moluccensis, Megapodius reinwardt, Himantopus leucocephalus, Charadrius peronii, Numenius phaeopus, Actitis hypoleucos, Sterna albifrons, Caloenas nicobarica, Alcedo atthis, Pelargopsis capensis* and *Halcyon chloris.*
Mammals include *Sus scrofa, Cervus timorensis, Macaca fascicularis, Pteropus vampyrus* and various large and small cetaceans. Skulls of the Estuarine Crocodile *Crocodylus porosus* have been found as recently as 1973. Reptiles still present include *Varanus* sp and *Natrix sp.*
Special floral values: No information.
Research and facilities: None
References: FAO (1981a).
Criteria for inclusion: la.
Source: Agustinus W. Taufik and Edi Djuharsa.

Wetland name: Wetlands in Komodo National Park
Country: Indonesia
Coordinates: 8°35'S, 119°30'E;
Location: about 30 km off the west coast of Flores in the Sape Straits, between Flores and Sumbawa, West Flores, Nusa Tenggara.
Area: Area of wetlands unknown; islands and surrounding waters 55,579 ha.
Altitude: Sea level to 735m.
Biogeographical province: 4.23.12.
Wetland type: 01, 04, 05 & 07.
Description of site: The National Park comprises the two substantial islands of Komodo and Rinca, together with numerous small offshore islands and surrounding marine waters. The islands are generally rugged with sheer cliffs, numerous small bays and inlets, numerous coral reefs and powerful offshore currents which isolate and protect the islands. Komodo has a chain of hills along the north-south axis averaging 500-600m in height. Rinca comprises mainly rolling hills but the south is dominated by the sprawling Doro Ora (667m), and the north has the low but steep peaks of Gunung Tumbah (187m) and Doro Raja (351m). Wetland habitats include mangrove swamps, sandy beaches and shallow inshore waters with coral reefs.
Climatic conditions: Rather dry tropical monsoonal climate. The Park is in one of the driest parts of Indonesia, with an annual rainfall of only 800-1,000 mm. In only one month of the year does the precipitation exceed 200 mm. The northwest monsoon occurs from January to March; the southeast monsoon reaches a peak in August, when the winds are consistently strong and sea conditions rough. The weather is hot and dry from September to December, with temperatures rising as high as 49°C.
Principal vegetation: The dominant plant communities are tropical tall grassland (70%) and tropical dry deciduous forest (25%). Mangrove and beach vegetation comprise 5% of the area, and include species such as *Avicennia marina, Ipomoea pescaprae, Spinifex littoreus, Cassutha filiformis, Rhizophora* spp*, Ceriops candoleana, Sonneratia* spp*, Capplaris seplaria, Calophyllum inophyllum, Terminalia catappa, Hypoestes populifolia, Sterculia foetida, Cassia javanica, Tamarindus indica, Borrassus flabillifer* and *Gleichenia oleosa.*
Land tenure: State owned (Indonesian Government).
Conservation measures taken: The islands were first designated as a Game Reserve (Suaka Maragasatwa) in 1965. In 1980, the reserve was gazetted as a National Park. In 1977, 30,000 ha on Komodo Island were accepted as a Biosphere Reserve. The fauna and flora of the islands are totally protected.
Conservation measures proposed: The waters surrounding the Komodo Islands have been proposed as a Marine Conservation Area.
Land use: Fishing and harvesting of other marine products. There are some human settlements and agricultural activities on the islands.
Disturbances and threats: Expansion of the human settlements, the cutting of trees for timber and firewood, and dynamite fishing. There is also some illegal hunting of Timor Deer (the prey of the Komodo Dragon). The hunting dogs are often abandoned and live wild, competing with the dragons for food.
Economic and social values: The islands are of considerable scientific interest, and have great potential for tourism.
Fauna: No information is available on the fishes.
Seventy-two species of birds have been recorded in the National Park, including *Fregata ariel, Butorides striatus, Egretta sacra, Ardea sumatrana, Haliastur indus, Megapodius freycinet, Esacus magnirostris, Glareola isabella, Pluvialis dominica, Charadrius peronii, Numenius arquata, Tringa totanus, Actitis hypoleucos, Sterna albifrons, Caloenas nicobarica, Ducula bicolor* and *Halcyon chloris.*

Mammals include the Timor Deer *Cervus timorensis, Macaca fascicularis, Sus scrofa, Muntiacus muntjac, Rattus rintjanus, Pteropus eleta, Paradoxurus hermaphroditus, Herpestes javanicus, Dopsonia peroni* and a variety of large and small cetaceans.
The National Park is the only locality in the world for the spectacular Komodo Dragon *Varanus komodoensis.* Other reptiles include the Estuarine Crocodile *Crocodylus porosus* and Green Sea Turtle *Chelonia mydas,* as well as *Naja naja, Emoja sivilis, Draco volans, Peropus mutilatus, Mabouya multifasciata, Oreophryne* sp and *Cerberus rhynchops.*
Special floral values: No information.
Research and facilities: Various ecological surveys have been conducted, and a considerable amount of research has been carried out on the Komodo Dragon (e.g. by Auffenberg in 1969-1970).
References: Auffenberg (1975); Faculty of Forestry of UGM (1976); FAO (1977b & 1979c); Hoogerwerf (1954 & 1955); IUCN (in prep); Voogd (undated).
Criteria for inclusion: lb, 2a, 2b.
Source: Agustinus W. Taufik and Marcel J. Silvius.

Wetland name: Wetlands of Sumba Island
Country: Indonesia
Coordinates: 9°40'S, 120°00'E;
Location: East and West Sumba Districts, Sumba, East Nusa Tenggara. The main freshwater lakes are on the north coast of the island, 30 km east of Waingapu (9°39'S, 120°23'E).
Area: Area of wetlands unknown; island 1,100,000 ha.
Altitude: Sea level to 1,000m.
Biogeographical province: 4.23.12.
Wetland type: 05, 07, 08 & 14.
Description of site: Much the most extensive wetlands on Sumba Island are mangrove swamps, which cover almost 5% of the land area. Several mangrove areas have been identified as being of conservation interest and of importance to the local coastal fisheries. The southern part of the island is hilly, with a number of small fast-flowing rivers. Much of the north coast is low-lying, and there are several small lakes in natural depressions, particularly in the northeast. The most important of these is at Kadumbal, at the edge of a coralline plateau 30 km east of Waingapu. This is a complex of shallow, freshwater lakes and extensive reed-beds covering an area of 25-35 ha, and surrounded by overgrazed pasture, rice paddies and arable land. The lakes are fed by local run-off, and apparently dry out during the middle of the dry season (from June or July onwards).
Climatic condition: Dry tropical climate, with most rain falling in January-March. The highest hills are moist, but the rest of the island is rather dry.
Principal vegetation: Mangrove forest with species of *Avicennia, Sonneratia* and *Bruguiera;* reed-beds and sedge marshes around freshwater lakes in the north. Dominant plant genera elsewhere on the island include *Asplenium, Platycerium, Bulbophyllum, Dendrobium, Vomda, Selaginella, Begonia, Palaquium, Podocarpus* and *Amorphophallus.*
Land tenure: Mainly state owned; the Indonesian Government owns all land not proven to belong to a given individual or group.
Conservation measures taken: None.
Conservation measures proposed: The Mount Wanggameti and Laiwanga area has been proposed as a Game Reserve (5,000 ha). This would include some coastal mangrove areas.
Land use: The mangrove forests are quite heavily exploited by the local people for firewood and timber for boat-building. There is some fishing, hunting and livestock grazing at the freshwater lakes and marshes in the north, and rice-growing and other agriculture in adjacent areas.

Disturbances and threats: Illegal grazing, shifting cultivation and excessive wood-cutting. Hunting may cause a considerable amount of disturbance at the lakes.
Economic and social values: The mangroves are of considerable importance in maintaining the local fishery, and also provide firewood, charcoal and timber. The freshwater marshes are an important dry season refuge for domestic livestock. Freshwater wetlands of the type found on the north coast of Sumba are rare in Wallacea; consequently the Sumba wetlands, although small, are of considerable scientific interest and conservation value.
Fauna: No information is available on the birds of the mangrove areas. Water birds observed by Bishop (in prep) during a brief survey of Kadumbal Lake included:
10 *Tachybaptus ruficollis*
10 *Ardea purpurea* (breeding)
300 *Dendrocygna arcuata*
10 *Porphyrio porphyrio*
25 *Chlidonias hybrida*
along with smaller numbers of *Phalacrocorax sulcirostris, P. melanoleucos, Pelecanus cons picillatus, Ixobrychus cinnamomeus, Ardeola speciosa, Egretta garzetta, E. intermedia, E. alba, Ardea novaehollandiae, Plegadis falcinellus, Pandion haliaetus, Anas gibberifrons, A. superciliosa, Himantopus leucocephalus, Pluvialis dominica* and *Calidris ferruginea.* The observations of I. *cinnamomeus, P. falcinellus, H. leucocephalus* and *C. hybrida* were the first records of these species on Sumba. *Stiltia isabella* was found to be common and widespread throughout the grasslands. Other birds recorded from the island include *Megapodus reinwardt, Actitis hypoleucos* and the kingfishers *Halcyon chloris* and *H. sancta.*
Mammals known to occur on the island include *Macaca fascicularis, Cervus timorensis* and *Sus scrofa.*
Special floral values: Two rare species of plant, *Mamilkara kauki* and *Santalum album,* occur on the island, but are now virtually extinct. Two plants with edible tubers, *Dischorea* sp and *Amorphophallus companulatus,* are of local importance.
Research and facilities: K.D. Bishop has conducted a preliminary avifaunal survey of Kadumbal Lake.
References: Bishop (in prep); FAO (1982b); MacKinnon & Artha (1982c); White & Bruce (1986).
Criteria for inclusion: lb. 2b, 3b.
Source: K. David Bishop, Agustinus W. Taufik and Edi Djuharsa.

Wetland name: Kelimutu Lakes
Country: Indonesia
Coordinates: 8°43'-8°47'S, l21°43'-121°52'E;
Location: 20 km northeast of Ende, Kabupaten Ende, East Flores, Nusa Tenggara.
Area: c.5,000 ha.
Altitude: 800-1,690m (Mount Kelimutu).
Biogeographical province: 4.23.12.
Wetland type: 11 & 14.
Description of site: A number of crater lakes, each with its own specific water color. The lakes are relatively small, and lie within disturbed and mostly secondary forest, which, however, still provides a very scenic backdrop to the lakes. The color of the lakes is caused by the high content of minerals and gases.
Climatic conditions: Relatively dry, tropical, monsoonal climate with an annual rainfall of less than 1,000 mm.

Principal vegetation: No information is available on the aquatic vegetation. The vegetation in surrounding areas includes *Eucalyptus urophylla, Spinifex littoreus, Cassia javanica* and *Cassutha filiformis.*
Land tenure: Under the responsibility of the Forestry Service of Ende.
Conservation measures taken: None.
Conservation measures proposed: An area of 500 ha has been proposed as a Recreation Park. Three of the lakes are included within the proposed Kelimutu Lake Nature Reserve.
Land use: Management of forest and wildlife; forestry and cultivation in surrounding areas.
Disturbances and threats: Shifting cultivation, road construction and wood-cutting.
Economic and social values: The lakes have outstanding scenic values and great potential for outdoor recreation and tourism. They are also of great hydrological value.
Fauna: Little information is available. Water birds known to occur at the lakes include *Butorides striatus, Egretta sacra, Ardea sumatrana* and *Pluvialis dominica.* Mammals include *Cervus timorensis, Macaca fascicularis, Sus scrofa, Pteropus* sp and *Herpestes javanicus.* Reptiles include *Oteophryne* sp*, Mabouya multifasciata* and *Emoia similis.*
Special floral values: No information.
Research and facilities: None
References: Direktorat P.P.A. (1980a); MacKinnon & Artha (l982c).
Criteria for inclusion: la.
Source: Agustinus W. Taufik and Edi Djuharsa.

Wetland name: Maumere Bay
Country: Indonesia
Coordinates: 8°11'-8°38'S, l22°l2'-122°32'E;
Location: on the northeast coast of Flores at Maumere, Kabupaten Sikka, East Flores, Nusa Tengarra.
Area: Bay 66,400 ha; islands 7,000 ha.
Altitude: Sea level to 431m.
Biogeographical province: 4.23.12.
Wetland type: 01, 03, 05 & 07.
Description of site: A large, shallow sea bay with eight islands, fringed with mangrove forests, sandy beaches and coral reefs. The main island is Pulau Babi (3,000 ha).
Climatic conditions: Tropical monsoonal climate with the annual rainfall varying from 1,092 mm to 1,766 mm. The average temperature ranges from 25 to 28.4°C, and the relative humidity, from 70 to 92%.
Principal vegetation: Mangrove forest with *Rhizophora* sp*, Sonneratia alba, Avicennia* sp *and Bruguiera* sp. There is also some dry beach forest with *Barringtonia asiatica, Terminalla catappa, Hibiscus tiliaceus, Pandanus tectorius* and *Borossus* sp.
Land tenure: State owned.
Conservation measures taken: None.
Conservation measures proposed: The site has been proposed as a Recreation Park (Taman Wisata) and Marine Park (Taman Laut).
Land use: Outdoor recreation; agriculture and forestry in adjacent areas.
Disturbances and threats: Illegal felling of trees, dynamite fishing, and encroachment of agriculture and human settlements.
Economic and social values: The area has great scenic beauty and high potential for outdoor recreation and tourism.
Fauna: The coral reefs are very rich in fish species. Little information is available on the water birds; the few species reported include *Nycticorax caledonicus, Butorides striatus, Ciconia*

episcopus and *Actitis hypoleucos. Dugong dugon, Delphinus delphis* and *Eubalsema glacialis* occur in the bay. Land mammals include *Cervus timorensis, Paradoxurus hermaphroditus* and *Sus* sp. Reptiles include species of *Varanus, Python* and *Mabouya.*
Special floral values: No information.
Research and facilities: None
References: Departemen Kehutanan (1986); FAO (1981b).
Criteria for inclusion: 1b, 2a.
Source: Edi Djuharsa and Agustinus W. Taufik.

Wetland name: Kupang Bay
Country: Indonesia
Coordinates: 10°04'S, 123°45'E;
Location: on the south shore of Timor, 20 km east of Kupang, West Timor Province, East Nusa Tenggara.
Area: 6,800 ha.
Altitude: Sea level.
Biogeographical province: 4.23.12.
Wetland type: 01, 04, 06, 07, 10 & 15.
Description of site: A large west-facing bay, with coral reefs fringing the northern and southern shores west of l23°42'E. There are approximately 4,000 ha of intertidal mudflats at the head of the bay, at the northwest corner of Oesau Plain; this is the only large area of mudflats on the island of Timor. Some 1,400 ha of the mudflats lie seaward of the fringing mangroves; the mud is very soft, with mixed mud and rock along the northern edge, and sand flats and raised beaches along the southern edge near a raised coral headland. The remaining 2,600 ha of mudflats lie inland of the mangroves; they are devoid of vegetation and are inundated only on the higher spring tides. The area is crossed by five tidal creeks lined with mangroves and with extensive stands of mangroves at their mouths. Pulau Kera is a small sandy island in the mouth of the bay, with fringing coral reefs and sea-grass beds. During the wet season (November to March), freshwater pools form on the inland mudflats. At the height of the wet season, these pools cover about 260 ha, but most have dried out by the end of April. The maximum tidal amplitude at Kupang is 2.2m.
Climatic conditions: Tropical monsoonal climate, regulated by the ESE monsoon from May to October, and the WNW monsoon from November to April. Cyclones are rare, but there are periods of very heavy rainfall and prolonged droughts, particularly in the west.
Principal vegetation: Mangrove forest dominated by species of *Avicennia* and *Rhizophora.* One species of *Avicennia* dominates at the edge of the coastal mudflats and along tidal creeks. *Rhizophora stylosa* occurs on scrub-covered embankments behind the Oebelo Flat and at Pasir Putih. *R. apiculata* occurs in monotypic stands at the mouths of the Beno, Nunkurus and Mulutupi creeks. There is some mixed tropical monsoon forest northeast of the head of the bay near Bipolo. Rice paddies extend to the edge of the mudflats in some areas; in drier or slightly higher areas, the vegetation adjacent to the inner flats is more typical of the plains and salt flats of the north coast.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: Sections of Kupang Bay should be declared nature reserves. Detailed proposals need to be developed.
Land use: Commercial exploitation of the mangrove forest is limited to operations at Tambak Oebelo (initiated in 1974) and at Tambak Merdeka (initiated in 1985). Ponds are used for aquaculture in the wet season (November to March) and salt production during the rest of the year. Fish traps are in operation at the mouths of the creeks, and shellfish and crabs are harvested on suitable tides. The adjacent Oesau Plain is largely under cultivation for rice from December to

March. The southern shore of the bay is densely populated, particularly around the town of Kupang.
Possible changes in Land use: Various drainage and irrigation schemes are being implemented on the Oesau Plain, with funding from Canadian aid.
Disturbances and threats: The mangroves near three small fishing villages are heavily cut for poles for making fish traps. There is a little hunting of birds on the mudflats, but no large-scale trapping for food. The monsoon forest near Bipolo is severely threatened by local farmers who view the land as more productive under rice paddy.
Economic and social values: The mangroves and mudflats support an important fishery (finfish, shellfish and crabs). The area is also important for salt production.
Fauna: A very important staging area for migratory shorebirds, thirty-two species of which have been recorded. The most abundant are as follows: *Stiltia isabella* (flocks of 5,000-10,000 in autumn), *Pluvialis squatarola, Charadrius ruficapillus* (over 400 in March and September 1985), *C. leschenaultii, C. veredus, Numenius phaeopus, N. madagascariensis* (over 250 in March and October 1985), *Calidris ruficollis, C. acuminata, C. ferruginea* and *Limicola falcinellus.* Other species recorded in autumn 1985 included up to four Asian Dowitchers *Limnodromus semipalmatus,* the first record of this species in Wallacea. Up to 150 Australian Pelicans *Pelecanus conspicillatus* have been recorded. Dugons *Dugong dugon* feed on sea-grass in the vicinity of Pulau Kera. The Estuarine Crocodile *Crocodylus porosus* still occurs regularly in Nunkurus Creek. Two individuals, two meters and five meters in length respectively, were observed there in 1985.
Special floral values: None known.
Research and facilities: P. Andrew carried out shorebird surveys in March 1985 and August-October 1985. The recently established Environmental Study Centre at Chendara University in Kupang, Timor Barat, is conducting some studies in the area.
References: Andrew (in prep-a & in prep-b); Beudels (1981); Karpowicz (1985).
Criteria for inclusion: lb. 2a, 2c, 3a.
Source: Crawford Prentice.

Wetland name: Pulau Menipo
Country: Indonesia
Coordinates: 10°10'S, 124°21'E;
Location: on the south coast of Timor, 85 km east of Kupang, West Timor Province, East Nusa Tenggara.
Area: 2,499.5 ha.
Altitude: Sea level.
Biogeographical province: 4.23.12.
Wetland type: 02, 05 & 07.
Description of site: Menipo Island is a small, sandy island in the estuary of the Noilmira River. The island supports mangrove forest, beach vegetation with *Pandanus* trees, and a line of *Spinifex* grass just above the beach. The estuary contains some good mangrove forest, but most areas outside the Game Reserve have been degraded by the inhabitants of three nearby villages.
Climatic conditions: Rather dry, tropical monsoonal climate with an annual rainfall of less than 1,200 mm. The average temperature is 28°C.
Principal vegetation: Mangrove forest with *Rhizophora* sp, *Bruguiera* sp, *Xylocarpus moluccensis* and *Sonneratia acida;* beach vegetation with *Pandanus* sp, *Spinifex* sp, *Barringtonia asiatiea, Hibiscus tiliaceus, Terminalia catappa* and *Crotalaria retusa.*
Land tenure: State owned; managed by PHPA.
Conservation measures taken: The area was designated as a Game Reserve in 1977.
Conservation measures proposed: None

Land use: Fishing.
Disturbances and threats: Shifting cultivation, illegal settlement, and cutting of mangroves for firewood.
Economic and social values: No information.
Fauna: Little information is available. Water birds known to occur in the area include *Phalacrocorax sulcirostris, Nycticorax caledonicus, Egretta sacra, Dendrocygna guttata, Esacus magnirostris, Actitis hypoleucos* and *Halcyon sancta.* Mammals include *Pteropus* sp*, Macaca fascicularis, Sus scrofa* and *Paradoxurus hermaphroditus.* Reptiles include *Chelonia mydas, Vipera russeli* and *Draco volans.*
Special floral values: The island is noted for its Sandalwood *Santalum albium.*
Research and facilities: None
References: FAO (l981c); Planologi Kehutanan (1980).
Criteria for inclusion: lb.
Source: Agustinus W. Taufik.

Wetland name: Maubesi Mangrove Swamp
Country: Indonesia
Coordinates: 9°31'-9°34'S, 124°57'-125°00'E;
Location: Kabupaten Bulu, West Timor, East Nusa Tenggara.
Area: 1,830 ha.
Altitude: 0-30m.
Biogeographical province: 4.23.12.
Wetland type: 02, 05 & 07.
Description of site: A coastal area with sandy beaches, about 1,100 ha of undisturbed mangrove swamp and, further inland, some curious cold mud volcanoes.
Climatic conditions: Tropical monsoonal climate. The average temperature is 33.1°C, and the average relative humidity, 82.4%.
Principal vegetation: Mangrove forest with species of *Rhizophora, Sonneratia, Bruguiera and Avicennia,* still in good condition; also dry beach forest with *Hibiscus tiliaceus, Terminalia catappa, Casuarina* sp and *Zizyphus horsfieldii.*
Land tenure: State owned (Forest Service of Nusa Tenggara Timur).
Conservation measures taken: None.
Conservation measures proposed: The area has been proposed as a Nature Reserve.
Land use: Fishing.
Possible changes in Land use: A project to develop the water resources of the Besiham plain for agriculture would drastically alter the water regime and cause substantial changes to the mangrove forest.
Disturbances and threats: Cutting of mangroves for firewood, illegal hunting and illegal fishing. Human population pressure is increasing rapidly in the area.
Economic and social values: The cold mud volcanoes are of considerable geological interest, and could provide a novel attraction for tourists.
Fauna: The mangrove swamps are important for a wide variety of water birds including *Nycticorax nycticorax, Bubulcus ibis, Egretta intermedia, Ciconia episcopus, Plegadis faicinellus, Threskiornis* sp, *Dendrocygna* sp, *Anas* sp, *Pandion haliaetus, Numenius arquata* and *Actitis hypoleucos.*
Mammals include a species of *Macaca* and a species of *Cervus.* The Estuarine Crocodile *Crocodylus porosus* occurs in the mangroves, and Hawksbill Turtles *Eretmochelys imbricata* have been recorded. Other reptiles include *Varanus salvator, Cerberus rhynchops* and *Mabouya multifasciata.*

Special floral values: No information.
Research and facilities: None
References: Crippen International (1978); Direktorat P.P.A. (1980b); FAO (1981c).
Criteria for inclusion: lb. 2a, 3b.
Source: Edi Djuharsa.

Wetland name: Muara Sebuku
Country: Indonesia
Coordinates: 3°50'-4°05'N, 117°20'-117°40'E;
Location: 70 km north of Tarakan, Kabupaten Bulungan, East Kalimantan.
Area: 110,000 ha.
Altitude: Sea level to 100m.
Biogeographical province: 4.25.12.
Wetland type: 07 & 21.
Description of site: A large area of coastal mangroves, swamp forests and lowland forest including about 55,000 ha of mangrove forest and 10,000 ha of peat swamp forest, along the Sebuku and Sembakung Rivers, north of the Sungai Sesajab. The mangrove forest is now the least disturbed area of mangroves remaining in East Kalimantan Province.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest and peat swamp forest.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: The area has been proposed as a Nature Reserve (Cagar Alam), and the proposal is receiving high priority.
Land use: No information.
Disturbance and threats: There are plans to log the area.
Economic and social values: The mangrove swamps and peat swamp forest are very important for fisheries production.
Fauna: The Proboscis Monkey Nasalis larvatus is known to occur in the area, but no other information is available.
Special floral values: No information.
Research and facilities: None
References: MacKinnon & Artha (1981a).
Criteria for inclusion: 1b, 2a.
Source: Marcel J. Silvius.

Wetland name: Sangalaki Archipelago
Country: Indonesia
Coordinates: 2°09'N, 118°20'E;
Location: 50 km off the mouth of the Berau River, Kabupaten Tanjung Redeb, East Kalimantan.
Area: 65 ha.
Altitude: Sea level.
Biogeographical province: 4.25.12.
Wetland type: 03, 05 & 07.
Description of site: A group of small coral islands with extensive sandy beaches and some mangrove forest, off the mouth of the Berau River. The principal islands are Pulau Semana, Pulau Sangalaki, Pulau Belambangan, Pulau Bilangan, Pulau Mataha and Pulau Sambit.
Climatic conditions: Humid tropical climate.

Principal vegetation: Mangrove.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: Pulau Semana and Pulau Sangalaki have been proposed as Nature Reserves (Cagar Alam).
Land use: Harvesting of sea-turtle eggs. Some two million turtle eggs are harvested annually from the islands. The right to collect turtle eggs is under the control of the local government, which grants concessions to local contractors in return for fees. Records of the harvest are maintained by the Fisheries Department, Tanjung Redeb.
Disturbances and threats: Excessive harvesting of turtle eggs and dynamite fishing on the coral reefs.
Economic and social values: The income from the harvest of sea-turtle eggs was at one time the main source of revenue for the Kabupaten Tanjung Redeb, but it is now of only minor significance compared to the royalties from logging activities.
Fauna: The islands are probably the most important nesting area for Green Sea Turtles *Chelonia mydas* in the whole region. Hawksbill Turtles *Eretmochelys imbricata* also breed on the islands, but in much smaller numbers. The peak nesting period is between June and December, when about 70% of the eggs are laid. No information is available on the other fauna of the islands.
Special floral values: None known.
Research and facilities: None
References: FAO (l977a); MacKinnon & Artha (1981a).
Criteria for inclusion: lb. 2a, 2c.
Source: Marcel J. Silvius.

Wetland name: Wetlands in Kutai National Park
Country: Indonesia
Coordinates: 0°05'S-0°35'N, 116°55'-117°35'E;
Location: in the Kutai Basin, 50-120 km NNE of Samarinda, Kabupaten Kutai, East Kalimantan.
Area: Area of wetlands unknown; National Park 200,000 ha, proposed extension 120,000 ha.
Altitude: Sea level to 398m.
Biogeographical province: 4.25.12.
Wetland type: 07, 11, 14 & 21.
Description of site: A large National Park containing examples of all the lowland habitats of East Kalimantan, including: (a) submerged and raised beaches, (b) mangrove and Nypa swamps, (c) freshwater swamps, (d) floodplains, (e) areas with poorly drained to moderately drained soils, (f) areas with well drained soils, and (g) excessively drained podsol soil or "kerangas" areas. There are some 7,000 ha of mangrove swamps in the coastal zone, backed *by Nypa* swamp and freshwater swamp forest. The latter also extends along the rivers, such as the Sungai Santan and Sungai Teluk Pandan. There are a few lakes in the area, notably Danau Maau, Santan, Besar and Sirapan, surrounded by freshwater swamp forest.
Climatic conditions: Humid tropical climate with an annual rainfall of over 2,000 mm. The heaviest rainfall occurs during the west monsoon (December to February); the rainfall is relatively low during the east monsoon (June to August). There have been nine drought years since 1940 coinciding with El Nino events. Average temperatures range from 26-27°C.
Principal vegetation: The lakes are overgrown with *Hanguana malayana.* Mangrove forest is dominated by species of *Rhizophora* and *Bruguiera,* with trees up to 25m in height. *Nypa fruticans* forms some pure stands further inland. Other mangrove species include *Avicennia* spp *and Sonneratia* spp. The freshwater swamp forest is dominated by *Eugenia* sp, and the floodplain forest by species of *Octomeles, Pterosperinum* and *Barringtonia.* In the western half of the park,

there are forests of *Eusideroxylon zwageri, Shorea* spp and kapur, with trees up to 35m in height. In poorly drained conditions, *E. zwageri* is dominant. The other main forest types are mixed dipterocarp and kerangas forest.
Land tenure: State owned (PHPA, Indonesian Government).
Conservation measures taken: The entire area (200,000 ha) was designated as a Wildlife Reserve (Suaka Margasatwa) in July 1971, and upgraded to the status of National Park in October 1982, during the Third World Congress on National Parks in Bali.
Conservation measures proposed: There is a proposal to extend the National Park to a total of 320,000 ha.
Land use: Nature conservation, shifting cultivation, logging, fishing (mainly in the swamp areas and lakes), and exploration for oil and gas. Large tracts of the adjacent forests are under logging concessions or are used for shifting cultivation.
Possible changes in Land use: There are plans to clear-fell and develop all areas of forest surrounding the National Park.
Disturbances and threats: Most of the area has been damaged to some extent by logging, oil exploration, shifting cultivation and forest fires. The park is completely surrounded by development activities including organized and spontaneous human settlement, development of the oil and natural gas industries, logging and coal-mining. Eventually, the National Park will be the only forested area in the region, and as such will become invaluable.
Economic and social values: The park serves as an important gene pool for forest products. It also plays an important role in protecting water catchment areas and stabilizing the flow in the Kedang Rantau, Mahakam, Sengata and Santan Rivers. This is crucial to the use of these rivers for transportation and as a source of water for local industries. The park has considerable potential for recreation, tourism and scientific research.
Fauna: The lakes are said to be very rich in fishes, but no details are available.
The area is very rich in mammals, having nearly all the species occurring in East Kalimantan, although the Asian Two-horned Rhinoceros *Dicerorhinus sumatrensis is* now probably extinct. Some 300 species of birds have been recorded, including about 80% of the forest birds of Borneo. Water birds include a variety of herons, egrets and shorebirds, six species of rails (Rallidae) and ten species of kingfishers (Alcedinidae). Both the Estuarine Crocodile *Crocodylus porosus* and False Gharial *Tomistoma schlegelii* still occur in the area along with a variety of other reptiles such as monitor lizards, tree lizards, flying lizards, pythons and cobras.
Special floral values: No information.
Research and facilities: Numerous faunal and floral surveys have been carried out in the National Park, but little attention seems to have been given to the wetland habitats and almost no work has been conducted on the waterfowl.
References: IUCN (in prep); Wirawan (1985).
Criteria for inclusion: lb., 2a, 2b.
Source: Marcel J. Silvius.

Wetland name: Muara Kaman
Country: Indonesia
Coordinates: 0°25'N-0°07'S, 1l6°37'-ll6°48'E;
Location: 80 km northwest of Samarinda, Kabupaten Kutai, East Kalimantan.
Area: 62,500 ha.
Altitude: 20-60m.
Biogeographical province: 4.25.12.
Wetland type: 21.

Description of site: A large area of lowland peat swamp forest between the Kedang Kepala and Menamang Kiwa Rivers.
Climatic conditions: Humid tropical climate.
Principal vegetation: Peat swamp forest with ramin *Gonystylus bancanus.*
Land tenure: State owned (PHPA).
Conservation measures taken: The entire area was designated as a Nature Reserve (Cagar Alam) in May 1976.
Conservation measures proposed: It has been suggested that the status of Wildlife Reserve (Suaka Margasatwa) would be more appropriate for the area. Human settlements should be excluded when the boundaries of the reserve are marked in the field.
Land use: Hand logging of ramin, and agriculture near settlements.
Disturbances and threats: Disturbance from human settlements, illegal logging and hunting.
Economic and social values: No information.
Fauna: No information.
Special floral values: No information.
Research and facilities: None
References: MacKinnon & Artha (1981a).
Criteria for inclusion: lb.
Source: Marcel J. Silvius.

Wetland name: Perairan Sungai Mahakam
Country: Indonesia
Coordinates: 0°07'-0°29'S, l16°03'-116°52'E;
Location: in the Mahakam Valley, 90 km west of Samarinda, Kabupaten Kutai, East Kalimantan.
Area: 200,000 ha.
Altitude: 20-lOOm.
Biogeographical province: 4.25.12.
Wetland type: 10, 11, 13, 14 & 21.
Description of site: A vast complex of freshwater lakes, swamps and interconnecting channels in the Mahakam River valley, with surrounding freshwater swamp forests (30,000 ha) and peat swamp forests (10,000 ha). The lakes cover an area of about 15,000 ha. The largest is Semayang Melintang; other smaller lakes include Batu Bumbus (450 ha), Lokang (400 ha), Siran (750 ha) and Jantur (200 ha). The area is inhabited by large numbers of people and the river is important for transport.
Climatic conditions: Humid tropical climate with an average annual rainfall of 2,000 mm. The mean temperature is 30°C.
Principal vegetation: Freshwater swamp forest and peat swamp forest. *Eichhornia crassipes is* common in the lakes.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: The entire area has been proposed as a Nature Reserve (Cagar Alam). However, because of the high level of human settlement, a more modest proposal may be required (MacKinnon & Artha, l981a).
Land use: Fishing; forestry in surrounding areas.
Disturbances and threats: There is a considerable amount of disturbance from heavy shipping (logging boats and rafts) on the river. Other threats include pollution, over-fishing, human encroachment and the catching of freshwater dolphins *Orcaella brevirostris.*
Economic and social values: The lakes support a major inland fishery.

Fauna: The rich fish fauna includes *Mystus nemurus, Helastoma temmincki, Ophiocephalus striatus, Pristis* sp*, Laptabarbus haerani, Clarias batrachus, Anabas* sp*, Puntius* sp*, Dasyatis* sp and *Pangasius* sp.
The lakes are said to be of considerable importance for water birds, but few data are available.
Species known to occur include *Ardeola* sp, *Egretta intermedia, Leptoptilos javanicus, Gallinula chioropus* and *Sterna albifrons.* Seven White-shouldered Ibises *Pseudibis davidsoni were recorded in October* 1983.
The Mahakam River is inhabited by a distinct subspecies of the rare Irrawaddy or Snubfin Dolphin *Orcaella brevirostris.* Other mammals include *Macaca fascicularis, Nasalis larvatus, Hylobates* sp*, Neofelis brevirosris, N. nebulosa, Helarctos malayanus, Cervus unicolor* and *Sus barbatus.*
Special floral values: No information.
Research and facilities: None
References: Holmes & Burton (1987); Kanwil Departemen Kehutanan Kalimantan Timur (1984); MacKinnon & Artha (1981a).
Criteria for inclusion: lb. le, 2a, 2b, 2d. 3b.
Source: Marcel J. Silvius.

Wetland name: Teluk Apar and Teluk Adang
Country: Indonesia
Coordinates: 1°35'-2°15'S, 116°1O'-116°35'E;
Location: 50-120 km southwest of Balikpapan, Kabupaten Pasir, East Kalimantan.
Area: 130,000 ha.
Altitude: O-30m.
Biogeographical province: 4.25.12.
Wetland type: 07 & 21.
Description of site: The extensive mangrove forests, swamp forests and intertidal mudflats in the deltaic systems of the Apar and Kandilo Rivers. The mangrove swamps are still in an almost undisturbed condition; they cover an area of 90,000 ha and are backed by about 40,000 ha of freshwater swamp. The deltas are rather stable, with very little land erosion or accretion. During the rainy season, input of freshwater from the adjacent uplands creates rapid and significant changes in salinity and turbidity. The area is usually subject to tidal inundation twice daily; the tidal amplitude varies from 1.0m at neap tides to 1.8m at spring tides.
Climatic conditions: Humid tropical climate, with an average annual rainfall of about 2,280 mm, most of which falls during the rainy season, from December to April. The average monthly temperature does not exceed 29°C.
Principal vegetation: Mangrove forest, very rich in species. Sukardjo (1987) lists 38 species (28 genera and 1 7 families) in the mangrove forests of the Apar Delta. Five types of mangrove community are recognized:
a) *Avicennia* forest, with *A. officinalis* predominating;
b) *Rhizophora* forest, predominantly *R. apiculata* and/or *R. mucronata* interspersed *with* a variety of mangrove associates such as *Paramignya angulata;*
c) *Ceriops tagal* forest, either as pure stands or mixed with other species;
d) Bruguiera-Rhizophora forest, with *B. parviflora* predominating;
e) *Nypa fruticans* forest, either as pure stands or mixed with other species.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: A strict prohibition on the felling of mangrove trees is already in force in the area of the proposed nature reserve.
Conservation measures proposed: A proposal that the area be designated as a Nature Reserve (Cagar Alam) has been approved. Sukardjo (1987) has proposed that a fish reserve be established

in the tidal areas of the Apar Delta, and that a fish sanctuary be created in the subsidiary creeks and small tributaries of the inner delta.
Land use: Both deltas are major log-loading points. There are some settlements in adjacent areas.
Disturbances and threats: There is some disturbance from logging activities and nearby human settlements.
Economic and social values: The Orang Laut/Bajau people who live around the estuary of the Kandilo River are dependent on the mangrove resources for food, fuel and shelter. The mangrove swamps provide breeding and nursery grounds for a very large proportion of the fishes and prawns taken by commercial and traditional fishermen in Apar Bay. Over two-thirds of the East Kalimantan fisheries production is linked to the healthy mangrove areas. The mangrove swamps are also important in the maintenance of the water table for agriculture, in flood control, and in protecting the delta region from erosion.
Fauna: The deltas are rich in estuarine fishes, crabs (notably *Scylla serrata),* prawns (notably *Macrobrachiurn rossenbergii* and species of *Penaeus, Metapenaeus)* and molluscs. The juveniles of about 220 species of estuarine, marine, riverine and brackish water fishes, crustaceans and molluscs have been collected in the Apar delta.
The area is very important for water birds. Resident species include *Phalacrocorax* sp*, Anhinga melanogaster, Nycticorax nycticorax, Egretta intermedia, E. alba, Ardea cinerea, Leptoptilos javanicus, Dendrocygna* sp, *Haliastur indicus, Haliaeetus leucogaster, Ichthyophaga nana* and *Halcyon chloris. Plegadis falcinellus, Anas* sp, a variety of shorebirds and *Sterna hirundo* occur on passage and during the northern winter. The Proboscis Monkey *Nasalis larvatus* is known to occur in the area.
Special floral values: The site contains one of the largest expanses of relatively undisturbed mangrove forest in Indonesia.
Research and facilities: S. Sukardjo conducted an ecological study of the mangrove forest of the Apar Delta between 1980 and 1982 (Sukardjo, 1987).
References: MacKinnon & Artha (198la); Sukardjo (1987).
Criteria for inclusion: lb. le, 2a, 2b, 2c, 3b.
Source: Marcel J. Silvius and references.

Wetland name: Pamukan
Country: Indonesia
Coordinates: 2°32'S, 116°20'E;
Location: 85 km NNE of Kotabaru, Kabupaten Kotabaru, South Kalimantan.
Area: 10,000 ha.
Altitude: Sea level.
Biogeographical province: 4.25.12.
Wetland type: 07.
Description of site: A mangrove and estuarine swamp forest. The mangrove is well developed and little disturbed.
Climatic conditions: Humid tropical climate with an annual rainfall of 1,200-3,260 mm. Average temperatures range from 25-27°C.
Principal vegetation: Extensive mangrove forest with species of *Avicennia, Rhizophora, Sonneratia* and *Bruguiera.*
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: A proposal that the area be designated as a Nature Reserve (Cagar Alam) has been approved.
Land use: No information.

Disturbances and threats: Cutting of mangroves trees. There is a possibility that the area will be logged for wood chips.
Economic and social values: The mangrove forests are of considerable importance as nursery and breeding areas for marine fishes and crustaceans, which form the basis of the inshore fishery.
Fauna: No information.
Special floral values: A large stand of relatively undisturbed mangrove forest.
Research and facilities: None
References: MacKinnon & Artha (1981a).
Criteria for inclusion: lb.
Source: Marcel J. Silvius.

Wetland name: Tanjung Kelumpang
Country: Indonesia
Coordinates: 2°50'-3°08'S, 116°05'-116°15'E;
Location: 30 km north of Kotabaru, Kabupaten Kotabaru, South Kalimantan.
Area: 13,750 ha.
Altitude: Sea level.
Biogeographical province: 4.25.12.
Wetland type: 02 & 07.
Description of site: A large concave estuary of mangrove forests and mangrove islands. The forests are well formed and show several vegetation zones.
Climatic conditions: Humid tropical climate.
Principal vegetation: Extensive mangr
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: The area has been proposed as a Nature Reserve (Cagar Alam).
Land use: Coastal protection and fisheries.
Disturbances and threats: Cutting of mangroves.
Economic and social values: The mangrove forests are important in sustaining the local fishery resource, and provide coastal protection.
Fauna: No information.
Special floral values: The site contains an excellent example of mangrove forest typical of the east coast of Kalimantan.
Research and facilities: None
References: MacKinnon & Artha (1981 a).
Criteria for inclusion: lb.
Source: Marcel J. Silvius.

Wetland name: Hutan Bakau Pantai Timur
Country: Indonesia
Coordinates: 3°07'-3°36'S, 115°59'-1l6°12'E;
Location: southwest of Kotabaru, Kabupaten Kotabaru, South Kalimantan.
Area: 66,650 ha.
Altitude: Sea level to 300m.
Biogeographical province: 4.25.12.
Wetland type: 05, 06, 07 & 11.

Description of site: A large area of coastal mangrove forest and *Nypa* swamps adjacent to a small area of dry-land forest.
Climatic conditions: Humid tropical climate with an annual rainfall ranging from 1,285 to 3,785 mm. The average temperature ranges from 24°C to 26°C, and the relative humidity from 40 to 42%.
Principal vegetation: Mangrove forest with species of *Avicennia, Rhizophora, Bruguiera* and *Sonneratia,* and *Nypa fruticans;* lowland forest with *Dipterocarpus* sp, *Shorea* sp, *Anthocephalus cadamba, Gonystylus* sp and *Vitex pubescens.*
Land tenure: State owned; managed by the Forest Management Unit of Kota Baru, Forest Service, South Kalimantan Province.
Conservation measures taken: None.
Conservation measures proposed: The area has been proposed as a Nature Reserve.
Land use: Fisheries; forestry in surrounding areas.
Disturbances and threats: Illegal wood-cutting, especially for firewood or charcoal, and hunting.
Economic and social values: The mangroves protect the coast from erosion, and provide a breeding and nursery area for marine fishes and crustaceans important in the local fishery.
Fauna: Water birds known to occur in the area include species of *Phalacrocorax, Egretta* and *Sterna,* and the kingfishers *Pelargopsis capensis, Halcyon chioris.* Mammals include *Nasalis larvatus, Macaca fascicularis, M. nemestrina, Hylobates* sp*, Sus barbatus* and *Muntiacus muntjak.* Reptiles include the Green Sea Turtle *Chelonia mydas,* the monitor
lizard *Varanus salvator* and *Python* sp.
Special floral values: No information.
Research and facilities: None
References: Direktorat P.P.A. (1980k).
Criteria for inclusion: lb, 2a, 2c.
Source: Edi Djuharsa and Agustinus W. Taufik.

Wetland name: Pleihari Tanah Laut
Country: Indonesia
Coordinates: 4°00'- 4°12'S, 114°35'-l l4°50'E;
Location: 80 km south of Banjarmasin, Kabupaten Tanah Laut, South Kalimantan.
Area: 35,000 ha.
Altitude: Sea level to 102m.
Biogeographical province: 4.25.12.
Wetland type: 07 & 21.
Description of site: A low-lying coastal area with 40% grassland and shrub land and 50% swamp. The remaining 10% are hilly with Gunung Tunggal as the highest peak (102m). The swamps consist of mangrove forest (4,000 ha) and freshwater swamp (20,000 ha) including swampy grasslands and swamp forest. Sandy beaches along the coast provide nesting sites for sea-turtles.
Climatic conditions: Humid tropical climate with an average annual rainfall of about 2,259 mm.
Principal vegetation: Mangrove forest dominated by *Sonneratia* sp; grasslands and swamp forest with *Melaleuca* sp*, Shorea balangeran, Gluta renghas, Dyera* sp*, Campnosperma macrophylla* and *Oncosperma tiggilarium.* In adjacent areas, heath forest with *Vitex* sp and *Callopliyllum* sp.
Land tenure: State owned (PHPA).
Conservation measures taken: The area has been protected in a Wildlife Reserve since 1974.
Conservation measures proposed: There is a proposal to upgrade the reserve to the status of Nature Reserve (Cagar Alam).
Land use: Nature conservation. The wetland serves as a natural reservoir for drinking water.

Disturbances and threats: Cutting of wood, hunting of deer, shifting cultivation, and grazing by domestic livestock.
Economic and social values: The mangrove swamps provide nursery areas for marine fishes and crustaceans important in the local fishery. The wetland is also an important water supply for local communities.
Fauna: Waterfowl known to occur at the site include *Bubulcus ibis, Egretta* spp and a variety of migratory shorebirds. The area is rich in mammals including *Neofelis nebulosa, Prionodon linsang, Nasalis larvatus, Macaca* sp, *Hylobates* sp*, Sus vittatus, Cervus unicolor* and *Muntiacus muntjak.*
The Green Sea Turtle *Chelonia mydas* and Hawksbill Turtle *Eretmochelys imbricata* nest on the sandy beaches. Other reptiles include the Estuarine Crocodile *Crocodylus porosus* and monitor lizard *Varanus salvator.*
Special floral values: No information.
Research and facilities: Basic faunal and floral surveys have been carried out.
References: IPB (1976a); IUCN (in prep); Karpowicz (1985); MacKinnon & Artha (1981a); Salm & Halim (1984).
Criteria for inclusion: 1b, 2a, 2c.
Source: Marcel J. Silvius and Edi Djuharsa.

Wetland name: Danau Bankau and other swamps in the Barito Basin
Country: Indonesia
Coordinates: 2°00'-3°15'S, 114°20'-115°25'E;
Location: in the lower Barito Basin, north from Banjarmasin to the region of Butong, South Kalimantan.
Area: 480,000 ha (excluding marginal areas under traditional intensive use).
Altitude: Near sea level.
Biogeographical province: 4.25.12.
Wetland type: 08, 11, 12, 13, 14, 18, 19, 20 & 21.
Description of site: The vast alluvial plain of the lower Barito Basin and its left bank tributaries, notably the Negara River. On first emerging onto the plain, the tributaries form a complex depositional network of levees and back-swamps that supports the densest rural population in Kalimantan (towns of Amuntai, Kandangan and Rantau). The tributaries then flow through a zone of deep water swamps (including Danau Bankau, Danau Panggang and Alabio Polder) which serves as a sump or floodwater storage area. The deep water swamps then drain slowly across the extensive, level, marine coastal plain into the Barito River and the sea. Peat swamps are located in the shallow basins between the rivers, which are permanently wet. Although the largest peat swamps in the Pulau Petak area have peat depths up to 190 cm or more and have a typical domed structure, most of these peats are young and comparatively shallow. The rivers have rather stable courses, but the Sungei Murung has changed its course in geologically recent times, leaving remnant channels in the lower Pulau Petak area. Annual flooding occurs during the wet season, from December to March. Brackish water incursion reaches about 30 km inland during the dry season, while tidal influences are felt up to 100 km inland during the wet season and up to 150 km during the dry. There are two open water lakes, Danau Bankau and Danau Panggang, with a depth of three meters or more.
The four major zones are as follows: (a) riverine alluvial plain consisting of levees and back-swamps, subject to intensive land use including the cultivation of rice; (b) deep swamps (128,000 ha) consisting of open marsh with some permanent lakes; (c) peat swamp forest (186,000 ha); (d) marine alluvial plain (166,000 ha) consisting of alluvial forest with extensive secondary forests of *Melaleuca,* and potential acid-sulphate soils.

Climatic conditions: Humid tropical climate, with an average annual rainfall of 2,500 mm. The wet season is from December to March, and the dry season from July to October.
Principal vegetation: Deep swamps with lake vegetation, grassy swamps and open forest; peat swallip forest; marine alluvial plains with swampy grassland, alluvial forest and *Melaleuca* scrub. There is intensive, rice-based agriculture in the riverine zone, and kerangas forest and sandy terraces to the north. The acidic swamps and peat swamps continue west of the Barito Basin.
Land tenure: The wetland is state owned (Indonesian Government); surrounding areas are under customary tenure.
Conservation measures taken: None.
Conservation measures proposed: Consideration should be given to the establishment of nature reserves in the deep water swamps, at Danau Bankau or the lake area west of Alabio, as there are reasons to believe that these lakes support some unique elements of aquatic fauna and flora, not found elsewhere in Kalimantan (Central Planning Consultancy Jakarta, 1979). Detailed surveys are needed to investigate the importance of the area for water birds and determine possible reserve boundaries.
Land use: Fishing, cultivation of floating rice and reed-cutting in the deep water swamps. The riverine zones of the Amuntai, Kandangan and Rantau Rivers are densely populated and under intensive cultivation. An attempt was made in 1936 to convert 6,000 ha of swamp at Alabio, upstream of the Sungai Negara, into polder, but the pumping capacity was too low and the project failed. Large areas of the polder have since fallen into disrepair. About 3,000 ha are planted with rice between May and August, when water levels are at their lowest. The polder supports an important fishery (8,000 metric tonnes per year) and is also an important duck-farming area (24 million eggs per year).
Possible changes in Land use: Many reclamation schemes are planned, especially in the riverine areas and marine alluvial plains but also in the swamps, despite the fact that peat areas and deep water swamps are usually considered to be unsuitable for reclamation.
Disturbances and threats: Reclamation schemes and drainage projects; some 279,700 ha have been listed as suitable for reclamation. Fishing, reed-cutting and bird-trapping may be excessive in the deep swamps, especially those lying adjacent to densely populated regions. Extensive forest clearance in the water catchment area is likely to affect water quality.
Economic and social values: The deep water swamps have a high value for flood control and as a source of water during dry periods. They are also important for fisheries and other traditionally harvested products. The peat swamp forests also play an important role in the hydrological balance of the region, as well as providing a good example of this ecosystem. At least 63,300 ha of swamps are listed as unsuitable for reclamation. In view of the large-scale reclamation schemes which are currently planned, these areas should be considered of high conservation value as they will eventually represent the only natural swamp habitats in the region.
Fauna: A very important area for a wide variety of waterbirds. Species recorded during brief surveys in recent years include *Anhinga rnelanogaster, Ixobrychus cinnamomeus, I. flavicollis, Butorides striatus, Ardea purpurea, Leptoptilos javanicus, Dendrocygna arcuata. Nettapus corornandelianus, Jchthyophaga ichthyaetus, Rallus striatus, Porzana cinerea, P. fusca, Gallinula chioropus, Rostratula benghalensis, Tringa nebularia, Chlidonias hybrida* (a common visitor) *and Pelargopsis capensis.* The endangered White-shouldered This *Pseudibis davidsoni* has been reported and may occur in significant numbers in the more remote areas. Large roosts of *Ardeola* sp (500) and *Egretta intermedia* (2,000) have been located, and it is likely that there are breeding colonies of large water birds in the area. Other waterfowl known only from 19th Century reports, but which are still likely to occur, include *Phalacrocorax sulcirostris, P. niger, Ixobrychus sinensis, Bubulcus ibis, Plegadis falcinellus, Gallinula tenebrosa* and *Himantopus hirnantopus.*
Special floral values: Probably the most important freshwater swamp in Kalimantan.

Research and facilities: Basic faunal and floral surveys have been carried out, and there have been several feasibility studies for reclamation schemes.
References: Central Planning Consultancy Jakarta (1979); Holmes & Burton (1987).
Criteria for inclusion: 1b, le, 2a, 2b, 3b.
Source: Derek A. Holmes.

Wetland name: Pulau Kembang
Country: Indonesia
Coordinates: 3°l6'S, 1l4°33'E;
Location: at Banjarmasin, Kabupaten Barito Kuala, South Kalimantan.
Area: 60 ha.
Altitude: 0- 1.6m.
Biogeographical province: 4.25.12.
Wetland type: 07.
Description of site: A small mangrove island in the middle of the Barito River in Banjarmasin town. There is a Chinese temple on the island.
Climatic conditions: Humid tropical climate with an annual rainfall of 1,200-3,260 mm. Average temperatures range from 25-27°C.
Principal vegetation: Mangrove forest with *Sonneratia* sp and *Nypa fruticans; Bambusa spiralis, Hibiscus tiliaceus* and *Pandanus tectorius* in adjacent areas.
Land tenure: State owned (PHPA).
Conservation measures taken: The island was designated as a Recreation Park (Taman Wisata) in 1976.
Conservation measures proposed: None
Land use: Tourism, recreation, scientific research and conservation of cultural heritage. The town of Banjarmasin lies around the site.
Disturbances and threats: Cutting of mud for bricks.
Economic and social values: The site has considerable potential for tourism. The Chinese temple is of considerable historical and cultural interest, and the large population of monkeys provides an interesting spectacle for tourists.
Fauna: The island supports a large population of the Proboscis Monkey *Nasalis larvatus* along with Long-tailed Macaque *Macaca fascicularis,* Silvered Langur *Presbytis cristata* and a wide variety of birds.
Special floral values: No information.
Research and facilities: None
References: Direktorat P.P.A. (l979c); MacKinnon & Artha (1981a).
Criteria for inclusion: 1b, 2a.
Source: Marcel J. Silvius and Edi Djuharsa.

Wetland name: Kelompok Hutan Kahayan
Country: Indonesia
Coordinates: 3°20'S, 113°45'E;
Location: 90 km west of Banjarmasin, Kabupatens Kapuas and Katingan, Central Kalimantan.
Area: 150,000 ha.
Altitude: 0-20m.
Biogeographical province: 4.25.12.
Wetland type: 07 & 21.

Description of site: A large area of swamp forest, with about 90,000 ha of peat swamp forest, 10,000 ha of freshwater swamp forest and 50,000 ha of mangrove swamp. The mangrove swamp is considered to be an extremely well developed example of Southern Kalimaritan mangrove.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest, freshwater swamp forest and peat swamp forest.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: The area has been proposed as a Nature Reserve (Cagar Alam).
Land use: No information.
Disturbances and threats: Human disturbance, the cutting of timber, and forest clearance for agriculture.
Economic and social values: The mangrove forest is presumed to be an important spawning area for *marine* fishes.
Fauna: No information.
Special floral values: No information.
Research and facilities: None
References: MacKinnon & Artha (1981a).
Criteria for inclusion: 0.
Source: Marcel J. Silvius.

Wetland name: Tanjung Puting National Park
Country: Indonesia
Coordinates: 2°35'-3°20'S, 111°50'-112°15'E;
Location: southeast of Kumai, Central Kalimantan.
Area: Area of wetlands unknown; the official area of the National Park is 300,040 ha, but only 296,800 ha are currently mapped.
Altitude: 0-11m.
Biogeographical province: 4.25.12.
Wetland type: 07 & 21.
Description of site: A vast low-lying area of coastal mangrove forests, Nypa swamp, peat swamp forest, freshwater swamp forest and kerangas forest, with areas of degraded fire-padang. The swamp forests are periodically flooded. The major source of water is local precipitation; the area is drained by several small, acidic, black-water rivers, which are brackish for a considerable distance inland from the coast (as indicated by the extent of the Nypa vegetation). At maximum flooding during the rainy season, the depth of water in the freshwater swamp forest varies from 0.5 to 1.5m. The tidal range in the Sehonyer River at Natai Lengkaus exceeds one meter.
Climatic conditions: Humid tropical climate, with two annual peaks in the rainfall (March and December). The main dry season is from June to September.
Principal vegetation: Wetland habitats include mangrove forest, *Nypa fruticans* swamp, peat swamp forest and freshwater swamp forest. Large areas of kerangas forest, some old ladang and fire-padang elsewhere in the Park.
Land tenure: State owned; managed by PHPA. There are some small private land-holdings and a few small settlements in surrounding areas.
Conservation measures taken: The area has been afforded some protection since June 1936; it was designated as a Biosphere Reserve in January 1977, and declared a National Park in October 1982. A management plan was published in 1983.
Conservation measures proposed: Pending Government approval and confirmation, another 190,700 ha will be added to the National Park as extensions to the north, west and southeast.

Settlements and development within these proposed extensions may, however, hinder the expansion of the Park. The extension to the west (70,000 ha) would include adjacent marine habitats to protect sea-turtles and Dugong *Dugong dugon.*

Land use: Illegal collection of forest products, poaching of Sambar Deer and fishing within the National Park; rice cultivation, coconut plantations, fishing and harvesting of forest products in surrounding areas.

Disturbances and threats: Illegal forest exploitation (for bark and jelutung *Dyera costulata),* illegal hunting and fishing, and the collection of eggs of *Egretta* spp for human consumption.

Economic and social values: The area is an important genetic resource of great value for scientific research.

Fauna: The National Park supports a very rich fauna typical of the lowland forests of Borneo. The fish *Scleropagus formosus* occurs in the rivers. There are significant populations of the rare Storm's Stork *Ciconia (episcopus) stormi* and *Dendrocygna arcuata,* and there is a large mixed breeding colony of water birds including *Phalacrocorax sp, Anhinga melanogaster, Nycticorax nycticorax, Egretta garzetta, E. alba, Ardea purpurea, Leptoptilos javanicus and Plegadis falcinellus.* The mammalian fauna includes large populations of Orang-utan Pongo *pygmaeus* and Proboscis Monkey *Nasalis larvatus.* The Irrawaddy Dolphin *Orcaella brevirostris* occurs in Kumai Bay adjacent to the Park.

Special floral values: The National Park contains the largest tract of kerangas forest in Borneo.

Research and facilities: The study area of the Orang-utan Research and Conservation Project is located in the National Park. PHPA maintains a camp on the Sehonyçr River at Natai Langkuas, which can be used by visiting scientists.

References: Direktorat P.P.A. (1980d); Galdikas *et al.* (1985); Holmes & Burton (1987); IUCN (in prep); Karpowicz (1985); MacKinnon & Artha (1981a); Nash & Nash (1986a); WWF (1983).

Criteria for inclusion: 1b, 2a, 2b, 3b.

Source: Anne and Stephen Nash.

Wetland name: Sungai Kumai and Kumai Bay

Country: Indonesia

Coordinates: 2°30'-3°OO'S, 111°38'-111°52'E;

Location: Kabupaten West Kota Waringin, West Kalimantan.

Area: 3,900 ha of wetlands in Kumai Bay; 80 km of river.

Altitude: Sea level to 500m.

Biogeographical province: 4.25.12.

Wetland type: 01, 05, 07 & 11.

Description of site: The lower reaches of the Kumai River and its estuary in Kumai Bay, a shallow sea bay with extensive mangrove forests, *Nypa* swamps and some sandy beaches. Kumai River is one of the smaller rivers in Kalimantan, with an average width of about 750m and average depth of 10-15m along its lower reaches. At about 80 km from its mouth, the river ceases to be navigable. At this point, two smaller rivers flow together to form the Kumai. The small village of Kumai lies on the right bank. By the end of the wet west monsoon, the river is fresh and the salinity of the bay is greatly reduced. By the end of the dry season (east monsoon), the river becomes brackish up to 80 km inland.

Climatic conditions: Humid tropical climate with an average annual rainfall of 2,562 mm. The wettest period is during the west monsoon in April and May; the dry period occurs during the east monsoon in September and October. The relative humidity ranges from 55% to 98%; the temperature, from 22°C to 33°C.

Principal vegetation: Mangrove forest, *Nypa fruticans* swamp and riverine swamp forest.

Land tenure: State owned; under the responsibility of Kota Waringin Local Government.

Conservation measures taken: None.
Conservation measures proposed: Kumai Bay has been proposed as a Marine Conservation Area.
Land use: Fishing by local people.
Disturbances and threats: Cutting of mangroves and disturbance from boat traffic.
Economic and social values: The mangrove swamps support a locally important fishery.
Fauna: About 80 species of brackish-water fishes are known from Kumai Bay. Water birds include *Phalacrocorax* sp*, Anhinga melanogaster, Egretta garzetta, E. alba, Ciconia episcopus, Leptoptilos javanicus, Pandion haliaetus* and *Haliaeetus leucogaster.* The Dugong *Dugong dugon* and *Irrawaddy Dolphin Orcaella brevirostris* occur in the bay, and Sus *scrofa* and *Pteropus* sp in the surrounding forests. Reptiles include the Estuarine Crocodile *Crocodylus porosus,* the sea-turtles *Eretmochelys imbricata, Chelonia mydas,* and the monitor lizard *Varanus salvator.*
Special floral values: No information.
Research and facilities: Basic faunal and floral surveys have been carried out.
References: Direktorat P.P.A. (1980j & 1984); Hardenberg (1936).
Criteria for inclusion: 1b, 2a, 2b, 3b.
Source: Marcel J. Silvius and Edi Djuharsa.

Wetland name: Tanjung Penghujan
Country: Indonesia
Coordinates: 2°55'S, 11 1°35'E;
Location: southwest of Kumai, Kabupaten Kotawaringin Barat, Central Kalimantan.
Area: 40,000 ha.
Altitude: 0-lOm.
Biogeographical province: 4.25.12.
Wetland type: 07 & 21.
Description of site: A swampy coastal area bordered by a fringe of mangrove forest (at least 17,500 ha) and backed by freshwater swamp forest.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangroves and freshwater swamp forest.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: The area has been proposed as a Nature Reserve (Cagar Alarn) and Recreation Park (Taman Wisata).
Land use: No information.
Disturbances and threats: Cutting of mangrove wood.
Economic and social values: The area has considerable potential for outdoor recreation.
Fauna: The area is known to support a great diversity of wildlife including Proboscis Monkeys *Nasalis larvatus* and many water birds, but no details are available.
Special floral values: No information.
Research and facilities: None
References: MacKinnon & Artha (l981a).
Criteria for inclusion: 1b, 2a, 3b.
Source: Marcel J. Silvius.

Wetland name: Muara Kendawangan
Country: Indonesia
Coordinates: 2°3O'-3°00'S, 11O°1O'-11O°30'E;

Location: 90 km SSE of Ketapang, Kabupaten Ketapang, West Kalimantan.
Area: c 150,000 ha.
Altitude: Sea level to 191m.
Biogeographical province: 4.25.12.
Wetland type: 06, 07 & 21.
Description of site: A large area of lowland swamp forests on the southwest coast of Kalimantan, with about 65,000 ha of peat swamp forest, 75,000 ha of freshwater swamp forest and 10,000 ha of mangrove forest. The site contains a complete seral succession of lowland habitats from coastal sand bars, mudflats and mangrove forest through swamp forest to dry lowland forest. The area is of low agricultural and forestry value, and is almost uninhabited.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest, freshwater swamp forest and peat swamp forest.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: A proposal that the area be designated as a Nature Reserve (Cagar Alam) has been approved.
Land use: Almost none; the area is almost uninhabited.
Disturbances and threats: None known.
Economic and social values: No information.
Fauna: Very little information is available. The site is known to be rich in wildlife including rare, protected species such as *Pongo pvginaeus, Nasalis larvatus* and *Crocodylus porosus*. The coastal mudflats and mangroves are thought to be important feeding areas for water birds including migratory shorebirds.
Special floral values: No information.
Research and facilities: No proper surveys have ever been carried out at the site.
References: MacKinnon & Artha (1981a).
Criteria for inclusion: lb. 2a, 2b.
Source: Marcel J. Silvius.

Wetland name: Gunung Palung and surrounding swamps
Country: Indonesia
Coordinates: l°02'-1°20'S, 109°53'-110°28'E;
Location: 150 km southeast of Pontianak, Kabupaten Ketapang, West Kalimantan.
Area: c.l30,000 ha.
Altitude: Sea level to 1,160m.
Biogeographical province: 4.25.12.
Wetland type: 04, 05, 06 & 07.
Description of site: A large area of relatively undisturbed hill and lowland forest around Gunung Palung mountain. The area contains a complete range of lowland to montane habitats, including 7,000 ha of mangrove forest, 20,000 ha of freshwater swamp forest, 30,000 ha of peat swamp forest, 5,000 ha of wet lowland forest on alluvium, 62,000 ha of moist lowland dipterocarp forest, 5,000 ha of wet hill forest and 1,000 ha of montane forest. Because of the superstitions of the local Malay villagers who believe that Gunung Palung is haunted, the bill forests are quite undisturbed. The lowland habitats have suffered some damage from logging and small-scale settlement, but this has had little effect on the fauna. Disturbance has been greatest in the coastal strip, which is now largely planted with coconuts. The beaches are partly muddy, partly sandy and partly rocky.
The double mountain Palung and Panti is isolated from any other mountain area by an extensive flat swampy plain. It is possible that the mountain was an island before the alluvial plain linked it

to the mainland. This isolation has resulted in an unusually high degree of endemism in the montane flora and fauna.

Climatic conditions: Humid tropical climate with an average annual rainfall of about 3,000 mm (180-190 rainy days per year). The site lies in the wettest climatic zone in Kalimantan.

Principal vegetation: The mangrove forest is heavily dominated by species of *Rhizophora* and *Bruguiera,* although its seaward edge is frequently lined with *Sonneratia alba* and *Avicennia* spp. The peat swamp forests are dominated by *Litsea amora, Parastemon* sp*, Hopea sangal* and *Shorea leprosala.* Other widespread species include *Calophyllum* sp and *Ganua motleyana.* Species diversity in the peat swamp forests is high; over 40 species were recorded in one half hectare plot. The freshwater swamp forests are dominated by *Litsea amora, Parastemon* sp, *Calophyllum* sp, *Hopea sangal, Alseodaphne* sp*, Parastemon urophyllum* and *Shorea laevifolia.* Beach forest formations include *Casuarina equisetifolia, Calophyllum inophyllum, Terminalia* sp*, Morinda* sp and *Hibiscus tiliaceus.*

Land tenure: State owned (PHPA, Indonesian Government).

Conservation measures taken: A Nature Monument of 30,000 ha was established in 193). Upon independence, this was upgraded. to Nature Reserve (Cagar Alam). The site was renotified by proclamation in 1981.

Conservation measures proposed: A proposal to upgrade the Nature Reserve to National Park status has been approved. There is also a proposal to extend the protected area to a total of 100,000 ha.

Land use: Logging by hand in the swamp forests (mainly for Ramin *Gonystylus bancanus),* some small-scale agriculture, fishing in the rivers, and the collection of firewood, building poles, mangrove bark, wild honey and resins. There is some commercial forestry in the surrounding areas. The nearest town to the reserve is Monggo Jering, about 10 km to the north. The human population density is low, ranging from 4.2 per sq km in the Simpang Hilir area to 31.9 per sq km in the Matan Hilir area.

Possible changes in Land use: Large areas to the north of the reserve are scheduled for a transmigration project. This will certainly increase boat traffic on the Simpang River.

Disturbances and threats: The most damaging human activity has been the logging of Rarnin especially near the Simpang and Matan Rivers. Only a small part of the existing reserve has been logged, but there has been extensive logging in the proposed extension to the reserve. Shifting cultivation has also caused some disturbance in the reserve.

Economic and social values: The site has considerable potential for outdoor recreation, with easy access and excellent possibilities for viewing wildlife. The reserve also serves a valuable function in watershed protection.

Fauna: No information is available on the fishes of the reserve, apart from the statement that there are fishes in the rivers and swamps, and mention of *Schieropagus formosus.*

A preliminary inventory of the avifauna recorded a total of 192 species of birds including 17 species of water birds. All Bornean bird families are represented. Some of the rarer species include Great Argus Pheasant *Argusianus argus,* the hornbills *Buceros rhinoceros, Rhinoplax vigil, Pitta baudi* and *Indicator archipelagicus.* Water birds include *Anhinga melanogaster, Butorides striatus, Egretta sacra, Ardea purpurea, A. sumatrana, Leptoptilos javanicus, Haliastur indus, Haliaeetus leucogaster, Amaurornis phoenicurus, Actitis hypoleucos, Sterna bergii,* the fish-owl *Ketupa ketupu* and the kingfishers *Alcedo meninting, A. puichella, Pelargopsis capensis, Ceyx rufidorsus, Halcyon pileata* and *H. chloris.* There is a very large roost of the Long-tailed Parakeet *Psittacula longicauda* on a steep hill near Kuala Melayu.

A preliminary list of the mammals of the Nature Reserve includes two Insectivora, four Chiroptera, seven Primata, seven Rodentata, two Carnivora and five Ungulata. Many more species (particularly nocturnal species) are known to occur in the area and presumably occur in the reserve. The reserve supports a very high density of Proboscis Monkeys *Nasalis larvatus,* which

live in large troops of up to 60 individuals and provide one of the main wildlife spectacles. The density of Orang-utans *Pongo pygmaeus* is the highest known for any site, perhaps because of the abundance of fruiting trees favoured by this species, e.g. *Durio* sp, *Garcinia* spp*, Ficus* spp*, Nephelium* sp, *Artocarpus* sp*, Dialium* sp*, Euphoria malayana, Dracontomelum mangiferum* and *Dillenia* sp. Other mammals include *Pteropus vampirus, Hylobates agilis, Macaca fascicularis, Presbytis rubicunda, P. melalophos, Nycticebus coucang, Helarctos malayanus, Viverra tangalunga, Tragulus napu, T. javanicus, Muntiacus muntjak, Cervus unicolor* and *Sus barbatus.* The rare Asian Two-horned Rhinoceros *Dicerorhinus sumatrensis* is known to have occurred in the past, but is now believed to be extinct in the area. The last definite record was an individual shot in 1939.
Reptiles include the rare False Gharial *Tomistoma schlegelii,* the monitor lizard *Varanus borneensis* (reported to be numerous) and the python *Python reticulatus.*
Special floral values: The forests support a great diversity of orchid species.
Research and facilities: Various preliminary surveys of the fauna and flora have been carried out, and several studies have been conducted on the primates.
References: FAO (1982c); IUCN (in prep); Karpowicz (1985); MacKinnon & Artha (l98la); Mahitala Unpar (1983).
Criteria for inclusion: 1b, 2a, 2b, 3b.
Source: Marcel J. Silvius and Edi Djuharsa.

Wetland name: Paloh
Country: Indonesia
Coordinates: 2°35'-2°46'S, 109°Ol'-l09°22'E;
Location: 50 km NNE of Singkawang, Kabupaten Sambas, West Kalimantan.
Area: 176,548 ha.
Altitude: 0-5m.
Biogeographical province: 4.25.12.
Wetland type: 02, 05 & 07.
Description of site: A large area of mangrove forest, dry beach forest and sandy beaches stretching for about 15 km along the coast from the mouth of the Belacan River; also some *Nypa* swamps along the lower reaches of the Belacan River. Some of the mangrove forest has been highly disturbed by logging activities.
Climatic conditions: Humid tropical maritime climate with an average annual rainfall of about 3,000 mm. Average temperatures range from 27-30°C; the average relative humidity is 80%.
Principal vegetation: Mangrove communities with species of *Avicennia, Rhizophora, Bruguiera* and *Sonneratia; Nypa fruticans* swamp, particularly along the Belacan River; dry beach forest with *Casuarina* sp*, Ipomoea pescaprae, Hibiscus tiliaceus, Terminalia catappa* and *Pandanus tectorius.*
Land tenure: BKPH-Sambas.
Conservation measures taken: None.
Conservation measures proposed: The area has been proposed as a Wildlife Reserve.
Land use: Forestry activities and the collecting of sea-turtle eggs.
Disturbances and threats: Excessive collection of sea-turtle eggs, cutting of mangroves for firewood and logging activities.
Economic and social values: The mangrove forest is a breeding and nursery area for species of marine fishes and prawns important in the local fishery.
Fauna: Fishes include *Labroides dimidiatus* and species of *Katsuwonis, Mugil, Lutjanus, Caranx, Epinephelus, Chaetodon, Acanthusus, Pomacentrus* and *Amphiprion.* Water birds known to occur in the area include *Phalacrocorax* sp*, Egretta intermedia, Ciconia episcopus, Pandion haliaetus, Haliaeetus leucogaster, Esacus magnirostris, Actitis hypoleucos, Sterna albifrons* and *Halcyon*

chloris. Mammals include *Macaca* sp, *Presbytis* sp, *Sus* sp*, Muntiacus muntjak, Cervus unicolor* and *Manis javanica.*
The sandy beaches provide important nesting sites for the sea-turtles *Chelonia mydas, Eretmochelys imbricata* and *Lepidochelys* sp. Other reptiles include *Callagur borneensis* and *Varanus salvator.*
Special floral values: No information.
Research and facilities: Preliminary faunal and floral surveys have been carried out.
References: Direktorat P.P.A. (1986e).
Criteria for inclusion: lb, 2a, 2c, 3b.
Source: Edi Djuharsa and Marcel J. Silvius.

Wetland name: Hutan Sambas
Country: Indonesia
Coordinates: 1°55'N, 109°25'E;
Location: in the extreme northwest corner of Kalimantan on the border with Sarawak, Kabupaten Sambas, West Kalimantan.
Area: 120,000 ha.
Altitude: Sea level to 600m.
Biogeographical province: 4.25.12.
Wetland type: 05, 07 & 21.
Description of site: A large area of lowland forest including about 43,000 ha of mangrove forest and 100 ha of beach forest. The rest of the area consists of peat swamps and moist lowland dipterocarp forest. The depth of water in the peat swamps varies from 50 cm in the wet season to 10-20 cm in the dry season. The main riverine system is the Sungai Sambas and its tributaries. The Sambas is about 500-1,000 meters wide and has a maximum depth of nine meters during the rainy season. Tidal influence is noticeable up to 30 km inland.
Climatic conditions: Humid tropical climate with an average annual rainfall of about 2,500 mm.
Principal vegetation: Mangrove forest, peat swamp forest, freshwater swamp forest and moist lowland dipterocarp forest. Dominant tree species include *Gonystylus bancanus, Dactyloclados stenostachys, Campnosperma auriculata, Vatica oblongifolia* and *Shorea* spp. The undergrowth consists of species of *Pandanus* and *Palmae.*
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: The area has been proposed as a Nature Reserve (Cagar Alam).
Land use: Forestry exploitation, shifting agriculture, hunting and harvesting of turtle eggs.
Disturbances and threats: Uncontrolled logging, hunting, harvesting of sea-turtle eggs and shifting agriculture. In 1979, the timber stock was considered to be sufficient for profitable exploitation, but it is not known whether or not commercial logging has since been carried out.
Economic and social values: The area could be part of an international reserve, linking up with the Samunsam Reserve in Sarawak, Malaysia.
Fauna: The area is known to be rich in wildlife, and there are several large and important sea-turtle nesting beaches.
Special floral values: The area is known to be of exceptional floral richness.
Research and facilities: A survey was carried out by the Direktorat Bina Program in 1979. An ecological survey was planned in 1986, but the researcher was not permitted to enter the area because of its military status (near the border with Sarawak).
References: Direktorat Bina Program (1979); MacKinnon & Artha (198la).
Criteria for inclusion: lb, 2a, 2b, 3b.

Source: Marcel J. Silvius and Eva T. Berczy.

Wetland name: Danau Sentarum
Country: Indonesia
Coordinates: 0°45'-l°02'N, 111°57'-l12°20'E;
Location: north of the Kapuas River, 700 km upstream from Pontianak, West Kalimantan.
Area: 80,000 ha.
Altitude: 35m.
Biogeographical province: 4.25.12.
Wetland type: 14 & 21.
Description of site: A low-lying plain with some 40,000 ha of lakes and almost 40,000of freshwater swamp forest and peat swamp forest, in the upper Kapuas river basin, some 700 km upstream from the delta. The plain is surrounded by hills rising to 400-500m, and a few isolated hills occur within the plain. This region, with its numerous lakes of various sizes and many interconnecting water courses, acts as a buffer for flood waters from the Kapuas River during the wet season, and regulates the flow of water further downstream. The lakes are shallow and ephemeral, and are best seen as extensive flood plains bearing a close similarity to the Grande Lac system in Kampuchea. The maximum depth of water during the wet season is about 7-8m. In most dry seasons, the lakes dry out completely leaving only a series of small streams. The pH is 5.0 in the lakes, 5.5-6.0 near the Kapuas River and about 4.0 in the peat swamps. The lake waters are coloured dark brown by tannic acids.
Climatic conditions: Humid tropical climate with an average annual rainfall of about 4,500 mm. The wettest months are October, November, December, March and often April; the driest months, June, July and August. The maximum temperatures are 35.0-35.5°C; the minimum, 21.5-22.0°C.
Principal vegetation: The aquatic vegetation includes *Eichhornia crassipes, Polygonum* spp*, Cyperaceae* and *Poaceae.* Stunted swamp forest is dominated by *Barringtonia acutangula, Croton slip, Eugenia* spp*, Garcinia* spp and *Ixora mentangis.* There are two types of freshwater swamp forest: forest near the Kapuas River is dominated by species of *Calophyllurn, Eugenia, Garcinia, Dyospyros* and *Melanorrhoea;* elsewhere the swamp forest is characterized by *Fragraea fragrans, Mallotus* spp and *Shorea balangeran.* The peat swamp forest is dominated by Calophyllum spp, Dryobalanops abnormis, Eugenia spp and *Shorea seminis.* Plant communities in adjacent areas include heath forest, hill dipterocarp forest and secondary forest.
Land tenure: State owned (PHPA).
Conservation measures taken: The area was declared a Wildlife Reserve (Suaka Margasatwa) in 1982**.** This conservation status is considered to be adequate, but actual protection is lacking (Giesen, 1987).
Conservation measures proposed: Giesen (1987) has made the following recommendations:
1. that logging and shifting cultivation be prohibited within the primary forest areas;
2. that various restrictions be placed on fishing activities, including curbs on mechanization and the prohibition of fine-meshed nets;
3. that village growth be curtailed;
4. that the boundary of the reserve be realigned to follow natural boundaries such as rivers.

Land use: Fishing, shifting cultivation, cultivation of rice and hunting. About 2,800-3,500 people live in some twenty villages within the reserve. Most are dependent on fisheries for their livelihood, while cultivation, logging and trade are of marginal importance.
Possible changes in Land use: Large tracts of the surrounding forests have been granted in concession to logging companies. There are plans to construct six dams for irrigation purposes and electricity generation on tributaries of the upper Kapuas River. These will have a profound effect

on the water regime of the Sentarum lakes and floodplain, and may result in a decline in fisheries production.

Disturbances and threats: Illegal logging, heavy hunting pressure and considerable human disturbance from the many small villages in the area. The forests are very susceptible to fire, and many hundreds of hectares have been lost to forest fires in recent years. Less than 1% of the reserve has been affected by shifting cultivation, but 50-70% of the adjacent hill slopes have been cleared of their original vegetation. The population of Asian Arowana *Scieropages formosus* is declining rapidly because of excessive trapping for the ornamental fish trade. Although the Arowana has been listed on Appendix I of CITES since 1975, international trade in the species continues.

Economic and social values: At least 3,000 to 4,000 fishermen are active in the lakes within the reserve. The annual production of fishes in the reserve is estimated at 3,000 metric tonnes. Productivity is high compared to other floodplain fisheries: 37.5 kg/ha/year for combined lakes and inundated forests, and 75 kg/ha/year for lakes alone. The total value of the fisheries in 1985 was calculated to be over 15,000 million rupees for edible fish and 775 million rupees for ornamental fish (Giesen, 1987). Some 300 tonnes of fish are consumed locally; the remainder is dried and salted for sale.

Of 207 plant species investigated by Giesen (1987), no fewer than 87% have a known use in the area, and most of these are useful to man.

Fauna: Some 113 species of fishes have been recorded. The commonest genera are:

Puntius (7 species)
Kryptopterus (6 species)
Osteochilus (6 species)
Ophiocephalus (5 species)
Rasbora (5 species)

The most abundant species in the fish catches are *Helostoma ternmincki, Mystus nernurus, Cyclocheilichthys janthochin, Osteochilus melanopleura* and *Kryptopterus micronema.* There is a marked seasonal migration of fish to and from the Kapuas River, and an annual cycle in the relative abundance of herbaceous and predatory fishes. The popular and very expensive red variety of the Asian Arowana *Scieropages formosus* occurs in the lake. Individuals of this variety, which in Indonesia is known only from West Kalimantan, may sell for as much as US dollar 2,700 in Jakarta.

The lakes and swamp forests support a wide variety of water birds including *Anhinga melanogaster, Ixobrychus cinnamomeus, Ardeola bacchus, Egretta* spp*, Ardea purpurea. Ciconia (episcopus) stormi, Sterna albifrons,* the raptors *Haliastur indus, Ichthyophaga ichthi'aetus, I. nana,* the fish-owl *Ketupa ketupu* and the kingfisher *Pelargopsis capensis.*

Mammals known to occur in the swamp forests include *Amblonyx cinerea, Nannosciurus melanotus, Nasalis larvatus, Macaca fascicularis, Cervus unicolor, Hystrix brachyura, Sus barbatus* and Tragulus spp. Other species occurring in surrounding hill forests include *Arctogalidia irivirgata, Helarcios malayanus, Hylobatus muelleri* and *Pongo pygmacus.*

Frogs are common. Common reptiles include *Chitra indica,* a tortoise, probably *Testudo ernys, Varanus borneensis* and *V. salvator.* The Estuarine Crocodile *Crocodylus porosus* and False Gharial *Tomistoma schlegelii* still occur in the swamps, but are now uncommon.

Four species of molluscs have been recorded, including two species of freshwater mussels.

Special floral values: Giesen (1987) recorded 282 species of plants of 70 families, including the first Bornean record of *Gluta pubescens* (Anacardinaceae) and a possible new species of *Vatica* (a dipterocarp). The latter is one of the commoner tree species in the inundated forests.

Research and facilities: The area has been visited by few scientists. The main expeditions to date have been those of Molengraaff, a geologist, in 1900, Polak, a soil scientist, in 1949, Vaas, an ichthyologist, in 1952, and Giesen, an ecologist, in 1984.

References: Giesen (1987).
Criteria for inclusion: 1b, le, 2a, 2b, 3b.
Source: Marcel J. Silvius and Eva T. Berczy.

Wetland name: The Marisa Wetlands
Country: Indonesia
Coordinates: 0°25'S, l2l°50'E;
Location: on the coast 130 km west of Gorontalo, in the western part of North Sulawesi.
Area: Over 2,000 ha of wetlands in a total region of c.94,000 ha.
Altitude: 0-10m.
Biogeographical province: 4.24.12.
Wetland type: 07, 11 & 21.
Description of site: Two coastal areas of mangrove forest, beach vegetation and freshwater swamp forest (1,000 ha) within the Randangan Proposed Wildlife Reserve, Panua Nature Reserve and Tanjung Panjang Proposed Wildlife Reserve. The Tanjung Panjang area also includes some islands of *Nypa* swamp with colonies of water birds.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest, *Nypa fruticans* swamp and beach vegetation.
Land tenure: The Randangan and Tanjung Panjang areas are state owned (Indonesian Government); the Panua Nature Reserve is state owned and under the management of PHPA.
Conservation measures taken: The Panua area (1,500 ha) has been protected as a Nature Reserve (Cagar Alam) since 1938.
Conservation measures proposed: The Randangan area (90,000 ha) and Tanjung Panjang area (2,500 ha) have been proposed as Wildlife Reserves (Suaka Margasatwa).
Land use: No information.
Disturbances and threats: Encroachment by settlers in the transmigration programme, the stealing of Maleo eggs, invasion by domestic livestock, and gold mining activities. There are plans to carry out logging in the area.
Economic and social values: The region's large population of water birds may be important in controlling pests on irrigated agricultural land in the Marisa Project. This project aims to irrigate a large area of saline swamp and accept large numbers of transmigrants.
Fauna: There are known to be several large breeding colonies of water birds on *Nypa* islands in the Randangan delta, but no details are available. Maleo Birds *Macrocephalon maleo* breed in the adjacent lowland forest.
Special floral values: No information.
Research and facilities: None
References: MacKinnon & Artha (1982d).
Criteria for inclusion: 1b, 2a, 2c, 3b.
Source: Marcel J. Silvius.

Wetland name: Togian Archipelago
Country: Indonesia
Coordinates: 0°08'-O°34'S, 121°34'-122°24'E;
Location: in Tomini Bay, Kabupaten Poso, Central Sulawesi.
Area: Unknown.
Altitude: Sea level to 542m.
Biogeographical province: 4.24.12.
Wetland type: 03, 04 & 05.

Description of site: A group of small islands with fringing sandy beaches and extensive, well developed and almost undamaged coral reefs, including atoll, barrier, fringing and patch reef types.
Climatic conditions: Humid tropical climate.
Principal vegetation: No information.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: The islands have been proposed as a Wildlife Reserve (Suaka Margasatwa), Nature Reserve (Cagar Alam) and Marine Conservation Area (Kawasan Pelastai ian Alam Laut).
Land use: Fishing.
Disturbances and threats: Dynamite fishing on the coral reefs; harvesting of sea-turtles, turtle eggs, tridacnid clams and coconut crabs for local consumption; and export of rattans, pearl oysters, trochus shells and coconut crabs by non-resident entrepreneurs.
Economic and social values: The islands are scenically very attractive and have great potential for the development of tourism. The surrounding waters support a locally important fishery.
Fauna: The Dugong *Dugong dugon* occurs around the islands. The sandy beaches are important for nesting Green Sea Turtles *Chelonia mydas* and Hawksbill Turtles *Eretmochelys imbricata*, and the Estuarine Crocodile *Crocodylus porosus* occurs. Invertebrates of note include coconut crabs, four species of tridacnid clams, pearl oysters and trochus shells. No information is available on the avifauna.
Special floral values: No information.
Research and facilities: None
References: MacKinnon & Artha (l982d).
Criteria for inclusion: lb. 2a.
Source: Marcel J. Silvius.

Wetland name: Perairan Pulau Peleng
Country: Indonesia
Coordinates: l°10'-2°15'S, l22°45'-123°55'E;
Location: around Pulau Peleng and the Banggi Islands, Kabupaten Banggai, Central Sulawesi.
Area: Unknown.
Altitude: Sea level.
Biogeographical province: 4.24.12.
Wetland type: 03, 04 & 05.
Description of site: The shallow waters around Pulau Peleng and the Banggai Islands, with their variety of coral reef and sea-grass habitats, and sandy beaches on several of the islands.
Climatic conditions: Humid tropical climate.
Principal vegetation: Extensive beds of sea-grasses.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: The area has been proposed as a Marine Park.
Land use: Fishing and hunting.
Disturbances and threats: Excessive hunting of Dugong and sea-turtles, and the harvesting of Tridacnid clams and sea-turtle eggs. Turtle eggs are collected in large numbers by the Bajo people to sell in Mantangan and Bonepuso.
Economic and social values: No information.
Fauna: A very important area for the Dugong *Dugong dugon,* which is still remarkably common despite heavy hunting pressure. Beaches on several of the Banggai Islands are important for nesting sea-turtles (e.g. Bokan Islands). No information is available on the avifauna of the islands.

Special floral values: No information.
Research and facilities: None
References: MacKinnon & Artha (l982d).
Criteria for inclusion: lb, 2a, 2c.
Source: Marcel J. Silvius.

Wetland name: Bakiriang
Country: Indonesia
Coordinates: l°37'S, 122°05'E;
Location: 70 km ENE of Tomari Bay, Kabupaten Banggai, Central Sulawesi.
Area: 1,000 ha.
Altitude: Sea level.
Biogeographical province: 4.24.12.
Wetland type: 05.
Description of site: A long, white, sandy beach, the adjacent narrow strip of beach forest, and part of the forested area behind the beach ridge.
Climatic conditions: Humid tropical climate.
Principal vegetation: Beach forest and lowland forest.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: The area has been proposed as a Wildlife Reserve (Suaka Margasatwa).
Land use: Harvesting of the eggs of Maleo Birds.
Possible changes in Land use: There is likely to be a considerable increase in population under transmigration schemes along the whole length of the coast.
Disturbances and threats: Clearing of forest in the feeding areas of the Maleo Birds, and lack of scientific guidelines in determining harvest quotas for their eggs.
Economic and social values: The eggs of the Maleo Birds have been harvested in the traditional way for many years, apparently on a sustainable yield basis.
Fauna: The beach is used as a nesting site by a large population of Maleo Birds *Macrocephalon maleo.*
Special floral values: None known.
Research and facilities: None
References: MacKinnon & Artha (1982d).
Criteria for inclusion: 1b, 2a, 2c.
Source: Marcel J. Silvius.

Wetland name: Morowali
Country: Indonesia
Coordinates: l°40'-2°10'S, 121°lO'-121°35'E;
Location: at the head of Tomari Bay, Kabupaten of Poso, Central Sulawesi.
Area: 200,000 ha, including 45,000 ha of alluvial plains along the coast.
Altitude: Sea level to 3,000m.
Biogeographical province: 4.24.12.
Wetland type: 01, 02, 03, 06, 07, 11, 12, 14 & 21.
Description of site: The main watershed of the eastern peninsula of Sulawesi, extending south towards Tomari Bay and including the water catchment basins of the Solato, Tiworo, Morowali and Ranu Rivers. There are three major mountain ridges running in a northwest to southeast

direction. Most of the area is covered with primary forest. There are some mangrove forests on the coast, especially in the estuaries of the Ranu, Morowali, Sumara, Tiworo and Solato Rivers.
The extensive alluvial plains are covered with mixed swamp forest, some of which is permanently inundated and some of which is seasonally inundated. There are two lakes (the Ranu Lakes) with large areas of open water, some muddy margins overgrown with sedges and rushes, and some small areas of *Pandanus* and sago palms. There are several small islands in Tomari Bay including Pulau Tokobae and Pulau Tomari. These islands are covered in virtually untouched forest and contribute largely to the spectacular views of the bay.
Climatic conditions: Tropical monsoonal climate with an average annual rainfall of 3,500-4,500 mm. Temperatures range from 21°C to 32°C (average at sea level 27°C). The average relative humidity is 75%.
Principal vegetation: *Rhizophora apiculata is* the dominant tree species in the mangroves.
Other species include *R. mucronata, Sonneratia alba, Bruguiera gymnorhiza, Lurnnitzera racernosa, Ceriops tagal, Xylocarpus granatum* and *Acrostichum* sp. The mixed swamp forests include *Pandanus* sp*, Aistonia scholaris, Calophyllum soulattri, Gonystylus macrophyllus* and *Palaquium* sp. Slender bamboos and rattans are abundant, and *Pandanus* is abundant in the undergrowth. Some areas of swamp forest are dominated by *Agathis* sp. Dominant plants in adjacent areas include *Acrostichum* spp*, Pandanus tectorius, Ficus* spp*, Eugenia* sp *and Casuarina* sp.
Land renure: Partly state owned (Indonesian government, PHPA) and partly owned by the Mon and Wana tribes.
Conservation measures taken: The area has been protected as a Strict Nature Reserve (Cagar Alam) since 1980.
Conservation measures proposed: None
Land use: Fishing in coastal areas; shifting cultivation and the collection of rattan and damar (resin of the *Agalhis* tree) in the forests. Local production amounts to 1,000 tons of rattan and 200 tons of damar per year. Local people hunt with blow-pipes. The Wana Tribe in the mountain forests are said to attack strangers with blow-pipes and darts. This is probably the main reason why the shores of the Ranu Lakes still remain unsettled. There are about 6,000 people registered in the area. Activities in surrounding areas include forestry and mining.
Disturbances and threats: Virtually the whole lower part of the Morowali Reserve has been allocated in timber concessions. There is some logging of *Agathis* trees, and the collection of resin kills the trees. The local people also collect the eggs of the Maleo Bird *Macrocephalon maleo.*
Economic and social values: The area has great potential for tourism and scientific research. The bulk of the production of ratan and damar is exported to Singapore and Hong Kong. The reserve incorporates the traditional hunting grounds and areas of shifting cultivation for several local tribes. The protected watersheds are also important for their irrigation capacity.
Fauna: The reserve is very rich in water birds. A great variety of species has been recorded including *Podiceps ruficollis, Pelecanus conspicillatus, Phalacrocorax sulcirostris, P. melanoleucos, Anhinga melanogaster, Jxobrychus sinensis, I. eurhythmus, I. cinnamomeus, I. flavicollis, Gorsachius goisagi, Ardeola speciosa, Bubulcus ibis, Butorides striatus, Egretta sacra, E. eulophotes, E. garzetta, E. intermedia, Ardea purpurea, A. sumatrana, Ciconia episcopus, Plegadis falcinellus, Dendrocygna arcuata, Nettapus coromandelianus, Anas gibberifrons, A. superciliosa, A. querquedula, Aythya australis, Rallus striatus, R. philippensis, Rallina eurizonoides, Porzana cinerea, Amaurornis isabellina, A. phoenicurus, Gallicrex cinerea, Gallnula tenebrosa, Porphyrio porphyrio* and *Irediparra gallinacea.*
Tomari Bay supports a variety of sea-birds including *Sula leucogaster, S. dactylatra, Fregata minor, F. ariel, Sterna sumatrana, S. albifrons, S. bergii* and *Anous stolidus.* The coastal zone is also of considerable importance for migratory shorebirds. The following species have been recorded in the Area: *Pluvialis dominica, P. squatarola, Charadrius dubius, C. alexandrinus, C.*

mongolus, C. leschenaultii, C. asiaticus, Limosa limosa, L. lapponica, Numenius minutus, N. phaeopus, N. madagascariensis, Tringa totanus, T. stagnatilis, T. nebularia, Xenus cinereus, Actitis hypoleucos, Heteroscelus brevipes, Phalaropus lobatus, Gallinago stenura, G. megala, Calidris tenuirostris, C. ruficollis, C. subminuta and *Limicola falcinellus.*
Resident shorebirds include the White-headed Stilt, Beach Thick-knee, Malay Sand Plover (*Himantopus leucocephalus, Esacus magnirostris, Charadrius peroni*) and the endemic Sulawesi Woodcock *Scolopax celebensis.* Other resident birds include *Pandion haliaetus,* the megapodes *Macrocephalon maleo, Megapodius freycinet,* and the kingfishers *Alcedo meninting, A. atthis, Pelargopsis capensis, P. melanorhyncha, Halcyon chloris, H. monachus* and *H. princeps.* Mammals known to occur in the Morowali area include *Phalanger celebensis, P. ursinus,* approximately 29 species of bats, *Tarsius spectrum, Macaca tonkeana, Macrogalidia musschenbroeki, Viverra tangalunga, Babirousa babirussa, Sus verrucosus, Cervus timorensis* and *Bubalus quarlesi.* Many of these species are endemic to Sulawesi.
The Estuarine Crocodile *Crocodylus porosus* is still fairly common in coastal areas and especially at the Ranu Lakes. Other reptiles include *Varanus* sp, *Hydrosaurus amboinensis, Testudo* sp, *Python reticulatus, Natrix* sp, *Psammodynastes* sp, *Dryophis* sp and *Trimersurus wagleri.*
About 230 species of butterflies have been collected in the reserve, mainly in the montane areas. The dominant families are Lycaimidae and Hesperiidae.
Special floral values: No information.
Research and facilities: The importance of the area for nature conservation was first recognized by A.P.M van der Zon and Yaya Mulyana in 1978. In 1980, a survey was carried out under the "Operation Drake" programme. This was based in Morowali from January to April 1980. A management plan has been prepared by A. Laurie (1980).
References: FAO (1978b); IUCN (in prep); Laurie (1980).
Criteria for inclusion: lb. 2a, 2b, 2c, 3b.
Source: Marcel J. Silvius and Edi Djuharsa.

Wetland name: Danau Poso
Country: Indonesia
Coordinates: 1°45'-2°05'S, 120°31'- 120°42'E;
Location: 125 km southeast of Palu, Central Sulawesi.
Area: c.38,000 ha.
Altitude: 510m.
Biogeographical province: 4.24.12.
Wetland type: 14.
Description of site: A large, permanent, freshwater lake in the hills of central Sulawesi. The lake drains north via the Sungai Poso into Tomini Bay.
Climatic conditions: Humid tropical climate.
Principal vegetation: No information.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing.
Disturbances and threats: The two endemic species of fishes of the family Adrianichthyidae may have been exterminated as a result of the introduction of predatory fish species.
Economic and social values: No information.
Fauna: The fish fauna includes four endemic species known only from this lake: *Adrianichthys kruyti, Xenopoecilus poptae* (Adrianichthyidae), *Weberogobius arnadi* (Gobiidae) and

Homorhamphus celebensis (Hemirhampidae). However, *A. kruyci* and *X. poptae* are very rare if not extinct. Introduced fish species include *Channa striata* and *Tilapia mossambica.*
The invertebrate fauna includes four endemic snails: *Tylamelania carko, T. neritiformis, T. porcellanica* (Thiaridae), and *Miratesta celebensis* (Planorbidae).
Special floral values: No information.
Research and facilities: None
References: Whitten *et al.* (1987).
Criteria for inclusion: lb, 2b, 2d.
Source: Marcel J. Silvius.

Wetland name: Napie Basin, Wuasa
Country: Indonesia
Coordinates: 1°35'S, 120°05'E;
Location: in the headwaters of the Sungai Lariang, 80 km SSE of Palu, Central Sulawesi.
Area: 10,000 ha, including 8,000 ha of wetlands.
Altitude: 1,100m.
Biogeographical province: 4.24.12.
Wetland type: 14, 15 & 18.
Description of site: A tectonic basin in the headwaters of the Lariang River, with extensive permanent swamps and seasonally inundated marshes. The alluvium is of lacustrine origin the tiny Lake Rano persists as a remnant of a former much larger lake. The extent of flooding probably varies seasonally according to rainfall in the catchment area. The wetland drains west via the Lariang River into the Makassar Strait, As with Lake Lindu (site 89), the swamps are reported to be a source of Schistosomiasis.
Climatic conditions: The basin is situated in a rain shadow and has a relatively dry tropical climate with an average annual rainfall of 1,500 mm. The wettest months are March-May, and the driest are August-September.
Principal vegetation: No information.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Some rice cultivation.
Disturbances and threats: No information.
Economic and social values: No information.
Fauna: No information.
Special floral values: A good example of a high altitude swamp.
Research and facilities: None
References: None
Criteria for inclusion: la.
Source: Derek A. Holmes.

Wetland name: Lake Lindu (Lore Lindu)
Country: Indonesia
Coordinates: 1°20'S, 120°05'E;
Location: 50 km SSE of Palu, Kabupaten Donggala/Poso, Central Sulawesi.
Area: Lake 4,250 ha; Wildlife Reserve 229,000 ha.
Altitude: Lake 960m; Wildlife Reserve 200-2,356m.
Biogeographical province: 4.24.12.

Wetland type: 14.
Description of site: An ancient, permanent, freshwater lake situated in a large Wildlife Reserve (the proposed Lore Lindu National Park). The only other wetland habitats in the prcposed National Park are the Lariang and Palu Rivers.
Climatic conditions: Humid tropical climate with an average annual rainfall of 2,330 mm. The temperature varies from 16-29°C, the relatively humidity, from 44-100%.
Principal vegetation: No information is available on the aquatic vegetation. The reserve contains extensive tracts of lowland, sub-montane and montane rain forest.
Land tenure: State owned (PHPA).
Conservation measures taken: The entire area (229,000 ha) was designated as a Wildlife Reseve (Suaka Margasatwa) in 1973 and 1981. A Recreation Park (Taman Wisata) of 31,000 ha was established around the lake in 1978.
Conservation measures proposed: The Wildlife Reserve has been proposed as a National Park.
Land use: Fishing and outdoor recreation; agriculture in surrounding areas.
Disturbances and threats: The endemic fish *Xenopoecilus sarasinorum* has become very rare and may, in fact, have been extirminated as a result of the introduction of predatory fishes. Populations of endemic snails have also been very much reduced by these predatory fishes. Over-fishing has become a problem, and there is a considerable amount of logging and hunting in surrounding areas.
Economic and social values: The reserve has great potential for outdoor recreation, and contains some of the finest megalith monuments in Indonesia, of considerable ethnic and historical interest. The lake is an important source of irrigation water for a large area of agricultural land. It is of special interest as one of the few sites in Indonesia with the disease Schistosomiasis. In the 1930s and 1940s, the related disease Echinostomiasis was also present. The endemic mussels *Corbicula lindoensis* and *C. subplanata* were the primary source of human infection.
Fauna: The lake and surrounding forests of the Wildlife Reserve contain a wealth of endemic wildlife. Six species of fishes have been recorded including the endemic *Xenopoecilus sarainorum***,** known only from this lake, and *Anabas testudineus.* Introduced fish species include *Channa striata* and *Tilapia mossambica.*
A wide variety of water birds has been recorded including *Podiceps ruficollis, Pelecanus conspicillatus, Phalacrocorax melanoleucos, Anhinga melanogaster, Ixobrychus cinnamomeus, I. flavicollis, Ardeola speciosa, Bubulcus ibis, Butorides striatus, Egretta garzetta, E. intermedia, E. alba, Ardea purpurea, Ciconia epsicopus, Plegadis falcinellus, Dendrocygna arcuata, Anas gibberifrons, A. superciliosa, Aythya australis, Haliastur indus, Haliaeetus leucogaster, Ichthyophaga nana, Amaurornis phoenicurus, A. isabel/ma, Rallus philippensis, R. striatus, R. torquatus, Poliolimnas cinereus, Gallicrex cinerea, Gallinula chioropus, G. tenebrosa, Porphyrio porphyrio, Irediparra gallinacea, Pluvialis dominica, Charadrius dubius, Tringa glareola, Actitis hypoleucos, Gallinago megala, Himantopus leucocephalus, Chlidonias hybrida,* the kingfishers *Alcedo meninting, A. atihis, Ceyx fallax, Pelargopsis melanorhyncha, Halcyon chloris, Cittura cyanotis, Actenoides monachus* and *A. princeps,* and the warbler *Acrocephalus orientalis.* Two species of rails endemic to Sulawesi, the Snoring Rail *Aramidopsis plateni* and Bare-faced Rail *Gymnocrex rosenbergii,* were observed in primary forest in the reserve in 1987. There have been no published records of the former species for about 45 years, while the latter was previously known from a single specimen and sight record. The endemic Sulawesi Woodcock *Scolopax celebensis* occurs in the forests around the lake.
Mammals include *Cervus tirnorensis, Macaca tonkeana, Phalanger ursinus, P. celebensis, Macrogalidia muschenbroeki, Sus celebensis, Babyrousa babyrusa* and *Anoa quarlesi.*
Amongst the reptiles, the snakes include *Python reticulatus, Elaphe erythrura, E. janseni, Psammodynastes pulverulentus, Xemopeltis unicolor, Ophiophagus hannah* and *Cylindrophis celebensis* (only one specimen known). Eleven species of lizards have been recorded including an

undescribed *Leiolopisma,* the endemic *Spenomorphus nigrolabris, Gekko gecko* and *Mabouya* spp. The twelve amphibians known from the area include an undescribed *Oreophryne.*
There are three endemic snails in the lake, *Brotia scalariopsis, B. teradjarum* (Thiaridae), and *Protancyclus adhaerens* (Viviparidae), and two endemic mussels, *Corbicula lindoensis* and *C. subplanata* (Corbiculidae).
Special floral values: No information.
Research and facilities: Several faunal and floral surveys have been carried out in the Wildlife Reserve.
References: Direktorat P.P.A. (1980c); MacKinnon & Artha (1982d); Whitten *et al.* (1987); WWF (1981).
Criteria for inclusion: lb, 2a, 2b, 2d, 3b.
Source: Marcel J. Silvius and Edi Djuharsa.

Wetland name: Lariang-Lumu Plains
Country: Indonesia
Coordinates: 1°l0'-l°45'S, l19°l7'-119°31'E;
Location: between Pasangkayu and Mamuju on the west coast of South Sulawesi, close to the border with Central Sulawesi.
Area: 145,000 ha, including Lumu 45,000 ha, Karosa 28,000 ha, Lariang 40,000 ha and Pasangkayu 32,000 ha.
Altitude: Near sea level.
Biogeographical province: 4.24.12.
Wetland type: 02, 05, 07, 08, 11, 13 & 21.
Description of site: The west coast plains of northern South Sulawesi are the most extensive areas of alluvium on the island of Sulawesi. Habitats range from sandy beaches and river mouths with narrow mangrove fringes and tidal areas, to extensive riverine alluvial swamps and peat swamps. Much of the area remains under primary forest.
Climatic conditions: Humid tropical climate with no marked seasonality. The average annual rainfall is 2,500 mm.
Principal vegetation: A wide range of natural forest types including mangroves, riverine forest and swamp forest.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: Surveys are urgently required to identify representative areas for conservation.
Land use: Extensive settlements on Lumu plain, scattered settlements along the coast (mainly fishing villages), and some new settlements along the rivers.
Possible changes in Land use: Spontaneous agricultural development and government development schemes.
Disturbances and threats: Most of the area has been studied under the transmigration planning programme and rejected as unsuitable for development. Nevertheless, spontaneous development is proceeding rapidly, and it is unlikely that such extensive alluvial areas can remain undisturbed for much longer in a densely populated island such as Sulawesi.
Economic and social values: No information.
Fauna: The area is known to be rich in wildlife, including Maleo *Macrocephalon maleo,* but no details are available.
Special floral values: The largest area of lowland alluvial forest on Sulawesi. The Lariang plain (40,000 ha) and contiguous Pasangkayu plain (32,000 ha) are the least disturbed areas.
Research and facilities: None

References: Binnie & Partners & Hunting Technical Services Ltd (1979).
Criteria for inclusion: lb.
Source: Derek A. Holmes.

Wetland name: Lampuko-Mampie
Country: Indonesia
Coordinates: c.3°25'S, 119°15'E;
Location: 30 km east of Majene, Kabupaten Polewali Mamasa, South Sulawesi.
Area: 2,000 ha.
Altitude: Sea level.
Biogeographical province: 4.24.12.
Wetland type: 07, 08 & 21.
Description of site:A low-lying, swampy area with disturbed secondary forests, 300 ha of swamp forest and
Climatic conditions: Humid tropical climate with an average annual rainfall of 1,500 mm, and an average temperature ranging from 27-31°C.
Principal vegetation: Mangrove forest dominated by *Ceriops tagal,Bruguiera* spp*,* with *Rhizophora* spp*, Sonneratia* sp, and *Acanthus ilicifolius. Pandanus* sp and *Casuarina* sp in adjacent areas.
Land tenure: State owned; managed by PHPA.
Conservation measures taken: The area was designated as a Wildlife Reserve (Suaka Margasatwa) in 1978.
Conservation measures proposed: None
Land use: Wildlife reserve; fishing, aquaculture and agriculture in surrounding areas.
Disturbances and threats: Drainage of swamps for agriculture, cutting of mangroves for timber and firewood, and hunting.
Economic and social values: The mangrove swamps play an important role in maintaining the local fishery resources.
Fauna: The area is reported to be rich in water birds such as egrets, storks, ibises and ducks. Concentrations of up to 500 *Plegadis falcinellus* have been recorded. Other species include *Tachybaptus ruficollis, Anhinga melanogaster, Egreita inlermedia, Ciconia episcopus, Dendrocygna arcuata, Haliaeetus leucogaster, Actitis hypoleucos* and several species of kingfishers (Alcedinidae). Mammals known to occur in the area include *Pteropus* sp*, Myotis* sp*. Macaca* sp*, Tarsius* sp, *Crocidura* sp*, Cervus timorensis, Viverra tangalunga* and Sus *celebensis.* Reptiles include the Green Sea Turtle *Chelonia mydas, Varanus salvator, Python* sp*, Lygosoma* sp, *Mabouya multifasciata* and *Emoia cyanura.*
Special floral values: No information.
Research and facilities: Preliminary faunal and floral surveys have been carried out.
References: Direktorat P.P.A. (1976c); MacKinnon & Artha (1982d).
Criteria for inclusion: lb. 2a, 3b.
Source: Marcel J. Silvius and Agustinus W. Taufik.

Wetland name: Bulurokeng
Country: Indonesia
Coordinates: 5°06'S, 119°26'E;
Location: 5 km northeast of Ujung Pandang, South Sulawesi.
Area: 3 ha.
Altitude: Sea level.
Biogeographical province: 4.24.12.

Wetland type: 10.
Description of site: A small area of under-utilized fish/shrimp ponds on the coast near Ujung Panjung, with adjacent tidal channels, mudflats and swampy pastureland. The tidal range in the channels is about one meter.
Climatic conditions: Humid tropical climate.
Principal vegetation: Marsh grasses, riverine scrub and palms. Mangroves are absent.
Land tenure: Privately owned.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Aquaculture on a relatively small scale; livestock grazing on adjacent pastures.
Possible changes in Land use: Intensification of aquaculture.
Disturbances and threats: The construction of a new airport highway along the east side of the site may have some adverse effects. Any intensification of aquaculture would reduce the suitability of the area for water birds.
Economic and social values: No information.
Fauna: A very important feeding and roosting area for a wide variety of waterfowl, notably herons, egrets and shorebirds. The Milky Stork *Mycteria cinerea* has been recorded on several occasions, and the Chinese Egret *Egretta eulophotes* has occurred. Garganey *Anas querquedula* occur in good numbers during the northern winter. Twenty-four species of shorebirds have been recorded, including *Limosa limosa* (up to 60), *Numenius madagascariensis, Caiidris acuminata* and *Philomachus pugnax.* Other species known to occur include *Ixobrychus sinensis, I. cinnamomeus, Ardeola speciosa, Bubulcus ibis, Egretta garzetta, E. intermedia, E. alba, Ardea purpurea, Ciconia episcopus, Dendrocygna arcuata, Anas gibberifrons, Chlidonias hybrida, C. leucoptera, Gelochelidon nilotica* and *Sterna albifrons.*
Monitor lizards *Varanus* sp are present in the area.
Special floral values: None known.
Research and facilities: None
References: None
Criteria for inclusion: 2a, 2b, 3b.
Source: C.J. Escott.

Wetland name: Muara Sungai Salowatu
Country: Indonesia
Coordinates: 4°22'S, 120°22'E;
Location: 20 km north of Watampone, Bone, South Sulawesi.
Area: 200 ha.
Altitude: Sea level.
Biogeographical province: 4.24.12.
Wetland type: 06, 07 & 10.
Description of site: A coastal area with about 140 ha of *Nypa* plantations, about 40 ha of other brackish swamps and marshes, and 20 ha of fishponds and prawn ponds. The wetlands are tidal, with brackish to saline waters.
Climatic conditions: Humid tropical climate.
Principal vegetation: *Nypa fruticans* swamp.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: None
Land use: The harvesting of *Nypa* for thatching purposes, aquaculture (fishponds and prawn ponds), and a little hunting. The area is inhabited by less than a hundred people.

Disturbances and threats: Hunting and the encroachment of agriculture.
Economic and social values: No information.
Fauna: The wetlands are important for a variety of water birds, and support a large mixed breeding colony of herons and egrets, located in very dense *Nypa* swamp. A survey in 1986 recorded the following:
100 *Bubulcus ibis*
100 *Egretta picata*
100 *E. garzetta*
40 *E. alba*
5 *Ardea purpurea*
33 *Mycteria cinerea*
2 *Haliaeetus leucogaster*
40 *Anas gibberifrons*
1,200 *A. querquedula*
and 80 *Nycticorax nycticorax* and *N. caledonicus*
Special floral values: No information.
Research and facilities: Interwader carried out a preliminary survey of the area in 1986, and has recommended that an aerial survey be conducted to assess the importance of the site for water birds.
References: Uttley (1986).
Criteria for inclusion: 1b, 2a, 2c, 3b.
Source: Marcel J. Silvius.

Wetland name: Danau Tempe and Danau Buaya
Country: Indonesia
Coordinates: 4°06'S, 119°58'E;
Location: 35 km ESE of Parepare, Kabupaten Wajo, Sinkang Region, South Sulawesi.
Area: 9,445 ha.
Altitude: c.50m.
Biogeographical province: 4.24.12.
Wetland type: 14.
Description of site: Two shallow, permanent, freshwater lakes in the same lacustrine system as Danau Sidenreng (site 95). Danau Tempe (6,000 ha) is much the larger of the two, and is an outstanding example of a shallow eutrophic lake ecosystem. There are several villages around the lake, and almost all of the surrounding forest has been cleared, except for the swampy forest between Tempe and Sidenreng. Both Tempe and Buaya are shallow (maximum depth about 5m) and support abundant floating vegetation.
Climatic conditions: Humid tropical climate with an average annual rainfall of 1,355 mm and high relative humidity.
Principal vegetation: The aquatic vege
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: Danau Tempe has been proposed as a Wildlife Reserve (Suaka Margasatwa).
Land use: Fishing; agriculture and human settlements in surrounding areas.
Disturbances and threats: Forest clearance, agricultural encroachment, over-fishing and illegal hunting.
Economic and social values: The lakes support a locally important fishery, and may have some potential for tourism.

Fauna: The lakes support a wide variety of fishes including two species known only from Danau Tempe and the nearby Danau Sidenreng (site 95): *Oryzias celebensis* (Adrianichthyidae) and *T. ladigesi* (Atherinidae). Other fishes include *Cyprinus carpio, Puntius javanicus, Anabas testudineus, Helastoma temmincki, Trichogaster pectoralis, Clarias batrachus, Chana hirata, Anguilla* sp and *Therapon microcanthus.*

Danau Tempe has a greater diversity of water birds than any other lake in Sulawesi. A survey in April 1986 recorded large numbers of *Ixobrychus flavicollis, Ardeola speciosa* and *Ardea purpurea,* along with:

35 *Nycticorax caledonicus*
50 *Egretta garzetta*
170 *Plegadis falcinellus*
315 *Dendrocygna arcuata*
40 *Anas gibberifrons*
10 *A. superciliosa*
50 *Chlidonias leucoptera*

Other species present included *Tachybaptus ruficollis, Phalacrocorax melanoleucos, Anhinga melanogaster, Ixobrychus sinensis, I. eurhythmus, I. cinnamomeus, Nycticorax nycticorax, Bubulcus ibis, Egretta alba, Ciconia episcopus, Amaurornis phoenicurus, Gallinula chloropus, G. tenebrosa, Porphyrio porphyrio, Irediparra gallinacea, Tringa glareola, Actitis hypoleucos, Calidris subminuta* and *Chlidonias hybrida.* Mammals include *Macaca maura, Paradoxus* sp and Sus sp; reptiles include *Hydrosaurus amboinensis, Crocodylus* sp and *Mabouya multifasciata.*

Special floral values: No information.

Research and facilities: Interwader carried out waterbird surveys at both lakes in April 1986 (Uttley, 1986).

References: Direktorat P.P.A. (19801); MacKinnon & Artha (1982d); Uttley (1986).

Criteria for inclusion: 1b, 2a, 2b, 2d, 3b.

Source: Marcel J. Silvius and Agustinus W. Taufik.

Wetland name: Danau Sidenreng

Country: Indonesia

Coordinates: 4°00'S, 119°52'E;

Location: 25 km east of Parepare, Central Sulawesi.

Area: c.3,700 ha.

Altitude: c.50m.

Biogeographical province: 4.24.12.

Wetland type: 14.

Description of site: A permanent freshwater lake in the lowlands of the southern peninsula of Sulawesi.

Climatic conditions: Humid tropical climate with an average annual rainfall of 1,355 mm.

Principal vegetation: No information.

Land tenure: State owned (Indonesian Government).

Conservation measures taken: None.

Conservation measures proposed: None

Land use: Fishing.

Disturbances and threats: No information.

Economic and social values: No information. The lake may have some potential for outdoor recreation and tourism.

Fauna: Little information is available. The lake is known to support a population of the endemic fish *Oryzias celebensis* (Adrianichthyidae), and may still support a population of *T. ladigesi*

(Atherinidae). Both these species are known only from this lake and Lake Tempe, six km to the southeast (site 94).
Special floral values: No information.
Research and facilities: None
References: Whitten *et al.* (1987).
Criteria for inclusion: lb. 2a, 2d.
Source: Marcel J. Silvius.

Wetland name: Lamikomiko
Country: Indonesia
Coordinates: 2°58'S, 120°11'E;
Location: near Palopo, at the northwest corner of Teluk Bone, Kabupaten Luwu, South Sulawesi.
Area: 5,000 ha.
Altitude: Sea level.
Biogeographical province: 4.24.12.
Wetland type: 07.
Description of site: Approximately 1,500 ha of coastal mangrove forest backed by lowland forest on alluvial soils. The forests are of high botanical interest and support a diverse avifauna.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest; lowland rain forest in adjacent areas.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: The area has been proposed as a Nature Reserve (Cagar Alam).
Land use: Cutting of mangroves for local use.
Disturbances and threats: Excessive exploitation of the mangrove forest.
Economic and social values: No information.
Fauna: The area is known to be rich in water birds, but no details are available.
Special floral values: A particularly diverse mangrove forest, of great botanical interest.
Research and facilities: None
References: MacKinnon & Artha (1982d).
Criteria for inclusion: 1b, 2b.
Source: Marcel J. Silvius.

Wetland name: North Coast of Teluk Bone
Country: Indonesia
Coordinates: 2°58'S, l20°l2'E to 2°35'S, l21°03'E;
Location: the north coast of Bone Bay between Palopo and Malili, South Sulawesi.
Area: c.5,000 ha.
Altitude: Sea level.
Biogeographical province: 4.24.12.
Wetland type: 01, 02, 06 & 07.
Description of site: About 100 km of coastline in a sheltered gulf, with many small river mouths fringed with mangrove forest. At low tide, about 200 ha of mudflats and about 5,000 ha of sandy flats are exposed.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest.
Land tenure: State owned (Indonesian Government, PHPA).

Conservation measures taken: Part of the area is totally protected.
Conservation measures proposed: None
Land use: Some aquaculture (prawn ponds and fishponds).
Possible changes in Land use: Part of the area has been designated for agricultural use.
Disturbances and threats: Encroachment of aquaculture ponds and agricultural development.
Economic and social values: No information.
Fauna: An important area for a wide variety of water birds. Birds recorded during a brief survey in April 1986 include *Ardeola speciosa, Butorides striatus, Egretta* sp (500)*, Ardea cinerea, A. sumatrana, Mycteria cinerea* and fifteen species of migratory shorebirds, mainly *Charadrius* spp*, Limosa lapponica, Numenius phaeopus, Tringa totanus, Xenus cinereus* and *Heteroscelus brevipes.*
Special floral values: No information.
Research and facilities: None
References: None
Criteria for inclusion: 1b, 2a, 3b.
Source: Marcel J. Silvius.

Wetland name: Malili Lake System
Country: Indonesia
Coordinates: 2°25'-2°56'S, l2l°13'-l21°41'E;
Location: in the hills east of Malili, Central Sulawesi, north of the border with South Sulawesi.
Area: Danau Towuti c.59,000 ha; Danau Matano c.16,500 ha; other lakes c.2,500 ha.
Altitude: 7l0-760m.
Biogeographical province: 4.24.12.
Wetland type: 14.
Description of site: Four permanent, freshwater lakes: Towuti, Matano, Mahalona and Wawontoa, remarkable for their high number of endemic fish species. Danau Towuti (59,000 ha), the largest lake in Sulawesi, is surrounded by forested hills. There are extensive nickel mines and hydro-electric power installations on the southern shore of Danau Matano.
Climatic conditions: Humid tropical climate.
Principal vegetation: No information.
Land tenure: Danau Towuti is state owned (PHPA); no information is available for the other lakes.
Conservation measures taken: A Recreation Park (Taman Wisata) has been established on the shore of Danau Towuti. The park includes 6,000 ha of lowland forest on ultra-basic rock.
Conservation measures proposed: None
Land use: Fishing at all four lakes; mining and generation of electricity at Danau Matano. There are several small villages around Danau Towuti.
Disturbances and threats: The human population is expanding rapidly in the area. Nickel mines cause a considerable amount of pollution in Danau Matano, and there is some disturbance from the hydro-electric power station. Many exotic fish species have been introduced in the lakes, and these introductions continue (four new species in recent years). The main threats to the endemic fishes are pollution of the lakes with organic effluents from the rapidly expanding human population, and the introduction of exotic fish species. There are plans to carry out logging in the forests around Danau Towuti.
Economic and social values: The lakes are set in an area of great scenic beauty, and have considerable potential for outdoor recreation and tourism.
Fauna: The lakes are remarkable for their high number of endemic fish species. No less than sixteen species are known only from these lakes, and ten of these are confined to a single lake.

Danau Towuti has the largest number of endemics (ten), followed by Matano (six), Mahalona (five) and Wawontoa (four). Introduced species include *Cyprinus carpio, Channa striata* and *Trichogaster tricopterus.*
Special floral values: No information.
Research and facilities: None
References: Direktorat P.P.A. (1977b); MacKinnon & Artha (1982d); Whitten *et al*. (1987).
Criteria for inclusion: 1b, 2b, 2d.
Source: Marcel J. Silvius and Eva T. Berczy.

Wetland name: Watumohae
Country: Indonesia
Coordinates: 4°22'-4°34'S, 121°44'-122°1O'E;
Location: 80 km southwest of Kendari, Kabupatens Kendari and Buton, Southeast Sulawesi.
Area: Hunting Park of 50,000 ha including 3,200 ha of mangrove forest.
Altitude: Sea level to 400m.
Biogeographical province: 4.24.12.
Wetland type: 05, 07, 11 & 18.
Description of site: An area of coastal plains and hills with many rivers, 3,200 ha of mangrove forest, 25,300 ha of grassland and savanna, and about 21,000 ha of tropical rain forest. The savanna is a secondary formation, formed as a result of shifting cultivation. Parts of the grassland and savanna are seasonally flooded.
Climatic conditions: Humid tropical climate with an average annual rainfall of 1,773 mm. The months of August, September, October, November and December are relatively dry; the rest of the year is wet.
Principal vegetation: Mangrove forest with *Bruguiera gyninorhiza, Sonneratia alba, S. acido, Ceriops tagal, Rhizophora stylosa, R. apiculata* and *Avicennia marina.* Dominant plants *elsewhere include Imperata cylindrica, Andropogon* sp, *Saccharum spontaneum, Cyperus* sp*, Arenga pinnata, Nauclea orientalis, Metrosidoros petiolata, Garcinia celebica, Hibiscus tiliaceus, Intsia bijuga, Asporosa* sp and *Vitex* sp.
Land tenure: State owned (PHPA).
Conservation measures taken: The Hunting Park (Taman Buru) of 50,000 ha was established in 1976.
Conservation measures proposed: It has been proposed that hunting should be prohibited and the status of the park upgraded to that of a Wildlife Reserve (Suaka Margasatwa). The protected area could eventually be linked with the nearby Rawa Opa Reserve.
Land use: Hunting; agriculture, hunting and tourism in surrounding areas.
Disturbances and threats: Illegal hunting.
Economic and social values: No information.
Fauna: Water birds known to occur in the park include *Phalacrocorax* sp, *Egretta* sp, *Mycteria cinerea, Plegadis falcinellus, Dendrocygna guttata, Anas* sp*, Pandion haliaetus, Haliastur indus, Sterna albifrons* and *Halcyon cyanoventris.* The Maleo Bird *Macrocephalon maleo* is present.
Mammals include *Cervus timorensis, Sus scrofa, Macaca nigra, Anoa depresicornis, Manis javanica, Pteropus* sp and *Bos bubulus.* Reptiles include the Estuarine Crocodile *Crocodylus porosus* and *Varanus salvator.*
Special floral values: No information.
Research and facilities: Preliminary faunal and floral surveys have been carried out.
References: Direktorat P.P.A. (1976d & 1978b); Djatmikas (1975); MacKinnon & Artha (1982d).
Criteria for inclusion: l b, 2a, 3b.
Source: Marcel J. Silvius, Edi Djuharsa and Agustinus W. Taufik.

Wetland name: Tanjung Peropa
Country: Indonesia
Coordinates: c.4°05'S, 122°45'E;
Location: Kabupaten Kendari, Southeast Sulawesi.
Area: Area of wetlands unknown; Wildlife Reserve 38,000 ha.
Altitude: Sea level to 800m.
Biogeographical province: 4.24.12.
Wetland type: 05, 07 & 08.
Description of site: A small area of coastal mangrove forest backed by dry shrub and brush forest. Further inland, the land becomes hilly and is covered with rain forest. Parts of the forest near the coast have been cleared for agricultural use (ladang). Several small rivers flow through the area; these are fringed with mangroves along their lower, tidal reaches.
Climatic conditions: Humid tropical climate with an average annual rainfall of 1,600 mm. The average temperature is 26.3°C, and the relative humidity, 80%.
Principal vegetation: Mangrove forest with *Sonneratia alba, Rhizophora mucronata, Ceriops tagal* and *Bruguiera* sp. Dominant plants in adjacent areas include *Imperata cylindrica, Jntsia bijuga, Tetrameles mediflora, Castaneopsis* sp, *Arenga pinnata, Bambusa* sp, *Ficus* sp, *Barringtonia* sp and *Hibiscus tiliaceus.*
Land tenure: State owned (PHPA).
Conservation measures taken: The area was designated as a Wildlife Reserve in 1980.
Conservation measures proposed: None
Land use: Nature conservation.
Disturbances and threats: Illegal wood-cutting, shifting cultivation and increased human settlement.
Economic and social values: No information.
Fauna: An important area for water birds; species known to occur include *Phalacrocorax sulcirostris, Anhinga melanogaster, Nycticorax caledonicus, Egretta alba, Ardea sumatrana, Ciconia episcopus, Pandion haliaetus, Himantopus leucocephalus, Chlidonias hybrida, Sterna albifrons* and the kingfishers *Alcedo atthis* and *Halcyon cyanoventris.*
Mammals include *Anoa depressicornis, Macaca nigra, Phalanger celebensis, Sus scrofa, Cervus timorensis* and *Callosciurus* sp. Reptiles and amphibians include the Estuarine Crocodile *Crocodylus porosus, Varanus salvator, Rana* sp and *Bufo* sp.
Special floral values: No information.
Research and facilities: Basic faunal and floral surveys have been carried out.
References: Direktorat P.P.A. (1978c & 1983b).
Criteria for inclusion: 1b, 2a, 3b.
Source: Edi Djuharsa.

Wetland name: Pulau Kawi-Kabia
Country: Indonesia
Coordinates: 6°54'S, 122°12'E;
Location: in the Flores Sea, 140 km SSW of Pulau Buton, Kabupaten Buton, Southeast Sulawesi.
Area: c.100 ha.
Altitude: Sea level.
Biogeographical province: 4.24.12.
Wetland type: 03 & 05.
Description of site: A small and very remote coral island, used by sea-turtles and sea-birds.

Climatic conditions: Humid tropical climate.
Principal vegetation: No information.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: The island has been proposed as a Nature Reserve (Cagar Alam).
Land use: Fishing.
Disturbances and threats: Over-fishing, the destruction of coral reefs, and stealing of sea-turtle eggs.
Economic and social values: No information.
Fauna: Sea-turtles are known to breed on the island, and there may be breeding colonies of sea-birds, but no details are available.
Special floral values: No information.
Research and facilities: None
References: MacKinnon & Artha (1982d).
Criteria for inclusion: lb, 2a, 2c.
Source: Marcel J. Silvius.

Wetland name: Tukang Besi Archipelago
Country: Indonesia
Coordinates: 5°15'-6°08'S, 123°27'-124°38'E;
Location: at the southeastern extremity of the Sulawesi islands, 30-180 km southeast of Pulau Buton, Kabupaten Buton, Southeast Sulawesi.
Area: Unknown.
Altitude: Sea level.
Biogeographical province: 4.24.12.
Wetland type: 03, 04 & 05.
Description of site: A number of small, offshore islands with an excellent range of coral reefs showing the progression from fringing reefs to barrier reefs and atolls. The remotest of the islands, Pulau Moromaho, supports a large breeding colony of sea-birds.
Climatic conditions: Humid tropical climate.
Principal vegetation: No information.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: The islands and adjacent seas have been proposed as a Marine Wildlife Reserve (Suaka Margasatwa Laut). It has also been proposed that Pulau Moromaho be designated as a Strict Nature Reserve (Cagar Alam).
Land use: Fishing.
Disturbances and threats: Over-fishing and the destruction of coral reefs.
Economic and social values: No information.
Fauna: The islands are known to be important for breeding sea-birds, Dugongs *Dugong dugon,* sea-turtles and other marine life, but no details are available.
Special floral values: No information.
Research and facilities: None
References: MacKinnon & Artha (1982d).
Criteria for inclusion: lb. 2a, 2c.
Source: Marcel J. Silvius.

Wetland name: Gunung Gamkonora Crater Lake
Country: Indonesia
Coordinates: l°15'N, l27°29'E;
Location: 55 km NNE of Ternate, Kabupaten Maluku Utara, Halmahera, Moluccas.
Area: c.100 ha.
Altitude: Unknown.
Biogeographical province: 5.1.13.
Wetland type: 14.
Description of site: An interesting crater lake on a steep volcano; the highest peak on Halmahera (l, 640m). The rich volcanic soils on the slopes of the volcano support lush forests, which are an important water catchment area for the fertile Akelamo valley and coastal agricultural land.
Climatic conditions: Humid tropical climate with heavy rainfall.
Principal vegetation: No information.
Land tenure: State owned.
Conservation measures taken: None.
Conservation measures proposed: Mackinnon and Artha (1981b) have proposed that the entire area (32,000 ha) be designated as a Wildlife Reserve (Suaka Margasatwa).
Land use: No information.
Disturbances and threats: There are plans to carry out logging in the lowlands.
Economic and social values: The crater lake is of considerable scientific interest, and the surrounding forests are of vital importance in protecting the water catchment area which, with its loose soils, steep slopes and heavy rainfall, is very vulnerable to erosion. The area has considerable potential for tourism.
Fauna: No information.
Special floral values: The forests around the crater lake are a good example of very wet forest on volcanic soils.
Research and facilities: There is an airstrip at Kuripasi and a trail leading up to the crater lake.
References: Mackinnon & Artha (1981b).
Criteria for inclusion: la.
Source: Alison Skene.

Wetland name: Wasile Bay
Country: Indonesia
Coordinates: 0°15'-035'N, 127°53'-1281O'E;
Location: Kabupaten Maluku Utara, Halmahera, Moluccas.
Area: Unknown.
Altitude: Sea level.
Biogeographical province: 5.1.13.
Wetland type: 01, 05, 07 & 11.
Description of site: A shallow sea bay and estuarine system with mangrove swamps and sandy beaches, in the central part of Halmahera. The bay is surrounded by a coastal plain varying between three and ten km in width.
Climatic conditions: Humid tropical climate. The rainfall is reported to be heavy and certainly exceeds 2,000 mm per year. The average temperature is 25°C.
Principal vegetation: Mangrove forest with *Bruguiera* spp*, Sonneratia alba* and *Heritiera* sp, and beach forest with *Corallia brachiata, Callophyllum inophyllum, Barringlonia* sp *and Calamus* sp. Lowland tropical rain forest in adjacent areas.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.

Conservation measures proposed: The entire area has been proposed as a Nature Reserve.
Land use: About 5,000 people live in the lowlands around Wasile Bay, near the proposed reserve.
Disturbances and threats: Illegal cultivation, development in transmigration schemes, particularly in coastal areas, and timber concessions.
Economic and social values: No information.
Fauna: Little information is available, although the area is known to be rich in endemic species. A variety of water birds have been recorded including *Fregata minor, Nycticorax caledonicus, Bubulcus ibis, Dendrocygna guttata, Tadorna radjah, Pandion haliaetus, Esacus magnirostris, Numenius minutus, Tringa nebularia* and *Sterna anaethetus.* Mammals include *Petaurus breviceps, Macaca* sp, *Sus scrofa, Pteropus* sp*, Paradoxurus hermaphroditus* and *Musaderma spasma.* The Estuarine Crocodile *Crocodylus porosus* is known to occur.
Special floral values: No information.
Research and facilities: None
References: FAO (1981d).
Criteria for inclusion: lb, 2a, 2d, 3b.
Source: Agustinus W. Taufik.

Wetland name: Wae Apo
Country: Indonesia
Coordinates: 3°20'S, l27°04'E;
Location: seven km southwest of Namlea, northeast Pulau Buru, Kabupaten Maluku Tengah, Moluccas.
Area: c.3,000 ha.
Altitude: Sea level.
Biogeographical province: 4.24.12.
Wetland type: 02 & 07.
Description of site: An excellent stand of stabilized and well-formed mangrove forest at the mouth of the Apo River. The area is virtually undisturbed.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest dominated by *Rhizophora* sp along the seaward edge, and species of *Avicennia* and *Bruguiera* further inland.
Land tenure: Partly state owned and partly owned by the local people.
Conservation measures taken: None.
Conservation measures proposed: MacKinnon and Artha (1981b) have proposed that an area of 3,000 ha be designated as a Nature Reserve (Cagar Alam). This would include only half of the mangrove forest; the remaining half is considered quite adequate to provide mangrove products to meet the genuine needs of the local people.
Land use: Some exploitation of mangrove products for local use.
Disturbances and threats: The cutting of *Rhizophora* timber for boat-building, and cutting of mangroves for firewood. The area has potential for logging.
Economic and social values: The mangrove forest is clearly of great importance in maintaining the local fishery, and protects the sawah areas of Wae Apo from tidal flooding.
Fauna: No information.
Special floral values: An excellent stand of mature mangrove forest; a rare habitat type in the Moluccas.
Research and facilities: None
References: MacKinnon & Artha (1981b).
Criteria for inclusion: lb.
Source: Alison Skene.

Wetland name: Pulau Kasa
Country: Indonesia
Coordinates: 3°18'S, 128°08'E;
Location: in Teluk Piru at the west end of Seram Island, Kabupaten Maluku Tengah, Seram, Moluccas.
Area: 2,000 ha (800-900 ha of land, 1,100-1,200 ha of sea).
Altitude: Sea level.
Biogeographical province: 5.1.13.
Wetland type: 03 & 05.
Description of site: A small sandy island with scrubby forest, sandy beaches and surrounding coral reefs; about eight km offshore in Piru Bay.
Climatic conditions: Tropical maritime climate.
Principal vegetation: Scrubby forest.
Land tenure: State owned.
Conservation measures taken: The land area was designated as a Wildlife Reserve (Suaka margasatwa) and the sea area as a Marine Park (Taman Laut) in 1978. The megapode *Megapodius reinwardi* that inhabits the scrubby forest has been protected by law since 1970.
Conservation measures proposed: It is essential that the wardening of the island be improved to stop the present gross abuses.
Conservation measures proposed: None
Land use: Fishing.
Disturbances and threats: The illegal gathering of megapode eggs, gathering of molluscs and corals, over-fishing and fishing with dynamite.
Economic and social values: No information.
Fauna: Little information is available. The megapode *Megapodius reinwardt* occurs in the scrubby forest, and sea-turtles nest on the sandy beaches.
Special floral values: No information.
Research and facilities: None
References: Kvalvagnaes & Halim (l979b); MacKinnon & Artha (l98lb); Salm *et al.* (1982).
Criteria for inclusion: lb, 2a, 2c.
Source: Alison Skene.

Wetland name: Wetlands in Manusela Proposed National Park (Wae Mual and Wae Nua Reserves)
Country: Indonesia
Coordinates: 3°00'S, l29°30'E;
Location: the central part of Seram Island from the north coast to Teluk Teluti, Kabupaten Maluku Tengah, Central Seram, Moluccas.
Area: Area of wetlands unknown; proposed National Park 180,000 ha.
Altitude: Sea level to 3,027m.
Biogeographical province: 5.1.13.
Wetland type: 04, 05, 07, 11 & 21.
Description of site: The proposed Manusela National Park extends across the central section of Seram from the north coast to the south coast (over 55 km). It includes sections of two major east-west mountain ridges, deep-sided river valleys, and the headwaters of several major rivers. North of the mountain chain, there are low hills and alluvial plains with low ridges of coral limestone and coral sands. The northern plains are drained by a number of shallow and often very

wide rivers. The southern region is drained by one major river, the Wae Kawa, and numerous fast-flowing streams in narrow valleys. Severe flooding occurs annually in the lowlands. Beach and mangrove communities occur along the north coast, and there are estuarine habitats at the river mouths. At the northwestern extremity of the reserve, there are steep limestone cliffs up to lOOm in height. In some areas, small pockets of lowland swamp forest occur between the coastal mangroves and the montane forests of the interior. Large areas of forest are swampy, especially in the wet season from December to April. Wae Nua Reserve alone covers the maximum altitudinal range possible on the island, and the whole park encompasses the complete spectrum of Seram's forest ecosystems.

Climatic conditions: Humid tropical maritime climate, with a long rainy season and temperatures ranging from 25-35°C. The average annual rainfall is approximately 2,000 mm; most rain falls during the wet season (December to April), but there is some rainfall throughout the year. The rainfall is not, however, uniformly distributed throughout the park, the pattern being influenced by the mountains. On the north coast and plains, the wet season lasts from November to April, and there are strong winds from January to March (west monsoon); the period from May to October is drier, with the monthly rainfall usually less than 100 mm. In southern areas, the wet season lasts from May to October; rainfall is heaviest in July, and there are strong winds in July and August (southeast monsoon). Manusela Valley has a climate similar to the north coast.

Principal vegetation: The mangrove communities, which are best developed on Tanjung Mual, include species of *Sonneratia, Rhizophora, Bruguiera* and *Avicennia* along with *Nypa fruticans.* Beach formations include *Casuarina equisetifolia* and species of *Ipomoea, Spinifex, Terminalia* and *Pandanus.* Lowland swamp forest occurs in small pockets behind the mangrove belt on the north coast. There are also areas of swampy forest to the north of Raho. Tree species in the swamp forest include *Nauclea* sp, *Barringtonia racemosa, Ficus nodosa* and *Melaleuca leucodendron.* Riverine vegetation is well developed along the major rivers. Characteristic species include *Octomeles sumatrana, Eucalyptus deglupta, Pometia pinnata, Casuarina equisetifolia, Ficus* spp*, Litsea* spp and *Eugenia* spp. Riverine forest is characterized by species of *Eucalyptus, Casuarina* and *Pandanus.* The dominant plant communities elsewhere in the park are lowland rain forest and montane rain forest.

Land tenure: State owned (Indonesian Government, PHPA).

Conservation measures taken: Two Nature Reserves (Cagar Alam) were established in 1982; the Wae Nua Nature Reserve (20,000 ha) and the Wae Mual Nature Reserve (17,500 ha). The Wae Mual Nature Reserve has since been extended to 35,000 ha.

Conservation measures proposed: MacKinnon and Artha (1981b) have proposed that an area of 180,000 ha, including both Nature Reserves, be designated as a National Park (Taman Nasional). Recommendations for management include: (a) limiting tourist development until demand exceeds the facilities already available; (b) better delimitation of the reserve boundaries; (c) increasing the number of management personnel; (d) enforcing strong protection measures for crocodiles and sea-turtles; (e) imposing a strict ban on the collecting of the famous endemic butterflies.

Land use: About 90% of the proposed Manusela National Park is untouched. The other 10% has a long history of human habitation, especially along the southeast coast where there has been a recent increase in settlement. Thus, it is in these coastal areas, up to 400m in altitude, that most forest clearance has taken place. Cleared land is cultivated with perennial crops such as cloves and coconuts. There is some agricultural land along the north coast, as well as large areas of alang-alang *(Imperata cylindrica).* Logging activities have disturbed large patches of forest in the coastal regions of the Mual plains just behind the mangrove belt, but this logging has now been stopped. Forest in the Manusela Valley is heavily disturbed as a result of more than a century of cultivation. This area contains numerous gardens, clearings and patches of secondary forest in all stages of development. Other activities in the forest include collection of damar (resin from

Agathis trees), rattans, firewood and timber, the trapping of birds for trade, and the hunting of pigs, deer and phalangers.

Possible changes in Land use: The island of Seram has been considered as a target area for transmigration schemes (DHV Consulting Engineers *et al*., 1982a & 1982b).

Disturbances and threats: Logging and clearance of forest for agricultural purposes are the main threats. Logging is currently being carried out in the southern part of Central Seram, but is also planned for many other areas. Part of the northern lowlands were logged prior to the establishment of a Nature Reserve. In 1981, there were three companies active in the region. Forest cover is essential for the prevention of erosion of the shallow soil both on slopes and in flat lowland areas where severe flooding occurs every year. There is an increase in human settlement and shifting agriculture in coastal zones, especially in the Wae Nua area. Large numbers of birds, such as parrots, cockatoos and lories, are trapped for the cage-bird trade, and there is a considerable amount of trade in butterflies. Large numbers of eggs of the Geen Sea Turtle *Chelonia mydas* are collected for human consumption. Damar and other forest products are over-exploited, especially in the coastal plains of Wae Mual, and there is a lack of control or management of these resources. Road construction and mineral exploitation may have adverse effects in the proposed National Park. The Wae Mual Nature Reserve has been threatened by an irrigation scheme (Wind & Amir, 1978).

Economic and social values: The forests are of vital importance in protecting the water catchment areas of some of Seram's largest rivers. Under appropriate management, a wide variety of forest products could be exploited on a sustainable basis. The area has high scenic values and great potential for scientific research, education and tourism. The proposed National Park includes a variety of unique biota and habitats, containing all of Seram's endemic species.

Fauna: The fauna is a transitional mixture of Australian and Asian elements. A total of 117 species of birds has been recorded, including 14 species endemic to the island of Seram, but little information is available on the water birds. There is reported to be a good nesting beach for the Maleo Bird *Macrocephalon rnaleo* one km west of Wahai. Twelve species of mammals have been recorded including *Cervus timorensis, Rhynchomeles* sp and *Phalanger* spp. Six of these are endemic to Seram.

Six amphibians and 41 reptiles have been recorded from Seram, and most are believed to occur in the proposed National Park. Amphibians include the very big frog *Hyla amboniensis.* Reptiles include the endemic snake *Calamaria ceramensis* and the sea-turtles *Chelonia mydas, Eretmochelys imbricata* and *Caretta caretta; C. mydas* occasionally occurs on sandy beaches along the north coast. The Estuarine Crocodile *Crocodylus porosus* may occur; suitable habitat is present at the mouths of several rivers, and local people talk of hunting them.

Over 90 species of butterflies have been reported, including several famous endemic species. There are also seven endemic species of land snails.

Special floral values: The proposed National Park contains a very rich and unique flora with many endemic species. The principal reason for the establishment of the two nature reserves was to protect endemic species of *Shorea.*

Research and facilities: Few botanical expeditions have ever visited the Moluccas, and no detailed studies of the flora have been made. There is obviously a need for more collecting expeditions, especially in the rugged mountains which are interesting from the point of view of plant geography. Most of the information on fauna dates from the first half of the 20th century, and further research is urgently required.

References: DHV Consulting Engineers *et al.* (l982a & 1982b); IUCN (in prep); MacKinnon & Artha (1981b); Smiet & Siallagan (l98la); Walker & Reynolds (1983); Wind & Amir (1978).

Criteria for inclusion: 1b, 2a, 2b, 2d.

Source: Alison Skene.

Wetland name: Pulau Manuk
Country: Indonesia
Coordinates: 5°33'S, 130°18'E;
Location: in the Banda Sea, 200 km south of eastern Seram and 115 km SSE of Pulau Banda, Kabupaten Maluku Tengah, Moluccas.
Area: 200 ha.
Altitude: Sea level to 300m.
Biogeographical province: 5.1.13.
Wetland type: 03.
Description of site: A small, very remote, volcanic island in the Banda Sea, with fumerole activity at the summit and a large, deep crater at the southern end.
Climatic conditions: Tropical maritime climate.
Principal vegetation: The slopes of the island, up to about 200m elevation, are partly covered with *Pisonia* and *Ficus* trees. The trees reach their greatest heights and densities on the northern and western sides of the island, where they are sheltered from the southeast monsoon.
Land tenure: State owned.
Conservation measures taken: The island was declared a Wildlife Reserve (Suaka Margasatwa) in 1981.
Conservation measures proposed: Gardens on the northeastern side of the island should be removed, and steps should be taken to eradicate introduced rats and cats (de Korte, 1984).
Land use: Nature protection.
Disturbances and threats: There is some habitat disturbance on the northeastern side of the island (gardens), and introduced predators, notably *Rattus norvegicus* and domestic cats, have probably contributed to the drastic decline in numbers of breeding seabirds since the early 1970s. There is also some egg-collecting by visiting fishermen.
Economic and social values: The sea-birds play an important role in the local fishing industry by guiding fishermen to shoals of fish.
Fauna: The island is one of the most important nesting sites for seabirds in the South Pacific. In the early 1970s, approximately 90,000 seabirds were present. In 1981, however, de Korte (1984) estimated that there were no more than 20,000 birds on the island. These included 300-900 pairs of *Phaethon aethereus,* 3,000-6,000 pairs of *Sula sula* (with 2,500-5,000 non-breeders), 2,500-5,000 pairs of *S. leucogaster,* 1,200-2,400 pairs of *Fregata minor,* some pairs of *Sterna anaethetus* and five pairs of *Anous stolidus.* Three species which were present in the early 1970s, namely *Phaethon lepturus, Sula dactylatra* and *Fregata ariel,* were not found in 1981.
Special floral values: None known.
Research and facilities: Seabird surveys were carried out in the early 1970s and 1981.
References: de Korte (1984); MacKinnon & Artha (1981b).
Criteria for inclusion: 1b, 2c, 3a.
Source: Marcel J. Silvius and Alison Skene.

Wetland name: Lucipara and Penyu Archipelagos
Country: Indonesia
Coordinates: 5°20'-5°36'S, 127°28'-l27°49'E;
Location: in the Banda Sea, 200 km south of the western tip of Seram and 250 km northeast of Wetar, Moluccas.
Area: c.6,500 ha of islands and reefs.
Altitude: 0-33m.
Biogeographical province: 5.1.13.

Wetland type: 03.
Description of site: Two groups of tiny islands with extensive fringing coral reefs in the middle of the Banda Sea, almost 200 km from the nearest large island. The Lucipara Archipelago in the west consists of four small vegetated coral islands connected by a reef, and to the south, a fifth low island without vegetation, surrounded by another reef. The Penyu Archipelago, some 25 km to the east, consists of three small islands each surrounded by its own reef. Pulau Mai in the Penyu group is the largest island, with an area of about 100 ha and a maximum elevation of 33m.
Climatic conditions: Tropical maritime climate.
Principal vegetation: No information.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: It is recommended that the whole of the Lucipara Archipelago be declared a Wildlife Reserve (Suaka Margasatwa). As a first step, the small and seldom visited southern island should be declared a Nature Reserve (Cagar Alam) to protect the nesting sea-turtles.
Land use: Hunting of turtles and harvesting of seabird eggs; some cultivation on the larger islands.
Disturbances and threats: In recent years, semi-permanent cultivation has appeared on some of the larger islands. Hundreds of sea-turtles are killed each year for food, and the eggs of Great Crested Terns *Sterna bergii* and possibly other terns are harvested on a very large scale. In June 1981, about 30,000 tern eggs were collected from the breeding colonies and sold in Ambon (de Korte, 1984).
Economic and social values: No information.
Fauna: The islands support large breeding colonies of *Sterna bergii* (tens of thousands of pairs) and possibly other tern species, and are important roosting sites for *Fregata minor* and *F. ariel* (100-200 individuals). There are important nesting beaches for Green Sea Turtles *Chelonia mydas* on the southern island in the Lucipara group.
Special floral values: No information.
Research and facilities: None
References: de Korte (1984).
Criteria for inclusion: 1b, 2a, 3b.
Source: Marcel J. Silvius.

Wetland name: Gunung Api
Country: Indonesia
Coordinates: 6°38'S, l26°40'E;
Location: in the South Banda Sea, 100 km north of the north coast of Wetar, Kabupaten Maluku Tenggara, Moluccas.
Area: 80 ha.
Altitude: Sea level to 280m.
Biogeographical province: 4.23.12.
Wetland type: 03 & 04.
Description of site: A small island comprising the summit of an active volcano rising directly from the ocean bed some 4,000m below sea level. This andesitic volcano is uninhabited, although it is sometimes visited by fishermen. There is crater about 80m deep in the centre of the island, about 200m above sea level. Except for some very steep slopes and barren areas around the crater, the island is entirely covered by vegetation, which is, however, poor in species. In 1938, there was strong fumerole activity along the lower western side of the crater, and dense vegetation survived

only on the other side of the island. In 1981, the fumerole activity had almost ceased, and the fast-growing *Pisonia* trees had covered half of the bare surface.
Climatic conditions: Tropical maritime climate.
Principal vegetation: Trees include *Pisonia sylvestris, Ficus* sp, *Terminalia catappa* and *Pandanus tectorius;* shrubs include *Trema virgata, T. orientale* and *Caesalpina crista;* herbs include *Cenchrus inflexus, Cyperus* sp*, Paspalum scrobiculatum* and *Ipomoea pescaprae.*
Land tenure: State owned (PHPA).
Conservation measures taken: The island has been protected as a Nature Reserve (Cagar Alam) since 1937.
Conservation measures proposed: None
Land use: Nature conservation; fishing in surrounding waters.
Disturbances and threats: The collecting of birds' eggs for human consumption. There are no rats or cats on the island at present, but the island is occasionally visited by fishing boats and there is constant danger that predators will be introduced accidentally.
Economic and social values: No information.
Fauna: The island supports a very large breeding colony of sea-birds. In August 1981, de Korte estimated the breeding populations at 600-1,800 pairs of *Phaethon rubricauda,* 40 pairs of *Sula dactylatra,* 100-200 pairs of *S. sula* (with 200-400 non-breeders present), 1,000-2,000 pairs of *S. leucogaster,* 400-800 pairs of *Fregata minor,* 200-600 pairs of *Sterna anaethetus* and 200-600 pairs of *Anous stolidus.* These figures suggest that the numbers of *P. rubricauda, S. leucogaster, F. minor* and *A. stolidus* have increased since Hoogerwerf's visit in 1938. Most of the seabirds breed on the western side of the island, which is partly sheltered from the strong winds of the southeast monsoon. Other birds known to occur on the island include *Egretta sacra, Falco peregrinus, Megapodius* sp*, Halcyon sancta* and a variety of shorebirds.
No mammals are present on the island, except for one species of bat. Invertebrates include an egg-eating species of crab.
Special floral values: None known.
Research and facilities: The island was explored by the Willebrord Snellius Expedition in 1929-30, by Hoogerwerf in July and August 1938, and by de Korte in August 1981.
References: Bemmel & Hoogerwerf (1940); Hoogerwerf (1939); de Korte (1984); MacKinnon & Artha (l98lb).
Criteria for inclusion: lb. 2c, 3a.
Source: Marcel J. Silvius.

Wetland name: Pulau Wetar and Telaga Thu
Country: Indonesia
Coordinates: 7°33'-8°04'S, 125°23'-126°5O'E;
Location: in the extreme western part of the southeastern Moluccas, Kabupaten Maluku Tenggara.
Area: Area of wetlands unknown; Wetar Island 360,000 ha.
Altitude: Sea level to 1,500m.
Biogeographical province: 4.23.12.
Wetland type: 04, 05 & 14.
Description of site: Pulau Wetar is a small island with sandy beaches, sea cliffs and a small freshwater lake known as Telaga Tilu. The monsoon forests of the lowlands have been almost entirely converted to savanna and agricultural land.
Climatic conditions: Tropical maritime climate, with an average annual rainfall of 1,080 mm (the lowest rainfall in the Moluccas). The dry season extends from July to November.

Principal vegetation: The beach vegetation is dominated by *Callophyllum inophyllum, Pandanus* and *Barringtonia* sp. Dominant species elsewhere on the island include *Eucalyptus* spp*, Corypha* sp*, Borassus* sp, *Acacia* sp, *Pterocarpus indicus, Tectonia grandis* and *Casuarina* sp.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: The entire island has been proposed as a conservation area.
Land use: Some small-scale fishing at the lake; forestry and agriculture elsewhere on the island.
Disturbances and threats: Shifting cultivation, increased human settlement, ladang encroachment and logging.
Economic and social values: No information.
Fauna: The island is very rich in wildlife. A wide variety of water birds have been recorded including *Pelecanus conspicillatus, Phalacrocorax melanoleucos, Anhinga novaehollandiae, Fregata arid, F. minor, Butorides striatus, Egretta garzetta, E. alba, Ardea sumatrana, Anas gibberifrons, Esacus magnirostris, Charadrius mongolus, Limosa limosa, L. lapponica, Numenius madagascariensis, Tringa glareola, Calidris ferruginea* and the kingfishers *Alcedo azurea, Halcyon sancta* and *H. chloris.* Mammals include *Phalanger orientalis, Suncus murinus, Pteropus* sp*, Rhinolophus emyotis, Sus scrofa* and *Cervus timorensis.* Reptiles include the Green Sea Turtle *Chelonia mydas, Varanus indicus* and species of *Cylindrophis, Draco* and *Mabouya.*
Special floral values: No information.
Research and facilities: Preliminary faunal and floral surveys have been carried out.
References: MacKinnon & Artha (1981b); Smiet *et al.* (1981).
Criteria for inclusion: lb. 2a, 2b, 3b.
Source: Agustinus W. Taufik and Marcel J. Silvius.

Wetland name: Yamdena and the Tanimbar Archipelago
Country: Indonesia
Coordinates: 6°38'-8°25'S, 130°40'-l32°OO'E;
Location: in the southeastern Moluccas, Kabupaten Maluku Tenggara, Moluccas.
Area: Area of wetlands unknown; Tanimbar Archipelago 505,800 ha, Yamdena Island 60,000 ha.
Altitude: Sea level to 240m.
Biogeographical province: 5.1.13.
Wetland type: 02, 05, 06, 07, 11 & 21.
Description of site: The Tanimbar Islands form the second largest archipelago in the southeastern Moluccas. The largest island, Yamdena, is surrounded by dozens of smaller islands and islets. The delta of the Wai Ranarmoje on the west coast of Yamdena supports extensive mangrove swamps, which extend up to ten km inland. Elsewhere on the west coast, there are beaches fringed with intertidal mudflats and backed by seasonal swamps. Further inland, the land remains relatively flat for about 20 km and then rises gently for another 20 km to form a row of hills. The central part of the island is covered with deciduous forest still in an almost pristine condition.
Climatic conditions: Tropical maritime climate with an annual rainfall of 1,951 to 2,070 mm.
Principal vegetation: Mangrove swamps with *Aegiceras corniculatum* and species of *Bruguiera, Ceriops, Avicennia* and *Rhizophora;* freshwater swamp forest with *Oncosperma* sp. *Nypa fruticans* and *Oncosperma* characterize the transition zone to freshwater conditions. Lowland deciduous forest in the interior of Yamdena Island.
Land tenure: State owned (PHPA).
Conservation measures taken: Three small conservation areas have been established: Angwarmase Island Nature Reserve (800 ha), off the south tip of Yamdena; Pulau Nuswotar Nature Reserve (7,500 ha), off the northwest coast of Yamdena; and Nustaran Nature Reserve (3,200 ha), incorporating a narrow strip on the west coast of Yamdena.

Conservation measures proposed: None
Land use: There is some agriculture and forestry on Yamdena.
Disturbances and threats: Illegal hunting, cattle grazing and shifting cultivation.
Economic and social values: No information.
Fauna: The islands are very rich in wildlife. A wide variety of waterfowl and sea-birds has been recorded including *Pelecanus conspicillatus, Phalacrocorax melanoleucos, P. sulcirostris, Sula leucogaster, Fregata arid, Nycticorax caledonicus, Butorides striatus, Egretta sacra, E. garzetta, Ardea sumatrana, Threskiornis molucca, Dendrocygna guttata, Tadorna radjah, Anas gibberifrons, Himantopus leucocephalus, Esacus magnirostris, Vanellus miles, Charadrius leschenaultii, Numenius madagascariensis* and *Tringa* spp. Birds of prey include *Pandion haliaetus, Haliastur indus* and *Haliaeetus leucogaster.*
The Dugong *Dugong dugon* occurs in shallow waters around the islands; terrestrial mammals include *Phalanger orientalis, Paradoxurus hermaphroditus, Suncus murinus* and *Sus scrofa.* Reptiles include the Estuarine Crocodile *Crocodylus porosus;* the sea-turtles *Chelonia mydas, Eretmochelys imbricata; Varanus* sp*, Hydrophis mertoni* and *Lygosoma* sp.
Special floral values: The forest in the central part of Yamdena is virtually untouched and is of great conservation value as one of the few remaining areas of lowland deciduous forest in Indonesia. There is an endemic orchid *Dendrobium phalaenopsis* on the island.
Research and facilities: Preliminary faunal and floral surveys have been carried out.
References: MacKinnon & Artha (198lb); Smiet *et al.* (1981).
Criteria for inclusion: lb, 2a, 2b, 3b.
Source: Marcel J. Silvius and Agustinus W. Taufik.

Wetland name: Kai Archipelago
Country: Indonesia
Coordinates: 5°30'S, 133°00'E;
Location: in the eastern Moluccas, Kabupaten Maluku Tenggara, Moluccas.
Area: 16,000 ha.
Altitude: Sea level to 801m (highest elevation at Kai Besar).
Biogeographical province: 5.1.13.
Wetland type: 05, 06 & 07.
Description of site: An archipelago consisting of two main islands (Kai Besar and Kai Kecil) and dozens of smaller ones. Kai Kecil is densily populated, and only its northern and southern ends are still forested. Kai Besar is long, thin and hilly. All coastal areas are under cultivation, and forests on the lower slopes of the hills have also been cleared. Wetland habitats include mangrove swamps and sandy beaches.
Climatic conditions: Tropical maritime climate with an average annual rainfall of about 2,000 mm.
Principal vegetation: Mangrove forest with species of *Rhizophora, Bruguiera, Sonneratia* and *Xylocarpus.*
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: The archipelago has been proposed as a nature conservation area.
Land use: Agriculture.
Disturbances and threats: Illegal cultivation, poaching, logging and forest clearance.
Economic and social values: No information.
Fauna: The archipelago has a rich avifauna, with five endemic species. Waterfowl and sea-birds include *Pelecanus conspicillatus, Sula dactylatra, S. sula, Phalacrocorax melanoleucos,*

P. sulcirostris, Fregata ariel, Ixobrychus sinensis, Butorides striatus, Egretta sacra, E. garzetta, E. alba, Threskiornis molucca, Plegadis falcinellus, Dendrocygna guttata, Anas gibberifrons, Himantopus leucocephalus, Charadrius mongolus, Nurnenius minutus, N. phaeopus, Actitis hypoleucos, Calidris ruficollis, Sterna bergii and the kingfishers *Alcedo atthis, Halcyon sancta* and *H.* chloris. Other birds include the raptors *Pandion haliaetus, Haliaslur indus, Haliaeetus leucogaster;* the Orange-footed Scrubfowl *Megapodius reinwardt* and the pigeon *Ducula bicolor.*
The surrounding coastal waters support a viable population of Dugongs *Dugong dugon.* Other mammals include *Myotis stalkeri* (endemic), *M. adversus, Echymipera rufescens, Hipposideros ater, Phalanger orientalis, Petaurus* sp*, Thylogale bruijnii, Suncus murinus, Dobsmia viridis* and *Rhizolophus keiensis.*
The sandy beaches are important nesting sites for the sea-turtles *Chelonia mydas* and *Dermochelys coriaceae.* Other reptiles include the Estuarine Crocodile *Crocodylus porosus, Draco ochropterus* and *Lygosoma beccari.*
Special floral values: No information.
Research and facilities: Basic faunal and floral surveys have been carried out.
References: Augustinus *et al.* (1984); Compost (1980); Smiet *et al.* (1981).
Criteria for inclusion: 1b, 2a, 2b, 2c, 2d, 3b.
Source: Marcel J. Silvius and Agustinus W. Taufik.

Wetland name: Pulau Kobroor
Country: Indonesia
Coordinates: 5°55'-6°22'S, 134°15'-134°47'E;
Location: in the Aru Archipelago, about 120 km off the south coast of Irian Jaya, Kabupaten Maluku Tenggara, Moluccas.
Area: 99,000 ha, including 9,000 ha of mangrove forest and 1,000 ha of peat swamp forest.
Altitude: Sea level to 125m.
Biogeographical province: 5.1.13.
Wetland type: 05, 06, 07, 08, 11 & 21.
Description of site: Kobroor is the central island of the Aru Archipelago. It is the least populated and least disturbed large island in the group, and has a wide range of habitats including mangroves, peat swamp forest and lowland deciduous tropical forest. The western part of the island is a karst area. The eastern part is generally flat with a few undulating hills. The few permanent rivers are subject to tidal influence far inland. There are many deep wells in which the water level rises and falls with the tides. These provide abundant fresh water throughout the year. The island is almost entirely fringed with mangrove swamps, and there are a few patches of seasonal swamp in the coastal zone.
Climatic conditions: Tropical maritime climate with an average annual rainfall of 2,177 mm.
Principal vegetation: Mangrove swamps with species of *Sonneratia, Bruguiera* and *Avicennia,* and the Nipah Palm *Nypa fruticans.*
Land tenure: State owned (BKPH P.P. Aru).
Conservation measures taken: None.
Conservation measures proposed: The island has been proposed as a Game Reserve.
Land use: Fishing and hunting.
Disturbances and threats: Shifting cultivation, illegal felling of mangroves, and illegal hunting of endangered species, particularly cockatoos, birds of paradise, crocodiles and dugongs. There is a considerable amount of trade in wildlife, and lack of any effective management.
Economic and social values: No information.
Fauna: The island is very rich in wildlife. Water birds include *Phalacrocorax melanoleucos, Nycticorax caledonicus, Butorides striatus, Egretta intermedia, Ardea sumatrana, Tadorna radjah,*

Haliastur indus, Esacus magnirostris and *Halcyon chioris.* Land birds of note include the Two-wattled Cassowary, Nicobar Pigeon, Sulphur-crested Cockatoo and Palm Cockatoo (*Casuarius casuarius, Caloenas nicobarica, Cacatua galerita* and *Probosciger aterrimus).*
The Dugong *Dugong dugon* occurs around the island; other mammals include *Phalanger orientalis, Thyogale bruijnii, Paradoxurus hermaphroditus, Sus scrofa, Cervus timorensis, Petaurus breviceps* and *Macroglossus lagochilus.* Both the Estuarine Crocodile *Cro*
Special floral values: No information.
Research and facilities: Preliminary faunal surveys have been carried out.
References: FAO (1981e & 1981f); Smiet *et al.* (1981).
Criteria for inclusion: 1b, 2a, 2b, 3b.
Source: Marcel J. Silvius and Agustinus W. Taufik.

Wetland name: Aru Tenggara Proposed Marine Reserve
Country: Indonesia
Coordinates: 6°35'-7°06'S, 134°22'-134°50'E;
Location: the southeastern part of the Aru Islands, Kabupaten Maluku Tenggara, Moluccas.
Area: 250,000 ha.
Altitude: Sea level to 15m.
Biogeographical province: 5.1.13.
Wetland type: 03, 05 & 07.
Description of site: The proposed reserve encompasses all coastal and marine ecosystems in the southeast part of the Aru Islands, one of the remotest areas of Indonesia located at the easternmost extremity of the archipelago, south of New Guinea. The islands are situated on the Sahul continental shelf, and are comprised of raised coral reefs of quaternary origin, fringed by living reefs. The entire area is relatively flat, rising to only a few meters above sea level. The marine area between islands is shallow (0.5-18m). The proposed reserve includes about 10,000 ha of mangrove forest, 40,000 ha of sea-grass beds and extensive sandy beaches. The area is contiguous with the Pulau Baun Bird of Paradise Reserve (13,000 ha).
Climatic conditions: Tropical maritime climate, with a dry season from May to August.
Principal vegetation: Mangrove forest with species of *Sonneratia, Bruguiera* and *Rhizophora,* and sea-grass beds; also beach formations with species of *Barringtonia, Casuarina, Pandanus* and *Hibiscus.*
Land tenure: State owned; under the management of BKPH P.P. Aru.
Conservation measures taken: None.
Conservation measures proposed: The entire area (250,000 ha) has been proposed as a Marine Reserve.
Land use: Traditional fishing.
Disturbances and threats: Hunting of dugongs, sea-turtles and crocodiles, collection of sea-turtle eggs, and cutting of mangroves.
Economic and social values: The mangrove swamps are important breeding and nursery grounds for many commercially important fishes and crustaceans.
Fauna: The reefs are rich in species of ornamental fishes; during a brief survey in 1973, 128 species of fishes were recorded. The area is known to be important for a wide variety of water birds and sea-birds, but little information is available. Species known to occur include *Pelecanus conspicillatus, Phalacrocorax sp, Egretta* spp*, Threskiornis molucca, Haliaeetus leucogaster* and many shorebirds. Marine mammals include the Dugong *Dugong dugon* and various small cetaceans. Reptiles include four species of sea-turtle *(Chelonia mydas, Eretmochelys imbricata, Lepidochelys olivacea, Caretta caretta),* the Estuarine Crocodile *Crocodylus porosus* and the New Guinea Crocodile *C. novaeguineae.* **Special floral values:** No information.

Research and facilities: Preliminary faunal surveys have been carried out.
References: Direktorat P.P.A. (1986f); IUCN (in prep); Smiet & Siallagan (l981a).
Criteria for inclusion: lb, 2a, 2b, 2c, 3b.
Source: Marcel J. Silvius and Edi Djuharsa.

Wetland name: Jamursba-Mandi Proposed Strict Nature Reserve
Country: Indonesia
Coordinates: 0°20'-0°22'S, 132°25'-132°39'E;
Location: 180 km WNW of Manokwari, North Kepala Burung, Irian Jaya. **Area:** 28 km of beach.
Altitude: Sea level.
Biogeographical province: 5.1.13.
Wetland type: 05.
Description of site: A 28 km stretch of sandy beach on the coast of the Tamrau Mountains, confirmed to be the most important nesting site for Leatherback Turtles in Southeast Asia.
Climatic conditions: Humid tropical climate.
Principal vegetation: Beach vegetation.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: None.
Conservation measures proposed: The site has been proposed as a Strict Nature Reserve, which would be distinct from the nearby North Tamrau Reserve.
Land use: No information.
Disturbances and threats: Recent immigrants collect turtle eggs for food. (The indigenous people have never exploited the sea-turtles).
Economic and social values: No information.
Fauna: The beach is the most important nesting site for Leatherback Turtles *Dermochelys coriacea* in Southeast Asia, and is also a major nesting area for Green Sea Turtles *Chelonia inydas.* An estimated 8,000 to 15,000 turtles use the beach each year. The northeast side of Kepala Burung is believed to support the largest population of Dugongs *Dugong dugon* in the world. No information is available on the avifauna.
Special floral values: None known.
Research and facilities: None
References: MacKinnon & Artha (1981b); Petocz (1983a).
Criteria for inclusion: 1b, 2a, 2c.
Source: Marcel J. Silvius.

Wetland name: Ajamaru Lakes
Country: Indonesia
Coordinates: 1°16'S, 132°l5'E;
Location: 120 km ESE of Sorong, Kepala Burung, Irian Jaya.
Area: c.1,500 ha.
Altitude: c.250m.
Biogeographical province: 5.1.13.
Wetland type: 14.
Description of site: Three small freshwater lakes and associated marshes in a valley in the mountains of the Vogelkop Peninsula. The largest lake, Danau Amaru (900 ha), drains east via the other two lakes into an upper tributary of the Sungai Kais.
Climatic conditions: Humid tropical climate.
Principal vegetation: No information.

Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: No information.
Disturbances and threats: No information.
Economic and social values: No information.
Fauna: Three species of fishes are known only from these lakes: *Melanotaenia ajamaruensis, M. boesemani* and *Glossogobius hoesei.* However, very little research has been carried out, and it is possible that many more endemic fishes occur in the lakes.
Special floral values: No information.
Research and facilities: Allen and Boeseman have investigated the fish fauna.
References: Allen & Boeseman (1982).
Criteria for inclusion: 1b, 2d.
Source: Marcel J. Silvius.

Wetland name: Sungai Kais
Country: Indonesia
Coordinates: 2°00'S, 132°05'E;
Location: on the southwest coast of Kepala Burung, northwest of Inanwatan, Kabupaten Sorong, Irian Jaya.
Area: 122,000 ha.
Altitude: Sea level to 150m.
Biogeographical province: 5.1.13.
Wetland type: 07 & 21.
Description of site: A proposed nature reserve which would include the richest and most extensive area of mangrove forest on Kepala Burung (Vogelkop Peninsula). The proposed reserve would stretch inland from the coast, and would include 9,760 ha of mangroves, 75,640 ha of peat swamp forest and 36,600 ha of wet lowland forest on alluvium.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest, peat swamp forest and wet lowland forest.
Land tenure: State owned.
Conservation measures taken: None.
Conservation measures proposed: It has been proposed that the site be excised from the existing timber concession and designated as a Strict Nature Reserve (Cagar Alam).
Land use: The site is currently within an agreed timber concession.
Disturbances and threats: Logging of the forest.
Economic and social values: Important for fisheries and prawns.
Fauna: No information.
Special floral values: The site contains excellent examples of mangrove and lowland swamp habitats.
Research and facilities: None
References: MacKinnon & Artha (l98lb).
Criteria for inclusion: lb.
Source: Marcel J. Silvius.

Wetland name: Anggi Lakes (Gigi and Gita East)
Country: Indonesia
Coordinates: Gigi 122'S, 133°55'E; **.....**

Location: Gita East 123'S, 133°59'E; in the hills at the eastern end of the Vogelkop Peninsula, 60 km SSW of Manokwari, Kepala Burung, Irian Jaya.
Area: Gigi 2,000 ha; Gita East 2,200 ha.
Altitude: Approximately 2,000m.
Biogeographical province: 5.1.13.
Wetland type: 14, 18 & 22.
Description of site: Two large, permanent, freshwater lakes and associated seasonally flooded grassland and peat bogs, fed by streams from the surrounding mountains. There is a marshy area at the north end of Gigi Lake. The lakes are separated by a ridge of high ground about three km wide.
Principal vegetation: No information is available on the aquatic vegetation. Most of the surrounding forest has been cleared, but the hillsides remain rich in ferns.
Climatic condition: None
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: The UNDP has proposed that an agro-forestry project be developed in the area.
Land use: Cultivation and cattle grazing around the lakes. There is a village on the shores of one of the lakes.
Disturbances and threats: Disturbance from human settlements in the area. A wide path has been made through the marshy area north of Anggi Gigi.
Economic and social values: No information.
Fauna: No information.
Special floral values: No information.
Research and facilities: No research seems to have been carried out at the lakes.
References: None
Criteria for inclusion: 0.
Source: Ian Craven.

Wetland name: Bintuni Bay
Country: Indonesia
Coordinates: 2°02'-2°4l'S, l33°3l'-l34°02'E;
Location: at the head of Bintuni Bay, 150 km ENE of Fakfak, western Irian Jaya.
Area: 450,000 ha.
Altitude: Sea level.
Biogeographical province: 5.1.13.
Wetland type: 07 & 21.
Description of site: A very extensive area of mangrove forest and small patch of freshwater swamp forest on the shores of Bintuni Bay.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest and freshwater swamp.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: The site has been proposed as a Nature Reserve (Cagar Alam).
Land use: Forest exploitation.
Disturbances and threats: Logging of mangrove forests.
Economic and social values: No information.
Fauna: An important area for the Estuarine Crocodile *Crocodylus porosus.* No other information is available on the fauna.

Special floral values: The site contains the largest stands of mangrove forest in western Irian Jaya.
Research and facilities: None
References: Petocz (l983a); Whitaker *et al.* 1985.
Criteria for inclusion: 1b, 2a.
Source: Marcel J. Silvius.

Wetland name: Wandammen Peninsula
Country: Indonesia
Coordinates: 2°30'-2°55'S, l34°28'-134°40'E;
Location: on the west side of Cenderawasih Bay, Kabupaten Pantai, Irian Jaya.
Area: Area of wetlands unknown; peninsula 79,500 ha.
Altitude: Sea level to 2,075m.
Biogeographical province: 5.1.13.
Wetland type: 01, 05, 06, 07 & 14.
Description of site: A very mountainous peninsula with peaks rising to 2,075m and many streams draining into Wandammen Bay and Umar Bay. On both sides of the peninsula, broad intertidal mudflats are exposed at low tide. Most of the peninsula is covered with moist lower montane forest (77,910 ha), but there are 1,590 ha of beach vegetation along the coasts and some sago swamps near the head of Wandammen Bay. The east coast is uninhabited, but there are several small settlements on the west coast.
Climatic conditions: Humid tropical climate.
Principal vegetation: Beach vegetation and sago swamps; moist lower montane forest elsewhere on the peninsula.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: The entire area has been proposed as a Nature Reserve (Cagar Alam).
Land use: A little cultivation, logging and hunting.
Disturbances and threats: Ladang encroachment on the western boundary, cutting of timber and hunting.
Economic and social values: No information.
Fauna: The intertidal mudflats are of considerable importance as staging and wintering areas for migratory shorebirds. Sixteen species have been recorded including *Numenius minutus, N. madagascariensis, Heteroscelus brevipes* and *H. incanus.* Other water birds known to occur include *Fregata ariel, Nycticorax caledonicus, Egretta sacra, E. garzetta, E. intermedia, E. alba* and *Rallicula leucospila.* No other information is available on the fauna.
Special floral values: No information.
Research and facilities: Diamond *et al.* (1983) have conducted some avifaunal surveys in the area.
References: Diamond *et al*. (1983); MacKinnon & Artha (1981b).
Criteria for inclusion: 1b, 3b.
Source: Marcel J. Silvius.

Wetland name: Teluk Cenderawasih
Country: Indonesia
Coordinates: 1°43'-3°22'S, 134°06'-135°1O'E;
Location: the southwest quadrant of Cenderawasih Bay, including all islands of the Kepulauan Auri and 510 km of mainland coast, Irian Jaya.

Area: c.80,000 ha of coral reefs and beaches; 2,500 ha of islands.
Altitude: Sea level.
Biogeographical province: 5.1.13.
Wetland type: 01, 02, 03, 04, 05, 06, 07 & 11.
Description of site:A large proposed marine reserve including many small islands (the Auri Islands), extensiv
Climatic conditions: Tropical maritime climate.
Principal vegetation: Extensive beds of sea-grasses, some mangrove swamp and 1,898 ha of beach vegetation.
Land tenure: Partly state owned and partly owned by the local people.
Conservation measures taken: Anggremos Island is protected in a Game Reserve (Suaka Margasatwa) of 2,500 ha, established in 1981.
Conservation measures proposed: The entire area has been proposed as a Game Reserve.
Land use: Fishing and exploitation of corals.
Disturbances and threats: Collection of shells and black corals, dynamite fishing, development of p
Economic and social values: The bay is a nursery ground for many commercially important fishes, and supports a fishery of considerable importance to the local people.
Fauna: The bay is noted for its rich coral reef fauna with a wide variety of fishes including the Clown Fish *A* on the beaches, and the Estuarine Crocodile *Crocodylus porosus* is present. Invertebrates include giant clams, *Trochus niloticus, Tridacna gigus* and *Charonia tritonis.*
Special floral values: No information.
Research and facilities: Faunal surveys have been carried out.
References: Diamond (1981); Gilkes & Adipati (1986); IUCN (in prep); Karpowicz (1985); MacKinnon & Artha (l981b); Petocz (1984).
Criteria for inclusion: lb. 2a, 2b, 2c.
Source: Marcel J. Silvius.

Wetland name: Pulau Supiori
Country: Indonesia
Coordinates: 0°37'-0°54'S, l35°22'-l3545'E;
Location: northwest of Pulau Biak, Kubupaten Cenderawasih, Irian Jaya.
Area: Area of wetlands unknown; island 44,500 ha.
Altitude: Sea level to 1,034m.
Biogeographical Province: 5.1.13.
Wetland type: 04 & 07.
Description of site: A rugged, forested island with a wide spectrum of habitats from mangrove swamps and rocky coasts to montane forests.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest; almost unspoiled virgin forest in the mountains.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: The island has been proposed as a Nature Reserve (Cagar Alam).
Land use: No information.
Disturbances and threats: There are plans to carry out logging on the island, and there has been some ladang clearance by local villagers.
Economic and social values: No information.
Fauna: The island is known to be rich in birds, but no details are available.
Special floral values: The montane forests remain in very good condition.
Research and facilities: None

References: MacKinnon & Artha (1981b).
Criteria for inclusion: lb.
Source: Marcel J. Silvius.

Wetland name: Wetlands of the Kumawa Mountains Proposed Nature Reserve
Country: Indonesia
Coordinates: 3°40'-4°05'S, l32°45'-l33°25'E;
Location: on the Bomberai Peninsula southwest of Kaimana, on the south coast of western Irian Jaya, Kubupaten Fakfak, Irian Jaya.
Area: Area of wetlands unknown; whole region 118,000 ha.
Altitude: Sea level to 1,600m.
Biogeographical province: 5.1.13.
Wetland type: 02, 11, 12, 14, 15&2l.
Description of site: The Kumawa Mountains lie at the southwestern extremity of the Bomoerai Peninsula, and consist of three sets of peaks exceeding 1,400m in elevation. The eastermost part of the region consists of flat alluvial lowlands, while the southern slopes of the mountains are especially steep. Most of the area is covered in moist lowland forest (56,640 ha) and montane forest (49,560 ha). Wetland habitats include 9,440 ha of coastal mangroves, 2,360 ha of beach vegetation, a marsh at 600m elevation three km east of northernmost peak (29 km SSE of Teluk Sebakar), and two freshwater lakes at an elevation of 1,200m three km south of the northernmost peak. There are several meandering rivers and several large waterfalls, including one of 70m on a river near Karawai Island. A small group of islets, the Paliki Islets, lies offshore.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest and beach vegetation; no information is available on the vegetation of the lakes and marshes. Moist lowland forest and montane forest elsewhere on the peninsula. One hundred and forty-four tree species have been identified in the area.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: The entire area has been proposed as a Nature Reserve (Cagar Alam).
Land use: Gathering of masoi (at 1,000m elevation) and some logging; fishing around the coast. The region is uninhabited except for Nusawalan Village on the south coast, and a transient fishermen's camp on Teluk Sebakor. There may be some exploration for oil in the future.
Disturbances and threats: Logging, human settlement and hunting.
Economic and social values: The waters around the peninsula are fishing grounds for the Buginese people. The area has high scenic values and may have some potential for tourism.
Fauna: The area supports a very diverse avifauna. Over 220 species of birds have been recorded, including many water birds such as *Pelecanus conspicillatus, Phalacrocorax melanoleucos, P. sulcirostris, Butorides striatus, Egretta sacra, E. intermedia, E. alba, Tadorna radjah, Pandion haliaetus, Haliaeetus leucogaster* and *Esacus magnirostris.*
Thousands of flying foxes, probably *Pteropus conspicillatus,* roost on the Fatar Islands. Other mammals include *Thyogale bruijni,* tree kangaroos *Dendrogalus* sp and *Phalanger macullatus.*
Special floral values: The mangrove forests are of considerable botanical interest.
Research and facilities: Preliminary faunal and floral surveys have been carried out.
References: Diamond *et al.* (1983); MacKinnon & Artha (1981b).
Criteria for inclusion: la, 1b, 3b.
Source: Marcel J. Silvius.

Wetland name: Danau Jamur
Country: Indonesia
Coordinates: 3°40'S, l34°47'E;
Location: 125 km east of Kaimana, Kabupaten Fakfak, Irian Jaya.
Area: c.3,500 ha.
Altitude: c.200m.
Biogeographical province: 5.1.13.
Wetland type: 14.
Description of site: A large freshwater lake and associated marshes in the upper drainage of the Omba River. There are some sago swamps to the north of the lake.
Climatic conditions: Humid tropical climate.
Principal vegetation: No information.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: No information.
Disturbances and threats: None
Economic and social values: No information.
Fauna: The fish fauna includes four of New Guinea's endemic fishes: *Anus* sp. A, *Cnatenocephalus randi, Ambassis reticulata* and *Terapon jamoenensis.* The new species of Arias and *T. jamoenensis* are known only from this site. Other fishes include *Nematalosa enebi, Toxotes oligolepis* and the freshwater shark *Canchanhinus leucas.*
No information is available on the other fauna.
Special floral values: No information.
Research and facilities: Allen and Boeseman have investigated the fish fauna.
References: Allen & Boeseman (1982); Boeseman (1964).
Criteria for inclusion: lb. 2d.
Source: Marcel J. Silvius.

Wetland name: Danau Paniai and the Wissel Lakes
Country: Indonesia
Coordinates: 3°48'-4°05'S, 136°l3'-136°25'E;
Location: near Enarotali, Kabupaten Pantai, Fakfak, Irian Jaya.
Area: Danau Paniai 15,000 ha; Danau Tigi 3,000 ha; Danau Tage 1,600 ha.
Altitude: 1,750m.
Biogeographical province: 5.1.13.
Wetland type: 14.
Description of site: A large freshwater lake (Danau Paniai) surrounded by agricultural settlements and steep hills supporting lower montane and montane forests, and two smaller freshwater lakes (the Wissel Lakes: Danau Tage and Danau Tigi) further to the south.
Principal vegetation: No information is available on the aquatic vegetation. Agricultural land, lower montane forest and montane forest in surrounding areas.
Climatic condition: None
Land tenure: No information.
Conservation measures taken: Lake Paniai is included within the Enarotali Nature Reserve (Cagar Alam), a reserve of 300,000 ha established in 1980 and spanning an altitudinal range of l,750-4,000m. The Wissel Lakes are unprotected.
Conservation measures proposed: None
Land use: Fishing; agriculture in surrounding areas.

Possible changes in Land use: There is a proposal to denotify the Enarotali Nature Reserve as it comprises one of the most densely populated areas in Irian Jaya. The forested portions should, however, be retained as protection forest.
Disturbances and threats: There are some 12,000 people living illegally in the Nature Reserve, making this one of the most densely populated regions in the whole of Irian Jaya. All flat areas have already been converted to agricultural land, and the lower hillsides have been denuded by wood-cutting and burning.
Economic and social values: No information.
Fauna: The lakes are important for *Oxyeleotris wisselensis,* an endemic species of fish known only from Paniai Lake, the Wissel Lakes and their tributary streams. No information is available on the other fauna.
Special floral values: No information.
Research and facilities: None
References: MacKinnon & Artha (1981b).
Criteria for inclusion: 2d.
Source: Marcel J. Silvius.

Wetland name: Sungai Rouffaer
Country: Indonesia
Coordinates: 2°45'-3°15'S, 137°20'-138°30'E:
Location: in the lowlands of north-central Irian Jaya, Kabupaten Jayawijaya, Irian Jaya.
Area: 310,000 ha.
Altitude: c.100m.
Biogeographical province: 5.1.13.
Wetland type: 11, 13, 15 & 21.
Description of site: A vast swampy plain crossed by a large meandering river, the Rouffaer, a tributary of the Mamberamo and Idenburg system (site 128). The site includes 201,500 ha of peat swamps, 31,000 ha of freshwater swamp forest and 77,000 ha of wet lowland forest.
Climatic conditions: Humid tropical climate.
Principal vegetation: Peat swamp, freshwater swamp forest, sago swamp forest and wet lowland forest.
Land tenure: State owned (Indonesian Government).
Conservation measures taken: The entire area has been designated as a Game Reserve (Suaka Margasatwa).
Conservation measures proposed: None
Land use: There are several human settlements dependent upon traditional sago harvesting, fishing and crocodile hunting.
Disturbances and threats: Excessive hunting of crocodiles.
Economic and social values: No information.
Fauna: The site is important both for the Estuarine Crocodile *Crocodylus porosus* and for the New Guinea Crocodile *C. novaeguineae.* No other information is available on the fauna.
Special floral values: No information.
Research and facilities: None
References: MacKinnon & Artha (l98lb); Whitaker *et al.* (1985).
Criteria for inclusion: lb. 2a, 2b.
Source: Marcel J. Silvius.

Wetland name: Wetlands in Mamberamo-Foja Proposed National Park

Country: Indonesia
Coordinates: 1°27'S, 137°50'E to 3°45'S, 140°15'E;
Location: along the Mamberamo and Idenburg Rivers in northeastern Irian Jaya.
Area: Over 728,000 ha of wetlands in an area of 1,442,500 ha.
Altitude: Sea level to 2,193m.
Biogeographical Province: 5.1.13.
Wetland type: 02, 05, 06, 07, 08, 11, 12, 13, 14 & 21.
Description of site: The site incorporates an excellent spectrum of habitats from mangrove forests and peat swamps on the north coast up to the montane forests of the Foja Mountains and down again through lowland forest to the swampy plain of the Idenburg River. The area is virtually pristine and contains a great wealth of wildlife. It includes one of the largest lakes in Irian Jaya, Danau Rombebai, a permanent freshwater lake of about 14,000 ha in the Mamberamo Delta. The site also includes the largest river in Irian Jaya, with its hundreds of oxbow lakes, and vast areas of peat swamp and freshwater swamp. Estimates of the total area of each major habitat are as follows: mangrove forest 36,062 ha; freshwater lakes 14,425 ha; peat swamp 432,750 ha; freshwater swamp on non-alluvial soils 216,375 ha; freshwater swamp on alluvial soils 28,850 ha; wet lowland forest on alluvium 43,375 ha; wet lowland forest on rocks 504,875 ha; wet lowland forest on ultra-basic rocks 43,475 ha.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest, freshwater swamp forest and peat swamp forest; no detailed information is available.
Land tenure: State owned.
Conservation measures taken: None.
Conservation measures proposed: The entire area has been proposed as a National Park and World Heritage Site.
Land use: Exploration for petroleum. There are only a few small settlements in the area of the proposed national park.
Disturbances and threats: Exploration for petroleum has been going on in the northern Mamberamo area for several years, and proposals have been made to carry out exploratory drilling.
Economic and social values: No information.
Fauna: At least 28 species of freshwater fishes have been recorded. Six of these are known only from the Mamberambo River: *Hemipimelodus bernhardi, Netuma microstoma, Zenarchopterus alleni, Melanotaenia praecox, Melanotaenia vanheurni* and *Parambassis altipinnis. A* further eighteen species are endemic to New Guinea: *Anus* sp*, Neosilurus equinus, N. idenburgi, Anguilla interioris, Zenarchopterus kampeni, Chilatherina crassispinosa, C. lorentzi, Glossolepis multisquamatus, Parambassis confinis, Hephaestus obtusifrons, Glossamia beauforti, G. gjellerupi, G. heurni, Ctenogobius tigrellus, Mogurnda* sp, *Odonteleotris nesolepis, Oxyeleotris fimbriata* and *0. novaeguineae.* The other four species, *Neosilurus ater, Mogurnda mogurnda, Oxyeleotris herwerdeni* and *0. lineolatus,* are of more widespread occurrence.
Some 330 species of birds, including many water birds, and 100 species of mammals have been recorded. The area supports the largest known populations of the Estuarine Crocodile *Crocodylus porosus* and New Guinea Crocodile *C. novaeguineae* in the world.
Special floral values: No information.
Research and facilities: Basic faunal and floral surveys have been carried out in the area.
References: Allen & Boeseman (1982); Karpowicz (1985); MacKinnon & Artha (198lb); Petocz (1984); Whitaker *et al.* (1985).
Criteria for inclusion: lb. 2a, 2b, 2d, 3b.
Source: Marcel J. Silvius.

Wetland name: Danau Sentani
Country: Indonesia
Coordinates: 2°33'-2°41'S, 14023'-140°38'E;
Location: 12 km southwest of Jayapura, northeastern Irian Jaya.
Area: c.l4,000 ha.
Altitude: Less than 100m.
Biogeographical province: 5.1.13.
Wetland type: 14.
Description of site: A large freshwater lake on the plains west of Jayapura.
Climatic conditions: Humid tropical climate.
Principal vegetation: No information.
Land tenure: None
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing.
Disturbances and threats: There were plans to construct a hydro-electric power station at the site, but this project has been cancelled, at least for the time being.
Economic and social values: No information.
Fauna: The fish fauna includes at least five of New Guinea's endemic fishes: *Anus* sp, *Neosilurus novaeguineae, Chilathenina sentaniensis, Glossolepis incisus* and *Glossogobius koragensis.* Two of these, *N. novaeguineae* and *G. incisus,* are known only from this site. The Saw Shark *Pristis microdon* also occurs in the lake. Very little research has been carried out, and it is possible that other endemic species may occur.
No information is available on the other fauna of the lake.
Special floral values: No information.
Research and facilities: Allen and Boeseman (1982) have investigated the lake's fish fauna.
References: Allen & Boeseman (1982).
Criteria for inclusion: lb. 2d.
Source: Marcel J. Silvius.

Wetland name: Wetlands in Lorenz Proposed National Park
Country: Indonesia
Coordinates: 3°52'N-5°l7'S, 136°40'-l38°20'E;
Location: from the highest peaks of the central highlands east of Enarotali south to the sea, Kabupaten Paniai, Jayawijaya, Fakfak and Merauke (Southern Division), Irian Jaya.
Area: Area of wetlands unknown; Nature Reserve 2,150,000 ha, proposed National Park 1,560,250 ha.
Altitude: Sea level to 4,884m.
Biogeographical province: 5.1.13.
Wetland type: 01, 02, 05, 06, 07, 11, 12 & 21.
Description of site: The Gunung Lorenz Nature Reserve is one of the few places in the world where glaciers still exist at tropical latitudes. The reserve includes a wide spectrum of habitats from the alpine and upper montane zones down through the lower montane and foothill zones to lowland alluvial plains and fans, fresh, saline and brackish water swamps, beach ridges and coastal mudflats. The wetlands form part of one of the largest swamp areas in the world. They consist of seasonally flooded alluvium forests, peat swamp forests, grassy swamps, sago woodlands, *Nypa* swamps, coastal mangrove swamps and littoral forests. The reserve contains the entire water catchment areas of several major rivers, from their headwaters in the perpetual snow fields of the

highest peaks to the coast, and thus incorporates the full range of riverine habitats. It is estimated that there are 301,500 ha of mangrove swamp and 351,750 ha of peat swamp in the reserve, along with 335,000 ha of wet lowland forest on rocky ground.

Climatic conditions: Humid tropical to alpine climate, depending on altitude.

Principal vegetation: Mangrove forest, *Nypa* swamp, peat swamp forest and grassy swamp.

Land tenure: Partly state owned (Indonesian Government) and partly owned by the local people.

Conservation measures taken: A Nature Reserve of 2,150,000 ha was established in January 1978.

Conservation measures proposed: Part of the Nature Reserve has been proposed as a National Park (1,560,250 ha) and World Heritage Site.

Land use: The area is inhabited by indigenous tribes of hunter-gatherers employing some shifting cultivation.

Possible changes in Land use: The current proposal to establish a National Park of 1,560,250 ha in place of the existing Nature Reserve (2,150,000 ha) would reduce the area under protection by 589,750 ha.

Disturbances and threats: Mining operations cause a considerable amount of disturbance in the reserve, and have caused some pollution of rivers and swamps. More than half of the reserve is under lease for petroleum exploration. Highland trails are a major threat to wildlife.

Economic and social values: The reserve is of considerable value, not only in terms of the commercial value of its forests, but also for its medicinal plants, genetic resources and tribal cultures. Its biological values, together with the spectacular scenery and unique culture of the inhabitants, rank the reserve as one of the most important conservation areas in the entire Pacific Basin.

Fauna: There are thought to be over 100 species of freshwater and brackish water fishes in the reserve, including 50 or more species which are known only from this area or its immediate vicinity.

Some 411 species of birds have been recorded, at least 20 of which are endemic to this region.

Water birds include *Tachybaptus novaehollandiae, Phalacrocorax melanoleucos, P. carbo, P. sulcirostris, Anhinga novaehollandiae, Ixobrychus flavicollis, Zonerodius heliosylus, Butorides striatus, Egretta picata, E. sacra, E. garzetta, E. intermedia, E. alba, Ardea novaehollandiae, A. sumatrana, Threskiornis molucca, Anseranas semipalmata, Dendrocygna arcuata, D. guttata, Tadorna radjah, Nettapus pulchellus, Anas waigiuensis* (a montane species), *Anas superciliosa, A. gibberifrons, Aythya australis, Haliastur indus, Haliaeetus leucogaster, Circus (aeruginosus) spilonotus, Rallina tricolor, Gymnocrex plumbeiventris, Megacrex inepta, Porzana tabuensis, Porphyrio porphyrio,* several montane species of Rallidae, *Irediparra gallinacea, Esacus magnirostris, Stiltia isabella, Pluvialis dominica, Charadrius dubius, Limosa lapponica, Numenius madagascariensis, Actitis hypoleucos, Arenaria interpres, Gallinago hardwickii, G. megala, Scolopax saturata* (above 1,000m elevation), and thirteen species of kingfishers (Alcedinidae).

One hundred and twenty-three species of mammals (80% of the total mammalian fauna of Irian Jaya) have been recorded. These include at least four species of phalangers, four bandicoots, four possums, four ringtails, three wallabies, one tree kangaroo, five marsupial mice, three marsupial cats and numerous bats and rodents.

Reptiles include both the Estuarine Crocodile *Crocodylus porosus* and the New Guinea Crocodile *C. novaeguineae.*

Special floral values: The reserve includes examples of all swamp habitat types occurring in this biogeographical region.

Research and facilities: Various faunal and floral surveys have been carried out in the reserve, but no serious ecological studies have been undertaken and much of the region remains poorly known.

References: Allen & Boeseman (1982); IUCN (in prep); Karpowicz (1985); Lever (1980); MacKinnon & Artha (l98lb); Petocz (l983a, l983b & 1984); Whitaker et *al.* (1985).
Criteria for inclusion: 123.
Source: Marcel J. Silvius.

Wetland name: Sungai Lorenz
Country: Indonesia
Coordinates: 4°40'S, 138°50'E to 5°30'S, 138°00'E;
Location: east of the Gunung Lorenz Nature Reserve, in the southern lowlands of Irian Jaya.
Area: c.140 km of river.
Altitude: Near sea level.
Biogeographical Province: 5.1.13.
Wetland type: 11 & 13.
Description of site: One of the large slow-flowing rivers of the southern lowlands of Irian Jaya, draining into the Arafura Sea near Agats. The river passes through several major wetland habitats including freshwater swamp forest, peat swamp forest and mangrove forest.
Climatic conditions: Humid tropical climate.
Principal vegetation: No information.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing.
Disturbances and threats: No information.
Economic and social values: The river supports an important freshwater fishery.
Fauna: Thirty-three species of freshwater fishes have been recorded, including six species known only from this site: *Doiichthys novaeguineae, Tetranesodon conorhynchus, Oloplotosus mariae, Plotosus papuensis, Melanotaenia ogibyi* and *Craterocephalus lacustris. A* further fifteen species are endemic to New Guinea: *Clupeiodes venulosus, Anus carinatus, A. latirostris, Cochiefelis danielsi, Hemipimelodus macrorhynchus, Nedystoma dayi, Neosilurus equinus, Anguilla interioris, Zenarchopterus novaeguineae, Melanotaenia goldiei, Hephaestus roemeri, Glossamia trifasciata, Mogurnda* sp. *nov., Oxyeleotris fimbriata* and *0. novaeguineae.* Other species include *Anus leptaspis, A. stirlingi, Neosilurus ater, N. brevidorsalis, Porochilus obbesi, Parambassis gulliveri, Pingalla lorentzi, Mogurnda mogurnda, Oxyeleotris herwerdeni, 0. lineolatus, Aseraggodes klunzingeri* and *Cynoglossus heterolepis.*
No information is available on the other fauna.
Special floral values: No information.
Research and facilities: Allen & Boeseman (1982) have investigated the fish fauna.
References: Allen & Boeseman (1982).
Criteria for inclusion: lb, 2a, 2b, 2d.
Source: Marcel J. Silvius.

Wetland name: Sungai Digul
Country: Indonesia
Coordinates: 5°15'S, 140°30'E to 7°15'S, 138°40'E;
Location: Merauke District, southeastern Irian Jaya.
Area: c.500 km of river.
Altitude: Mostly below 300m; source at over 3,000m.
Biogeographical province: 5.1.13.

Wetland type: 11, 12, 13 & 21.
Description of site: One of the largest rivers of Irian Jaya, with all the major riverine habitats characteristic of the region. The river rises in the eastern end of the Maoke Range near the Papua New Guinea border, and drains southwest across a vast swampy alluvial plain into the Arafura Sea.
Climatic conditions: Humid tropical climate.
Principal vegetation: No information.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: No information.
Disturbances and threats: No information.
Economic and social values: No information.
Fauna: Over thirty species of freshwater and brackish water fishes are known to occur, including 15 species endemic to New Guinea: *Clupeoides papuensis, Anus* sp. *nov., A. acrocephalus, A. carinatus, Cochiefelis danielsi, Hemipimelodus macrorhynchus, Nedystoma dayi, Neosilurus equinus, Melanotaenia splendida, Hephaestus roemeri, Bostrychus strigogenys, Oxyeleotris fimbriata, Oxyeleotris novaeguineae, 0. nullipora* and *0. paucipora.* The new species of Anus is known only from this river. Other fishes include *Nematalosa erebi, Thryssa scratchleyi, Scleropages jardinii, Cinetodus fregatti, Neosilurus ater, N. brevidorsalis, Anguilla interioris, Strongylura kreftti, Melanotaenia goldiei, Pseudomugil gertrudae, Ambassis macleayi, Pingalla lorentzi, Mogurnda mogurnda, Oxyeleotris herwerdeni, 0. lineolatus, Aseraggodes klunzingeri, Cynoglossus heterolepis* and *Pristis microdon.*
No information is available on the other fauna, but it is likely that the Estuarine Crocodile *Crocodylus porosus* occurs.
Special floral values: No information.
Research and facilities: Allen & Boeseman (1982) have investigated the fish fauna.
References: Allen & Boeseman (1982).
Criteria for inclusion: lb, 2a, 2b, 2d.
Source: Marcel J. Silvius.

Wetland name: Wetlands in Danau Bian Game Reserve
Country: Indonesia
Coordinates: 6°52'-7°32'S, 140°13'-140°43'E;
Location: around Muting, 50 km from the Papua New Guinea border, Kabupaten Merauke, Irian Jaya.
Area: c.50,000 ha of wetlands; Game Reserve 90,875 ha.
Altitude: c.50m.
Biogeographical province: 5.1.13.
Wetland type: 11, 13, 14&21.
Description of site: Seasonal lakes and swamps, and some permanent lakes in the upper reaches of the Bian River and its tributaries on the Oriomo Plateau. The substrate is sedimentary in origin. Poor drainage has led to the formation of extensive seasonal swamps (15,000 ha) and freshwater lakes (20,000 ha); the site also includes 15,000 ha of wet lowland forest on alluvium.
Climatic conditions: Humid tropical climate.
Principal vegetation: No information is available on the aquatic vegetation. The wetlands lie in a region of tall monsoon forest with trees up to 30-35m in height.
Land tenure: State owned.
Conservation measures taken: The entire area (90,875 ha) has been designated as a Game Reserve (Suaka Margasatwa).

Conservation measures proposed: Bishop (1984) has outlined management requirements for the reserve, including the prohibition of hunting of all native species, provision of adequately equipped guards and patrols, and the implementation of a conservation education programme.
Land use: There are a few villages and indigenous settlements within the reserve.
Disturbances and threats: Some hunting. Feral dogs are a menace to wildlife.
Economic and social values: No information.
Fauna: A total of 143 species of birds has been recorded in the reserve. Water birds include *Pelecanus conspicillatus, Phalacrocorax melanoleucos, P. sulcirostris, Anhinga novaehollandiae, Ixobrychus flavicollis, Butorides striatus, Nycticorax caledonicus, Egretta picata, E. intermedia, E. alba, Ardea sumatrana, Ephippiorhynchus asiaticus, Threskiornis molucca, Platalea regia, Anseranas semipalmata, Dendrocygna guttata, D. arcuata, Nettapus puichellus, Haliastur sphenurus, H. indus, Haliaeetus leucogaster, Grus rubicunda, Amaurornis olivacea, Irediparra gallinacea* and *Vanellus miles.*
Mammals include the Timor Deer, Wild Boar, Beaver Rat, Spotted Phalanger, Common Forest Wallaby and Agile Wallaby *(Cervus timorensis, Sus scrofa, Hydromus chrysogaster, Phalanger macullatus, Dorcopsos veterum* and *Macropus agilis).*
The wetlands are particularly important for the New Guinea Crocodile *Crocodylus novaeguineae* (a freshwater species), and young Estuarine Crocodiles *C. porosus* have also been reported.
Special floral values: No information.
Research and facilities: Preliminary faunal and floral surveys have been carried out in the Game Reserve.
References: Bishop (1984); IUCN (in prep); Karpowicz (1985); Whitaker *et al.* (1985).
Criteria for inclusion: 1b, 2a, 2b, 3b.
Source: Marcel J. Silvius.

Wetland name: Pulau Klmaam
Country: Indonesia
Coordinates: 7°43'-8°28'S, 137°33'-138°53'E;
Location: 170 km west of Merauke, Southern Division, Kabupaten Merauke, Irian Jaya.
Area: Game Reserve 600,000 ha.
Altitude: Sea level to 90m.
Biogeographical province: 5.1.13.
Wetland type: 02, 03, 06, 07, 14, 18 & 21.
Description of site: Pulau Kimaam (also known as Pulau Dolok, Pulau Kolepom and Frederik Hendrik Island), is a swampy island of about one million ha, separated from the mainland by a narrow channel. Most of the southern two-thirds of the island is wetland, and contains 99,000 ha of mangrove forest, 42,000 ha of freshwater swamps and 42,000 ha of peat swamp. The swamps include both forested swamps and open grassy swamps.
Climatic conditions: Humid tropical climate.
Principal vegetation: Eight principal types of vegetation have been defined (Bishop, 1984): (a) mangrove forest with species of *Avicennia, Sonneratia, Rhizophora;* (b) *Melaleuca* swamp forest dominated by *M. leucodendron* and *M. cajuputi;* (c) mixed swamp forest with species of *Ficus*, *Syzygium, Terminalia, Melaleuca, Acacia, Erythronia, Calophyllum, Barringtonia, Inocarpus, Campnosperma, Dracontomelon, Mangifera* and *Planchonia;* (d) clumps of bamboo; (e) seasonal swampy grasslands with *Phragmites karka; (f) Melaleuca* savanna; (g) mixed monsoon savannah; (h) aquatic vegetation such as *Nymphaea* sp in swamps with permanent open water.
Land tenure: Partly state owned and partly owned by the local people. The ownership of land is complicated because villages, which have moved to new locations, have retained their old land. In some cases, the old land is now a considerable distance from the new settlements.

Conservation measures taken: The southern part of the island (600,000 ha) was designated as a Game Reserve (Suaka Margasatwa) in 1978.
Conservation measures proposed: The island has been proposed as a Nature Reserve (Cagar Alam), but this would mean that the villages in the reserve would have to be resettled. The proposal has met with considerable local opposition. It has been suggested that if the villages are allowed to remain, the inhabitants could act as wardens and might be more effective than reserve wardens brought in from outside.
Land use: There are still a few villages in the southern part of the reserve. The local people have adapted to their swamp environment by constructing their houses and gardens on artificial islands (Serpenti, 1977).
Disturbances and threats: Excessive hunting of crocodiles, hunting of deer and birds, burning of grass in the dry season, and cutting of mangrove trees. There is some disturbance from the settlements in or close to the reserve.
Economic and social values: The local people are dependent on the swamps for their livelihood, and their peculiar culture is of considerable anthropological interest.
Fauna: An extremely rich area for wildlife. It is the best site in Irian Jaya for the conservation of crocodiles, and one of the richest for water birds, with important breeding, roosting and feeding areas. Over 200 species of birds have been recorded, including about 90 species of water birds, many of which are rare elsewhere in Indonesia. Herons, egrets, storks and ibises are particularly abundant. A recent count included:
over 1,000 *Egretta picata*
400 *E. garzetta*
1,000 *E. intermedia*
200 *E. alba*
15,000 *Threskiornis molucca*
2,500 *Plegadis falcinellus*
300 *Ephippiorhynchus asiaticus*
along with smaller numbers of *Ixobrychus minutus, I. sinensis, Zonerodius heliosylus, Nycticorax caledonicus, Butorides striatus, Egretta sacra, Ardea novaehollandiae, A. sumatrana, Carphibis spinicollis* and *Platalea regia.* Other resident waterfowl include *Tachybaptus novaehollandiae, Pelecanus conspicillatus, Phalacrocorax melanoleucos, P. sulcirostris, Anhinga novaehollandiae, Anseranas semipalmata* (up to 10,000), *Dendrocygna guttata, D. arcuata, Tadorna radjah, Nettapus pulchellus, Anas superciliosa, A. gibberifrons, Grus rubicunda, Rallus philippensis, Rallina tricolor, Irediparra gallinacea, Himantopus leucocephalus, Esacus magnirostris* and *Vanellus miles.* The island is very important as a staging area and wintering area for migratory shorebirds. Twenty-one species of migrant shorebirds from the Palearctic Region have been recorded, along with two species from Australia *(Haematopus longirostris* and *Stiltia isabella).* A recent count included:
86 *Pluvialis squatarola*
3,700 *Charadrius mongolus*
60 *Limosa limosa*
70 *L. lapponica*
1,175 *Numenius phaeopus*
130 *N. madagascariensis*
90 *Xenus cinereus*
90 *Calidris tenuirostris*
1,400 *C. ruficollis*
Terns include *Chlidonias hybrida, Gelochelidon nilotica, Sterna dougallii, S. sumatrana, S. albifrons, S. bergii, S. bengalensis, Anous stolidus* and *A. minutus.* Other wetland birds include the raptors *Pandion haliaetus, Haliastur sphenurus, H. indus* and *Haliaeetus leucogaster,* and the

kingfishers *Alcedo azurea, A. pusilla, Ceyx lepidus, Dacelo gaudichaud, D. leachii, Melidora macrorrhina, Halcyon nigrocyanea, H. mackleyi, H. torotoro, H. sancta* and *H. chloris.* Mammals include the Timor Deer, Wild Boar, Beaver Rat, Spotted Phalanger, Common Forest Wallaby, Agile Wallaby and Echidna *(Cervus timorensis, Sus scrofa, Hydromus chrysogaster, Phalanger macullatus, Dorcopsis veterum, Macropus agilis* and *Tachyglossus aculeatus).* The wetlands support a large, healthy population of the Estuarine Crocodile *Crocodylus porosus,* and the New Guinea Crocodile *C. novaeguineae* also occurs.
Special floral values: No information.
Research and facilities: Several faunal and floral surveys have been carried out. Bishop (1984) conducted a survey in September-December 1984 with emphasis on determining appropriate boundaries for the reserve, and S. and A. Nash have made a survey of the Estuarine Crocodile population on the island.
References: Bishop (1984); IUCN (in prep); Karpowicz (1985); MacKinnon & Artha (l981b); Petocz (1984); Schultze-Westrum (1978); Serpenti (1977); Whitaker *et al.* (1985).
Criteria for inclusion: 123.
Source: Marcel J. Silvius and K. David Bishop.

Wetland name: Pulau Pombo
Country: Indonesia
Coordinates: 7°47'S, 139°02'E;
Location: between Pulau Kimaam (Dolok) and the mainland, Kabupaten Merauke, Irian Jaya.
Area: 100 ha.
Altitude: Sea level.
Biogeographical province: 5.1.13.
Wetland type: 07.
Description of site: A small island covered in mangrove swamps, in the narrow channel between Pulau Kimaam (site 134*)* and the mainland.
Climatic conditions: Humid tropical climate.
Principal vegetation: Mangrove forest.
Land tenure: State owned.
Conservation measures taken: None.
Conservation measures proposed: The island has been proposed as a Nature Reserve (Cagar Alam).
Land use: Hunting and logging.
Disturbances and threats: Hunting of birds and cutting of mangrove trees.
Economic and social values: No information.
Fauna: An important roosting site for large water birds. Many of the birds feeding on the nearby Pulau Kimaam use this island for roosting.
Special floral values: None known.
Research and facilities: None
References: MacKinnon & Artha (198lb).
Criteria for inclusion: lb. 3b.
Source: Marcel J. Silvius.

Wetland name: Wasur and Rawa Biru
Country: Indonesia
Coordinates: 8°03'-9°06'S, l4O°3O'-l4l°OO'E;

Location: in southeastern Irian Jaya on the border with Papua New Guinea east of Merauke, Kabupaten Merauke, Irian Jaya.
Area: 431,000 ha, including the Wasur Game Reserve (308,000 ha) and Rawa Biru Strict Nature Reserve (4,000 ha within the Game Reserve).
Altitude: Sea level to 90m.
Biogeographical province: 5.1.13.
Wetland type: 02, 06, 07, 11, 14, 15, 16, 18 & 21.
Description of site: An extensive complex of permanent and seasonal freshwater lakes, marshes, flooded savanna woodland and riverine floodplains, dissected by numerous rivers, including the Maro, Dalrii and Bensbach, which rise in the Star Mountains to the north. Almost the entire area floods during the wet season (December to March or April), and generally becomes inaccessible except by shallow-draft boats and canoes. The only areas above water are along ancient raised beach ridges with their attendant monsoon forest. During the dry season, the region becomes extremely dry, and water is confined to a few permanent water bodies and the deeper river channels. Some permanent lakes, such as Rawa Biru, are very deep and probably acidic. In the south, vast areas of tidal mudflats and sandy flats extend westwards along the coast almost without break from the Papua New Guinea border to Pulau Kimaam (site 134). The tidal flats are backed by large and mainly undisturbed tracts of mangrove forest, seasonally flooded paperbark swamp forest and some areas of sand dunes. The tides are extremely variable, with no clear diurnal pattern. Ebb tides frequently expose as much as 500m of mudflats, while high spring tides flood large areas inland.
Climatic conditions: Humid tropical climate with a pronounced rainy season from December to March or April. The dry season is very hot, but with cooling onshore breezes along the coast.
Principal vegetation: Ten main vegetation types have been described including lowland forest, *Melaleuca-Eucalyptus* woodland, savanna, parkland, swamp vegetation, mangrove forest and beach vegetation. The Wasur Game Reserve includes 6,180 ha of mangrove forest and 161,180 ha of savanna; the Rawa Biru Nature Reserve includes 4,000 ha of seasonal freshwater swamps. The area also includes over 250,000 ha of seasonal peat swamp. Mangrove forest occurs in a belt up to three km wide along the coast, and also far inland in the Wasur Game Reserve along ancient creek beds. The coastal mangroves are dominated by species of *Avicennia, Sonneratia* and *Rhizophora. Bruguiera* sp occurs in association with species of *Acacia, Acanthus* and *Acrostichum* at inland sites. The freshwater swamp forest is dominated by *Melaleuca leucodendron.* The lush vegetation associated with permanent open water includes *Azolla imbricata* and species of *Nymphaea, Lotus, Utricularia* and *Lemna.* Creeping grasses, such as *Ischaeum* sp and *Pseudoraphis* sp, and tall herbs, such as *Hanguana* sp and *Cyclosorus* sp, grow around the margins of the lakes. Tall stands of *Phragmites karka* are rather scarce. The sand dune vegetation consists of a *"pescaprae"* formation with *Ipomoea pescaprae, Canavalia maritima,* creeping herbs, grasses and sedges. Further inland, there is a shrub zone with *Hibiscus tiliaceus, Barringtonia asiatica* and *Cocos nucifera.* There are some tidal sand flats covered *with Sesuvium portulacastrum* in the southeastern corner of Wasul Game Reserve.
Land tenure: Mainly state owned, with certain areas being leased to trans-migrant settlers and a few sites leased to ranchers. Originally, all or most of the land would have comprised native hunting ranges, and had traditional boundaries. These boundaries may still exist so far as the native people are concerned, but they have little credence with the authorities. All forested land is under the jurisdiction of the Forestry Department.
Conservation measures taken: Some 210,000 ha were designated as a Game Reserve (Suaka Margasatwa) in 1978, and this was extended by a further 94,000 ha in 1982. The permanent open-water swamps at Rawa Biru are protected in a Strict Nature Reserve (Cagar Alam) of 4,000 ha, established in 1978.

Conservation measures proposed: There is a proposal to extend the existing protected area by a further 127,000 ha.

Land use: Fishing, hunting, harvesting of birds' eggs, subsistence agriculture, livestock grazing and illegal logging. Most of the wetland areas are hunted by native people for meat (e.g. wallabies, deer, cassowaries and monitor lizards) and eggs of nesting birds such as Magpie Geese *Anseranas semipalmata,* herons, egrets, ibises and Brolga Crane *Grus rubicunda.* The native people also cultivate small garden plots, usually in the monsoon woodlands and typically for only one season before moving on to a new site. The principal crops are maize, taro, sweet potatoes and tapioc.

Disturbances and threats: The area is under great pressure from many sources, and it is estimated that within the next three years, a considerable portion of the reserve will have been destroyed. There are two major road systems in the reserve; a south coastal road from Merauke to the Papua New Guinea border, and the Trans-Irian highway which bisects the reserve into two almost equal parts. In addition, there are many smaller dirt roads and trails. This accessibility has resulted in a considerable amount of illegal hunting, logging, cutting and burning. At the height of the dry season, large areas are intentionally burned, presumably as a means of driving game for the hunt and killing snakes. Much of the marsh vegetation has been badly damaged by the large numbers of introduced Rusa Deer *Cervus timorensis* and Wild Boar *Sus scrofa*, and also by hunters in motor vehicles. Some coastal savanna woodland and grasslands, particularly within the Wasur Game Reserve, are illegally used by recent settlers for grazing cattle.

Economic and social values: The wetlands support a considerable amount of subsistence hunting and fishing. The proximity of Wasur to the large township of Merauke, its relatively easy access and its numerous natural attractions make it a valuable recreation resource with great potential for tourism.

Fauna: Over 390 species of birds have been recorded in the area. The site is particularly important for water birds, many species occurring in very large numbers. The wetlands are especially rich in herons, egrets, storks and ibises. A recent survey recorded:

2,500 *Egretta picata*
350 *E. garzetta*
5,000 *E. intermedia*
250 *E. alba*
over 30,000 *Threskiornis molucca*
over 350 *Ephippiorhynchus asiaticus*
350 *Carphibis spinicollis*
and over 4,000 *Plegadis falcinellus* (both *P. f. falcinellus* and *P. f. peregrinus).* Other resident waterfowl and dry season visitors from northern Australia include *Tachybaptus novaehollandiae, Pelecanus conspicillatus, Phalacrocorax melanoleucos, P. sulcirostris, Anhinga novaehollandiae, Ixobrychus minutus, I. sinensis, I. flavicollis, Zonerodius heliosylus, Nycticorax caledonicus, Butorides striatus, Egretta sacra, Ardea novaehollandiae, A. sumatrana, Platalea regia, Anseranas semipalmata* (10,000 in December 1983), *Dendrocygna guttata, D. arcuata, Tadorna radjah, Nettapus puichellus, Anas superciliosa, A. gibberifrons, Aythya australis, Grus rubicunda, Rallus philippensis, Rallina tricolor, Poliolimnas cinereus, Gymnocrex plumbeiventris, Porphyrio porphyrio, Irediparra gallinacea, Himantopus leucocephalus, Esacus magnirostris* and *Vanellus miles.* The rare New Guinea Flightless Rail *Megacrex inepta* may still occur in the area.

The coastal wetlands are an extremely important staging and wintering area for migratory shorebirds. Twenty-five species of Palearctic shorebirds and three Australian species (*Haematopus longirostris, Stiltia isabella, Charadrius cinctus*) have been recorded. The most numerous species (with recent counts in brackets) are as follows:

Pluvialis dominica (112)
Charadrius mongolus (3,130)
Limosa limosa (432)

Numenius minutus (4,000)
N. phaeopus (96)
N. madagascariensis (45)
Tringa nebularia (35)
T. glareola (large numbers)
Xenus cinereus (278)
Calidris tenuirostis (180)
C. ruficollis (520)
C. acuminata (655)
Gulls and terns include *Larus novaehollandiae* (a scarce winter visitor from Australia), *Chlidonias hybrida, Gelochelidon nilotica, Hydroprogne caspia, Sterna hirundo* and *S. albifrons.*
Other wetland birds include the raptors *Pandion haliaetus, Haliastur sphenurus, H. indus* and *Haliaeetus leucogaster,* and thirteen species of kingfishers: *Alcedo azurea, A. pusilla, Ceyx lepidus, Dacelo gaudichaud, D. tyro, D. leachii, Clytoceyx rex, Melidora macrorrhina, Halcyon nigrocyanea, H. macleayii, H. chioris, H. sancta* and *H. torotoro.*
Some 81 species of mammals have been recorded, including the introduced Rusa Deer *Cervus timorensis* (abundant), *Sus scrofa, Hydromys chrysogaster, Syconycteris australis, Tachyglossus aculeatus, Phalanger macullatus, Petaurus brevipes, Dorcopsis veterum* and *Macropus agilis.* Many of the mammals are endemic to New Guinea. The Dugong *Dugong dugon* still occurs along the coast.
Reptiles include the endemic monitor lizard *Varanus salvadorii* as well as *V. timoriensis, Chlamydosaurus kingi* and the endangered endemic *Carettochelys insuipta.* The Estuarine Crocodile *Crocodylus porosus* probably still occurs in very small numbers. Fishes include *Scieropages* sp.
Special floral values: The wetland ecosystems are unique in Indonesia, and quite different from any other wetland areas protected within reserves.
Research and facilities: In September-December 1983, Bishop (1984) conducted a survey of the area to determine appropriate boundaries for the reserve, to examine the impact of egg-collecting on the water bird populations, and to investigate the hunting of Rusa Deer as it related to conserving the reserve. Nash and Nash have carried out a survey of the Estuarine Crocodile population. There are no research facilities in the reserve, but the land-use agency Euroconsult maintains an office in Merauke with excellent mapping facilities.
References: Bishop (1984); IUCN (in prep); Karpowicz (1985); MacKinnon & Artha (198lb); Petocz (1984).
Criteria for inclusion: 123.
Source: Marcel J. Silvius and K. David Bishop.

Wetland name: Danau Wanam
Country: Indonesia
Coordinates:…….
Location: Irian Jaya (precise location unknown).
Area: Unknown.
Altitude: Unknown.
Biogeographical province: 5.1.13.
Wetland type: 14.
Description of site: A freshwater lake.
Climatic conditions: Humid tropical climate.
Principal vegetation: No information.

Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: No information.
Disturbances and threats: No information.
Economic and social values: No information.
Fauna: A species of fish, *Glossolepis wanamensis,* is known only from this lake. No other information is available on the fauna.
Special floral values: No information.
Research and facilities: None
References: Allen & Boeseman (1982).
Criteria for inclusion: 2d.
Source: Marcel J. Silvius.

Other Important Wetlands

In addition to the 137 internationally important sites described above, the Indonesian Wetland Inventory includes the following sites which would appear, on the basis of existing information, to be of national rather than international importance (Silvius *et al.,* 1987*).* It is likely, however, that many of these will be shown to be of international importance as further information becomes available.

	Area	Location
SUMATRA		
Kuala Jambu Air	10,000 ha	Aceh Timur
Rawa Cicim	3,000 ha	Aceh Timur
Kuala Langsa	7,000 ha	Aceh Timur
Kluet	20,000 ha	Aceh Selatan
Pulau Bangkaru	8,000 ha	Aceh Selatan
Dolok Sembelin	33,910 ha	Sumatra Utara
Lau Tapus	12,000 ha	Tapanuli Tengah
Sei Prapat	2,900 ha	Labuhan Batu
Siondop	17,950 ha	Sumatra Utara
Pulau Berkeh	500 ha	Riau
Tanjung Sinebu-Pulau		
Alang Besar	15,000 ha	Bengkalis
Danau Tanjung Padang	2,500 ha	Bengkalis
Meninjau North/South	22,106 ha	Sumatra Barat
Bukit Gedang Seblat	48,750 ha	Rejang Lebong
Sumatra Selatan	356,800 ha	Lampung
Tulang Rawang Backswamps	?	Lampung
JAVA		
Pulau Pan	7 ha	West Java
Jakarta Bay	190 ha	West Java
Muara Angke	15 ha	West Java
Pulau Minyawak	120 ha	West Java
Telaga Patengan	150 ha	West Java
Rawa Pening	?	Central Java

Kerumutan Lama
Gunung Su
Terusan Da
Danau Jepara

Babat	?	East Java
Baluran	1,750 ha	East Java
South Banyuwangi	62,000 ha	East Java
Meru Betiri	1,000 ha	East Java
Pamelokan	500 ha	Bali
NUSA TENGGARA		
Batugendang Forest	10,000 ha	Lombok Barat
Selalu Legini Lake	1,100 ha	Sumbawa
Pulau Panjang	10,000 ha	Sumbawa
Tainbora Selatan	30,000 ha	Dompu
Pulau Rusa	1,406 ha	Alor
Danau Rana Mesa	500 ha	Manggarai
Bena Plain	11,000 ha	West Timor
KALIMANTAN		
Kelompok Gunung		
Asuansang	28,000 ha	West Kalimantan
Mandor	2,000 ha	West Kalimantan
Central Kalimantan		
mangroves	84,400 ha	Central Kalimantan
Tanjung Puting (extension)	70,000 ha	Central Kalimantan
Danau Sembuluh	7,500 ha	Central Kalimantan
Teluk Sampit/Tanjung Bandaran	?	Central Kalimantan
Pulau Kaget	85 ha	South Kalimantan
South Kalimantan mangroves	90,000 ha	South Kalimantan
Pleihari Martapura	36,400 ha	South Kalimantan
Pulau Suwangi	500 ha	South Kalimantan
Pulau Sebuku	14,400 ha	South Kalimantan
Tanjung Dewa Barat	16,250 ha	South Kalimantan
Apar Besar	90,000 ha	East Kalimantan
Pantai Samarinda	95,000 ha	East Kalimantan
Sungai Berambai	15,000 ha	East Kalimantan
Muara Along	?	East Kalimantan
Pulau Birah-Birahan	?	East Kalimantan
Talisyan	?	East Kalimantan
Perairan Pulau Maratua and	?	East Kalimantan
Karang Muaras		
Muara Kayan	80,000 ha	East Kalimantan
SULAWESI		
Lantung Mangrove Forest	1,000 ha	Minahasa
Gunung Ambang Lakes	8,638 ha	Bolaang Mongondow
Pulau Dolongan	462 ha	Buol Toli-Toli
Air Terjun Wera	1,200 ha	Donggala
Laa Valley (upper section)	14,000 ha	Kolonodale
Laa Tambalako River mouths	19,000 ha	Kolonodale
Danau Towuti	59,000 ha	Luwu
Danau Matano and		
Danau Mahalano	30,000 ha	Luwu

Sungai Baliase	200 ha	South Sulawesi
Bulukumba	1 ha	South Sulawesi
Barombong	1 ha	South Sulawesi
Polewali-Mapili	10 ha	South Sulawesi
Lasolo Plain	10,000 ha	South East Sulawesi
Selat Muna	?	South East Sulawesi
Lambale/Laangkumbe Plain	3,000 ha	South East Sulawesi
Polewai	15,000 ha	Kendari
Tanjung Batikolo	5,500 ha	Kendari
Sampara Plain	13,000 ha	Kendari
Tondano Waterfall	?	Minahasa
Saluki 699 ha	Donggala	
Solo Maradja	50,000 ha	Central Sulawesi
MOLUCCAS		
Pulau Morotai	?	Maluku Utara
Bacan ?	Maluku Utara	
Gunung Kelapat Muda	?	Maluku Tengah
Wae Upa	22,000 ha	Maluku Tengah
Wae Nua	20,000 ha	Seram
Wae Mual	17,500 ha	Seram
Wae Bula	60,000 ha	Seram
Pulau Baun	13,000 ha	Maluku Tenggara
Pulau Suanggi	20 ha	Seram
Pulau Pulau Banda	2,500 ha	Maluku Tengah

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