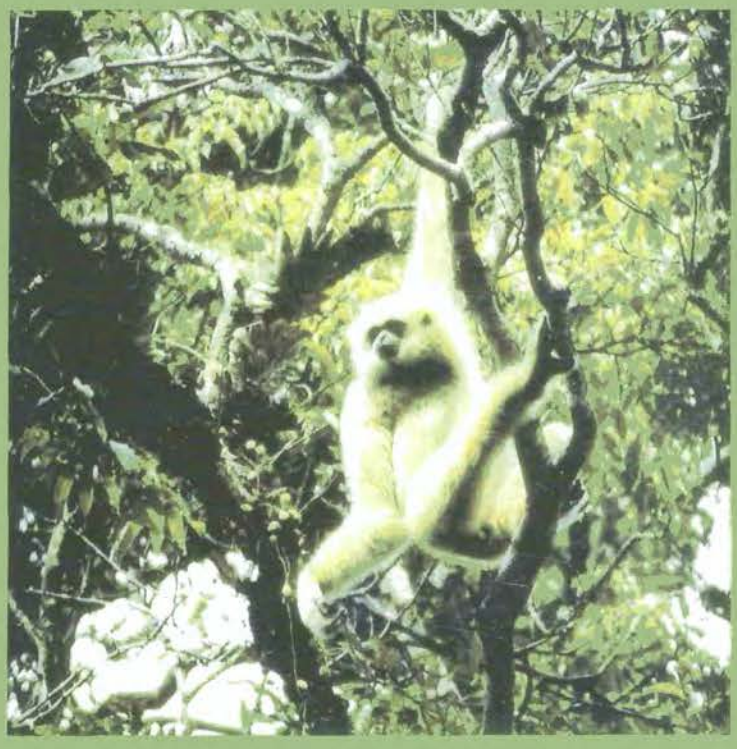
ASEAN HERITAGE PARKS AND RESERVES



By

ASEAN SENIOR OFFICIALS ON THE ENVIRONMENT

in collaboration with

JAPAN INTERNATIONAL COOPERATION AGENCY

and

UNITED NATIONS ENVIRONMENT PROGRAMME

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FOREWORD

This publication is a result of technical collaboration between the Association of South-East Asian Nations (ASEAN) and the United Nations Environment Programme (UNEP) under the ASEAN Environment Programme (ASEP) which was formulated in 1978 in cooperation with UNEP and includes activities for terrestrial ecosystems and nature conservation.

The first ASEAN Ministerial Meeting on the Environment held in Manila in 1981 adopted broad goals and priorities for collective action for the environment, among which was the establishment and management of a regional network of outstanding protected areas which represent the natural heritage of South-East Asia. Eleven areas were then selected and finally adopted as ASEAN Heritage Sites at the second ASEAN Ministerial Meeting on the Environment in November 1984. It is these sites which are introduced in this book.

The first edition of this book published in 1983 was prepared mainly Dr. Chew Wee-Lek, UNEP Consultant, based on his discussions with, and materials provided by, various ASEAN government authorities. This revised edition of 1988 was prepared by Dr. Warren Y. Brockelman, Director, Center for Wildlife Research, Mahidol University, Bangkok.

We are grateful to Japan International Cooperation Agency (JICA) for their substantial financial assistance for the printing of this edition.

We hope that this publication will help as many people as possible learn the importance of the natural heritage of South-East Asia and further contribute to conservation activities of the biological diversity of the region.

ASEAN Senior Officials on the Environment
and
United Nations Environment Programme
Regional Office for Asia and the Pacific

INTRODUCTION

ASEAN Activity in Nature Conservation

The ASEAN Environment Programme (ASEP) seeks to safeguard the natural heritage of the ASEAN Region through mutual exchange of information on the environment, special workshops on various topics, help in the establishment and management of protected areas, restriction of trade in endangered species, and many other activities. Priority areas endorsed at the First ASEAN Ministerial Meeting on the Environment, held in Manila in 1981, are:

1) Marine environment;
2) Environmental management, including environmental impact assessment;
3) Nature conservation and terrestrial ecosystems;
4) Industry and environment;
5) Environmental education and training;
6) Environmental information.

The business of planning and implementing programs under ASEP is carried out by the ASEAN Experts Group on the Environment (AEGE), which meets annually. Its technical work is aided by the ASEAN Group on Nature Conservation (AGNC) which annually convenes the ASEAN Meeting on Nature Conservation. The First AGNC Meeting was held during March 1982 in Singapore; subsequent meetings have been the Second in October 1983 in the Philippines, Third in October 1984 in Bali, Indonesia, Fourth in October 1985 in Malaysia, Fifth in March 1987 in Thailand, and the Sixth in Indonesia in 1988.

These ASEAN Meetings are the spawning ground for many new ideas and projects which form a significant part of the substance of the ASEP. The current ASEP (ASEP III), developed with the help of UNEP, in designed for the period 1988-1992. It contains 12 different projects dealing with nature conservation and terrestrial ecosystems.

The ASEAN Agreement on Nature Conservation

The AGNC drafted the ASEAN Agreement on Nature and Natural Resources which was signed by the six member nations on July 9, 1985, at the 18th ASEAN Ministerial Meeting in Kuala Lumpur. The Agreement, reproduced in Appendix 1, specifies "the measures necessary to maintain essential ecological processes and life-support systems, to preserve genetic diversity, and to ensure the sustainable utilization of harvested natural resources under their jurisdiction in accordance with scientific principles and with a view to attaining the goal of sustainable development" (from Article 1).

Successive chapters of the Agreement deal with conservation and development, conservation of species and ecosystems (species, vegetative cover and forests, soil, water and air), conservation of ecological processes, environmental planning (land use, protected areas, impact assessment), and various support measures such as research, education, information, training, and administration. A tremendous amount of thought and work has gone into this document and it will remain the blueprint for action for decades to come, providing that ASEAN nations maintain the will to implement it effectively and carry out the various required national supporting measures.

The ASEAN Endangered Species Lists

At the second ASEAN Meeting on Nature Conservation (1983) it was decided that the draft ASEAN Agreement should have an appendix listing endangered species which would not be allowed to be traded internationally, and threatened species in which trade would be restricted. Each country was directed to submit lists of candidate endangered and threatened species, and a lengthy and painful process of negotiation and "harmonization" of the species lists took place over numerous subsequent meetings and consultancies. The process was made difficult by differing interpretations of "endangered" and "threatened" by member nations and differing attitudes toward protection and trade. For example, Malaysia, with many native rare species, proposed a long list whereas Singapore, with few native species and a greater stake in commerce, insisted on a short list.

The task was also made difficult by the sheer diversity and complexity of the ASEAN fauna and flora. Delegates initially did not appreciate the technical complexity of the task (for example, there are around 2,000 species of birds alone native to the ASEAN region), but with some help provided by UNEP, the country lists were finally harmonized. Agreement on the ASEAN Endangered and Threatened Species Lists (Appendix 2) was finally completed at the Fifth AGNC Meeting in Chiang Mai, Thailand.

The ASEAN species lists were deliberately kept short so that only species agreed as endangered or threatened by all ASEAN countries would be included. The lists, therefore, do not necessarily coincide with lists of species recognized as endangered by the national legislation of the member countries. It is most desirable, also, that the lists concentrate on

species actually or potentially threatened by international trade, and be short, so that enforcement efforts will be simplified and made more effective. In this regard, the UNEP Regional Office for Asia and Pacific has agreed to assist in publishing an identification manual for the ASEAN endangered species to increase public awareness and aid enforcement efforts.

The ASEAN endangered species lists are admittedly imperfect in several ways. Many species not included in the lists are more endangered than most of those included. Some species not included are also being hurt by international trade; for example, the Asian bony tongue (fish), Scleropages formosus. It is hoped that these deficiencies will be corrected at future meetings. Also, a more standardized method of selecting and approving species for inclusion that is agreeable to all countries would be desirable.

Approval of the present ASEAN Endangered Species Lists, however, is an important milestone for species protection under the ASEAN Agreement.

ASEAN Heritage Parks and Reserves

ASEAN heritage parks and reserves is a category of protected areas recently conceived for a select group of national parks and nature reserves that have outstanding wilderness and other values. The concept of this category was mooted by the ASEAN Experts on the Environment at their first regional meeting 1978. Keenly aware of the uniqueness of a number of the region's national parks and reserves, the Experts recommended that they be given the highest regional recognition so that their importance as conservation areas be appreciated internationally. This was endorsed by

ASEAN conservationists at their first workshop held in Bali, Indonesia in September 1981.

The conservationists further called on UNEP and IUCN to support a consultancy to prepare a regional action plan on conservation in which the establishment of a network of ASEAN heritage parks and reserves would be a main feature. IUCN responded to this request, and with financial assistance from UNEP, fielded a staff-consultant to prepare the Action Plan on Nature Conservation in the ASEAN Region, which identified and recommended the establishment of ten protected areas as ASEAN Heritage Parks and Reserves.

The Fourth AEGE Meeting in 1981 recommended that a group of experts on nature conservation be convened to consider the draft Action Plan, and this spawned the first meeting of the ASEAN Experts on Nature Conservation (now called the AGNC mentioned earlier). At the second AGNC meeting in 1983, a set of principles, objectives, criteria and guidelines for the selection, establishment and management of protected areas in the ASEAN Region was proposed. These are reproduced here in Appendix 3.

When Brunei acceeded to ASEAN, an 11th Heritage Park was soon proposed for that country.

Finally, the Second ASEAN Ministerial Meeting in Bangkok, on 29 November 1984, issued the important Declaration on Heritage Parks and Reserves which created the first group of 11 Heritage Sites described in this book.

Manual on Planning for ASEAN Heritage Parks and Reserves

The ASEAN Declaration specified that master plans (or management plans, as they are now usually called) be developed for the ASEAN heritage sites. In 1985, the United States Park Service (USPS) was requested by the ASEAN Expert Group on the Environment to help in drafting model guidelines for the preparation of management plans for the ASEAN heritage sites. Some technical and financial assistance was also provided by the UNEP Regional Office for Asia and Pacific. An excellent manual, Planning for ASEAN Heritage Parks and Reserves, was completed in 1986; it summarizes the international state of the art on the subject, based largely on guidelines previously published by Kenton Miller, former Director-General of IUCN, and by Rodney Salm and John Clark (for marine areas). The USPS consultant, Ms. Joanne Michalovic, also visited five ASEAN countries, conferred with local experts and officials, and made some special recommendations for the parks visited.

The Planning manual meticulously lays out all the necessary steps in the planning process, and gives a suggested outline for the master plan with detailed explanations.

Preparation of a master plan, of course, is largely an exercise in research and writing which, by itself, does little to solve the problems of management and conservation. If done thoughtfully, however, it should result in the confrontation with and solution of management problems, providing that the will and the finances exist.

The most serious management problems of parks in tropical countries concern the management of indigenous peoples. This is true not only in the ASEAN Region but throughout most of the world. It is now a widely accepted

view that there exists a pressing need to integrate protected area conservation into national and local social and economic development, and vice versa. This point was not explicitly emphasized in the ASEAN Declaration on Heritage Parks and Reserves (see Chapter 1), although it was implied by the references to management.

The problem, however, receives emphasis in the Planning manual in Chapter II, which is brief but seminal essay by Joanne Michalovic. Several paragraphs deserve to be read here; they are quoted below without further comment.

> When local, indigenous people are relocated when new parks are expanded or created, limited alternatives and compensation for subsistence use leads to competition for resources, illegal harvesting of timber and wildlife, trespass grazing, and subsequent management and enforcement problems. This inhibits public support, alienates large sections of the population, disrupts local and traditional socio-cultural patterns and lifestyles, and promotes the image of the conservationist as being a fanatic preservationist. Most importantly, it creates the misconception that conservation is directly opposed to resource use and development.
>
> There is a critical need to change public perception about the role and compatibility of protected areas with a country's development requirements. To be effective, a country cannot take an inherited approach of designation and management of parks and protected areas from the developed world, it must be set in the context of a country's particular needs.

Protected areas need to meet a set of management objectives which give maximum flexibility, and environmental, social, and economic benefits to local and regional communities. At the same time, significant park areas and resources must not be compromised. There are international standards for national parks that must not be weakened. However, there are other internationally recognized categories one may use if one wishes a "lesser" level of protection...

Planning methodology must reflect this changing role of parks and protected areas, and address the issues and concerns peculiar to Southeast Asia. Planning for a park in isolation of surrounding land uses and peoples, and without interagency cooperation, is not only unacceptable - it will not work.

ASEAN Workshop on Nature Conservation

Following up on recommendations in the ASEAN Agreement concerning collaboration in improving management of national parks and reserves and promoting their integration into national development, a Workshop on Nature Conservation was held in conjunction with the Fifth Meeting on Nature Conservation held in Chiang Mai, Thailand, April 1986. It featured discussions under the theme "People and Wildlife Management", at which participants related experiences and lessons from their own countries. Topics under this theme included (1) problems caused by people living in and around protected areas; (2) protected area management for promotion of tourism and recreation; (3) wildlife management and methods of conserving endangered species; and (4) national park management problems. The

emphasis on human-related management problems reflects the growing difficulty of protecting natural areas throughout Asia (and indeed, the world) in the face of still-expanding human populations, especially in poverty stricken rural areas. ASEAN countries must develop their own solutions to these problems, and they will very somewhat from one country to another, as well as differ from those of Western countries.

At the Nature Conservation Workshop each country was requested to present a review of the laws, policies and management problems of its respective parks and reserves. This material has been summarized briefly in Chapter 4. It testifies to the great progress made in ASEAN countries in conserving their natural ecosystems. There are indications, however, that many problems in safeguarding these reserves far into the future remain to be solved. The work has only begun.

CHAPTER 1: WHAT ARE ASEAN HERITAGE PARKS?

1.1 ASEAN Declaration on Heritage Parks and Reserves

The concept of ASEAN heritage sites is best understood by reading the opening paragraphs of the ASEAN Declaration on Heritage Parks and Reserves which was signed by the six member states in 1984. These are quoted below, along with the list of the 11 heritage parks. The ASEAN Member States,

"CONCERNED with the necessity to preserve and protect national parks and nature reserves of the ASEAN member countries;

"AWARE of the uniqueness, diversity and outstanding values of certain national parks and reserves of ASEAN member countries, that deserve the highest recognition so that their importance as conservation areas could be appreciated regionally and internationally;

"RECOGNIZING that conservation areas should be managed to maintain ecological processes and life support systems, preserve genetic diversity; ensure sustainable utilization of species and ecosystems; and maintain wilderness that is of scenic, cultural, educational research, recreational and tourism values;

"CONSIDERING that to achieve the aims, purpose and objectives of the heritage parks and reserves of the ASEAN member countries, a master plan should be drown for each heritage park which shall include but not be limited to management guidelines, research on structure and function of ecosystems and education on wilderness values;

"FURTHER CONSIDERING that environmental concerns transcend national boundaries and that individual states are primarily responsible for their respective indentified heritage sites;

"DO HEREBY DECLARE the following national heritage sites and reserves:

1. Brunei Darussalam
   a. Tasek Merimbun

2. Indonesia
   a. Leuser National park
   b. Kerinci-Seblat National Park
   c. Lorentz Nature Reserve

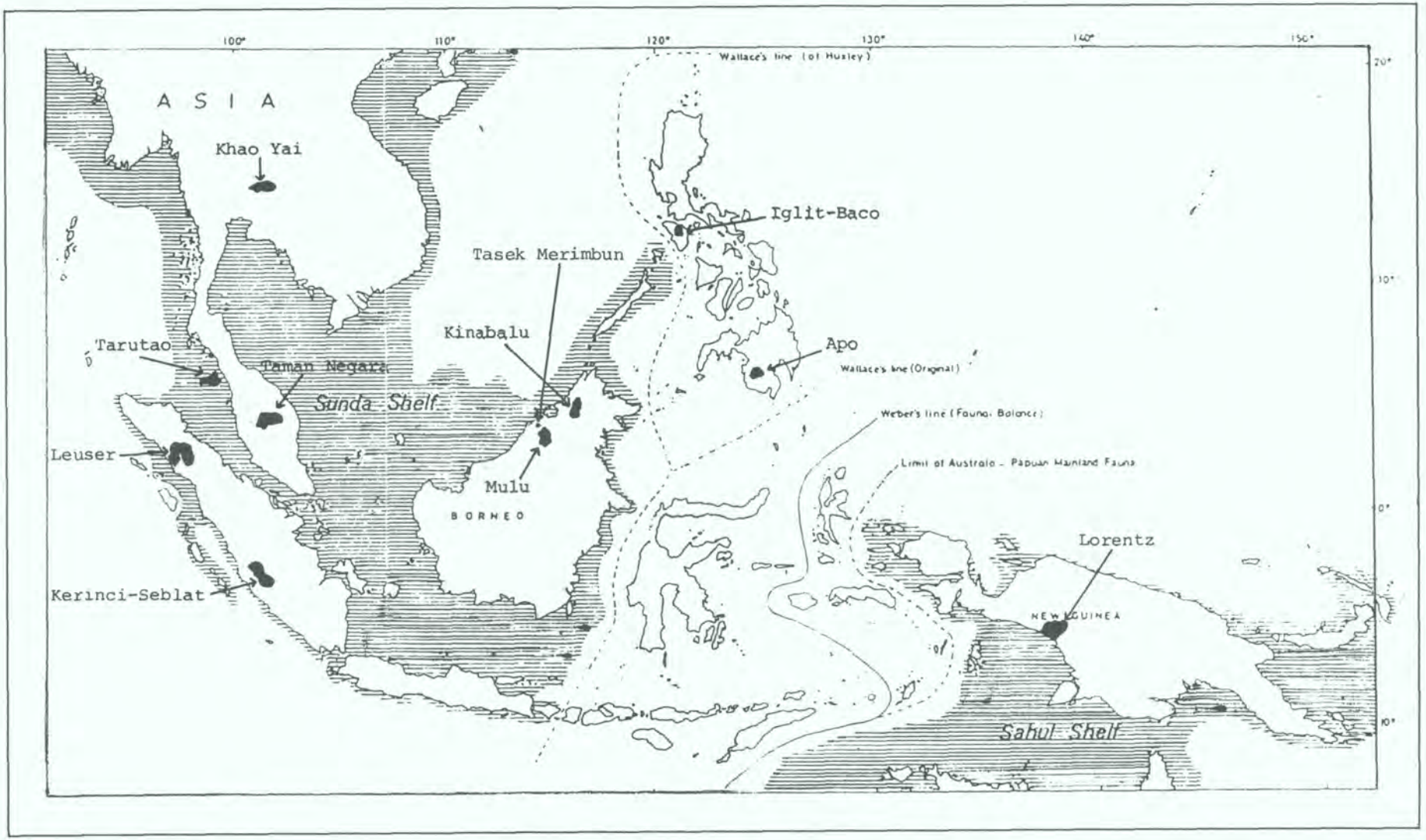
3. Malaysia
   a. Kinabalu National park
   b. Mulu National Park
   c. Taman Negara National Park

4. Philippines
   a. Mt. Apo National Park
   b. Iglit-Baco National Park

5. Thailand
   a. Khao Yai National Park
   b. Tarutao National Park

as ASEAN national heritage parks and nature reserves..."

Heritage sites thus are unique areas and have outstanding values that deserve to be recognized regionally and internationally. The goals of management are stated in the third paragraph. The fourth states that a



LOCATION OF ASEAN HERITAGE PARKS AND RESERVES

master plan should be drawn up for each park which shall include guidelines for research on the ecosystems and education. Plans are now being made to prepare master plans for ASEAN heritage parks with assistance from the United States Park Service. Finally, the Agreement states that cooperation between the ASEAN states is necessary to manage the heritage parks and calls for a "regional mechanism" for the support of national efforts. The regional mechanism is still the ASEAN Group on Nature Conservation which continues to play an active role in fostering regional projects to aid development and management of the heritage parks.

The 11 ASEAN heritage sites are in fact truly outstanding. Gunung Lorentz in Irian Jaya, Indonesia, for instance, is the only snow-capped mountain in the region, and it contains a unique representation of the New Guinea biota. Gunung Mulu in Sarawak, Malaysia, has the most impressive limestone cave system in the tropics. Mt. Apo and Mt. Iglit-Baco in the Philippines are respectively the homes of the endangered Philippine Eagle and the Tamaraw. The other areas, as will be explained in the following pages, show various degrees of uniqueness and are equally worthy of recognition at the reional level.

Six of the 11 areas are in the 1982 United Nations List of National Parks and Equivalent Reserves: these are Kinabalu, Mulu and Taman Negara in Malaysia, Mt. Apo in the Philippines and Khao Yai and Tarutao in Thailand. Leuser and Kerinci-Seblat are listed as Nature Reserves by IUCN. When Gunung Lorentz becomes a national park, it should be included in IUCN's list of distinguished areas. The sites included on this list have outstanding natural and cultural values, and no doubt would be appropriate for consideration for the Unesco World Heritage list; it is strongly encouraged that the ASEAN countries accede to the World Heritage Convention

as soon as possible, so that appropriate international recognition can be accorded to these sites.

Dedication of these heritage areas is not an exercise in isolation. Indeed, it is an integral part of a global effort to ensure that the use of the world's natural resources be made sustainable. The ASEAN Experts on the Environment and conservationists are making a very significant regional contribution to this cause.

Yet, the direct beneficiaries of this conservation action are the ASEAN people. Those living in the immediate vicinity of the protected areas shall continue to have a more dependable water supply, forest products, and increased benefits from tourism. The urban populations will also benefit from being able to visit these areas to experience wilderness.

Most ASEAN decision makers are aware of the values of tropical rainforests. Indeed, the main obstacle to conservation among the educated is not so much ignorance as the general lack of political will to give conservation action the highest priority it deserves. It is hoped that this report will encourage the leading citizens in the ASEAN region to commit themselves to conservation.

1.2 Heritage Parks and Reserves and the World Conservation Strategy

To appreciate the significance of the ASEAN contribution to world conservation, it is necessary to digress a little to discuss the objectives of the World Conservation Strategy. This will facilitate and analysis of the role of the heritage areas in fulfilling the objectives.

Conservation has been defined by IUCN in their World Conservation

Strategy (published in 1980 with the advice and support of UNEP and WWF) as "....the management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations."

Thus defined, conservation has four basic objectives:

(i) To maintain essential ecological processes and life support systems. Ecological processes are processes that keep the ecosystem functioning; and these are of two types: (a) water cleansing, soil regeneration, nutrient recycling as listed by IUCN, and (b) all those interactions between animals and plants and their environment. Not listed by IUCN, these include predation, parasitism, pollination and the breakdown of animal and vegetable remains by invertebrate animals, fungi and bacteria. By life support systems, we mean the ecosystems such as rainforests, limestone forests, kerangas forests, peat swamps, cave systems, etc., all of which contain essential ecological processes.

Pristine environments have much more diverse ecological processes and life-support systems than areas that have been converted to agriculture. They are also more self-sustaining and in 'balance'. Amongst pristine environments, tropical forests and coral reefs have the greatest diversity of living things and the most intricate ecological processes.

(ii) To preserve genetic diversity. Genetic diversity is defined as the range of genetic material found in the world's organisms. Thus it is obvious that it is in the pristine environments that genetic diversity is greatest. In agricultural systems, genetic diversity is drastically reduced to a few cultivars and attendant species of pests, weeds and parasites. In urban environments, genetic diversity is confined to a few

pests and commensals of man, and pets and ornamental plants that are not self-sustaining.

There is an intimate, but poorly understood relationship between genetic diversity and ecological processes. Great genetic diversity from high species richness is associated with more complex ecological processes and this leads to greater variety of habitat types and life-support systems. An excellent example is the insect pollination of plant groups like orchids and figs - both pollinators and host plants are known for their enormous diversity of life-forms and ecological life styles.

(iii) To ensure sustainable utilization of species and ecosystems. Forestry, fishery and grazing of livestock are three areas of activities most prone to over-exploitation which lead to either depletion of the stock or degradation of the resource base itself. In the rainforests in the Far East, over-logging seems to be a common problem, and shifting cultivation not far behind.

(iv) To maintain wilderness, scenic and other cultural values for education, research, recreation and tourism. As our societies advance in affluence through national economic and social development, more and more people take to the countryside for leisure and education. They have more time and money to find out about their own environment.

What, then, must be done in order to achieve the conservation objectives?

In order to maintain ecological processes we must not perturb natural ecological communities and their constituent species excessively. Conversely, to maintain the ecosystem we must not perturb the ecological

processes excessively, such as by polluting or altering the climate. However, it is not always possible or desirable to avoid all disturbance of nature, due to peoples' need to have land for cultivation and other uses; the optimal approach is to institute proper land-use planning to ensure efficient and sustained use of resources.

Although the setting aside of suitable areas as national parks or nature reserves is the most effective way to protect ecological processes, it is not justifiable to prevent all use of the areas by humans. Human use and economic benefits may continue in various non-disruptive forms such as employment in the tourism service sector, in park management, transportation, or as limited and managed harvest of minor forest products. One must not forget that humans have been a part of every ecosystem on earth, and if we eliminate one type of economic exploitation we must replace it with another, more sustainable, one.

The obvious requirement for preserving genetic diversity is preventing the extinction of species and the erosion of their genetic variability by protecting populations of significant size. This again is best achieved through the setting aside of areas with high species diversity and endemism for protection. This method is particularly effective if the protected areas are large enough to include a broad range of ecosystem types.

Sustainability of utilization can only be achieved if the extraction of the resource does not exceed the reproductive or replenishment capacity of the resource base. Regulation of harvesting, collecting and hunting through good management plans and the maintenance of habitats of resource species add greatly to making resource use

sustainable.

The last objective of conservation is served if the above three objectives are achieved. Wilderness and scenic values are enhanced if the ecosystems are healthy and diversified.

It can be justifiably claimed that the ASEAN Heritage Parks and Reserves constitute a significant regional contribution to world conservation. In the first place, ten of the areas are de jure and de facto national parks or nature reserves; and the last to be proposed, Tasek Merimbun is scheduled to become a national park. The main management objective is maintenance of the ecosystems and their species; and though a range of uses is permitted in these areas, they are compatible with this objective.

The heritage areas are strategically spread out in South-East Asia. Extending from continental Thailand through the heart of South-East Asia to Irian Jaya in New Guinea, the network of conservation areas is in fact a cross-section of the ecosystems in this archipelago.

In Thailand, Khao Yai National Park harbours samples of tropical forests closely related to those of South Asia, while the marine Tarutao Park contains fine island-marine ecotones typical of the Andaman Sea.

The three national parks in Malaysia and the two in Indonesian Sumatra are most strategically located to conserve almost the whole range of land ecosystem types on the Sunda Shelf. Gunung Leuser and G. Kerinci both represent adequately the island of Sumatra on the western edge of the Sunda Shelf. Taman Negara in West Malaysia contains fine forests typical of the Malaysian Peninsula. In East Malaysia, G. Mulu, Mt. Kinabalu and

Tasek Merimbun together contain almost all major land ecosystem types in Borneo. In the Philippines, the Mt. Apo and Iglit-Baco Parks contain ecosystems quite typical of the Philippine Archipelago which, as will be explained later, has a different biota from the rest of South-East Asia. At the extreme south-east corner of the ASEAN region, the Lorentz Reserve contains a very wide range of New Guinea ecosystem types.

Together, this network of 11 conservation areas is a vast regional store-house of ecological processes and genetic resources that are endemic to this part of the world. Loss of these resources would not only be a loss to the ASEAN countries but also to the world at large.

The setting aside of rich forest land for world conservation also directly benefits the ASEAN people through the maintenance of ecological processes. The rural populations in the vicinity of the protected areas are assured of higher quality water supplies, their river systems are protected from silting thus protecting freshwater fish, and their cultivated lands may be spared from severe flooding. Under proper regulation the rural people will continue to be able to collect seeds, nuts, fruits and materials for their homes from the forests. Even the urban population gains the use of these wilderness areas for leisure and nature study. Kinabalu, Taman Negara, Khao Yai and Mt. Apo national parks are now favourite wilderness areas for an increasing number of ASEAN tourists from the capital cities of Bangkok, Jakarta, Kuala Lumpur, Manila and Singapore.

The dedication of these national parks and nature reserves as ASEAN heritage parks and reserves is very timely. In the last couple of decades, ASEAN nations have implemented a series of national economic and social

development plans. Aimed at raising the standard of living of the people, these plans have called for considerable output from the primary industries, especially forestry, fishery and agriculture. Felling of valuable timber for export has increased, fishing intensified, much land has been cleared for settlement and forested valleys drowned to produce hydroelectric power. These activities have brought wealth to the region from which the ASEAN people have benefited, but the economic successes have been at the expense of much priceless wilderness and rich genetic resources. In the face of accelerating threats and pressures to the environment, the establishment of the ASEAN heritage parks and reserves is none too soon.

CHAPTER 2: OVERVIEW OF ASEAN TERRESTRIAL ECOSYSTEMS

The conservation significance of the ASEAN heritage parks and reserves can best be seen against a backdrop of the general environment and terrestrial ecosystems in the region. The purpose of this chapter is to provide a brief account of the major vegetation types in the region and their flora and fauna.

Situated astride the equator, the ASEAN countries lie across two rather different geological regions. In the west and north-west, peninsular Thailand, peninsular Malaysia, Sumatra, Java, the island of Borneo and Palawan lie on the Sunda Shelf which is an extension of South-East Continental Asia. Irian Jaya, the Indonesian half of New Guinea, on the other hand, lies on the Sahul Shelf, an equally stable continental shelf extension of Australia. In between are the archipelagoes of the Philippines, Sulawesi, Maluku and the Lesser Sunda Islands. In contrast to the continental shelves, the archipelagic interzone is a zone of great volcanic activity and consequently is considered geologically unstable. This archipelagic interzone is now popularly known as Wallacea; and the Sunda Shelf is called Sundaland, the other the Sahuland.

The biogeographical implications of this are as follows. First, the present islands and the peninsula on Sundaland had actual land connections between themselves and continental South-East Asia in at least two periods in the last 500,000 years when the sea was lowered as a consequence of the ice-ages. Similarly, during these periods of lowered sea-levels, Sahuland also had a land connection with Australia. Second, Wallacea had no land connections and was in effect somewhat of a barrier to the free exchange of biota between the two shelves. The result of all this

is that the Sundaland has a biota strongly related to that of South-East Asia while New Guinea has its relationship to that of Australia.

The climate of the ASEAN region is truly tropical; that means high rainfall and much sunshine. Excepting some local areas affected by topography or special soil conditions, the region as a whole is conducive to the development of tropical rainforest. Extensive areas of seasonally dry or monsoon forest exist also. Some important basic characteristics of the rainforest formation are: (a) a relatively closed, multilayered canopy; (b) spectacular diversity of plant life forms including trees, shrubs, herbs, climbers, epiphytes, saprophytes and parasites; (c) high species diversity, in which the majority of species are uncommon or rare; (d) high primary productivity and biomass in the upper layers of the forest (not near the ground), where a high diversity of herbivores such as birds, primates, civits, squirrels, etc. forages.

In the ASEAN region at least 15 types of rainforest formations have been distinguished (T.C. Whitmore, IUCN 1976).

The most important in terms of extent, species diversity, structural complexity and economic values is the lowland evergreen rainforest. Occurring from sealevel to about the 1,200 metre contour, this forest type can rach some 40-50 metres in height. It is commonly 3-layered: the top layer is a discontinuous layer of giant emergents, the second is usually a more continuous layer about 25 metres in height while the lowest or understorey layer of canopy is again somewhat discontinuous. The forest floor is often sparsely covered with shade-tolerant herbs. The huge trees are often notable by their huge cylindrical boles sometimes reaching 35 metres high and 4 metres in girth. Trees are often strongly

buttressed and are commonly covered with woody climbers. This forest type is the most common vegetation in Indonesia, Malaysia and the Philippines. In Thailand, it occurs mainly in the peninsula, but also in much of Khao Yai Park in central Thailand.

The Sundaland lowland rainforests are distinguishable from those in the Sahulland by the dominant presence of the tree family Dipterocarpaceae. There are dipterocarp species also in Sulawesi, Maluku and Irian Jaya, but these are not common and they certainly do not dominate the landscape. In New Guinea, the lowland rainforests are characterized by a mixture of different tree families such as Meliaceae, Leguminosae, Anacardiaceae, Myrtaceae, etc.

It is also in this forest formation that one encounters the richest diversity of fauna. In Sundaland, notable animals include the tiger, elephant, gaur, rhinoceros, orang utan, gibbons, etc. Though the Sahuland is relatively poor in mammal life, it is compensated by the presence of a strong Australian element which includes tree kangaroos, cassowaries and a most fantastic array of beautiful birds.

The lowland rainforest is a gigantic storehouse of genetic resources of value to man. These include the dipterocarp species of wood commerce, wild bananas, rattans, bamboos, and wild populations of well known fruit trees such as durians, rambutans, mangosteens, mangoes, which flood the local markets in season. The bulk of medicinal plants used by forest dwelling peoples and the rural population also comes from the lowland forests.

In addition, this forest type has tremendous tourism, recreational and educational values. With growing affluence, more and more ASEAN

citizens are taking to the forests on weekends to experience tropical wilderness, and groups of students from schools are a common site in parks at which suitable facilities have been developed.

But rainforests virtually everywhere are unfortunately threatened with depletion; and the threat arises from two main sources. The first is logging for their valuable timber. The second is conversion of the forest to agriculture, settlement, production of hydroelectricity, mining and recreation areas like golf links.

The alarmingly rapid rate of depletion of the lowland evergreen rainforest has been well reported, documented and discussed at international meetings; and it suffices to state here that by the end of the present century, the last remaining areas of this forest type may well be found only in a few of the national parks.

In southern peninsular Thailand and also in some of the more seasonal parts of the Philippines there occur small stretches of lowland rainforests that are noted by the presence of a significant number of deciduous trees. Called lowland semi-evergreen rainforest, this forest formation, which usually occurs adjacent to the lowland evergreen rainforests, is really a variant of the evergreen. The semi-evergreen rainforest is of slightly lower stature and has more bamboos. This forest type is more susceptible to fire, and once burnt, may be overrun by Imperata grass from which it may not recover.

Because of the presence of dipterocarps, the semi-evergreen forest is also under pressure from logging. Fortunately, a sizeable area of this is still intact in Tarutao Naitonal Park and in Taman Negara in peninsular

Malaysia.

In Borneo, especially in the Malaysian State of Sarawak, there occurs a type of soil derived from rocks with high silica content. These soils are very acidic, coarse in structure and hence very porous to water. The vegetation that develops on this soil is called Kerangas forest. It is vastly different from the lowland evergreen (dipterocarp) forest in structure, physiognomy and species content. The Kerangas forest is low and singlestoreyed with few emergents. The trees tend to be small with small sclerophyll leaves; and the forest has a somewhat reddish-brown colour. The plant family Myrtaceae appears to be an important component of the forest which is also known for the high frequency of occurrence of insectivorous plants like Nepenthes and Drosera. In aspect, the Kerangas reminds one of the dry eucalypt forest in eastern Australia.

If cut down, this forest type rapidly deteriorates into a sort of coarse savanna and in certain less favourable areas into open sand with poor tussocks of grass. Fortunately, the Kerangas is not much threatened; and there is great potential to manage the remaining stretches of this forest for production of valuable timber.

The ASEAN region is well endowed with limestone habitats. Limestone hills are common features down peninsular Thailand, the north-east and north-west parts of peninsular Malaysia, and Sarawak in East Malaysia. This rock formation supports yet a special type of forest, the limestone forest, which contains a high percentage of plants confined ecologically to this rock type. A good proportion of these are endemics, i.e. not found elsewhere in the world. Another interesting feature is the occurrence of a large number of plants with high horticultural value.

These include the balsams, the gesneriads and begonias; and the finest collections of these plants are to be found in the limestone hills of Mulu National Park.

This forest type is only threatened in certain areas, notably by quarrying, fire, and destruction following prospecting for gold.

Another rock type that supports a special forest is the ultrabasic rock. Not as common as limestone, this rock is found in pockets in peninsular Malaysia and Kinabalu in East Malaysia and perhaps elsewhere in Indonesia. Because of the highly variable nature of this rock, the forest it supports is just as variable and is consequently one of the most difficult to characterize. In peninsular Malaysia, the forest in Raubour ultrabasic has been found by Whitmore to be almost indistinguishable from the surrounding evergreen rainforest. Elsewhere, in Kinabalu National Park, for example, it can readily be distinguished by its lower structure and more uniform leaf-size. In many places in Sabah, East Malaysia, these forests support a different set of dipterocarp species from the adjacent evergreen forests. In the extreme case, pure stands of Casuarina nobilis have been observed. Happily most of this forest type seems to occur in our protected areas; and may be spared from logging for a while!

ASEAN countries, being largely archipelagic, contain vast stretches of beach woodlands. This is not a highly diversified vegetation formation, being composed of species which have a wide range of distribution in the tropics. Prominent species include Barringtonia asiatica, Calophyllum inophyllum, Casuarina equisetifolia, Hibiscus tiliaceus, Pandanus tectorius, Scaevola taccada, Terminalia catappa, Hernandia nymphaeifolia and Thespesia populnea. Inland, this woodland merges gradually into the

lowland evergreen forest where conditions permit.

The forest formation most intimately related to the marine environment is the mangrove forest which is found in every ASEAN country Of all the tropical forest formations, this is perhaps the most important to man for three reasons: (a) it is at the boundary between terrestrial and marine ecosystems and many important ecological processes cross its borders; (b) human communities depend on it directly for charcoal, wood, shrimp, crabs, clams and other marine animals; and (c) this ecosystem, lying at a critical interface, is subject to competing demands and has been heavily disturbed by man in many ways.

The adjacent marine ecosystem receives considerable inputs of nutrients and organic material from the mangrove ecosystem, so that destruction of the latter is likely to affect marine productivity.

This most valuable and interesting ecosystem has come under very severe utilization pressure in various parts of the ASEAN region from a number of sources. Departments of forestry and fisheries often come into conflict on use of the mangroves: the former are interested in wood production, the latter in fish or shrimp production. The problem is compounded by municipalities and factories which have found the mangroves a convenient place for waste disposal.

At the inner edge of the mangroves and along estuaries subject to tidal influence, the nypa forest is found. This is normally a pure stand of the palm Nypa fruticans. This vegetation type is especially common in Sarawak in East Malaysia.

Much of the attap used for thatching comes from this vegetation.

The seeds of this palm have been used for food by the local people for centuries. It also harbours an interesting brackish water fauna though not particularly rich.

Where the soil is poorly drained, and the rainfall sufficiently high, peat swamp forest may develop. The peat soil, which may be up to 20 metres thick, is made up of slow decaying plant materials like roots, wood, leaves, etc., which gives the water a reddish-brown colour. It is usually rather acid and lacking in nutrients.

Peat swamp forests are very extensive in Sumatra, peninsular Malaysia and especially Borneo. In Sarawak, they are reported to cover about 12 per cent of the state's land area. Peat swamps are easily characterized. The forest floor is domed and the forest is concentrically zoned. In Sarawak, J.A.R. Anderson recognized six major zone types: the outermost is uneven canopied forest similar to the surrounding rainforest though of lower stature and species diversity. Then comes a similar one that differs in having a high frequency of Shorea albida. The third zone is also of Shorea albida but more even-canopied; to be followed by dense even-canopied forest often of xeromorphic aspect with slim trees. The fifth zone is a dense jungle of poles with low canopy and in the centre of the swamp is savanna woodland with few trees exceeding 30 cm in girth. Apparently, this multi-zonation is not so evident in many other areas.

Peat swamps have a high proportion of species in common with evergreen dipterocarp forests, especially those at the periphery of the peat; but in the centre, species tend to be of a specialized type adapted to extreme conditions.

Peat Swamp is a very valuable forest resource. In Sarawak, this

forest type contains valuable timber trees, especially Gonystylus bancanus and Shorea albida.

Yet another type of swamp forest in the ASEAN countries is the freshwater swamp forest, which develops on land periodically or seasonally flooded by freshwater that is rich in nutrients. Peat may be found, but it is never thick, and it is periodically subject to drying when the water recedes. This forest type is most variable and difficult to generalize about. It is of lower species diversity and height than ordinary lowland rainforest, and is characterized by plants that have the means to withstand flooded conditions.

This forest type is not extensive; it occurs in peninsular Thailand where Melaleuca is the common tree species. Although freshwater swamp forest is not of great commercial importance, its habitat in many areas is suitable for the cultivation of wet rice. This fact constitutes the single major threat to this vegetation type.

As one ascends any mountain, one leaves the lowland forests and encounters different types due to changes in climate arising from higher altitudes. This vegetation zonation is observed irrespective of the parent rock material - granite, sandstone or limestone. At higher elevations temperature is lower, which increases relative humidity and precipitation. Water droplets in clouds may collect on plant surfaces and soak the environment; in some places this 'cloud forest' effect contributes considerably to precipitation and stream flow.

The altitudinal range of each zone is very difficult to define. On more massive mountains, each zone tends to be wider and reach higher

altitude, whereas on small and low mountains, zones tend to be contracted somewhat. Similar zones also tend to occur at lower elevations at higher latitudes (farther from Equator). At risk of oversimplification, three broad zones can be distinguished in high mountains in the ASEAN region. From about 1,000 to 2,000 metres, one finds the lower montane forest. This is followed by the upper montane zone from about 2,000 to the 3,000 metre contour. Above 3,000 metres, one finds cloud forest or alpine forests or bare summit with a cover of shrubs, sedges, mosses and other high altitude tolerant plants. The tree-line appears to be reached at about the 3,500-metre contour. As there is considerable variation from mountain to mountain, the detailed description of the various vegetation types is best taken up in the succeeding sections dealing with each heritage park.

We have touched here and there on the values of the tropical rainforests, but it should be emphasized that these values are more numerous than popularly known.

Apart from the high value of dipterocarp and other quality hardwood timber which is logged mainly for export, the lowland and even lower montane rainforests yield other species of timnber which are used in a tremendous variety of ways by the local population. These include species in the tree families of Leguminosae, Myrtaceae, Ebenaceae, Lauraceae and Rhizophorceae. Many species of the Myrtaceae, Sapindaceae, Meliaceae, Euphorbiaceae, Guttiferae, Anacardiaceae etc. produce fruits for wildlife and humans; many of these are now among the major domesticated commercial fruits of the region.

The palm family (Palmae) is particularly useful to local people throughout the region. The leaves are used for thatching, wrapping, etc.

The fibre-free growing "cabbage tip" is eaten raw or cooked. Sago is extracted from the trunks of at least three genera of palms. Rattan for building and furniture is obtained from the climbing palms.

Not to be forgotten are the medicinal plants. They are extremely diverse and a short account cannot hope even to introduce them. The reference "Economic Products of the Malay Peninsula" by I.H. Burkill gives a fair idea of the importance of the tropical forest as a source of medicinal plants. Just to cite one example, the forest dwelling Punans in the Mulu National Park in Sarawak are known to use at least 40 species for various medical purposes.

Many species of animals are also useful to the rural population. Deer and many species of birds are regularly hunted for food. Forest-dwelling people like the aborigines in peninsular Malaysia and the Punans in Sarawak eat monkeys and gibbons regularly. Ibans in Sarawak are known to relish wild pigeons, hornbills and other birds of sufficient size. Lastly, in Irian Jaya (and in Papua New Guinea), local people quite happily eat roasted larvae of beetles. In fact in many areas, hunting for food is the second major threat to wildlife, behind forest destruction. The establishment of national parks in these wildlife-rich areas will allow proper regulation or limitation of hunting so that the people will continue to be able to benefit from these resources for a long time to come without depleting them.

CHAPTER 3: ASEAN HERITAGE PARKS AND RESERVES

3.1 Brunei Darussalam

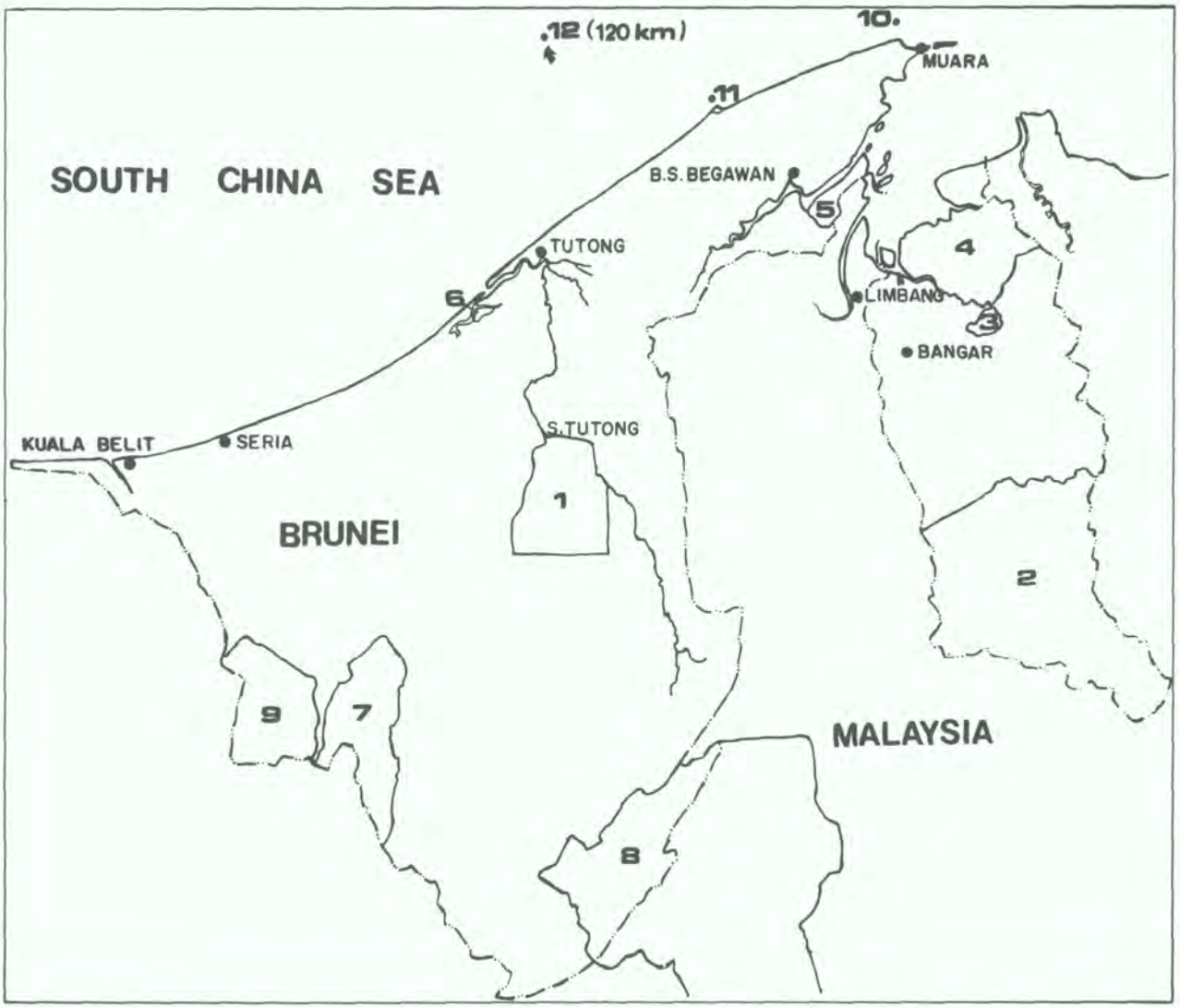
The State of Brunei Darussalam is a small country in Northern Borneo adjacent to Sarawak (Malaysia) bordering the South China Sea. It is the newest ASEAN country and its heritage site, Tasek Merimbun, the most recently proposed, will be the first to be described in this chapter.

Brunei Darussalam has more than 80 percent of its land area covered with forest and much of this remains relatively undisturbed. As a result, management of the forest estate has been a key aspect of government policy. A comprehensive forest inventory for the whole of Brunei Darussalam was carried out in 1984 which identified areas that (1) safeguard water catchments and steep terrain; (2) represent the principal ecotypes; (3) have recreational potential; and (4) are able to support timber stands of economic potential on a sustained yield basis.

Although the principal findings of the 1984 Forest Reserves Study are being implemented, there is, as yet, no legislation established on national parks or conservation areas, except for the 1978 Wildlife Protection Enactment which lists protected species and allows wildlife sanctuaries to be established by decree.

(a) Tasek Merimbun

Tasek Merimbun (the Merimbun Lakes) is an area with a unique natural environment in Brunei Darussalam. It is currently designated as a conservation area. Approval has recently been obtained from His Majesty the Sultan of Negara Brunei Darussalam for the area to be designated as a national park. It will be the first national park to be established in the



The first protected conservation areas of Brunei Darussalam. Area 1 is Tasek Merimbun National Park. For names of the other areas shown see Appendix 4A.

country, and will then form part of the regional distribution of heritage parks within ASEAN.

Tasek Merimbun, covering 10,900 ha, is situated some 32 km to the south of the Tutong-Kuala Belait coastal highway on the west bank of Sungai Tutong in Mukim Rambai, Tutong District. The lakes have long been considered as an area of outstanding natural beauty, particularly, the low lying wetland area surrounding the only permanent lakes in the country. The areas contains fragile freshwater ponds, grass marshes and swamps rich in water birds and other aquatic life, habitat types which are rare in Borneo. Such an environment will clearly benefit through being protected as an area for public enjoyment, nature education and scientific endeavors.

The government has also taken a number of steps to open up the area to visitors and to assess its scientific and educational value. These include:

- the delineation of provisional park boundaries;
- the allocation of funds to the Tutong District Office to provide and maintain facilities for the benefit of visitors at Kampong Merimbun, the only settlement within the park; and
- a number of studies under-taken by a multidisciplinary team under the auspices of the Brunei Museum during 1983-84 to gather information on plant species, animals, birds and human activities within the park, and also to assess the extent to which the park could be opened up to the public for both educational and recreational uses.

Aerial view of Tasek Merimbun.

"Purun" reeds which dominate the lake edge during dry season in Tasek Merimbun Park.

The park is located in an area of low population density. Kampong Merimbun is the only settlement found within the park with a population of 47. However, there are a number of other small settlements close to the park's western, northern and eastern boundaries with a total population of 584. There is no habitation immediately to the south of the park.

Much of the land within the proposed park is flat except in the east which is undulating and hilly. The elevation of the land generally lies between 15 and 70 metres.

The park encloses a catchment of small river systems that feed into the Tasek Merimbun Lakes. The extent and depth of the lakes vary according to the rainfall. A survey in July 1981 found a low water level during the dry season whilst August 1984 showed the flooded conditions during the south-west monsoon. The lakes are separated by a narrow strip of land which at one point is broken by a narrow channel, which permits the water to flow between the lakes depending on conditions. The western lake, in particular, has a great variation in surface area as it is drained by a small river which connects with the Sungai Tutong. The area as a whole has very poor drainage due to the geology and relief, forming various swamp and wetland habitats.

Over 80 percent of the park has deep peat soil sometimes overlain with a shallow soft gley soil and alluvial soils in the valley bottoms. A clay or loamy soil can be found on the eastern park of the park.

Mixed dipterocarp forest is the main vegetation found in the park, especially to the south of the lakes. A fresh water swamp forest can be seen around the two lakes and the Medit Swamp (i.e. east of the park). In addition to these, a mixed peat swamp forest is found extending to the

Flooded freshwater swamp in Tasek Merimbun National Park. The major tree species is **Combretocertus rotundatus.**

The banded linsang, **Prionodon linsang** *- a rare species of civet found in Tasek Merimbun primary forest.*

Sungai Tutong in the north-east. There is, as yet, no species list available for the plants of the park other than for trees.

A team from the Brunei Museum carried out a series of studies during 1983-84, and saw or caught 139 types of birds at Tasek Merimbun, including many waterbirds, and 17 species freshwater fishes, including Notopterus chitala, Chanda ranga and Rasbora sumatrana. Mammals included 38 species including clouded leopard, banded linsang, white-collared fruit bat, Bornean gibbon, Vordermann's flying squirrel and grey leaf monkey. The fauna of the park still remains to be studied in detail.

The 1983-84 survey by the Museum team resulted in the drafting of a preliminary park development programme. Following this in 1986, the Negara Brunei Darussalam Master Plan Consultants were commissioned to produce the 'Special Report on Wildlife and Conservation Management'. The Wildlife and Conservation Report included a fairly comprehensive development programme for Tasek Merimbun. Recommendations included in this programme were to revise the park's boundaries, delineating management zones to control visitor use, and for developing the park headquarters and other visitor use facilities in the vicinity of Kampong Merimbun.

3.2 Indonesia

Indonesia is the most extensive of the ASEAN countries. With some 13,000 islands over 5,000 km from west to east, the country spans the three biogeographic regions of Sundaland, Wallacea and Sahuland. Coupled with the fact that Sumatra and Irian Jaya have high mountain ranges, it is not difficult to realize the richness and diversity of Indonesia's terrestrial ecosystems.

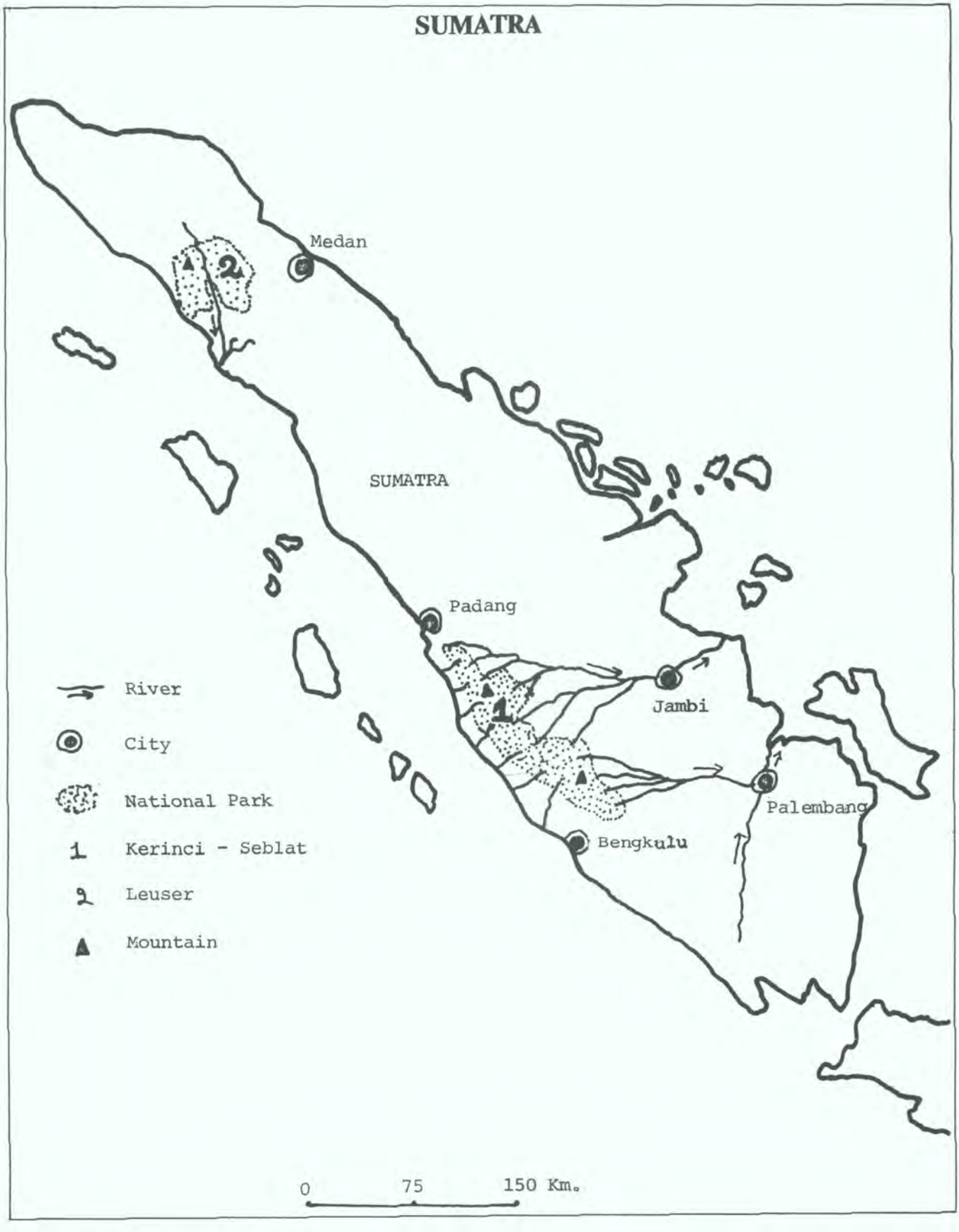
The Indonesian Government is aware of the value of this immense storehouse of ecosystems and genetic resources; and has consequently launched an intensive conservation programme in 1975. With strong support from IUCN, UNEP and the World Wildlife Fund, the programme includes the establishment and maintenance of a system of national parks and reserves aimed at putting about 10 per cent of the nation's pristine land under protection.

By September 1982, 304 areas had come under various forms of protection covering a total area of some 11 million hectares. These are in addition to scores of small nature reserves found throughout the country. The three most important areas in this system are Leuser and Kerinci-Seblat in Sumatra and Lorentz in Irian Jaya.

(a) Kerinci-Seblat National Park

The Kerinci-Seblat is a composite of reserves already declared a national park in October 1982. It is part of the southern half of the Barisan Range with Mt. Kerinci rising to some 3,800 metres in altitude. The reserve is elongate in shape with a length of 345 km and an area of 1,484,600 ha. Still covered with undisturbed forests, it is the vital catchment area of the two largest rivers in South Sumatra - the Sungai Musi and Sugai Batang Hari.

Kerinci-Seblat is not easily accessible. Of a number of approaches, the least uncomfortable is the coastal road from Padang to Sungai Penuh via the coastal villages of Painan, Kambang and Tapan; this can easily take a whole day. When you reach the densely populated town of Sungai Penuh, you are in the heart of the reserve. (The city of Padang can


SUMATRA
Medan
SUMATRA
Padang
Jambi
Palembang
Bengkulu
River
City
National Park
1 Kerinci - Seblat
2 Leuser
Mountain
0
75
150 Km.

be reached by air from Singapore via Medan in North Sumatra or from Jakarta direct.)

The reserve lies in the high rainfall part of Sumatra; but because of the mountainous nature of the topography, there is great variation in local climate. The western slopes of the mountain receive very heavy rainfall which tends to have two peaks in the year, about April and November. The eastern slopes also receive high precipitation though not as much as the west. The Sugai Penuh mountain plain is the driest part - relatively.

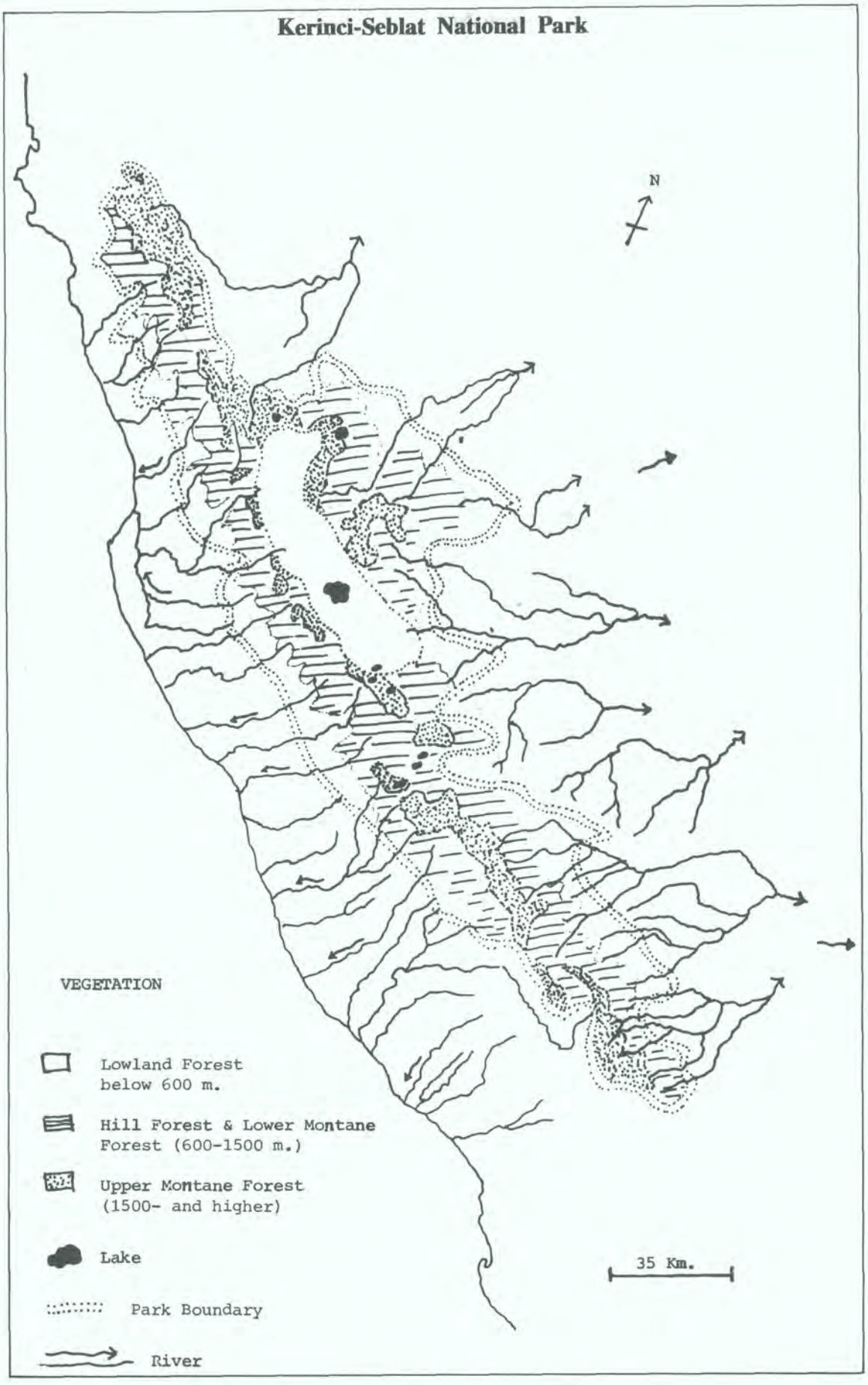
The topography of the reserve is largely mountainous, but right in the middle, the mountain opens up to form a relatively flat valley about 70 km in length, and between 900 and 1,300 metres in altitude. This is the densely populated enclave right in the middle of the national park, the Kerinci Valley.

The reserve lies on the volcanic belt which stretches in an arc from Sumatra through Java to the Lesser Sunda Islands. Kerinci itself is an active volcano but has not erupted since the turn of the century, though ash emission is often observed.

The drainage system is quite simple. The western slopes are drained by a dense network of short rivers flowing straight to the Indian Ocean, irrigating rice fields on the way. The north-eastern part of the reserve drains north-easterly, and streams ultimately join up with the Batang Hari to flow through Jambi into the sea of the Lingga archipelago. The south-east corner, from the Rawas river, drains south-easterly into the Musi river which flows through Palembang to empty into the Bangka Sea. The three drainage systems are of vital importance to the people living around

Gunung Kerinci, the highest mountain in Sumatra, often misty and clouded over. The foothills in the foreground are planted with tea.

Gunung Tujuh, in the Kerinci-Seblat National Part. Large tracts in this area are still under primary rainforest.


Kerinci-Seblat National Park
N
VEGETATION
Lowland Forest
below 600 m.
Hill Forest & Lower Montane
Forest (600-1500 m.)
Upper Montane Forest
(1500- and higher)
Lake
Park Boundary
River
35 Km.

the reserve. They depend on these rivers for their drinking water and irrigation of their rice fields.

The soils on Kerinci-Seblat are largely volcanic. They range in series from the brown-earth to the red-earth. The former, called the Andosol, is considered quite fertile; the other is the Latosol. These soil types are fairly common up to about the 1,000-metre contour. From that altitude upward, the soil gets more peaty and acidic until near the summit almost bare volcanic ash occurs. The Kerinci valley enclave has largely alluvial soil.

A very interesting feature of Kerinci-Seblat is the presence of mountain lakes. The largest is the Danau Kerinci (Danau = Lake) in the Kerinci enclave. It is about 10 by 6 km and reported to be 110 metres deep! Unfortunately it is overused and large parts are infested with water hyacinth, Eichornia crassipes. The Danau Gunung Tujuh is the next largest. It is actually a filled-in volcanic crater of some 10 sq. km in extent; being at 2,000 metres altitude, it is the highest lake in the reserve. Other lakes include the Danau Sati and Danau Ladehpanjang west of Danau Gunung Tujuh at the north end of the enclave. At the south end of the enclave are the Danau Langkat, Danau Kechil and Danau Dua. Farther south, about 300 km south of the southern border of the enclave, is a group of three lakes: Danau Pauh, Danau Kechil and Kanau Dipatiampat.

Kerinci-Seblat is covered with tropical rainforests, one of very few places to have vast stretches of it undisturbed. The vegetation pattern is quite simple; there are only three major zones.

Lowland rainforest covers the foothills up to the 1,000-metre contour. Then comes the lower montane forest which goes up to about the

1,500-metre contour. The upper montane forest takes up from there to the sumit zone.

The lowland rainforest is of course dipterocarp dominated with many species belonging to the Leguminosae. Most important genera include Shorea, Parashorea and Dipterocarpus (Dipterocarpaceae), Dialium and Koompassia (Leguminosae), Garcinia (Guttiferae), Diospypros (Ebenaceae), Artocarpus; Ficus (Moraceae), Aglaia (Meliaceae). The highly prized durian is quite common in the reserve.

The dipterocarps are still present in the lower montane zone, but less frequent. In the lower montane forests, Lauraceae and Myrtaceae begin to increase in frequency and ecological significance.

In the upper montane zone, the dipterocarps disappear. The dominant plants belong to the Lauraceae and Fagaceae, the oak family. Near the summit, Ericaceae become prominent. Ericaceous genera include of course Vaccinium and Rhododendron. As in all tropical high mountains, temperate species are found near the summit. On Gunung Kerinci, these include Viburnum, Hydrangea and Lysimachia.

In the Kerinci Valley enclave, the forest has been completely replaced by rice fields in the flats of the valley. The entire hillside facing the valley has also been cleared of forest. Almost half the hillside is now wasteland while the remainder is being used for tea, cinnamon, coffee and other crops like cassava, bananas, and others.

The Kerinci-Seblat is rich in fauna. It is the habitat of the Sumatran rhinoceros (Dicerorhinus sumatrensis), elephant (Elephas maximus), tapir (Tapirus indicus), tiger and clouded leopard (Neofelis nebulosa).

The most important primates include the siamang (Symphalangus syndactylus), dark-handed gibbon (Hylobates agilis), long-tailed macaque (Macaca fascicularis), pig-tailed macaque (Macaca nemestrina) and others. The slow loris and western tarsier are present in the lowland forests and lower montane forests. Barking deer, sambar and serow also occur.

A total of 140 species of birds has so far been recorded in the reserve. These include 4 species of birds of prey, 6 species of kingfishers, 5 of hornbills and the Salvadoris pheasant (Lophura inornata), a Sumatran endemic.

A number of these species are confined to this part of Sumatra and are not found in the north. Botanists have also noticed that the dipterocarp forests in central and south Sumatra differ from those in the north in species combination and frequencies. The biota in this reserve represents a major untouched storehouse of genetic resources.

The Kerinci-Seblat Park has one other asset that has economic potential. The mountain lakes, especially the Danau Gunung Tujuh and its environs, have great potential for tourism. This area has fine scenic views and wildlife, including waterfowl.

This most valuable reserve, however, is threatened from within. The agricultural activities of the enclave population have already devoured the forests of the inner hillsides and threaten to spread further. If this is not controlled somehow, the three vital values of Kerinci-Seblat will be destroyed: important catchment areas for rivers on which millions of Sumatrans are dependent, rich plant and animal genetic resources and tourism potential.

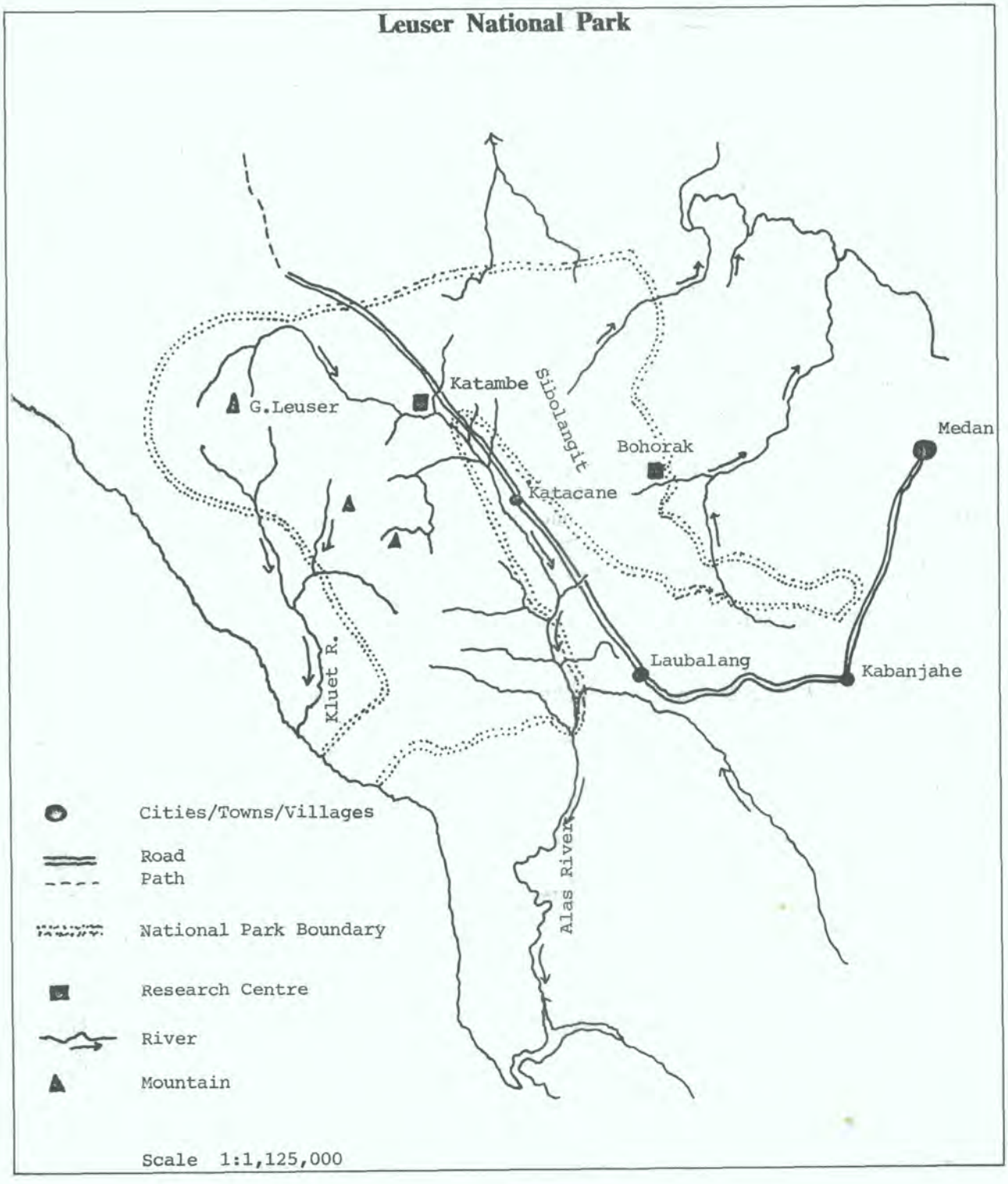
(b) Leuser National Park

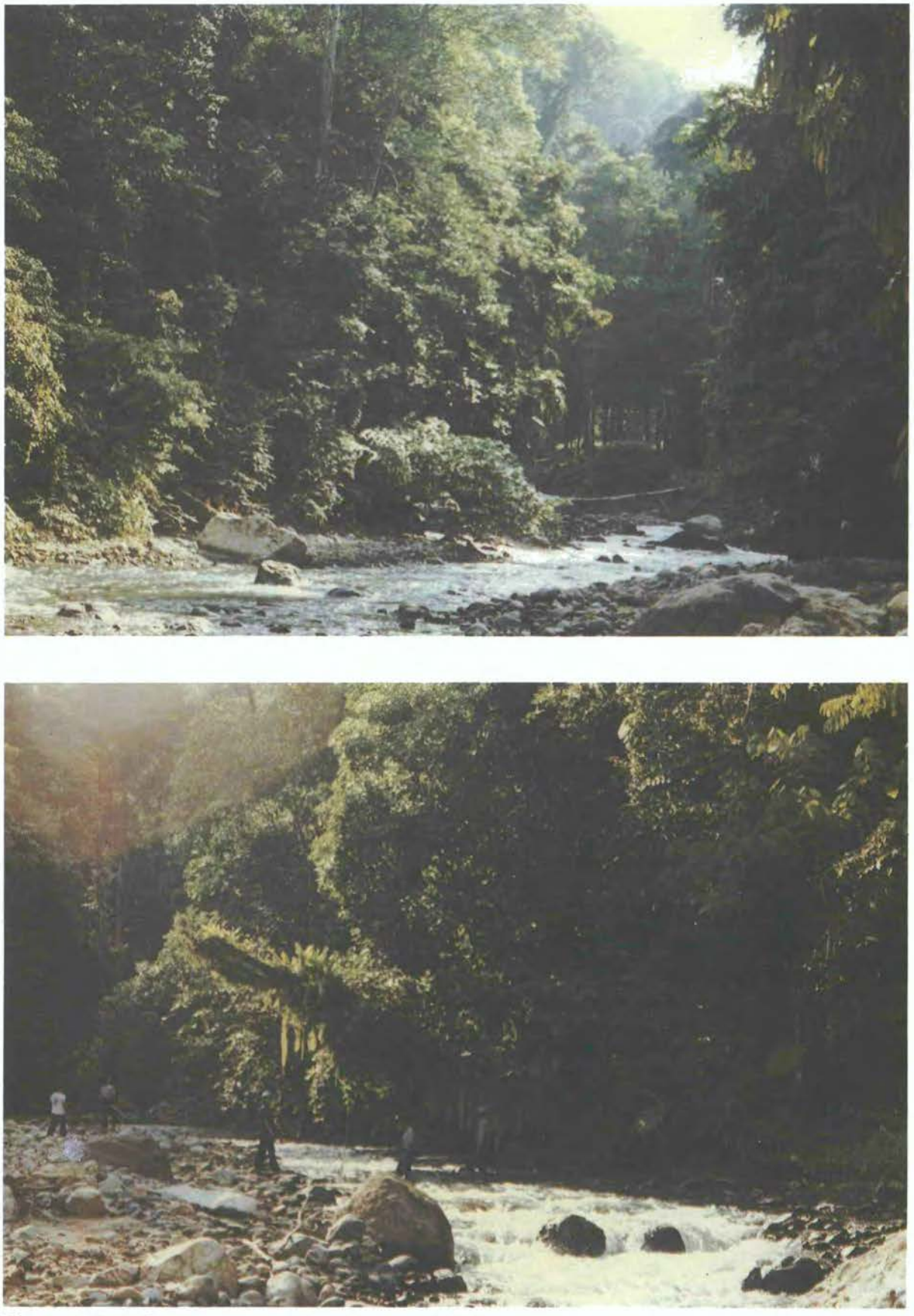
Leuser National Park, situated near the north-west tip of Sumatra's Barisan Range, is one of the most complex mountainous national parks in the ASEAN region. It is a composite of mountain ranges and volcanic plateaus with deep gorges and narrow velleys, and has little land below 600 metres in altitude. Though many parts are still quite inaccessible, Leuser is one of the best known in the region.

The area came to the attention of conservationists at the turn of the century as the richest wildlife refuge in north Sumatra and by the 1930s most of the present areas had come under various forms of protection. In 1980, the entire complex became a national park; it is a little over 1 million ha in extent.

Of the number of approaches to the park, the most convenient and educational is the south road from Medan to Kabanjahe, then westward to Laobalang and from there up the Alas Valley through Kotacane and Tanah Merah. This brings the motorized visitor right into the middle of the park. (Medan has an international airport servicing flights from South-East Asia.)

En route, one gets a good a view of village life in north Sumatra. There are acres of Kemiri plantations on the hillsides in the lower part of the Alas Valley. Orchards of cloves lie side-by-side with hill rice, maize and other crops. Higher up in the valley coffee is grown. Durian is also grown widely, mainly for the Chinese market in Medan. As one drives along the Alas river one meets alternately a Muslim village then a Christian, then Muslim and so on. The most easily recognized feature of a Christian


Leuser National Park
G.Leuser
Katambe
Sibolangit
Medan
Bohorak
Katacane
Laubalang
Kabanjahe
Kluet R.
Alas River
Cities/Towns/Villages
Road
Path
National Park Boundary
Research Centre
River
Mountain
Scale 1:1,125,000



Upper reaches of the Alas River, Leuser National Park.

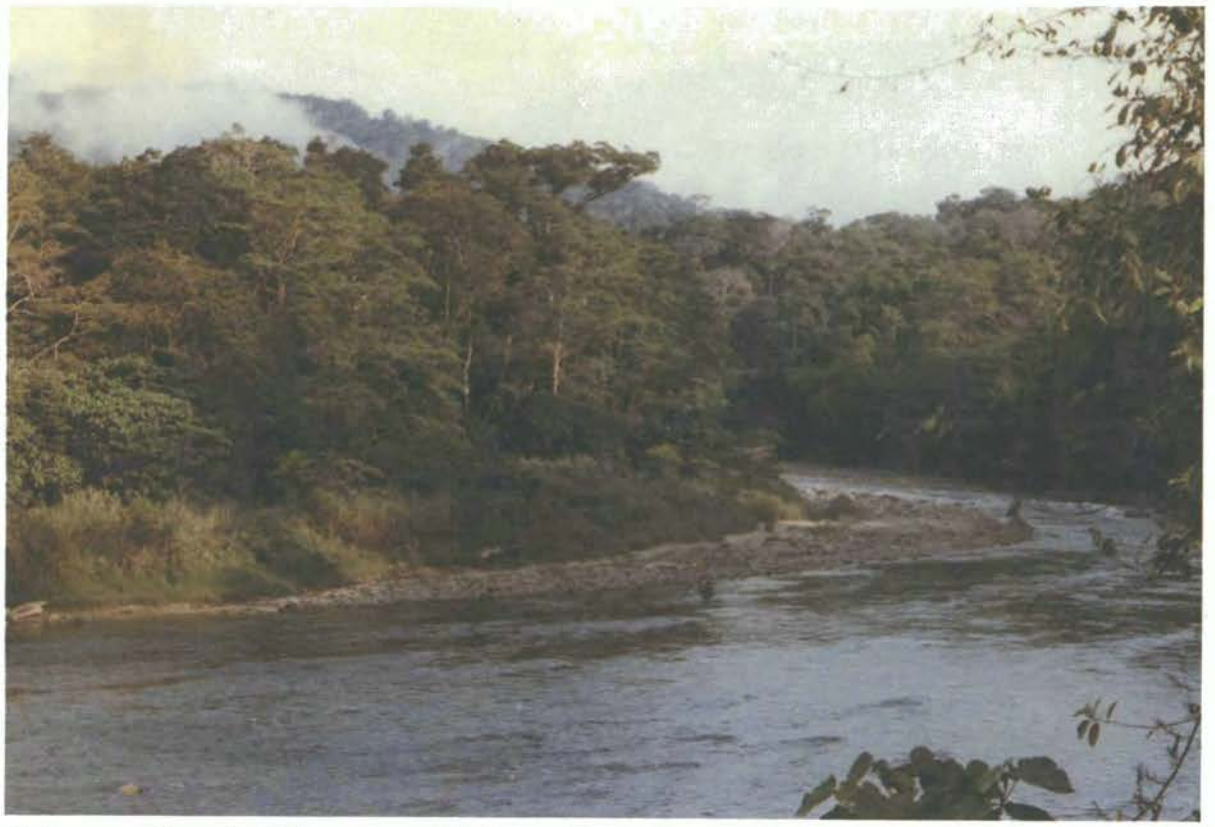
village is the pig.

Somewhat squarish in shape, the park is almost cut in two by the densely populated Alas Valley which runs south-easterly in the same direction as the island itself. East of the river lies the Sibolangi Range which slopes north-eastward to the east coast. On the west lies the small West Alas Range and further west the main Leuser Range, a small trench lying in between. The Leuser Range slopes westward into the Kluet Valley on the west coast. The mountain ranges all have a northwest-southeast trend, being part of the Barisan Range.

In a recent study of the area, N.J. van Strien recognized four geographic zones in the park. Below 600 metres in altitude is the lowland zone; from 600 to 1,500 metres, the upland zone; from 1,500 to 2,500 the montane zone and above 2,500 metres the high montane zone. Van Strien estimated that only 12 pecent of the park area lies below 600 metres in altitude. The greater part of the park area (48 percent) lies in the upland zone while 35 pecent lies in the montane zone. In brief, 83 percent of the park area is either upland or montane.

The ecological implication of this is serious. In general, the lowland rainforest has the greatest diversity of wildlife and as altitude rises, ecosystems usually get poorer in species. Leuser is no exception. Since only 12 percent of its surface is lowland, its richest biota is confined to this very narrow zone. What is worse, the lowlands are the most threatened in the Leuser region.

The rainfall for the region is typical tropical. Two maxima are found, one in the months of April to June and a higher one in October to November, soon after the equinoxes. The distribution of rainfall over the



Entrance to Ketambe Primate Research Centre, Leuser National Park.

Environs of Ketambe Primate Research Centre, Leuser National Park.

park, however, is uneven due to the topography. The rainfall tends to increase with altitude, but the park has many rain shadow areas. The western coastal plains receive an annual rainfall of some 3,000 mm. This increases to about 4,500 mm per annum on the Leuser Range but decreases rapidly down to the Alas Valley which receives between 1,500 and 3,500 mm. Rainfall increases again up the Sibolangit from the Alas Valley to some 4,000 - 4,500 mm per annum, then drops rapidly to 2,000 mm per annum on the eastern coastal zone. It must be noted that rainfall increases with altitude up to about the 2,000 metre contour when it begins to fall again. Thus G. Leuser itself has lower rainfall than the mid-montane areas to the south-east on the Leuser Range.

The rainforest in Leuser is closely allied to that of the Malay Peninsula and Borneo. It is indeed very diversified and four altitudinal zones can be distinguished. Below 600 metres, lowland dipterocarp forest is the dominant vegetation, but unfortunately, this is not extensive in the park. The most common genera include Shorea and Dipterocarpus both of which have species with high commercial value. In addition, some species of Dipterocarpus yield the "Keruing oil" which the local people tap for sale as perfume fixative. Other families common in this lowland forest include Meliaceae, Burseraceae, Anacardiaceae, Sapindaceae, Lauraceae, Myristicaceae, Rubiaceae and a host of others. A very important plant in this zone is the Rafflesia, a most unusual type of parasite with an enormous flower about 30 cm in diameter but without leaves, stems and roots. It parasitises a climber in the dipterocarp forest.

From 600 to about 1,500 metres, one finds lower montane forest. Dipterocarps are still present but considerably less conspicuous, especially at high altitudes. Figs become quite common and so are Eugenia,

Aglaia, species of Myristicaceae, Lauraceae and oaks. The upper montane forest begins round about the 1,500-metre contour. Here the trees are strongly knarled and dwarfed and woody climbers are very rare. Mosses increase greatly in number and are found on branches of trees and on forest floors. Sunlight is poorer as this is a zone of fog. The alpine zone begins at about 2,500 metres. Here one finds shrubs of Ericaceae forming a mass of crooked trees. The genus Nepenthes is quite common in this zone, as are the mountain-loving orchids. Here and there in this summit zone are "blangs", which are treeless fields of grasses and sedges with a few shrubs in between. Some of these "blangs" are marshy and contain much peat.

Leuser National Park has a very impressive list of animal species. The park has 105 species of mammals (which is about 60 percent of the total mammalian species in Sumatra), 313 species of birds (again 60 percent of that for the island), 76 species of reptiles and 18 species of amphibians. Van Strien estimated that for the entire fauna, Leuser holds more than half the total for Sumatra. This high diversity is attributed to the great diversity of habitat types found in Leuser.

A great number of endangered species find refuge in this park. The Sumatran rhinoceros (Dicerorhinus sumatrensis) is found in the Blangbeke trench area between the Leuser and West Alas range where an estimated 40 animals are said to exist. The Sumatran elephant (Elephas maximus sumatrensis) is certainly present in the reserve, mostly in the lower Alas Valley especially on the western ranges. (The tapir, present in Kerinci-Seblat, has not been recorded from Leuser.)

The tiger (Panthera tigris sumatrensis) is reported to be common in Leuser where it occurs everywhere except in populated areas. The orang-

utan (Pongo pygmaeus abelii) is well represented in Leuser. Estimates vary considerably between different zoologists, but all have agreed that Leuser holds at least 900 individuals which is indeed high. The Leuser Park is an excellent reserve for research on orang-utan and other primates and the Bohorok Orang-utan "Rehabilitation" Centre is now world famous. The Primate Research Centre in Ketambe has excellent facilities for visiting primatologists including a small but useful library.

Other endangered species found in Leuser include the clouded eopard (Neofelis nebulosa), wild dog (Cuon alpinus) Malayan sun-bear (Helarctos malayensis), siamang (Symphalangus syndactylus) and the white-handed gibbon (Hylobates lar). These are apparently still quite common in the park.

Gunung Leuser in north Sumatra and Gunung Kerinci-Seblat in south Sumatra are an excellent complementary pair of protected areas. Together, they contain practically all major ecosystem types and species groups found throughout Sumatra.

Botanists have maintained that the forests in north Sumatra are significantly different from those in the south not so much in being distinct forest types as in differences of species content. The same claim has been made by zoologists for major groups of the fauna.

Like the Kerinci-Seblat Park, Leuser is also threatened from within. There is much encroachment into the forest by the people in the small but growing enclave at the gorge at the head of the Alas River. As most of the lowlands have already been taken over, the encroachment is now mainly on rather steep land. The ecological impact of this encroachment is

as adverse as it is serious.

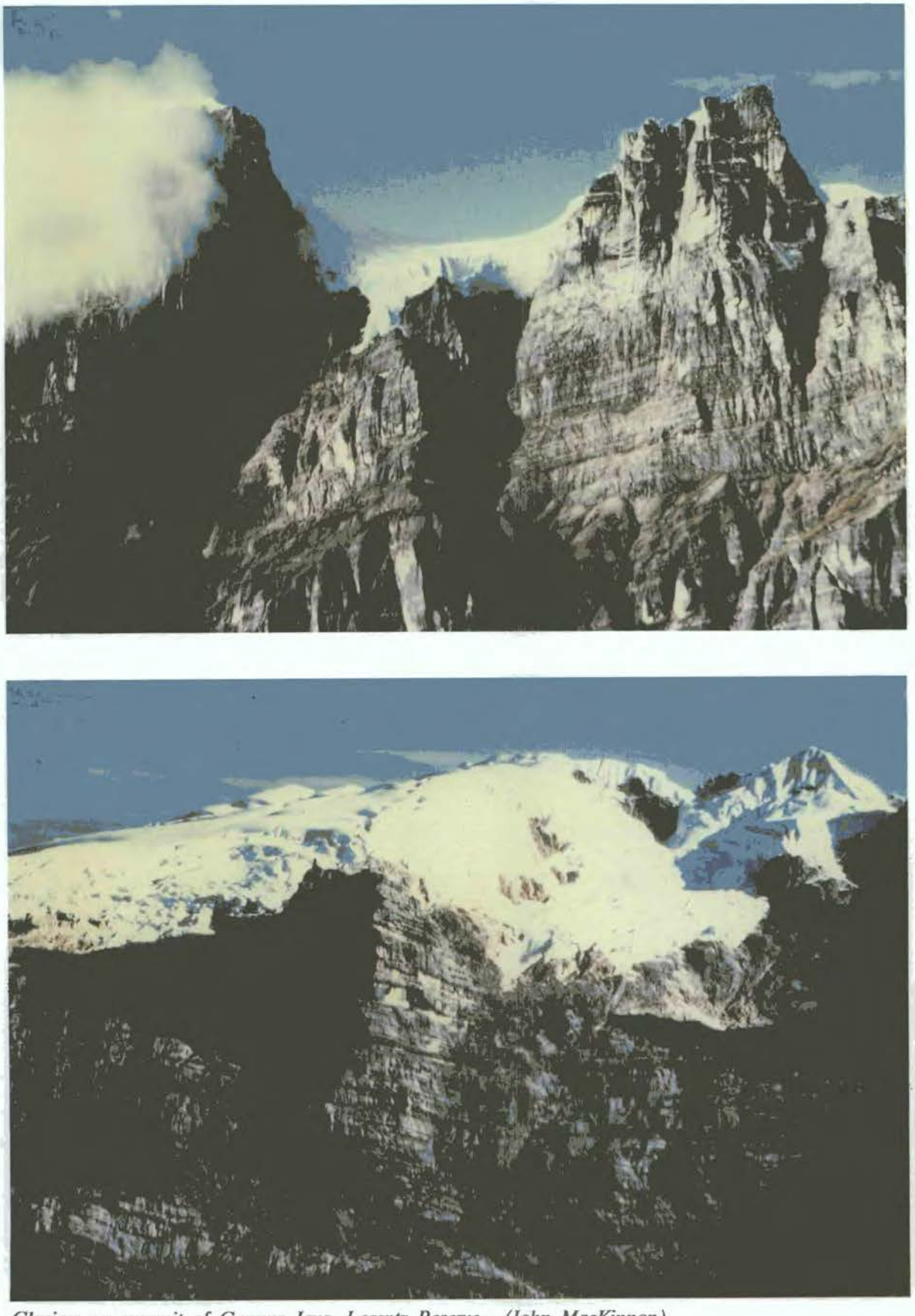
Yet, conservation of Leuser has three clear benefits for the people. First, the reserve is a vital watershed for the river systems that provide water for the rural population and their cultivated land. Then, there are the enormously rich genetic resources in the reserve that have potential to benefit Indonesian agriculture in the long run. Last, the area has, like Kerinci-Seblat, high tourism potential.

(c) Lorentz Nature Reserve

Superlatives are needed to describe the Lorentz Nature Reserve. It is the largest single protected area in South-East Asia, with the highest peak east of the Himalayas and the only one in the region with a glacier. It has the most complete spectrum of New Guinean ecosystems, from mangroves on the coast through montane forest to alpine. Yet Lorentz today is still most inaccessible and hence least known.

The nearest port of entry is Jayapura in the north coast; regular flights are available from Jakarta. From there the Christian Missionaries operate air services to a number of towns and villages, but these are private services, and requests for seats by non-mission travellers have lower priority of allocation. Except for footpaths used by the local tribal people, there are no roads through the reserve. Neither are there guard posts, ranger stations nor modern overnight accommodations. Visitors must be prepared to trek and camp without any reliable maps for guidance.

Slightly over 2 million hectares in extent, the reserve was gazetted a strict nature reserve in 1978. Roughly square in shape, the area includes a number of villages on its northern montane side. When it



Glaciers on summit of Gunung Jaya, Lorentz Reserve. (John MacKinnon)

becomes gazetted as a national park, it is expected that the northern boundaries will be re-aligned to exclude the settlements and the resultant national park will be reduced to some 1,675,000 hectares.

The lay of the land is such that it rises somewhat northerly from the coast to the Sudirman Range, the great central range that runs east-west through Irian Jaya. The contour belts are approximately parallel to the trend of the range.

The southern third of the reserve is almost wholly flat lowland. Further inland is a band of undulating country rising not too abruptly to the montane region. The northern quarter of the proposed park is largely montane and alpine culminating in Gunung Jaya in the north-west corner which rises to just over 5,000 metres.

The mountains are very young. Gunung Jaya is reported to be a limestone massif pushed up through the Sudirman Range in the late Pliocene. The reserve is also reported to have ultrabasic rocks.

The reserve as a whole lies in the tropical belt of high rainfall though north and north-east of the mountains are relatively dry areas. (No rainfall data are available for the reserve.) The south slopes of the reserve are drained by five major rivers flowing almost directly to the Aru Sea. Before entering the sea, the rivers flow through very extensive belts of freshwater swamps and then mangrove swamps.

With such an extensive area, in a high rainfall region and a varied terrain, the Lorentz Reserve is reported to have a great diversity of ecosystem types. Along the coast is a very broad belt of mangrove forests covering the river deltas. Farther inland is an equally broad belt of

brackish-water swamps, freshwater and peat swamps. In the undulating but rising country in the middle of the reserve, evergreen rainforest predominates. This merges into the lower montane forests, the upper montane forests and finally the alpine zone. In addition, there are also forests on limestone and ultrabasic rocks. The reserve as a whole is almost entirely pristine, and as such, it is the largest single block of pristine reserve in South-East Asia.

The vegetation is typical of New Guinea. The lowland forests have very strong alliances with those of South-East Asia in structure and physiognomy, but differ in species content. The Dipterocarpaceae which dominate the lowland forests in the Sundaland are only represented by three genera with about 10 species. The New Guinea lowland rainforest has a mixture of genera from a number of families. The most important genera include Dracontomelum, Pterocarpus, Intsia, Dialium, Palaguin and Pometia.

The mangroves are the only forest type with almost the same plant generic content as their counterparts in South-East Asia. In the freshwater swamps, the Sago palm (Metroxylon sagu) is most common. In other swamp areas, Camnosperma and Terminalia are the most common trees. Not much is known of the limestone flora; John Mackinnon in his report to the PPA on New Guinea mentioned the common appearance of Casuarina papuana and species of Alphitonia, Myrtella and Stypholia.

The lower montane forests tend to be largely fagaceous, i.e. dominated by oaks, but in the upper montane zone the forest becomes dominated by Notofagus. The coniferous forests are found at the higher altitudes where the common genera include Podocarpus, Dacrycarpus, Papuacedrus and Phyllocladus. Araucaria and Agathis are common on ridges.

The alpine zone consists of temperate elements such as Vaccinium, Rhododendron, Drimys, etc.

A most noteworthy aspect of the flora is the very high degree of endemism. In a recent study of the pepper family of plants, four out of 15 species were found to be endemics (Chew, 1972). Chew has already identified five more species of Piper which are new to science.

The fauna is just as exotic. At least 350 species of birds have been recorded for the reserve, and this represents more than half the total number of avian species for New Guinea. These include two species of cassowary, four megapodes, 31 pigeons, 30 parrots, 13 kingfishers, 20 birds-of-paradise, 6 species of bower birds and a host of others. The greater part of the reserve is still not surveyed.

The New Guinea fauna is very poor in carnivorous mammals, unlike the Sundaland. In Lorentz, mammals include two monotreme echidnas, six bandicoots, four cuscus, six ring-tails, two oppossums, three wallabies, one species of tree kangaroo and ten other species of marsupials. The mammalian fauna is thus strongly Australian related.

In the swamps, crocodiles are extremely common - so important that the Indonesian government is considering establishing a crocodile farming industry in the province.

In addition to its wildlife, Lorentz holds other conservation values. The first is the very rich genetic resources the area contains; and the highland people are to a large extent directly dependent on these for their daily needs. Secondly, the people in the area still practise traditional fishing, hunting and gathering; and as their population has

been rising, regulation of hunting through a long-term management plan would benefit the people, utlimately. Lastly, Lorentz has great tourist potential in view of the presence of glaciers. If developed, Lorentz National Park could become the greatest centre for leisure, education and research in the natural and social sciences.

3.3 Malaysia

Malaysia is considerably smaller than Indonesia; and as the country lies entirely within one biogeographic region, the Sundaland, it is to be expected that the biota is somewhat less diverse than that of Indonesia. Nevertheless, it still has vast stretches of pristine land with high conservation value, especially in the eastern states of Sarawak and Sabah.

Although Malaysia has a relatively low population, its lowland rainforests are just as threatened as those elsewhere in the region where population densities are higher. This arises from two factors. First, development in Malaysia is proceeding at a faster rate, especially rural development, and the methods and technology used are perhaps more sophisticated. Second, most wild areas in Malaysia are easily accessible, thus making exploitation that much more convenient.

The three most important national parks in Malaysia are Kinabalu in Sabah, Mulu in Sarawak and Taman Negara in peninsular Malaysia. Each is as rich as it is unique; and their spread in the country enables the network to include a broad range of ecosystem types.

(a) Kinabalu National Park

When told that Gunung Jaya in the Lorentz Reserve is considerably

higher than Kinabalu, the Kadazan National Park officer replied, "Yes, but Kinabalu is very big!" This in a way reflects the view of most visitors to the park, especially those who have climbed the mountain: the mountain is majestic and awe-inspiring.

4,100 metres high, Mt. Kinabalu, the centrepiece of Kinabalu National Park, is the loftiest mountain in the Sunda Shelf, and has the highest cultural value in the region. For centuries before their recent adoption of today's traditional religions, the Kadazan's relationship with the mountain had come close to a religion. As late as 1960, it was an officially recognized practice for visitors to bear the cost of cockerels for sacrificial slaughter at the summit by the Kadazan guide.

The cultural aspect of the mountain is thought to have an ancient past. The late Tom Harrisson, in a rather romatic introduction to "Kinabalu - Summit of Borneo" recently published by the Sabah Society, postulated that the Chinese had known Kinabalu by the 15th Century. Citing the Brunei Annals, Harrisson informs us that a Chinese explorer Ong Sum Ping had visited Borneo in search of the giant pearl supposed to be held by a dragon on Mt. Kinabalu. Perhaps it is this mythology that gives rise to one of the interpretations of the name Kinabalu: Kina standing for China or Chinese and Balu for widow.

Kinabalu is today easily accessible. The nearest port of entry is the state of Kota Kinabalu. From there, a beautiful all-weather tarmac road built several years ago enables visitors to reach the park headquarters in less than two hours. With prior arrangement and good timing, one can easily get to the park headquarters (alt. 1,550 metres) from any ASEAN capital city within a day. There are very comfortable

Tun Mustapha's Peak (3,932 m.), Mt, Kinabalu, showing smooth glaciated plateau in the foreground.

Donkeys Ears (4,054 m.), Mt. Kinabalu, one of the most distinctive peaks on the summit.

chalets and other forms of accommodation at headquarters with hot water, power and restaurant services. The second day, one begins the climb of the mountain, but the actual trail really begins at the power station (alt. 1,830 metres) which is either an hour's walk on dirt road or 15 minutes drive from headquarters. From the power station, there is a well maintained trail leading the visitor right to the summit. It is, however, necessary for the visitor to spend the night at the Panar Laban which is about 3,505 metres in altitude. The climb of some 1,675 metres from the power station to Panar Laban takes from five to eight hours depending on one's fitness.

At Panar Laban there are comfortable huts some with spacious rooms, dormitories, kitchens, toilets, running but very cold water, beds, sleeping bags, and other basic necessities except food.

The third day, the visitors usually start the climb for the summit not later than 4:00 in the morning. From Panar Laban the walk to Low's Peak (4,101 metres), the summit, takes about two hours. This part of the trail is quite exciting. One climbs ladders, walks on roots and scrambles up rock faces with the aid of installed ropes, but the climb is most rewarding from the scenic point of view. At this hour in the morning one can see the lights of Bundu Tuhan and Kundasang at the southern foot of the mountain. As the day breaks, the various peaks at the summit begin to take shape and with some cloud cover, the scene can be most dramatic. By 9:00 a.m., one should be able to have the knee-softening experience of looking down into the incredible depths of Low's Gully from Low's Peak.

Visitors should soon begin descending the mountain before the clouds envelop the summit which makes descent in the summit region very

difficult if not dangerous. On the return journey, one usually comes straight down the mountain to the park headquarters in one go.

A visit to the hot springs at Poring before leaving the park is highly recommended. The springs are not as hot as those in G. Leuser and not so sulphur charged; and a bath is an invigorating experience. There are now comfortable facilities at Poring for a stay of a couple of days.

Kinabalu is one of the youngest mountain in the world. Hardly more than two million years old, the mountain was formed by the upward thrust of an enormous granitic dome through layers of sedimentary rocks laid down some 35 million years previously. The dome rose very rapidly and is still rising at the rate of about 5 mm per annum, which is very rapid, geologically. As the overlying rocks became weathered away the present granitic summit began to appear. Then in more recent times, a large tract of the summit area became covered by a glacier (a slow moving river of ice formed by accumulated snow) which did not melt until some 3,000 years ago. The glacier polished the summit as it moved downhill, and at the same time moved tons of boulders of all sizes down the valleys. The present landscape of smooth plateaus at the summit and huge boulders and gravel, called moraine, at the lower level, has come about from these geological processes, and in view of its accessibility, the mountain is an excellent field educational site for ASEAN students of earth sciences.

Situated in a region of high rainfall, Kinabalu is very wet and misty. With a diversity of rock and soil types, a very rich tropical vegetation has developed. The mountain is a botanical paradise.

Up to about the 900-metre contour, the lowland rainforest is mainly lowland dipterocarp forest. Unfortunately, large tracts of this forest

type have already been cut down for cultivation, though there are still primary tracts of it left in the north and east of the park. Two types of dipterocarp forest have been identified. That which grows on sandstone-derived soils differs markedly from that on ultrabasic rocks. They differ not only in species association, but also in the morphology of the trees - as discussed in Chapter 2 of this report.

From 900 to about 2,000 metres, one encounters the lower montane forest. The dipterocarps are still present but largely concentrated at the lower altitudes, becoming less frequent higher up. At about 2,000 metres, oaks and laurels take over. It is also in this lower montane zone that Rafflesia is commonest.

The upper montane forest is found in the 2,000 to 3,000 metre belt. In this zone which becomes increasingly wet, mossy and misty with altitude, Ericaceae and Nepenthes become more prominent. The rhododendrons are a special feature of this mountain and one can easily busy oneself studying these beautiful plants alone.

The uppermost part of this zone can be considered the alpine zone, but the transition between the two zones is sometimes not easy to define.

The summit zone starts from 3,200 metres. it is a treeless zone with bare granite rocks; the vegetation is confined largely to herbs and small shrubs that grow in rock crevices. Genera typical of temperate climates appear in this zone, including Potentilla, Rubus, Gentiana and buttercup. Two species of rhododendrons are also found here.

Mt. Kinabalu is rich in ultrabasic rocks, especially on the south side between 2,600 and 3,200 metres. As mentioned in Chapter 2, this rock

Rafflesia tuan-mudae *on Mt. Kinabalu. This endangered species is also found in West Malaysia and Sumatra. (A. Phillipps)*

Rhododenduan retinervium, *one of the delights of Mt. Kinabalu at about the 2,100 m. contour. (A. Phillipps)*

type supports a different vegetation notable by its lower stature and more even with smaller leaves.

The eminent botanist E.J.H. Corner of Cambridge calls Kinabalu a botanical paradise; and by all counts, he is right. In the foothills where lowland dipterocarp forest is the dominant vegetation type, one encounters mostly species native to the Sunda Shelf lowlands. These include species of Shorea and Dipterocarpus, Artocarpus, Eugenia, Garcinia, Aglaia, Diospyros and many others. From the 2,000-metre contour one meets tropical oaks such as Castanopsis and Lithocarpus. In the 1,500-2,000 metre zone, a new primitive genus of oak-like tree was discovered in 1961. In the upper montane zone, species with temperate affinities begin to appear and mingle with Bornean elements. The only species of buttercup (Ranunculus lowii) in Borneo is found on Kinabalu above 3,300 metres. In addition, the mountain holds four other genera of the buttercup family - Anemone, Thalictrum, Clematis and Naravelia. Then there are Potentilla (family Rosaceae), Euphrasia, two endemic species of Gentiana (gentians), two violets and a host of others. Most of these herbaceous .pn76 plants have relatives in temperate climates either in Europe, Asia or Australia.

Most visitors to the mountain who have botanical interests often comment on four plant groups - orchids, rhododendrons, Nepenthes and the Rafflesia.

The orchids are the most diversified and occur in a broad altitudinal range from 1,500 to 3,000 metres, but they are most prolific at about 2,000 metres. Nearly 1,000 species have been recorded from the park, many of them having high horticultural value. Rhododendrons are the next most common group. Occurring mainly between 2,000 and 3,000 metres, most

Nepenthes villosa, *a fairly common pitcher plant on the summit trail of Mt. Kinabalu at about 2,400 m. altitude. (A. Phillipps)*

A civet in Mt. Kinabalu National Park, common but not readily seen. (A. Phillipps)

have rather showy flowers.

The Pitcher-plants (Nepenthes) are best developed in the 1,700-3,600 metre belt. Ten species are reported to occur on Kinabalu. Of these the most spectacular are Nepenthes villosa, N. Lowii and N. edwardsiana.

Rafflesia is best seen at Poring Hot Springs and the East Ridge to a point at about 1,000 metres. One can occasionably find Rafflesia flower buds for sale at village fairs. They are sometimes eaten as medicine.

The fauna of Kinabalu is also impressive. Animals are, however, like most fauna in the tropics, difficult to see for they are either high up in the trees or only roam about at night. The line-up of mammals in the park includes five species of insectivorous mammals, the flying lemur, 18 species of bats, 7 species of tree shrews (the highest number for any one mountain), slow loris, tarsier, grey leaf monkey (Presbytis aygula), red leaf monkey (P. rubicunda), the Borneo gibbon (Hylobates muelleri), orang-utan (Pongo pygmaeus), scaly ant-eater, 28 species of squirrels, 15 species of rats, 4 mice and two porcupines. Amongst the carnivores, Kinabalu has the Malay bear, 2 civets and leopard cat. There are also barking deer and two mouse deers.

Perhaps the most impressive of the fauna are the birds of which nearly 300 species have been recorded for the park. 254 species are residents, the others being an assortment of migrants, stays, etc. The best represented are the babblers and laughingthrushes of which Kinabalu has 29 species. These are followed by the flycatchers which are represented by 28 species, then the cuckoo family (Cuculidae) with 19 species, the bulbuls with 17 species and the sunbirds (Nectarinidae) with 13 species. The hornbills must not be forgotten, there are 6 species of

The highest mountain between the Himalayas and New Guinea, Mt. Kinabalu in Sabah, Malaysia, is very accessible. One can reach the summit within three days from any ASEAN capital city assuming one gets to Kota Kinabalu by air first. (Francis Liew)

these in Kinabalu. The other families have less than 10 species each in the park.

The Kinabalu National Park fulfils at least three conservation needs. It has one of the richest montane biotas in the region. It has a broad range of geomorphological features which are fascinating to students of earth science. Last but not least, the wilderness value of the mountain is appreciated by a rapidly increasing number of ASEAN youths. This is gratifying for the visitors and the national park.

(b) Mulu National Park

Though not more than 300 km apart, Mulu in Sarawak and Kinabalu in Sabah are vastly different national parks. Instead of one massive granitic mountain rising sharply to some 4,100 metres, as is the case with Mt. Kinabalu, Mulu National Park consists of a variety of geological formations dominated by a large sandstone mountain of some 2,376 metres in altitude, namely the Gunung Mulu, and two smaller mountains of limestone: Gunung Api and Benarat.

What Mulu lacks in size and grandeur it compensates in having such a varied terrain that it harbours an array of the most interesting land-types in the ASEAN region. The Mulu National Park can boast of dramatic limestone pinnacles and awe-inspiring caves, and a great diversity of plant and animal life. Mulu National Park is indeed complementary to Kinabalu; between them, they encompass nearly all land ecosystem types found in Borneo.

The 53,000-ha Mulu Park lies in north-east Sarawak about 4 north of the equator and at 114 east longitude. It lies astride the watershed

Limestone Pinnacles, Gunung Api, Mulu National Park, Sarawak, Malaysia. (Sarawak Forestry Department/ Royal Geographical Society)

Gua Air Jernih (Clear Water Cave), Mulu National Park, Sarawak, Malaysia. (Sarawak Forestry Department/ Royal Geographical Society)

between the Sungai Tutuh which marks the park's southern boundary and the Sugai Medalam in the north.

Still largely pristine, this park is the least accessible of the three Malaysian heritage parks. At present, there are two long and rather difficult riverine routes into the area. The main route, opened by the Forest Department in 1961, enters the park from the south-west via the Baram River and its tributary, the Tutuh River. The riverine distance is some 140 km, and up-river, the journey from Marudi to Long Terawan takes one day and from there to the park headquarters at Long Pala nearly the whole of the next morning. If the water is low, which is frequently, the second part of the journey can take a whole day. Marudi is connected to the outside world by air via Miri and the state capital city of Kuching.

The other route enters the park on its northern boundary, following the Limbang and then the Medalam Rivers. From a point on the Medalam River west of Gunung Buda, one can reach the park through a Penan trail that runs southerly and west of G. Benarat to the Melinau Gorge.

Mulu National Park comes under the control of the State Forestry Department. The Director of Forests administers it through the National Parks and Wildlife Section which delegates the management of the park to the Sectional Forest Officer at Miri.

Until 1977, the Mulu National Park was explored mainly by botanists from the Sarawak Forest Department and the botanic gardens in Edinburgh and Singapore. Their visits were of short duration and they were mainly concerned with the taxonomy and vegetation ecology of the flowering plants. In that year, the Sarawak Forest Department and the Royal Geographical Society of London jointly launched a major year-long expedition of well

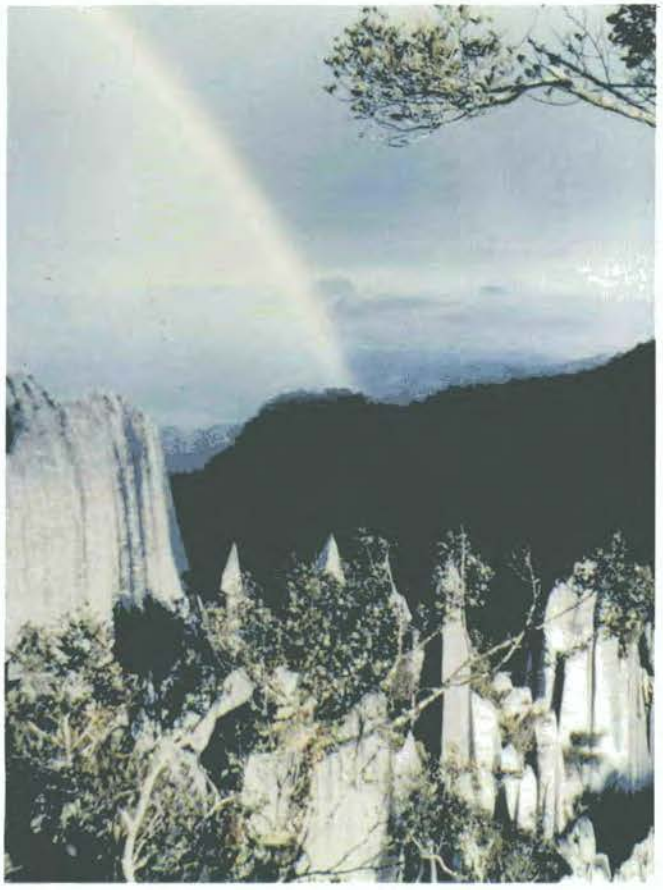
over a hundred scientists to investigate major aspects of the park's natural history including its climate, geology, soil and geomorphology. The immediate result of this was a series of reports and a draft management plan which contains an excellent account of the natural history of the area; the present account draws heavily from these materials.

The most significant aspect of the climate of the park is the rainfall; Mulu has plenty of it. Of the eight rain gauges established during the year-long expedition, seven recorded annual rainfall of over 5,000 mm. Though there is no distinct dry season, there is some seasonality in the precipitation. There appear to be two distinct maxima, one in the October-November period and other in April-May. Some areas also receive high rainfall in January at the height of the northeast monsoon. The south-west monsoon in August-September, which brings torrential rain to many parts of South-East Asia, loses most of its moisture by the time it reaches Mulu, and the months of August and September are significantly less rainy.

A very important feature of the rainfall in Mulu is the occasional heaviness of the downpour. On 2 November 1977, the expedition recorded some 187 mm (over 7 inches) on that single day. These heavy storms often cause the upper reaches of the rivers to swell and rise very rapidly. Sugai Melinau has been known to rise 10 to 30 feet overnight.

The plentiful supply of tropical rainfall with its high erosive power has worked wonders on the rocks of the park. It has supplied Mulu with a very extensive network of rivers and tributaries, shaped parts of the limestone hills into impressive pinnacles, cut deep gorges and dug enormous caves in the karst region. Mulu National Park is one of the most

Limestone-Sandstone interface, Mulu National Park, Sarawak, Malaysia. (Sarawak Forestry Department/ Royal Geographical Society)



Limestone-Sandstone interface, Mulu National Park, Sarawak, Malaysia. (Sarawak Forestry Department/Royal Geographical Society)

interesting tropical landscapes in the world.

Shaped like a badly drawn hexagon, the park slopes quite abruptly to the north-west. Gunung Mulu, reaching 2,376 metres in altitude, dominates the south-eastern half of the park with its five radiating ridges, each with an altitudinal range of 500 to 2,000 metres. Between the ridges, the valleys are deeply incised by dendritic-patterned rivers.

Separating the Mulu highlands in the south-east from the Melinau-Mentawai plains in the north-west is a row of limestone mountains thrown diagonally in a south-west to north-east direction right across the middle of the park. These limestones culminate in the spectacular mountains of Gunung Api and Benarat, both reaching slightly over 1,500 metres, the loftiest limestone mountains in the region. Their most interesting aspects are the limestone pinnacles, caves and underground streams of which more will be said later.

The Melinau-Mentawai alluvial plains occupy almost the whole north-west third of the park. The plains are low - below 250 metres - but they are not entirely flat: they are rolling with outcrops of limestones and alluvial terraces some of which may rise abruptly to 50 metres above the surrounding plains.

At the north-west corner of the park along the Brunei-Sarawak border, there occurs a strip of scarplands or high terraces. These form a ridge of about 210 metres in altitude and the drainage pattern is mainly trellised.

Just as the land dips from the south-east to the north-west, the geological sequence also changes in the same direction, from Gunung Mulu,

the oldest rock, to the alluvial plains in the north-west where the youngest formations are found.

Gunung Mulu is of sandstone and shales which are the main rock types over the south-east half of the park; these are reckoned to be from the Paleocene and Eocene.

The karst region is made up of exceptionally massive limestone many parts of which have been found to be very pure and often metamorphosed into marble. (This extensive limestone is in fact believed to lie beneath the alluvial plains which explains the limestone outcrops in the lowlands). The limestones are younger than the Mulu sandstones and shales, being largely from the Oligocene and early Miocene. This rock formation was studied closely by Hans Friedrich during the recent expedition of the Royal Geographical Society and he reported that the limestone mountain is composed of three parts. The tops of ridges are normally weathered to round-top pillars with deep joints in between up to 10 metres deep and only a few metres wide. Lower down the slopes, the limestones weather into wedge-shaped pinnacles many of which tower spectacularly to some 50 metres. The best examples of such pinnacles are on the north face on Gunung Api between the 1,000 and 1,500 contours. And at the lower level one finds limestone screes. The Benarat and Api were probably one massive limestone at some stage, but are now separated by a deep gorge cut by a tributary of the Sungai Me Linan.

If anything, it is the limestone caves that will make Mulu world famous. The Park has 14 such caves and over 50 kilometres of cave passages. The most spectacular is the Gua Payau (Gua = cave, Payau = deer; the Deer Cave) which has a dimension at the downstream end of 170 metres

high and 120 metres wide, reckoned to be the largest cave in the world. The longest cave passage is recorded in Gua Air Jernih (Clear Water Cave) where it reaches 26 kilometres. And the most beautiful one is certainly the Gua Ajaib (Wonder Cave) which is adorned with all shapes and sizes of calcite formations such as fans and delicate halictites.

The limestone caves teem with life. The Gua Payau houses an enormous bat population estimated to be near a million, and tens of thousands of swiflets. Their combined guano on the cave floor is some 30 metres deep; and this in turn supports a thriving ecosystem of cave animals such as beetles, earwigs, millipeds and their predators such as hunting spiders, the dreaded (and dangerous) long-legged and fast-moving centipedes and cave snakes.

The geology of the rest of the park is a little less spectacular though it has its own notable features. The lowlands to the west of the limestone region are made up of recent alluvial deposits such as clays, silts and boulders derived from sandstone. The undulations of the plains are broken by terraces which may rise some 50 metres above the surrounding land; these terraces occur also near the Brunei border.

Further west there is a broad band of shales known as the Setup Shales which is largely composed of dark clay-shales and siltstones. And further west along the Brunei border one encounters the Belait rock which is described by the Geographical Society as a sandier version of the Setup Shales. The notable feature of these terraces is that they support the kerangas forest and have a trellised pattern of river drainage, as opposed to the dendritic pattern which characterises Gunung Mulu in the south-east.

Given such a favourable environment, abundance of rainfail and a

variety of rock and land forms, the stage is set for the development of a great diversity of vegetation types. Nearly all the major inland vegetation types found in Sarawak are represented in the park.

J.A.R. Anderson and Paul Chai, Sarawak's experts on the vegetation, identified four main vegetation formations in the park comprising a total of 14 forest types.

Except for the lowlands, the Mulu massif has a vegetation different from the rest of the park. Lowland mixed dipterocarp forest is the dominant vegetation type on Mulu below 800 metres. This is high forest up to 55 metres in some places, with huge buttressed trees dominated by the Dipterocarpaceae. Its richness can be gauged by the fact that in three sample plots totalling only 1-2 ha, Anderson and Chai recorded some 284 species of trees with girth 30 cm and above. The main dipterocarp genera in this zone are Shorea and Dryobalanops. Genera of other families well represented in this forest type include Durio, Diospyros, Calophyllum, Garcinia, Eugenia and Artocarpus. It must be remarked here that this forest type is fast disappearing in other parts of Borneo and even South-East Asia, and it has been largely felled by shifting cultivation in Kinabalu. At this rate of destruction, Mulu might one day be the last major refuge of lowland dipterocarp forest.

From 800 to 1,200 metres, the forest gets lower, mostly about 30 metres high, trees become smaller, the Dipterocarpaceae begin to lose their dominance and the oaks and myrtles begin to increase in frequency. The ground herbs also begin to increase in numbers. This is the lower montane forest and it merges into the next forest type.

The upper montane forests extend from the 1,200-metre level to the summit of Mulu. Three types are recognized at different elevations on the mountain and they differ from each other in structure and height and in the frequency of montane flowering plant families. But they have in common the absence of Dipterocarpaceae and an increasing presence of bryophytes and lichens. With increasing altitude, the forest tends to decrease in height and the trees are more stunted and knarled with more encrusting mosses and lichens. At the lower levels, oaks and chestnuts predominate, but they are replaced by Podocarpaceae, Myrtaceae and Guttiferae at the higher levels, and near the summit, the Ericaceae and Nepenthaceae become very prominent.

The limestone forest is the next important forest formation in Mulu. Though very variable, it is highly distinct from the lowland rainforest on sandstones or other rock types. For Mulu, it is not easy to give a blanket description because of the various widely differing sub-types present.

On boulder-strewn scree slopes, the limestone forest is open and approaches a woodland with massive emergents such as Azadirachta excelsa, Sindora coriacea and Scorodocarpus borneensis. On limestone slopes, the forest can range from low dense associations of small shrubs and treelets on steep slopes to high forest on more gentle slopes. On more gentle slopes, the dipterocarps are present; these include Hopea and Shorea.

On steep limestone cliffs, a different type of flora is found. Here one finds plants of high ornamental value such as Monophyllea, Cyrtandra and Boea.

On the limestone mountains, the vegetation can be classified into tow altitudinal belts as in the sandstone forest formation. From 800 to

1,200 metres, one finds the lower montane limestone forest and from 1,200 to the summit the upper montane limestone forest. In the lower montane forest, the only dipterocarp species is Hopea argentea; the forest is largely composed of non-calcicolous species such as Parishia maingayi, Tristania obovata, and species of Canthium, Palaquium, etc. In the upper montane limestone forest, especially where the soil is better developed, conifers like Dacrydium and Phyllocladus are common. Other conspicuous plants include three species of Rhododendrons, three Pandanus, the pitcher plant Nepenthes and the genus Leptospermum.

The vegetation of the alluvial plains north-west of the limestone massifs is perhaps the most variable in the park. This is largely because the soils in the flood plain are derived from a variety of sources. Not very dense, the canopy tends to be uneven and open. Common species include Eusideroxylon melagangai, Parashorea macrophylla, and species of Pometia, Octomeles, Dracontomelum and Pterospermum. The forest floor is rich in ground flora and climbers and epiplytes are common features in the high forest. Eusideroxylon melagangai is the famous Bornean ironwood which produces the much-sought after Belian wood; and there is evidence that this species is locally threatened through over-felling by local people.

The kerangas forest is found on the terraces of the plains in the park. It is mainly composed of small trees with straight stems. Large woody climbers are generally absent and climbing palms are few and specially adapted to this habitat. Shorea albida is common and is often the dominant species. Other tree species include Melanorrhoea macrocarpa, two species of Calophyllum, Cotylelobium burkii and Shorea scabrida. Two species of Nepenthes are found as ground plants: N. bicalcarata and N.

rafflesiana.

The Mulu plains also have a small area of peat swamp of about 180 ha. The concentric zonation of the forest typical of large peat swamps is present in the park peat area. Here four zones are recognized.

In the north-western part of the park, the Setup Shales support another type of vegetation. Closely allied to the lowland dipterocarp forest of the Mulu massif, it differs somewhat in structure and stature but more importantly in species composition. Classed as a mixed dipterocarp forest, its main dominants include four species of Shorea, Dryobalanops beccarii and Parashorea smythiesii.

The fauna of the park was investigated very fully by the expedition and details are now available from the Sarawak Forest Department. It suffices to make the following comments. Except the orang-utan, the Sumatran rhinoceros and banteng, which are absent, most of the mammals expected to be there are in the park. These include five species of monkeys, the western tarsier, slow loris, Bornean gibbon, the sambar deer, barking deer, bearded pig and carnivores like the Malayan sun bear, civets, etc. But these occur in much lower numbers than expected and the present low density of populations is thought attributable to hunting. (The rhino, orang-utan and banteng had obviously been hunted out.) Smaller mammals and carnivores like bats, rats, shrews are all there in good numbers.

Birds are very well represented in Mulu. At present 262 species have been recorded. Of the most important groups, there are 13 species of birds of prey, all 8 Bornean species of hornbills and numerous species of sunbirds, flycatchers, bulbuls, babblers, etc.

Other vertebrates include 25 species of snakes, 23 lizards, 75 frogs and toads including the Wallace's flying frog R. nigropalmatus, and 52 species of freshwater fishes, the majority of which are edible.

The invertebrate fauna is also very rich. Notable are the earthworms, scorpions, millipedes, centipedes, and an incredible array of insects.

There is no doubt Mulu has immensely rich genetic resources. In the plant kingdom, the genetic diversity of the Dipterocarpaceae has great potential for silviculture. The palm family, also reported to be very diversified, has potential for a rattan industry. Horticulture can also benefit from an introduction of new varieties of trees and flowers for gardens. Medicinal plants should not be ignored: 40 species have been recorded as having been used by Penans for various ailments.

As for the fauna, riverine fish constitute an important food resource. If protected and managed well, they could bring long-term benefits for the Bornean people.

For aesthetics, recreation and research, Mulu's limestone formations have much to offer but the park needs careful management if it is to be enjoyed in perpetuity.

(c) Taman Negara National Park

Taman Negara, the largest of the Malaysian heritage parks, has all the geological formations that constitute Kinabalu in Sabah and Mulu in Sarawak. Shales, sandstones, granite and limestone are all in Taman Negara. Situated in the centre of peninsular Malaysia with a varied

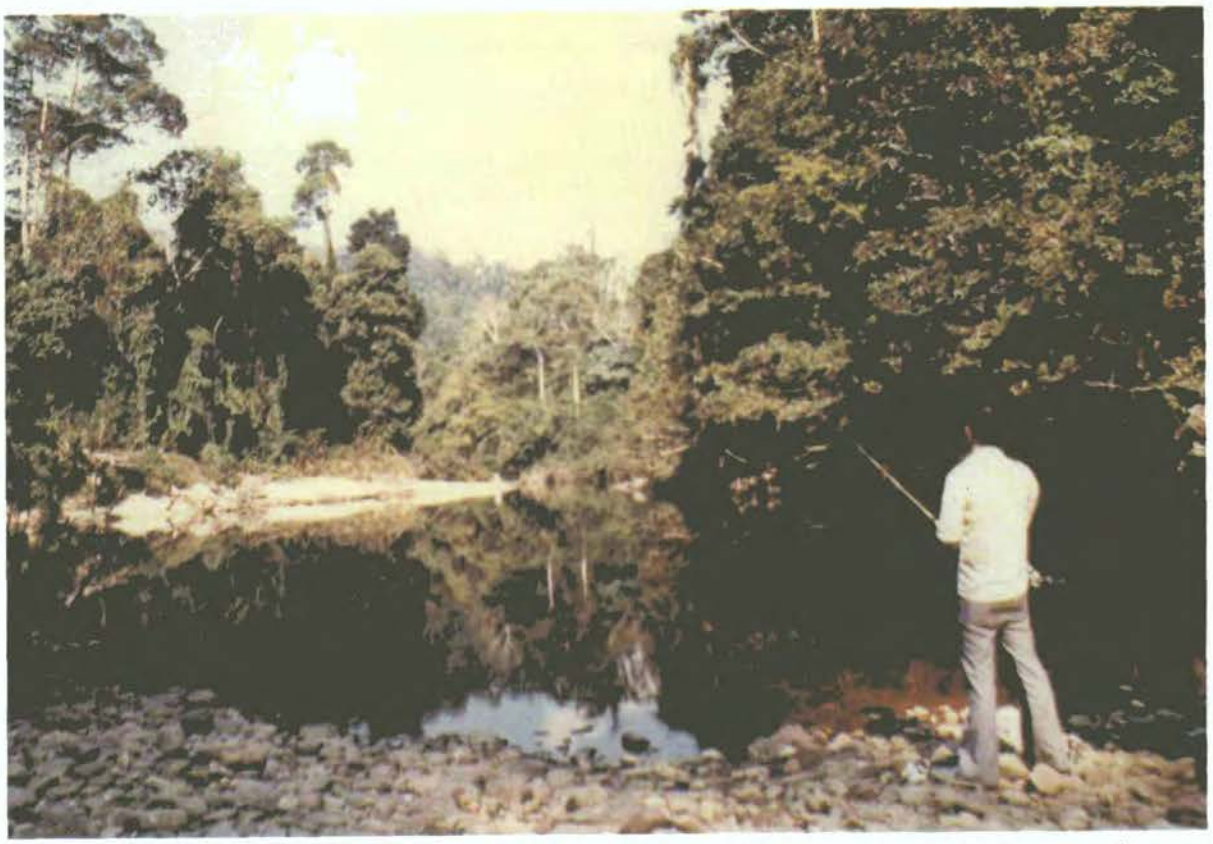
terrain, it has a very wide range of ecosystems rich in wildlife. Like Kinabalu and especially Mulu, the park is still largely pristine.

Lying astride the eastern range of the Malaysian peninsula, the 434,000-ha national park is quite accessible. The port of entry is Kuala Lumpur, and there are excellent roads including a super-highway to Kuala Tembeling. From Kuala Tembeling, one travels by the motorized long boat up the Sungai Tembeling to the park headquarters at Kuala Tahan; the 60 km riverine journey can take three to five hours depending on the level of water in the Tembeling River.

Taman Negara is not as mountainous as Kinabalu or Mulu. The western third of the park is dominated by the Gunung Tahan massif (2,187 m) the highest mountain in peninsular Malaysia. The central portion is hilly with lowlands to the north and south. The eastern third is again mountainous, the two main peaks being Gunung Gagau (1,376 m) and Mandi Angin (1,459 m). There is much lowland in the park, nearly 58 percent of the area lies below 330 metres. If one takes anything below 700 metres as lowland, then something like 75 percent of the park is lowland.

Gunung Tahan is sandstone and quartzite; this geological formation, which is quite extensive in the park, is surrounded by shales, the most extensive rock type in the park. The eastern third of the park has a central strip of shales surrounded by granite. Here and there in the western half are limestone hills with caves.

Lowland dipterocarp forest is extensive in Taman Negara. In the western part of the park, that which occurs at the foothills of G. Tahan appears to have a good concentration of commercial wood, whereas the dipterocarp forests in the east are smaller in stature. Dominant genera in



Lubuk Simpson, Taman Negara, Peninsular Malaysia (National Parks and Wildlife Department).

The Kijang, Taman Negara, Peninsular Malaysia (National Parks and Wildlife Department).

this forest type include Shorea, Anisoptera and Dipterocarpus. The non-dipterocarp tree genera include Diospyros, Canarium, Knema, Myristica, Eugenia, Durio, Xerospermum, Calophyllum, Garcinia, Castanopsis, Lithocarpus, Agathis, Koompassia, and Parkia.

The forest in the 330 to 1,000 metre altitudinal zone can be classified as lower montane, though on high mountains this zone is still largely covered with lowland species. In Taman Negara, however, the dipterocarps give way to oaks and myrtles in this zone, and the main tree genera include Castanopsis, Lithocarpus, Quercus, Agathis and Eugenia. The palms are especially rich in this forest. They include Eugeissona, Pinanga, Licuala and Johannestei jesmannia, the well-known umbrella palm.

The upper montane forest starts at about 1,200 metres, much lower than in the highest mountains in Malaysia or Indonesia. Prof. E. Soepadmo of the University of Malaya calls this the ericaceous forest which he describes as composed of "...shrubby looking trees ...with horizontal branches and flat-topped crowns..." Significant tree genera include Leptospermum and Dacrydium, and shrub genera such as Podocarpus, Rhododendron, Vaccinium, Styphelia, Weimannia, Gordonia and other types of highland forms.

Other vegetation types include padang vegetation, riverine forests and forest on limestone.

A rich fauna has developed in this diversity of habitat types, which is said to be highly representative of that of the entire peninsula. The Earl of Cranbrook estimated that 60 percent of the Malaysian endemic mammals occur in the park.

Sungai Tahan, Taman Negara, Peninsular Malaysia (National Parks and Wildlife Department).

Park Headquarters, Taman Negara, Peninsular Malaysia (National Parks and Wildlife Department).

The lowland rainforest areas contain the richest assemblage of fauna. As altitude rises, the diversity of the fauna decreases.

Khan reported in the Journal of the Malayan Nature Society the presence of herds of elephants in many areas, and their total number in the park has been estiamted at about 70 animals.

The seladang (Bos gaurus) is found in at least four major areas in the park. The largest number, estimated to be about 30, are in the south in the vicinity of Kuala Tahan. In all, no less than 70 head of seladang are estimated for the park.

The highly endangered Sumatran rhinoceros is in Taman Negara. Recent estimates put their numbers at three to five animals. Other endangered species found in the park include the tapir (Tapirus indicus), sambar deer (Cervus unicolor equinus), serow (Capricornis sumatraensis) and the tiger.

Taman Negara is thought to contain all the inland birds of peninsular Malaysia; 254 species had been identified in the park by mid-1970. Including migrants, the figure would be much higher.

As in Mulu National Park, the rivers in Taman Negara are teeming with fish which await study to determine their distribution.

The park appears to be rich in wild relatives of cultivated plants. The highly prized durian (Durio zebithinus) has two closely related species growing in the park: D. lowianus and D. griffithii. The close relatives of the rambutan (Nephelium lappaceum) include N. eriopetalum and N. glabrum. The euphorbiaceous genus Baccaurea is represented by seven species with edible fruits while the jack fruit has four relatives that

have market potential. In fact most of the wild relatives of Malaysian native fruits and food plants are found in the park.

Tourism potential in Taman is very high and is presently being developed. The park headquarters at Kuala Tahan now has excellent accommodation for visitors - chalets, a rest house, hostel and campsites. Power is available and all accommodations have piped water. There is a restaurant, a small coffeeshop and a tiny bazaar offering a variety of vegetables and fruit for sale.

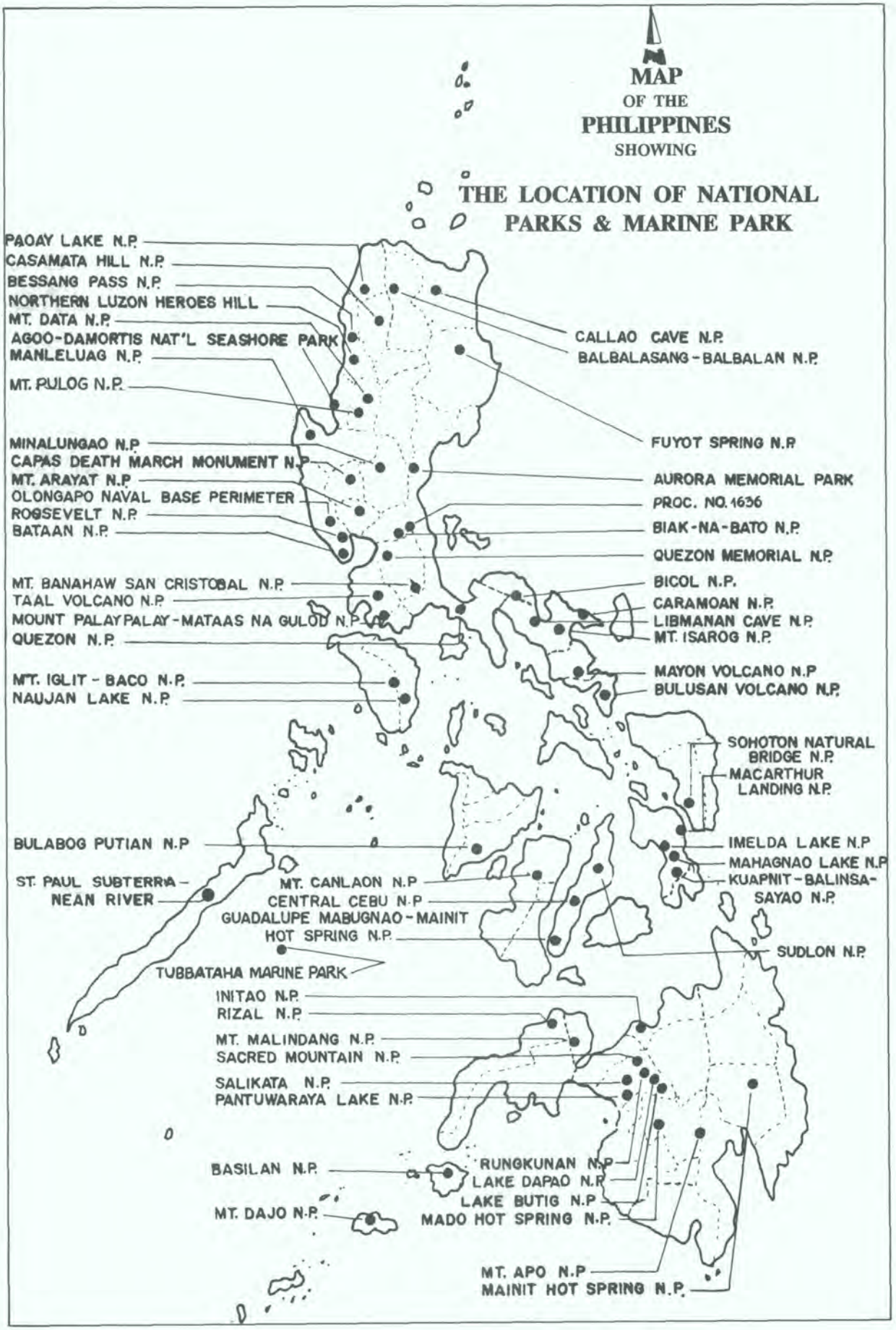
The Sungai Tembeling and Tahan are excellent rivers for boating. Each has exciting but not dangerous rapids (as in Mulu). Thes rivers have also several excellent areas for fishing and swimming.

The forest and mountains are excellent for game watching and hiking. The park has 14 salt licks with five in the vicinity of headquarters. Observation towers called hides have been built at some of these licks; chances of seeing seladang, deer, tapir and elephant are good either early in the morning or at night with a spotlight.

The park authorities have established nature trails in many places in the park and they vary greatly in extent and ease of hiking. Perhaps the most challenging is the track up Gunung Tahan which may take a couple of days. Camping equipment is needed for this hike.

3.4 Philippines

Situated in the northern third of the Wallacea subregion, the Philippine archipelago consists of some 7,100 islands of which only 462 are larger than 250 hectares. Largely volcanic in origin, the islands are


MAP
OF THE
PHILIPPINES
SHOWING
THE LOCATION OF NATIONAL
PARKS & MARINE PARK
PAOAY LAKE N.P.
CASAMATA HILL N.P.
BESSANG PASS N.P.
NORTHERN LUZON HEROES HILL
MT. DATA N.P.
AGOO-DAMORTIS NAT'L SEASHORE PARK
MANLELUAG N.P.
MT. PULOG N.P.
MINALUNGAO N.P.
CAPAS DEATH MARCH MONUMENT N.P.
MT. ARAYAT N.P.
OLONGAPO NAVAL BASE PERIMETER
ROOSEVELT N.P.
BATAAN N.P.
MT. BANAHAW SAN CRISTOBAL N.P.
TAAL VOLCANO N.P.
MOUNT PALAYPALAY-MATAAS NA GULOD N.P.
QUEZON N.P.
MT. IGLIT - BACO N.P.
NAUJAN LAKE N.P.
BULABOG PUTIAN N.P.
ST. PAUL SUBTERRA - NEAN RIVER
MT. CANLAON N.P.
CENTRAL CEBU N.P.
GUADALUPE MABUGNAO - MAINIT HOT SPRING N.P.
TUBBATAHA MARINE PARK
INITAO N.P.
RIZAL N.P.
MT. MALINDANG N.P.
SACRED MOUNTAIN N.P.
SALIKATA N.P.
PANTUWARAYA LAKE N.P.
BASILAN N.P.
MT. DAJO N.P.
RUNGKUNAN N.P.
LAKE DAPAO N.P.
LAKE BUTIG N.P.
MADO HOT SPRING N.P.
MT. APO N.P.
MAINIT HOT SPRING N.P.
CALLAO CAVE N.P.
BALBALASANG - BALBALAN N.P.
FUYOT SPRING N.P.
AURORA MEMORIAL PARK
PROC. NO. 1636
BIAK-NA-BATO N.P.
QUEZON MEMORIAL N.P.
BICOL N.P.
CARAMOAN N.P.
LIBMANAN CAVE N.P.
MT. ISAROG N.P.
MAYON VOLCANO N.P.
BULUSAN VOLCANO N.P.
SOHOTON NATURAL BRIDGE N.P.
MACARTHUR LANDING N.P.
IMELDA LAKE N.P.
MAHAGNAO LAKE N.P.
KUAPNIT - BALINSA-SAYAO N.P.
SUDLON N.P.

mostly mountainous and peaks of 1,200 to 1,500 metres . are common. The archipelago has never had any land connection with either of the South-East Asian continental shelves except the Palawan Islands which lie just north-east off Borneo.

The ecological significance of these geographical features is as follows. First, the Philippines has a relatively depauperate biota in comparison with its ASEAN neighbours. This can be explained by the theory of island biogeography which maintains that the smaller the land area, the less diverse is the biota. This is a reflection of diversity of habitats and rate of extinction and recruitment through immigration of plant and animal species. Secondly, the relative geographical isolation of the archipelago from the rest of South-East Asia has prevented the exchange of species between the Philippines and the rest of the region. And thirdly, the impact of typhoons on the environment is such that the ecosystems suffer from frequent disruption of their ecological processes and this has not enhanced the diversity of the biota.

The environmental situation is being confounded by increasing human utilization pressure on the pristine land in recent decades. Fully aware of this situation, the Philippine authorities have established a wide network of conservation areas throughout the country to ensure that the wildlife and its habitats are protected for the benefit of the Philippine people.

Two of the Philippine national parks have been dedicated as ASEAN heritage parks. The Mt. Apo in Mindanao reaching some 2,954 metres in height is the highest and one of the richest parks in the country. A major asset of Mt. Apo is that it is the home of the endangered Philippine eagle

(Pithecophaga jefferyi). The other heritage park is Mts. Iglit-Baco in Mindoro. Mts. Iglit-Baco is the refuge of another endangered species, the tamarau (Anoa mindorensis). Both species are found nowhere else in the world but in the Philippines.

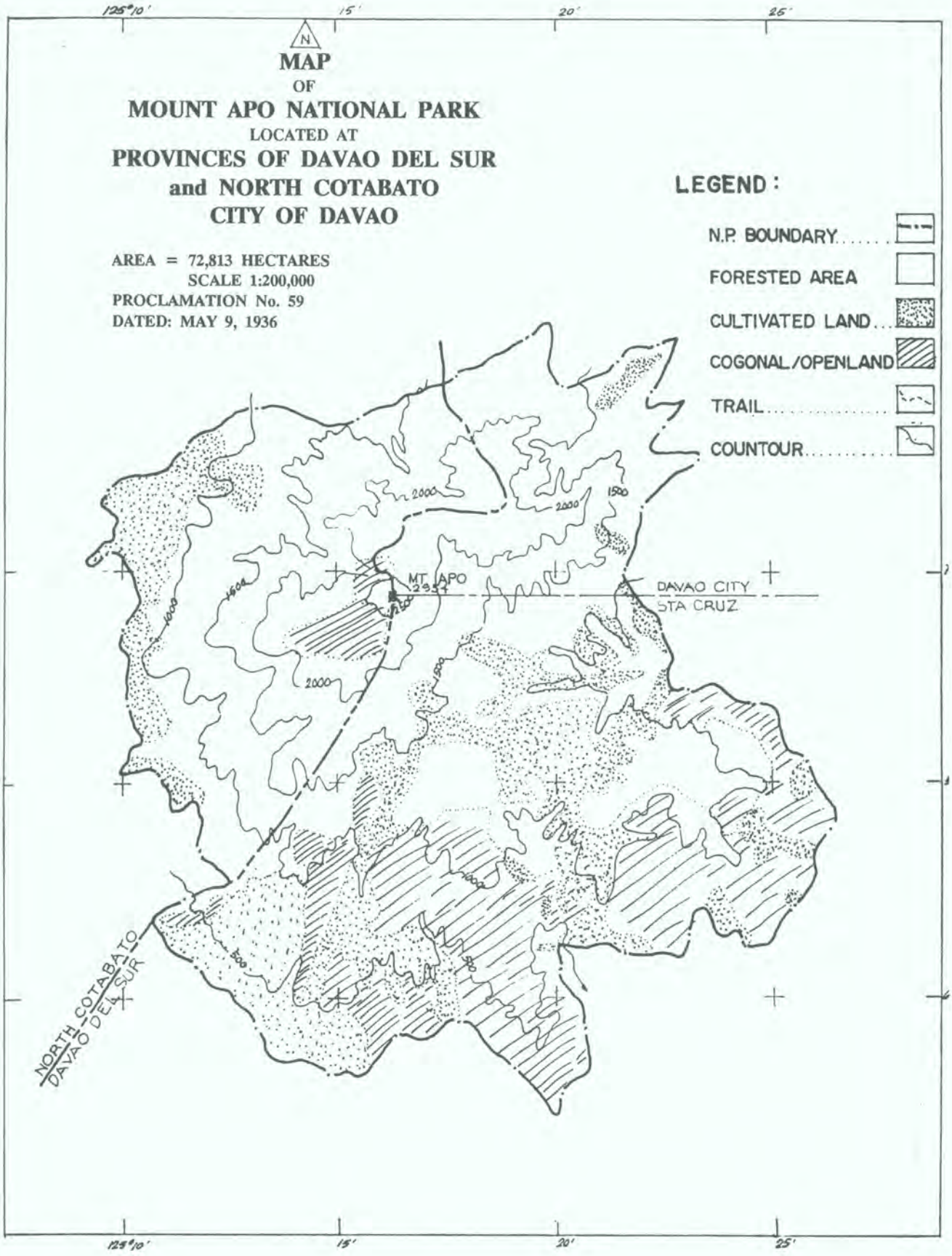
(a) Mt. Apo National Park

The 72,813 ha Mt. Apo National Park lies in the mountains south-west of Davao City in the southern island of Mindanao. Somewhat rectangular in shape, the park is dominated by the highest Philippine mountain, Mt. Apo, a volcano rising to 2,954 metres in altitude.

The park is easily accessible through Davao City which has excellent air connections with the outside world through Manila. From Davao City, one can motor to the foothills from where there are trails to the summit of Apo.

There are three routes to the park. The first is the north-east trail through Baracatan which is steep but short. The second is the north-west trail from Kidapawan in Cotabato which requires two days' marching. The third is the south-west through Makilala which also takes two days of tracking. These three routes have a significant common factor: they are teeming with terrestrial leeches.

A study of the flora of Mt. Apo has revealed that the lower elevations of the habitat of the Philippine eagle are covered with multi-stratal rainforest with closed canopy ranging from 10 to 20 metres high. The dominant tree genera include Syzygium, Lithocarpus, Cinnamomum and other less important ones like Artocarpus, Ficus, Canarium and Aglaia. Dominant epiphytes .pn104 includes orchids, Nepenthes and strangling figs.


125°10'
15'
20'
25'
N
MAP
OF
MOUNT APO NATIONAL PARK
LOCATED AT
PROVINCES OF DAVAO DEL SUR
and NORTH COTABATO
CITY OF DAVAO
AREA = 72,813 HECTARES
SCALE 1:200,000
PROCLAMATION No. 59
DATED: MAY 9, 1936
LEGEND:
N.P. BOUNDARY
FORESTED AREA
CULTIVATED LAND
COGONAL/OPENLAND
TRAIL
COUNTOUR
MT. APO
2954
DAVAO CITY
STA CRUZ
NORTH COTABATO
DAVAO DEL SUR
2000
1500
1000
500

Rattans and Freycinetias are most common. The lower reaches however, have been subjected to human activities such as shifting cultivation by settlers and logging.

At higher altitudes, from 1,200 metres upward, the vegetation becomes lower in stature and the trees are smaller with twisted knarled stems covered with mosses and epiphytic orchids and ferns. Dominant tree species include Syzygium malagsam, Dacrycarpus cumingii, Agathis philippinensis and species of the genera Podocarpus and Lithocarpus.

Botanically, Mt. Apo is considered to be one of the richest mountains in region. There are many genera with very numerous species. Also, species endemism is very high amongst flowering plants. Pandanus for instance is represented by 9 species on the mountain; 8 of these are endemic. Lithocarpus (oak family) has 10 species of which three are endemic; Pinanga, 4 species, all endemic. Other well diversified genera with endemic species are: Artocarpus, 4 species, all endemic; Ficus, 27 species, five endemic; Aglaia, all seven species endemic; Elaeocarpus, 9 species, 8 endemic; Syzygium, 11 species all endemic; Medinilla 18 species and every one found nowhere else in the world. And the list goes on. The same holds true for the high altitude plants. Rhododendron is represented by 6 species, all endemic. One group that is notable by its low diversity, however, is the Dipterocarpaceae. Mt. Apo has four genera with a total of six species, all endemic: Dipterocarpus (2 species), Hopea (1), Shorea (2) and Vatica (1). This is indeed most noteworthy and the situation clearly reflects the early isolation of the archipelago from the rest of South-East Asia.

The fauna of Mt. Apo, however, is not as diversified as the plants

are. The park has a number of interesting mammals. Among these are flying lemur (Cynocephalus volans), Philippine tarsier (Tarsius syrichta), Philippine deer (Cervus philippinensis), Philippine civet (Paradoxurus philippinensis), and a number of squirrels and rats.

So far, a total of 84 species of birds have been recorded in the park. There are 3 genera of hornbills, at least 10 species of doves, 5 of parrots, one megapod, and one species of Buceros, namely Buceros hydrocorax mindanaoensis. Also present are woodpeckers and flycatchers and many other passerine forms.

Charles Lindbergh called the Philippine eagle "the air's noblest flier". It is indeed a fantastic bird. Weighing some 8 kilogrammes and with a wing span of up to 8 feet, the Philippine eagle is the second largest eagle in the world. A mature pair is estimated to need a feeding range of 50 to 100 square kilometres.

The bird has a low fecundity: it produces only one egg per clutch and the breeding cycle lasts two years. The egg is white, slightly larger than a tennis ball and is laid in a huge nest built on epiphytes and often very high up in the canopy of a tall tree. In most cases, the nests are 120 to 150 feet off the ground. The incubation lasts about 60 days and is largely undertaken by the female; the male spends the time hunting. The female continues to remain in the nest looking after the chick. In the early stages after hatching, the female does almost all the feeding, but as the chick grows into an eaglet, male and female take turns in feeding. The eaglet remains in the nest for about 5 months during which time it is entirely dependent on the adults for food.

Adult eagles feed on a variety of animals: flying lemurs, monkeys,

squirrels, palm civet, and even 30-pound deer. They also take snakes and birds like hornbills.

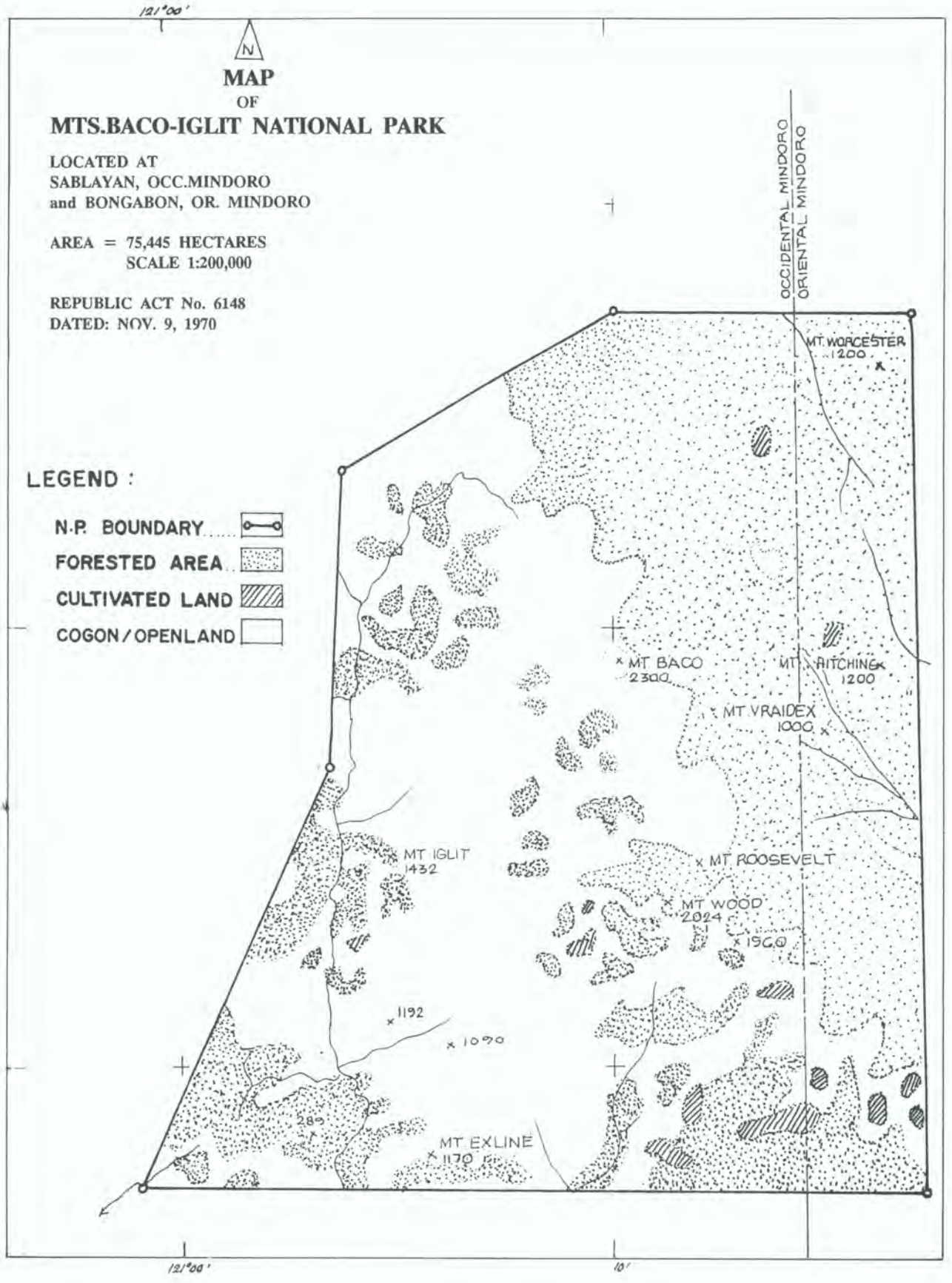
Robert Kennedy, who studied the Philippine eagle, recently reported happily that the total population of the species may well reach 500 birds and that the Philippine eagle can live in a very wide range of habitats from primary rainforests to remnants of forest amidst cultivated land. If this finding is confirmed, then the Philippine eagle has a future.

(b) Iglit-Baco National Park

The Iglit-Baco National Park lies almost in the middle of the southern half of the island of Mindoro and sits astride the two climatic zones on the island. The western half of the park lies in what is called the type 1 zone, i.e. zone with two pronounced seasons, wet and dry. The eastern half is in type 3 zone in which there is neither a pronounced rainy season nor a prolonged dry one.

Iglit-Baco Park is quite mountainous: it encompasses a closely spaced group of 10 low mountains. The centre of the park is dominated by Mt. Baco with a peak of some 2,300 metres in altitude. South-west of Baco is Mt. Iglit (1,432 m) while to the south-east lies Mt. Wood (2,024 m). East of Baco, there are the much lower Mt. Vraidex (1,000 m) and Mt. Hitching (1,200 m) and in the extreme north-east corner of the park is Mt. Worcester (1,200 m). The highlands lie somewhat north-northwest to south-southeast across the middle of the park which slopes north-easterly and south-westerly.

The eastern part of the park is drained by the Bongabon River and the south by the Bugsuanga and Lumintao Rivers.


121°00'
N
MAP
OF
MTS.BACO-IGLIT NATIONAL PARK
LOCATED AT
SABLAYAN, OCC.MINDORO
and BONGABON, OR. MINDORO
AREA = 75,445 HECTARES
SCALE 1:200,000
REPUBLIC ACT No. 6148
DATED: NOV. 9, 1970
OCCIDENTAL MINDORO
ORIENTAL MINDORO
MT. WORCESTER
1200
LEGEND :
N.P. BOUNDARY
FORESTED AREA
CULTIVATED LAND
COGON / OPENLAND
MT BACO
2300
MT. RITCHIE
1200
MT. VRAIDEX
1000
MT IGLIT
1432
MT ROOSEVELT
MT WOOD
2024
1192
1090
289
MT EXLINE
1170
121°00'
10'

The Philippine, or monkey-eating, eagle, one of the largest eagles of the world and most beautiful fliers. It stands a meter in height and may weigh 7 kilograms.

The island of Mindoro receives the full impact of the south-west rain-bearing winds which blow during the south-west monsoon. From May to October, especially in August, the western half of the park receives torrential rain; but in the other period, i.e. during the north-east monsoon when the prevailing winds shift to north-east, this western part becomes a rain shadow area. This is the prolonged dry period for the western half of the park. The eastern half, however, experiences only a brief dry spell.

This climatic pattern has consequences for the vegetation. Because of the monsoonal nature of the climate, the western part of the park has a large area of grassland. The eastern half on the other hand supports mainly forests. In recent decades, however, the grass communities have expanded very greatly in area because of human activities. The main grass species are Themeda traindra and Imperata cylindrica, and the latter is increasing rapidly following continual human disturbance.

The national park contains one of the most important habitats of the endemic tamarau (Anoa mindorensis): Mts. Iglit-Baco is one of the critical habitats, the others being Mt. Calavite in the northern tip of the island and Sablayan on the west coast.

A descendant from the carabao, cow and the deer, the tamarau has often been mistaken for the carabao from which it differs in size and horns. It is smaller than carabao and its horns grow straight up in a "V" shape and are not circular as in the carabao. It stands about 1.35 metres and its body length is about 2.3 metres.

With a life expectancy of about 20 years, the young calf remains

tame until 3 years when it begins to have a strong sense of smell. It is reported that the animal can smell a human a kilometre away. The sexes are easy to differentiate. The adult male has somewhat flattened horns, is generally brownish in colour and has a dark band on its back. The female is usually darker, has rounded horns and no band on her body. The female is reported to be the more ferocious. They roam in herds of eleven animals often with only one bull; but during the mating season from about April to July, monogamy is the rule. They resume herd life when the mating season is over.

Another interesting feature of the Mts. Iglit-Baco National park is that the park and its environs are the home of four Philippine minority tribal peoples. These are the Batangan, the Hinunuo, the Mangyan and the Bangon. There are about 100 families of Batangans and 500 families of Hinunuos. These tribal populations practise shifting cultivation of upland rice, and hunt animals in the mountains for food. They are therefore dependent on the Iglit-Baco ecosystem for their water supply and partly for animal protien.

During the dry season, Iglit-Baco is excellent for hiking. The area offers exotic scenery with its high mountains.

The national park is quite accessible. From Manila, there is a daily flight to San Jose, which is situated south of the park in the south-west corner of the Island. The flight takes 40 minutes. From San Jose, there is a 55-kilometre road to the park but the road journey can take anything from four to six hours. This brings the visitor to Barrio Poypoy. From Barrio Poypoy to the summit of Mt. Iglit is a four to five hour trek and a further one hour to the tamarau habitat. With perseverance, stealth and a

bit of luck, the visitor may be able to see the tamarau.

3.5 Thailand

Thailand is the most continental of the ASEAN countries. Except for the narrow southern peninsula, the greater part of the country lies properly in continental South-East Asia. It is between Kampuchea and Laos in the east and Burma in the west.

The geographical position of the country has two important impacts on the ecosystems. First, Thailand has a much greater proportion of monsoonal ecosystem types than the other ASEAN countries. Rainforests are largely confined to peninsular Thailand and a few central and south-eastern areas where rainfall is sufficiently high and the dry season not too severe. Second, the wildlife in Thailand has a distinctly continental aspect to it, more so than the other ASEAN nations.

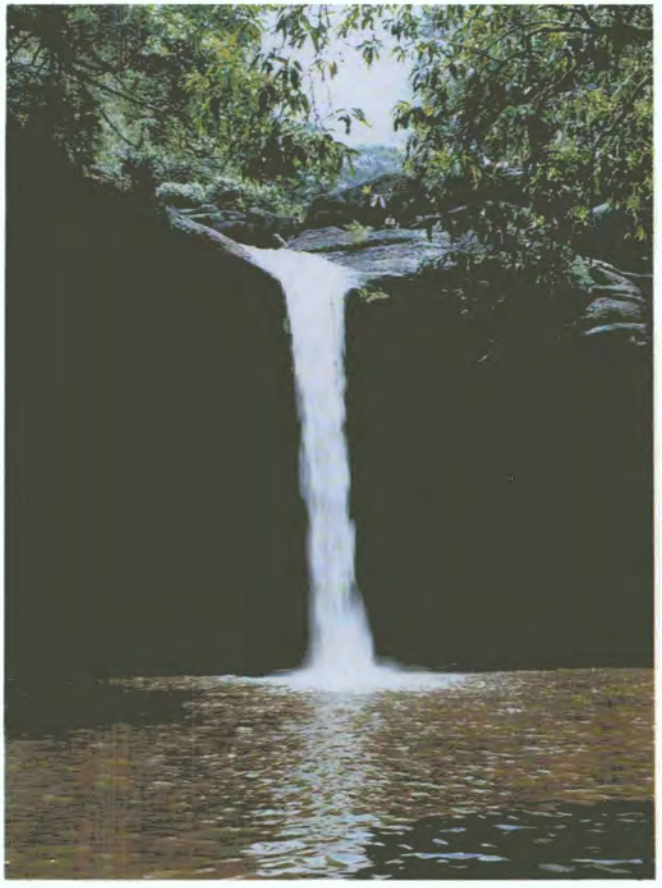
Thailand has a wide network of national parks, forest parks, wildlife sanctuaries and other forms of protected areas. The choices of Khao Yai National Park and Tarutao Marine National Park as Thailand's contribution to the ASEAN heritage sites are indeed very good ones as will be explained in the following account.

(a) Khao Yai National Park

Khao Yai is the only ASEAN heritage park situated in continental Asia. Being not far from the primate city of Bangkok, it is the most frequented of the heritage parks by tourists.

With an area of 2,168 square km, Khao Yai National Park (Khao Yai means big mountain') is perched on the south-west edge of the Khorat

*Great hornbill (*Buceros bicornis*) flying from its nest hole in Khao Yai National Park, Thailand. (A. Tsuji: Hornbill Project)*



Haew Suwat Waterfall in Khao Yai National Park, Thailand.

Plateau of Thailand and its terrain represents a significant change in topography from the central lowlands. The park is now entirely surrounded by fairly densely populated cultivated lowlands.

Khao Yai is highly accessible, being about 240 km north-east of Bangkok and reachable by car along first-class roads in about 3 hours. Visitors can reach the park headquarters from any ASEAN capital city within one day, with suitable prior arrangements.

The park is not situated in a high rainfall part of the country, but because most of it is elevated above the plain, annual rainfall is in the region 3,000-4,000 mm. Most rain falls in the months of June to October during the south-west monsoon. It receives very little rain during the north-east monsoon. Because of the mountainous nature of the terrain, the distribution of the rainfall is not even. Higher elevations tend to have higher precipitation than lower parts. Because the visitor facilities are located at an elevation of 700-740 metres, the park seems refreshingly cool in comparison with Bangkok.

Somewhat rectangular in shape, the park has an east to south-east tilt: the west and north-west half being most mountainous while the east and south-east are lower and undulating. The mountainous part has three highland areas. In the north lies Khao Laem, the second highest mountain whose sharp peak reaches 1,326 metres. About ten kilometres south-west of Khao Laem is Khao Rom whose ridge reaches 1,350 metres, which is connected to Khao Khieo, reaching 1,292 metres. Then about 15 km north-west of Khao Khieo is Khao Sam Yot with a peak of 1,200 metres. The northern and eastern parts of the park drop steeply to the Khorat Plateau. From its northern rim the park tilts southward and eastward before dropping abruptly

Haew Narok Waterfall, Khao Yai National Park, Thailand (Pilai Poonsawad).

The Khao Yai National Park in Thailand is the most visited national park in the ASEAN region. It is also a vital water catchment area for the water supply of densely populated low-lands around its perimeter. The Park is rich in mammals and birds and is an excellent teaching-cum-research ground for universities in Bangkok.

to the flood plains to the south.

There are four drainage systems in the park which are vital catchments for four rivers. The Takhong River drains the central area around headquarters north and east into the Mekong system. The eastern half of the park, the undulating part, is drained by the Sai Yai system which flows easterly and then southerly into the flood plains and ultimately to the Gulf of Thailand. These rivers feed the rice fields in Prachantakam District. The south-west part of Khao Yai drains through the Nakhon Nayok system which irrigates rice fields and orchards in Nakhon Nayok Province on the south side. The fourth drainage area is in the far west: this drains westward through Saraburi Province and then southward towards the Gulf. This system is also vital to the rice fields and orchards in Saraburi.

The Park has a varied geology. Limestones are present and are along the Dong Rek range. Sandstones occur in the south and in the north with shales, schist, etc. The southern steep slopes are of granite and conglomerate. Limestone appears again in the Kabinburi area.

Dr. Tem Smitinand identified five vegetation types in the park:

Dry mixed deciduous forest. This occurs largely in the north-west corner of the Park in the 400-600 metre range. The principal tree species include Afzelia xylocarpa, Pterocarpus macrocarpus, Lagerstroemia calyculata, Pterocymbium javanicum, Gmelina arborea, Adina cordifolia, Vitex pinnata and Anogeissus acuminata. The ground flora is composed largely of grass species especially Bambusa arundinacea.

Dry evergreen forest. This forest type occurs in the eastern

borders and largely confined to elevations between 100 and 200 metres. The upper storey trees have a high dipterocarp content: Dipterocarpus alatus, Vatica cinerea, Shorea sericeiflora, Hopea odorata and Hopea ferrea. The non-dipterocarp trees include species of Lagerstroemia, Tetrameles, Lophopetalum, Afzelia, Parkia and others. The palms Areca traindra and Corypha lecomtei are quite frequent. The ground flora is largely Marantaceae and Zingiberaceae.

Moist rainforest. This is the dominant vegetation type in the park, and occurs from the 400 to the 1,000-metre contours. At the lower elevations, dipterocarps are more numerous than in the dry evergreen forests. The dominant species include Dipterocarpus dyeri, D. baudii, D. gracilis and Anisoptera costata. There are very few deciduous species. The ground flora does not differ much from that of the dry evergreen forest except perhaps in being denser. In this last attribute, the park's moist evergreen forest differs quite markedly from those in other parts of South-East Asia.

In higher altitudes, the species D. baudii, D. dyeri and Anisoptera costata are replaced by D. costatus and D. macrocarpus. In addition, there are a number of fagaceous species such as Lithocarpus annamensis, L. eucalyptifolius, L. rodgerianus, Quercus fleuryi, Q. myrsinaefolia and Castanopsis acuminatissima which tend to become conspicuous in the lower storey. In the shrubby stratum, the main genera include Embelia, Maesa, Viburnum, Mussaenda, Canthium and others. In wetter areas at these higher altitudes, tree ferns become quite common. Epiphytic life is largely dominated by ferns and orchids, and in damp shaded areas filmy ferns are common.

Hill evergreen forest. This forest type appears above 1,000 metres, and in many areas, the change from lowland to hill evergreen is quite abrupt. Dipterocarp species disappear at this elevation and are replaced by gymnosperms: Podocarpus neriifolius, P. imbricatus and P. fleuryi and Dacrydium elatum. The oaks that appear in the higher levels of the moist rainforest continue to grow in this forest type. This forest type is quite dense with a rich ground flora. Epiphytes become quite abundant and they include many species of mosses and liverworts.

The fifth vegetation type is largely man-made and includes grassland and secondary thickets. Species of grasses include Imperata cylindrica, Themeda arundinacea, and species of Saccharum and Thysanolaena.

In a brief analysis of the highland species of plants occurring in Khao Yai, out of a group of 125 species, Smitinand found that 16 were endemics, 17 of Himalayan origin, 14 from Annam highlands and only 12 had affinities with species in Malaysia. The mountains of Khao Yai are a small meeting place of elements from South Asia and South-East Asia.

Before leaving the botany of Khao Yai, it is worth mentioning the plant species Aquilaria crassna which produces an aromatic wood called gharuwood, or mai hom in Thai. The aromatic wood comes from the core of the trunk; and aroma is produced after the wood gets darkened by fungus attack following an attack by insects. Mai hom is used for incense, and the best quality pieces can fetch a price of about US$ 250 per kilogramme. Poaching in Khao Yai and other areas is driving this plant near to extinction. This is an excellent example of a valuable genetic resource which should be developed through an intensive silvicultural programme.

Khao Yai has a rich wildlife. Among the larger mammals, the most

important are the tiger, leopard, elephant, gaur (or seladang), black bear, wild dog (Cuon alpinus), barking deer, sambar deer, mouse deer and four civets. The most spectacular are of course the elephant, tiger and gaur, an enormous wild cattle. These animals do appear at the salt licks and many visitors have seen elephants on their first visit to the park. The gaur are very shy and generally stay in more remote sections of the park. Tigers are common around headquarters where they can prey on deer which graze in the grasslands, but their tracks are much more commonly seen than they are. Sambar and barking deer come out of the forest into the fields to graze on new shoots before dusk, when they are most easily seen.

In addition to the pig-tailed macaque (Macaca nemestrina), there are two species of gibbons in the park; and this is the only place where the two species are found to co-exist. These are the white-handed gibbon (Hylobates lar) and the pileated gibbon (Hylobates pileatus). They are easily separated by their songs which carry through the forest every morning. The gibbon habitat in Khao Yai is excellent and as the gibbons occur in good numbers, they have been the subject of a long term research programme by biologists at Mahidol University in Bangkok and others.

Close to 300 species of birds have been recorded from Khao Yai. These include a very great diversity including 6 species of hawk-eagle, 5 pigeons, 7 cuckoos, and a list of owls, pheasants and allies, broadbills, flycatchers, babblers, barbets, woodpeckers, and more. The most spectacular for many visitors are the four species of hornbills which are all common in the park. These are the great, wreathed, brown and Indian pied hornbills. The wreathed is especially evident just after the breeding season from July to October; large flocks of adults and juveniles can be

observed. The hornbills have been the subject of study by Ms. Pilai Poonsawad of Mahidol University.

While it is certainly a happy situation that the park should have such a good concentration of wildlife, it is most probable that these species represent a group of wildlife marooned in this last major outpost of rainforest in south-central Thailand. Khao Yai National Park has since the late 1970's become surrounded by densely-populated agricultural areas, and the wildlife therein is now isolated from the rest of the country.

In addition to wildlife, Khao Yai has a number of beautiful waterfalls such as the Nang-Rong Waterfall near Nakhon Nayok Province, the Salika Waterfall and the Haew Suwat Falls which attract thousands of visotors on weekends. The closest one is the Kong Keaw Waterfall not far from the park headquarters. Many other beautiful falls occur along the many clear bubbling forest streams tucked away in remote areas of the park never seen by tourists. To reach them one has to trek through the forest on elephant trails. This can only be done with official permission and with local guides. There is also a beautiful shrine at the entrance to the park and a number of view points over the lowland plains.

The Parks Division has built a number of wildlife watch-towers and 23 kilometres of nature trails following streams and often leading to waterfalls. These follow well-worn elephant trails. The Tourist Authority of Thailand has a concession area in which it has established bungalows, motels and a restaurant for the public. With well over 200,000 visitors per year, Khao Yai National Park is today the most accessible and visited of the heritage parks.

Conservation of Khao Yai's wilderness serve three purposes. First,

the area is the vital catchment for four streams that serve the surrounding country with fresh water for drinking and irrigation. Second, it harbours an outstanding community of plants and animals. Thirdly, the park has tremendous recreational and educational value.

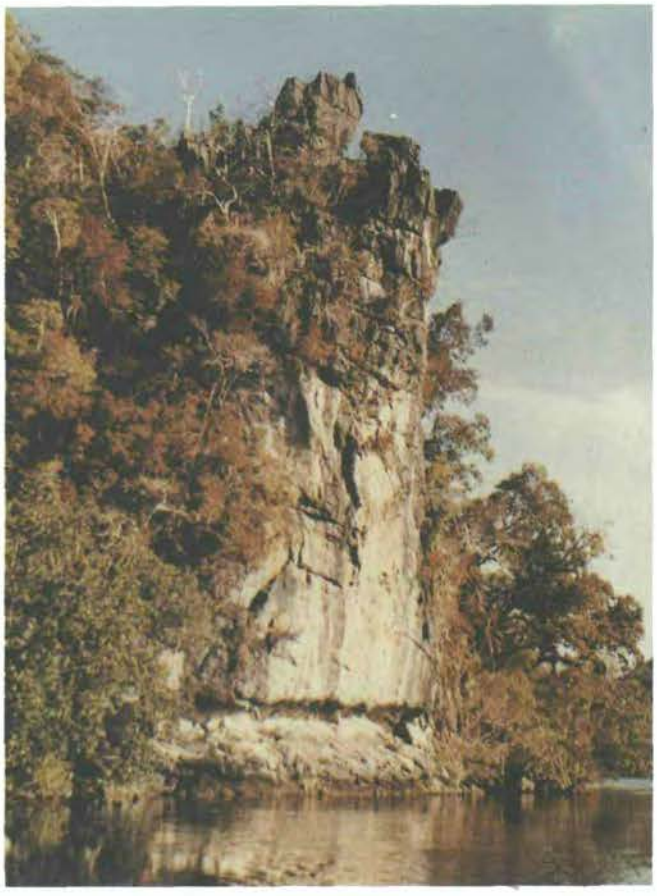
Poaching of wood and animals has been a perennial problem in Khao Yai, and several projects have been initiated to improve economic development and education of poor villagers near the boundaries of the park to help reduce this problem.

(b) Tarutao National Park

Tarutao National Park is the only heritage park with a major marine component. Consisting of some 51 islands, encompassing a land-cum-sea area of about 150,000 ha, the park lies just 26 km off the south-west corner of peninsular Thailand in the Andaman Sea.

The largest island in the group is Ko Tarutao (Ko = island) which is about 27 km long, 12 km wide and 15,000 ha in extent. Headquarters is located on this island. Only two other islands have areas exceeding 10 square km, and these are Adang (3,000 ha) and Rawi (3,100 ha). The Adang group of islands which comprises Adang, Rawi, Dong and Lipe lie about 50 km west of Tarutao.

This marine national park is fairly accessible. The mainland port of departure for Ko Tarutao is Pak Bara. The ride to Ko Tarutao takes about 1½ hours in the fishing boats that serve as ferries but only 30 minutes by speed boat. Haad Yai, the nearest major city is connected by air with Bangkok and Penang and Kuala Lumpur.



Ko Tarutao, the largest island in Tarutao Marine National Park in Thailand, has within its small space of 150 square km a wide range of ecosystems from coral reefs, sandy beaches, mangroves, semi-evergreen forest to forest on limestone. It has proven to be an excellent training ground for students of earth and biological sciences and those interested in terrestrial-marine interphase. (Boonruang)

Ko Tarutao has good stretches of coral reefs, but dynamite fishing and collecting for the aquarium trade in the park are serious problems. (Picha Pitayakajornwute)

At the park headquarters, there are accommodations and other facilities to house up to 300 visitors at any one time. There are meeting and lecture halls, picnic grounds, restaurants, and campsites. Adang Island also has accommodations and food for visitors and is the best place for snorkelling and observing coral reefs. Boats travel there nearly every day from Ko Tarutao, but the journey requires an additional 2 hours.

The park receives the full impact of the south-west monsoon. Rainfall in the period May through October is heavy, averaging 300 mm per month. In the other six months, during the north-east monsoon, Tarutao becomes a rain shadow area and receives very little or no rain at all.

The park has been surveyed by scientists from Mahidol University and botanists from several institutions and the following information is largely based on their reports.

The Tarutao islands are surprisingly rugged and hilly. The main island of Tarutao is the highest with a peak of 708 metres; most of the area on the island lies between 200 and 400 metres. The Adang group of islands is also steep and rugged: the highest point on Adang is about 702 metres and Rawi 463 metres. These two smaller islands have much less flat land than Ko Tarutao.

Ko Tarutao is made up of two main rock types: sandstones and limestones. A good 65 percent of the island is sandstone while the remaining 35 percent, largely confined to the northern and eastern parts, is limestone. In between the hills and ridges, the valleys are filled with quarternary alluvium. The Adang group of islands is largely granite - no limestone or sandstones occur there.

Catimbium latilabre *in Ko Tarutao Marine National Park, Thailand.*

Gordon Congdon (Nat. Hist. Bull. Siam Soc. vol. 30, 1982, p. 135-198) surveyed the plants of the park from 1979 to 1981 and identified ten vegetation types.

Mangrove forest. Characterized by the ubiquitous Rhizophora, Bruguiera, Ceriops and Sonneratia, the mangroves cover a good 4.5 percent of Ko Tarutao. Adang and Rawi have very small patches of this forest type.

Freshwater swamps. In Tarutao, some swamps occur along flat river banks that are seasonally flooded. The spiny palm Salacca conferta is common. On Rawi, some freshwater swamp occurs behind the beach.

Freshwater marshes. These develop in areas that are kept wet by small springs, and result after the forest has been cleared. Common herbaceous plants include species of Fuirena, Lepironia, Lipocarpha, Eriocaulon, Xyris and others.

Pes-caprae vegetation. Ipomoea pes-caprae and other sand creeping species take over sandy areas above the high tide mark along the beach. Species include Canavalia maritima, Cassythea filiformis, species of Cyperus and others.

Further inland from the pes-caprae vegetation along the beach, the barringtonia vegetation appears. This is a very open sort of woodland and the main tree species include Barringtonia asiatica, Calophyllum inophyllum, Terminalia catappa, Casuarina equisetifolia, Cocos nucifera, Heritiera litoralis, Hernandia nymphaefolia, Hibiscus tiliaceous and others. This vegetation type is common on the west coast of Tarutao and north of Rawi.

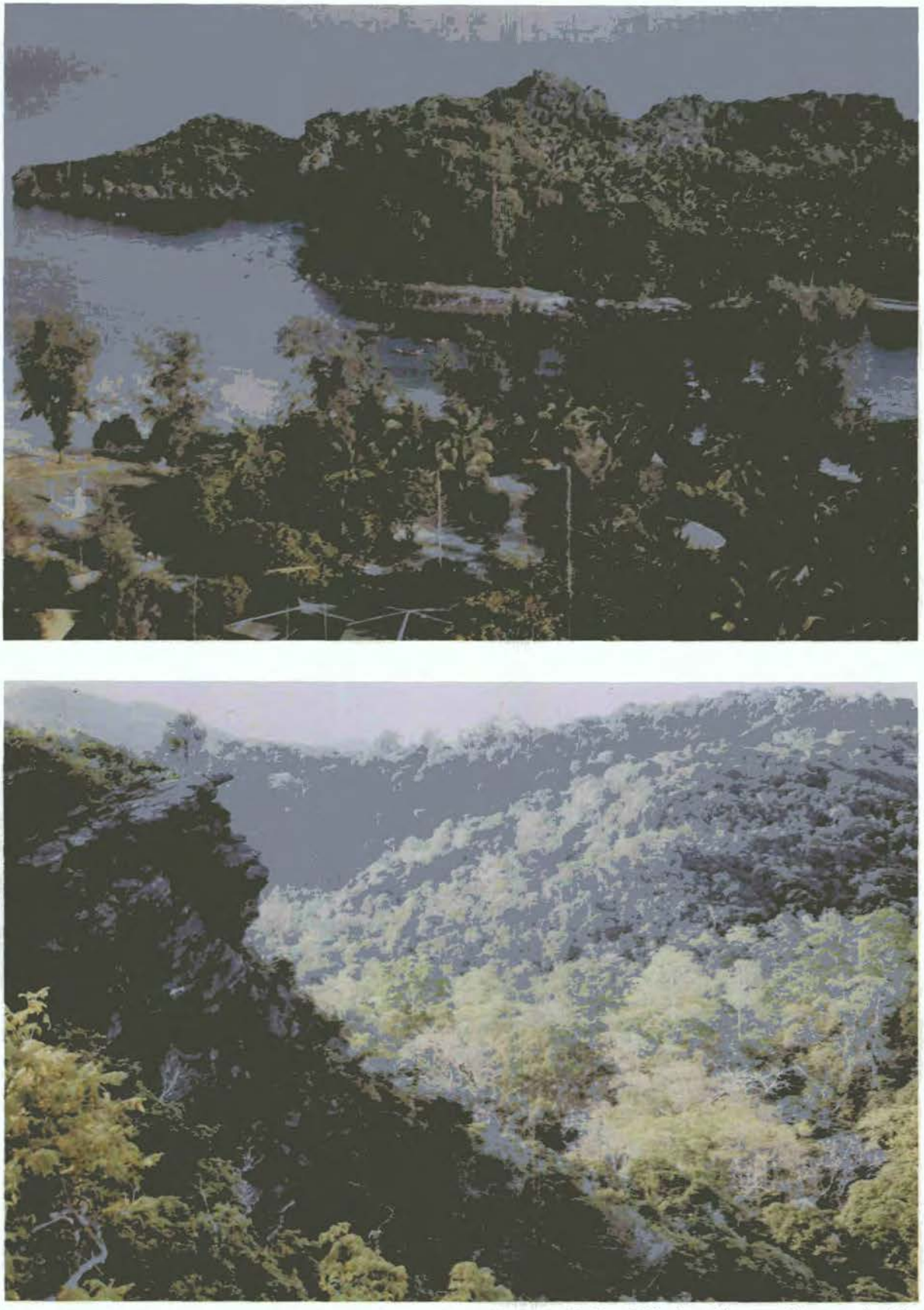
The tropical heath forest is found in the park. It occurs on old raised beaches which are infertile with poor water-holding capacity. Common trees include species of Anacardium, Melaleuca, Vitex, Myrsine, etc.

There are fairly extensive areas of limestone forest in the park, especially in the north and eastern parts of Ko Tarutao. These forests vary greatly in stature, structure and also species association depending on terrain. On exposed limstone rock, the vegetation is low, sparse and thorny. This type is common on the north of Tarutao.

The limestone forest becomes taller where moisture and soil are more available. Common trees are species of Hopea, Sapium and Terminalia. These areas are also rich in herbs of the Gesneriaceae, Zingiberaceae and orchids. As elsewhere in South-East Asia, the limestone vegetation has a high percentage of species endemism.

On the south sides of Adang and Rawi are rocky hillsides covered with a sort of open grassy woodland. Called scrub forest, Congdon reports the following trees as infrequent elements: Dillenia obovata, Rhodamnia cinerea, Myrsine porteriana, and Erythroxylum cuneatum. Main shrubs include species of Bridelia, Desmodium, Tephrosia, etc.; and main herbs include species of Arundinella, Cymbopogon, Dianella, Ichaemum and others. This is actually likely to be an arrested form of secondary vegetation.

Semi-evergreen rainforest. About 60 percent of the island of Tarutao is covered with this vegetation type. Generally, it is high forest dominated by families Dipterocarpaceae, Anarcardiaceae, Meliaceae and Leguminosae. Three-layered, this forest type is the richest in the park in both plant and animal species.



Two views from the viewpoint behind headquarters at Tarutao National Park. Above: view overlooking administration buildings and the inlet. Below: view of the deciduous forest growing on limestone.

The tenth vegetation type is secondary forest. A good 10 percent of Ko Tarutao is covered with this vegetation which has a high content of Imperata cylindrica and Neyraudia reynaudiana. Secondary bush trees include Macaranga, Trema, Dillenia, Vitex and other light-loving plants.

In comparing the species list of Ko Tarutao with the Adang islands, Congdon finds that only 21 percent of the 833 species of plants are common between the two island groups; 69 percent of Tarutao's species do not occur in the Adangs and 58 percent of the Adangs' do not appear in Tarutao. This certainly reflects differences in geology between the two island groups.

As is typical of islands, the number of terrestrial animal species is not large. The main mammals include the wild pig, mouse deer, crab-eating macaque, slow loris, dusky langur, tree shrew, 3 species of squirrels, 12 species of bats and a number of rodents. Partly because of the absence of large carnivores, mouse deer are especially common.

The bird list for the park, numbering nearly 100, is typical of islands with relatively few primary forest species but a large percentage of birds preferring disturbed and aquatic habitats. The list includes 4 herons and bitterns, 8 birds of prey, 7 pigeons and doves, 6 kingfishers, 3 hornbills, 5 thrushes, 4 sunbirds and 3 flowerpeckers. Two island specialists are the Nicobar and pied imperial pigeons.

The casual visitor should not fail to notice Brahminy kites circling about the cliffs along the shore and a pair of magnificant white-bellied sea eagles which perch on dead brances above the cliff just north of headquarters and fish along the nearby shores. The eagles are easily spotted from the main swimming beach with the aid of binoculars.

The park has one of the best coral reef areas in the Andaman Sea. Though many areas have been disturbed by dynamite fishing, ample areas of pristine corals still exist. Reasonally priced day tours to Adang Island and its coral reefs are available for snorkellers. The seas within the park boundaries have always been rich fishing grounds; and since protection started recently, the area has become very rich in fish life. Three species of dolphins are commonly seen in the park waters; these are the Malay dolphin, common dolphin and eastern bottle-nosed dolphin.

A very interesting aspect of the marine life is the occurrence of four species of marine turtles in the park. These are the Pacific ridley, green turtle, hawksbill turtle and the leatherback. These nest on several of the islands' beaches from September to April.

The park has a number of nature trails. The nearest to the park headquarters is the Toe-Boo Chief Trail, which is short and ends at a nice look-out atop a cliff which affords a panoramic view of the surrounding island. There is a 4-hour trail that leads to the old prison site at Talo Wao which has now been converted into temporary accommodation for visitors.

The main scenic attractions of the park are the beautiful stretches of beach and the impressive rocky cliffs along much of the shoreline which often overhang caves. Visitors can hire boats to explore the shoreline and observe the coral reefs with their spectacular fishes, sea urchins, crinoids, sea fans, polychaete worms, and countless other denizens.

Tarutao National Park thus has a number of conservation values. The land and seas in the park are still largely pristine and wilderness value is indeed very high. There are many places with high recreational

value such as the coral reefs, sandy beaches, limestone hills and caves and estuarine swamps. The popularity of the park is attested by the fact that 15,000 to 20,000 persons now visit it per annum. Lastly, the park is an excellent teaching and research area. Vegetation ecologists will find plenty to study on the relationship between the forest types and their underlying rock while marine ecologists have equally good opportunities to study not only the structure and function of coral reefs but also their successional ecology after disturbance by man.

CHAPTER 4: PROTECTED AREA MANAGEMENT SYSTEMS

The promotion of systems of parks and reserves at the national level is a major objective of the ASEAN Agreement on the Conservation of Nature and Natural Resources. Most ASEAN nations, however, had already initiated systems of protected areas before the Agreement and made considerable progress in designing conservation policies that would integrate with and complement their economic development programs. What ASEAN hopes to do, through its expert groups on environment and nature conservation, is to help exchange information about conservation management efforts and associated problems in order to bring the efforts in all countries up to the state of the art, and to share the benefits of conservation among all ASEAN nations. In the process, it will also instill a sense of pride and shared stewardship among all member nations concerning their outstanding natural heritage.

In this chapter we will very briefly outline the protected area management systems developed in the different ASEAN countries. This will not only inform and encourage conservation planners in each country, but will hopefully help to inform the citizens of ASEAN at large concerning the achievements of their countries, so that they will visit and use these conservation areas.

Topics summarized are policies, major legislation, management authority and, in Appendix 4, lists of major protected areas.

Most countries have followed more-or-less closely the international categories of protected areas as defined by The International Union for the Conservation of Nature and Natural Resources, (IUCN), which are defined in Appendix B of Planning for ASEAN Heritage Parks and Reserves

prepared by The United States Park Service. Most ASEAN Reserves are in three of the categories defined by IUCN, which are given below along with their aims.

Category I: Scientific Reserve/Strict Nature Reserve. To protect nature (communities and species) and maintain natural processes in an undisturbed state in order to have ecologically representative examples of the natural environment available for scientific study, environmental monitoring, education, and for maintenance of genetic resources in a dynamic and evolutionary state.

Category II: National Park. To protect natural and scenic areas of national or international significance for scientific, educational, and recreational use.

Category IV: Nature Conservation Reserve/Managed Nature Reserve/Wildlife Sanctuary. To assure the natural conditions necessary to protect nationally significant species, groups of species, biotic communities, or physical features of the environment where these require specific human manipulation for their perpetuation.

4.1 Brunei Darussalam

Policy

The country's protected area system dates from 1933 when the Forestry Department was established with the purpose of conserving the country's national resources in the long term. The government's current proposals are to zone the forest resources into: (i) protection forests on

important watersheds, (ii) conservation forests, (iii) recreation forests, (iv) production forest and (v) remaining forest available for agriculture.

Laws and Management

The Wildlife Protection Act of 1978 allows for the establishment, by decree, of wildlife sanctuaries besides protecting a number of wildlife species including the proboscis monkey, clouded leopard, dugong, hornbills, sea turtles and others. This act lies under the responsibility of the Brunei Museums.

Brunei Darussalam has set up three types of totally protected areas, namely national parks, wildlife sanctuaries and nature reserves. A recent act also establishes a Parks and Conservation Department to administer these areas. Twelve protected areas have been so far established (Appendix 4A).

The Brunei Museum and the Tutong District Office have played important roles in the planning and development of the first national park, Tasek Merimbun.

4.2 Indonesia

Policy

The government's policy for conservation is based on the desire to promote the cultural and economic development of the Indonesian people in harmony with their natural environment. All forms of natural life and examples of all ecosystems within Indonesia must be preserved for the benefit of future generations. In particular, the air, water, soil, plants, fish and other animals upon which people depend must be protected.

In order to conserve representative samples of all major ecosystems in the country, the Indonesian government has recently launched a major effort to establish and manage a system of national parks and reserves which will reach a target of an area of about 10 percent of terrestrial areas of the country. Furthermore, there are plans to designate 10 million hectares of marine protected areas within the Fourth Five Year Development Plan (1984-1989).

It is being proposed in Indonesia that the new parks be considered a part of an overall development package, which will include such things as better education and other welfare facilities, improved irrigation systems, new and improved communication systems, and more agricultural extension advice. Since the parks are considered to be for the national interest, the government will, it is planned, channel special funds into the areas surrounding national parks, with support being specifically allocated to compensate the local people for the deprivation of some of their traditional rights to exploit the forest which are now contained in the national parks. The local people should be made aware that this development boost is part of the national park development, that it is a direct benefit of the nearly natural area being zoned by the central government for non-consumption uses. Obviously, national parks must be clearly seen to be in the regional interest so that their establishment will constitute a net benefit, rather than an added hardship, to the rural people living around them.

Laws and Management

The history of protected areas in Indonesia began in colonial times when the first reserve, the Cibodas Nature Reserve, was decreed by the

Dutch colonial government in 1889.

Wildlife protection acts date from 1931. The Act of 1967 established basic provisions for forestry, and the Act of 1982 the basic provisions for the management of the living environment. Responsibility for managing protected areas, both terrestrial and marine, comes under the Directorate General of Forest Protection and Nature Conservation, Ministry of Forestry, which is headquartered in Bogor. It handles its affairs through a network of regional offices.

The first five national parks in Indonesia were declared in 1980, and another 11 were inaugurated in 1982. Indonesia is establishing six different categories of protected areas: national park (Taman National), nature reserve (Cagar Alam), game reserve (Suaka Margasatwa), recreation park (Taman Wisata), hunting reserve (Taman Buru), and protected forest (Hutan Lindung).

4.3 Malaysia

Policy

A network of reserves and national parks exists in Malaysia (see Appendix 4C), but these were not the result of overall planning for national development, and unfortunately in most cases there is no secure land tenure. There is a growing concern among conservationists that the Government better safeguard conservation areas and include national park management in the overall national development plan. It is already recognized that parks contribute to national development through promotion of tourism.

The Taman Negara is still the only and premier national park of peninsular Malaysia. The main concept underlying the initial establishment of Taman Negara was a desire to protect wildlife populations from being indiscriminately hunted and killed. The purpose of the park is to preserve and maintain a functioning ecosystem of ecological communities and their environs. Human usage and other benefits to the people, however, are emphasized in its management, including the attraction of both local and foreign tourists. The parks being established in Sarawak and Sabah have similar aims, but these are under the jurisdiction of these states.

Laws and Management

Law relating to Taman Negara was established in 1939 which covered the three States of Pahang, Terengganu and Kelantan. The Wildlife Protection Act 76 of 1972 and related amendments further directly and indirectly provided protection of the park's resources and wildlife.

In peninsular Malaysia, national parks are administered by the Department of National Parks and Wildlife whose director-general reports to the Minister of Science, Technology and Environment. The Department is independent of the Department of Forestry.

In Sarawak, however, the national parks are the responsibility of the Director of Forestry. Sabah has yet another system: the state government appoints a board of trustees to administer the protected area.

4.4 Philippines

Policy

The history of nature conservation in the Philippines goes back at

least to 1932, when the first national park legislation was passed. Policy concerning nature conservation is implicit in the numerous acts since then which have created at 69 national parks scattered throughout the archipelago totalling 492,964 ha.

The Presidential Decree No. 1559 of 1978 states that the purpose of a national park is to "... preserve the scenery, the natural and historic objects and the wild animals or plants therein, and to provide enjoyment of these features in such a manner as will leave them unimpared for future generations." This policy statement thus stresses protected areas as serving the needs of protection and conservation, as apposed to exploitation, for enjoyment of the scenery and other features by the people.

Laws and Management

Major recent acts establishing national parks policy were enacted in 1974, 1975 and 1978. The last Presidential Decree 1559, proposed four types of protected areas: (1) national parks, (2) marine parks, (3) national seashore parks, and (4) game refuges and bird sanctuaries.

In 1972, the administration of national parks became the responsibility of the Bureau of Forest Management, which contained the Parks and Wildlife Division. At present, there are 68 national parks, of which 59 are now under the jurisdiction of the Bureau of Protected Areas and Wildlife of the Department of Environment and Nature Resources, and 9 are under the administration of other agencies outside Department.

4.5 Thailand

Policy

Until the 1950s the forestry policy of Thailand had been mainly geared toward regulation of commercial exploitation. The modern concept of establishment of protected areas came into being when the Prime Minister Sarit Dhanarajata, as head of the Revolutionary Government, directed the Ministries of Agriculture and Interior to establish national parks and other protected areas and to draft enabling legislation for the areas.

In 1959 the cabinet established the National Parks Committee and the Wild Animals Reservation and Protection Committee to recommend areas for inclusion in a new protected area system, to prepare legislation, and to advise the government on matters relating to protected areas. The government was assisted by a representative of the United States Park Service, Dr. George Ruhle, in designing the protected area system. The first national park, Khao Yai, was decreed in 1962 and the first wildlife sanctuary in 1965. Since then, the protected area system has expanded to approximately 10 percent of the area of the kingdom.

Because of the rapid destruction of reserved forests managed by the Royal Forest Department, and the need to protect important ecosystems and watersheds, the government approved a policy document by the Forest Department in 1985 which stipulates that 40 percent of the area of Thailand should be maintained as production forest (much of it to be managed as tree plantations planted by the private sector) and 15 percent should be maintained as protection forest. The latter would comprise national parks, wildlife sanctuaries and other conservation units and watershed management units. The Forest Department is presently completing a comprehensive

forest zoning plan based largely on watershed value.

The functions of national parks and wildlife areas are stated in the enabling legislation (given below). Area preserved as national park is "land, the natural features of which are of interest, to be maintained with a view to preserving it for the benefit of public education and pleasure" (in translation from Thai).

A wildlife sanctuary is decreed for the purpose of preserving wild animals.

It is generally agreed, however, that the park and wildlife reservation acts, passed in the early 1960s, do not adequately define the full values and functions of these protected areas. A major rationale for increasing the areas to a substantial percentage of the kingdom has been to save forests, especially important watersheds, from encroachment and destruction.

Laws and Management

Thailand's protected area system rests on two laws: the Wild Animals Reservation and Protection Act (WARPA) of 1960, and the National Parks Act (NPA) of 1961. WARPA provides for the creation of wildlife sanctuaries and non-hunting areas. The latter differing in prohibiting only hunting and taking of animals, but not all other human activities. Wildlife Sanctuaries include some of the largest protected area units in Thailand, whereas non-hunting areas are usually small and protect particular species, or small wetlands. Both sanctuaries and non-hunting areas are managed by the Wildlife Conservation Division of the Royal Forest Department.

The other act, NPA, specifies the creation of national parks of which there are now 58 plus several more pending approval. "Forest parks" are also created under this act, which are smaller forested areas usually managed for recreation and enjoyment. The National Park Division of the Forest Department manages areas under the NPA. Some forest parks are managed by regional forestry authorities rather than the central department.

National Parks and Wildlife Sanctuaries of Thailand are listed in Appendix 4E.

APPENDIX 1

ASEAN Agreement on the Conservation of Nature and Natural Resources

The Government of Brunei Darussalam,

The Government of the Republic of Indonesia,

The Government of Malaysia,

The Government of the Republic of the Philippines,

The Government of the Kingdom of Thailand,

Member States of the Association of South East Asian Nations (ASEAN)

Recognizing the importance of natural resources for present and future generations;

Conscious of their ever-growing value from a scientific, cultural, social and economic point of view;

Conscious also that the interrelationship between conservation and socio-economic development implies both that conservation is necessary to ensure sustainability of development, and that socio-economic development is necessary for the achievement of conservation on a lasting basis;

Recognizing the interdependence of living resources, between them and with other natural resources, within ecosystems of which they are part;

Wishing to undertake individual and joint action for the conservation and management of their living resources and the other natural elements on which they depend;

Recognizing that international co-operation is essential to attain many of these goals;

Convinced that an essential means to achieve such concerted action is the conclusion and implementation of an Agreement;

Have agreed as follows;

Chapter 1

Conservation and Development

Article 1

Fundamental Principle

1) The Contracting Parties, within the framework of their respective national laws, undertake to adopt singly, or where necessary and appropriate through concerted action, the measures necessary to maintain essential ecological processes and life-support systems, to preserve genetic diversity, and to ensure the sustainable utilization of harvested natural resources under their jurisdiction in accordance with scientific principles and with a view to attaining the goal of sustainable development.

2) To this end they shall develop national conservation strategies, and shall co-ordinate such strategies within the framework of a conservation strategy for the Region.

Article 2

Development Planning

1) The Contracting Parties shall take all necessary measures, within the framework of their respective national laws, to ensure that conservation and managment of natural resources are treated as an integral part of development planning at all stages and at all levels.

2) To that effect they shall, in the formulation of all development plans, give as full consideration to ecological factors as to economic and social ones.

3) The Contracting Parties shall, where necessary, take appropriate action with a view to conserving and managing natural resources of significant importance for two or several Contracting Parties.

Chapter II

Conservation of Species and Ecosystems

Article 3

Species - Genetic Diversity

1) The Contracting Parties shall, wherever possible, maintain maximum genetic diversity by taking action aimed at ensuring the survival and promoting the conseration of all species under their jurisdiction and control.

2) To that end, they shall adopt appropriate measures to conserve animal and plant species whether terrestrial, marine and freshwater, and more specifically

   a) conserve natural, terrestrial, freshwater and coastal or marine habitats;

   b) ensure sustainable use of harvested species;

   c) protect endangered species;

   d) conserve endemic species; and

   e) take all measures in their power to prevent the extinction of any species or sub-species.

3) In order to fulfil the aims of the preceding paragraphs of this Article the Contracting Parties shall, in particular endeavour to

   a) create and maintain protected areas;

   b) regulate the taking of species and prohibit unselective taking methods;

   c) regulate and, where necessary, prohibit the introduction of exotic species;

   d) promote and establish gene banks and other documented collections of animal and plant genetic resources.

Article 4

Species - Sustainable Use

The Contracting Parties shall pay special attention to harvested species, and, to that effect, shall endeavour to

1) develop, adopt and implement management plans for those species, based on scientific studies and aiming at

   a) preventing decrease in the size of any harvested population to levels below those which ensure its stable recruitment and the stable recruitment of those species which are dependent upon, or related to them;

   b) maintaining the ecological relationship between harvested, dependent and related populations of living resources of the ecosystem considered;

   c) restoring depleted populations to at least the levels referred to in sub-paragraph (a) of this paragraph;

   d) preventing changes or minimizing risk of changes in the ecosystem considered which are not reversible over a reasonable period of time.

2) Take the appropriate and necessary legislative and administrative measures on harvesting activities in the light of their national interests whereby

   a) such activities must conform to the management plans referred to above;

   b) the conduct of such activities is controlled by a permit system;

   c) all indiscriminate means of taking and the use of all means capable of causing local extinction of, or serious disturbance to, populations of a species of related species are prohibited;

   d) such activities are prohibited or strictly regulated at certain periods, seasons or places of importance in the life cycle of the species;

   e) such activities may be regulated more strictly, temporarily or locally in order to assist restoration of population levels or counterbalance any threat caused by special circumstances;

   f) special measures, such as restocking, are provided for whenever the conservation status of a species so warrants;

g) trade and possession of specimens or products of specimens are regulated whenever such regulations meaningfully contribute to the implementation of the harvesting regulations.

Article 5

Species - Endangered and Endemic

1) Appendix I to this Agreement shall list endangered species recognized by the Contracting Parties as of prime importance to the Region and deserving special attention. The Appendix shall be adopted by a meeting of the Contracting Parties.

   Accordingly, Contracting Parties shall, wherever possible,

   a) prohibit the taking of these species, except for exceptional circumstances by special allowance from the designated authorities of the Contracting Parties;

   b) regulate the trade in and possession of specimens and products of those species accordingly;

   c) especially protect habitat of those species by ensuring that sufficient portions are included in protected areas;

   d) take all other necessary measures to improve their conservation status, and restore their populations to the highest possible level.

2) Each Contracting Party shall, wherever possible, apply the above measures to species endangered at national level.

3) The Contracting Parties recognize their special responsibility in respect of species that are endemic to areas under their jurisdiction and shall undertake accordingly to take, wherever possible, all the necessary measures to maintain the populations of such species at the highest possible level.

Article 6

Vegetation Cover and Forest Resources

1) The Contracting Parties shall, in view of the role of vegetation and forest cover in the functioning of natural ecosystems, take all necessary measures to ensure the conservation of the vegetation cover and in particular of the forest cover on lands under their jurisdiction.

2) They shall, in particular, endeavour to

a) - control clearance of vegetation;

- endeavour to prevent bush and forest fires;

- prevent overgrazing by, inter alia, limiting grazing activities to periods and intensities that will not prevent regeneration of the vegetation;

b) regulate mining and mineral exploration operations with a view to minimizing disturbance of vegetation and to requiring the rehabilitation of vegetation after such operations;

c) set aside areas as forest reserves, inter alia with a view to conserve the natural forest genetic resources;

d) in reforestation and afforestation planning avoid as far as possible monoculture causing ecological imbalance;

e) designate areas whose primary function shall be the maintenance of soil quality in the catchment considered and the regulation of the quantity and quality of the water delivered from it;

f) ensure to the maximum extent possible the conservation of their natural forests, particularly mangroves with a view, inter alia, to maintaining maximum forest species diversity;

g) develop their forestry management plans on the basis of ecological principles with a view to maintaining potential for optimum sustained yield and avoiding depletion of the resource capital.

Article 7

Soil

1) The Contracting Parties shall, in view of the role of soil in the functioning of natural ecosystems, take measures, wherever possible towards soil conservation, improvement and rehabilitation; they shall, in particular, endeavour to take steps to prevent soil erosion and other forms of degradation, and promote measures which safeguard the processes of organic decomposition and thereby its continuing fertility.

2) To that effect, they shall, in particular, endeavour to

a) establish land use policies aimed at avoiding losses of vegetation cover, substantial soil losses, and damages to the structure of the soil;

b) take all necessary measures to control erosion, especially as it may affect coastal or freshwater ecosystems, lead to siltation of downstream areas such as lakes or vulnerable ecosystems such as coral reefs, or damage critical habitats, in particular those of endangered or endemic species;

c) take appropriate measures to rehabilitate eroded or degraded soils including rehabilitation of soil affected by mineral exploitation.

Article 8

Water

1) The Contracting Parties shall, in view of the role of water in the functioning of natural ecosystems, take all appropriate measures towards the conservation of their underground and surface water resources.

2) They shall to that effect, in particular, endeavour to

a) undertake and promote the necessary hydrological research especially with a view to ascertaining the characteristics of each watershed;

b) regulate and control water utilization with a view to achieving sufficient and continuous supply of water for, inter alia, the maintenance of natural life supporting systems and aquatic fauna and flora;

c) when planning and carrying out water resource development projects take fully into account possible effects of such projects on natural processes or on other renewable natural resources and prevent or minimize such effects.

Article 9

Air

The Contracting Parties shall, in view of the role of air in the functioning of natural ecosystems, endeavour to take all appropriate measures towards air quality management compatible with sustainable development.

Chapter III

Conservation of Ecological Processes

Article 10

Environmental Degradation

The Contracting Parties, with a view to maintaining the proper functioning of ecological processes, undertake, wherever possible, to prevent, reduce and control degradation of the natural environment and, to this end, shall endeavour to undertake, in addition to specific measures referred to in the following article;

a) to promote environmentally sound agricultural practices by, inter alia, controlling the application of pesticides, fertilizers and other chemical products for agricultural use, and by ensuring that agricultural development schemes, in particular for wetland drainage or forest clearance, pay due regard to the need to protect critical habitats as well as endangered and economically important species;

b) to promote pollution control and the development of environmentally sound industrial processes and products;

c) to promote adequate economic or fiscal incentives for the purposes of sub-paragraphs a) and b) above;

d) as far as possible to consider the originator of the activity which may lead to environmental degradation responsible for its prevention, reduction and control as well as, wherever possible, for rehabilitation and remedial measures required;

e) to take into consideration, when authorizing activities likely to affect the natural environment, the foreseeable interactions between the new activities proposed and those already taking place in the same area, and the result of such interactions on the air, waters and soils of the area;

f) to pay particular attention to the regulation of activities which may have adverse affects on processes which are ecologically essential or on areas which are particularly important or sensitive from an ecological point of view, such as the breeding and feeding grounds of harvested species.

Article 11

Pollution

The Contracting Parties, recognizing the adverse effect that polluting discharges or emissions may have on natural processes and the functioning of natural ecosystems as well as on each of the individual ecosystem components, especially animal and plants species, shall endeavour to prevent, reduce and control such discharges, emissions or applications, in particular by

a) submitting activities likely to cause pollution of the air, soil, freshwater, or the marine environment, to controls which shall take into consideration both the cumulative effects of the pollutants concerned and the self-purificating aptitude of the recipient natural environment;

b) making such controls conditional on, inter alia, appropriate treatment of polluting emissions; and

c) establishing national environmental quality monitoring programmes, particular attention being paid to the effects of pollution on natural ecosystems, and cooperation in such programmes for the Region as a whole.

Chapter IV

Environmental Planning Measures

Article 12

Land Use Planning

1) The Contracting Parties shall, wherever possible in the implementaion of their development planning, give particular attention to the national allocation of land usage. They shall endeavour to take the necessary measures to ensure the integration of natural resource conservation into the land use planning process and shall, in the preparation and implementation of specific land use plans at all levels, give as full consideration as possible to ecological factors as to economic and social ones. In order to achieve optimum sustainable land use, they undertake to base their land use plans as far as possible on the ecological capacity of the land.

2) The Contracting Parties shall, in carrying out the provisions of paragraph (1) above, particularly consider the importance of retaining the naturally high productivity of areas such as coastal zones and wetlands.

3) They shall, where appropriate, co-ordinate their land use planning with a view to conserving and managing natural resources of significant importance for two or several Contracting Parties.

Article 13

Protected Areas

1) The Contracting Parties shall as appropriate establish, in areas under their jurisdiction, terrestrial, freshwater, coastal or marine protected areas for the purpose of safeguarding

   - the ecological and biological processes essential to the functioning of the ecosystems of the Region;

   - representative samples of all types of ecosystem of the Region;

   - satisfactory population levels for the largest possible number of species of fauna and flora belonging to those ecosystems;

   - areas of particular importance because of their scientific, educational, aesthetic, or cultural interest;

   and taking into account their importance in particular as:

   - the natural habitat of species of fauna and flora, particularly rare or endangered or endemic species;

   - zones necessary for the maintenance of exploitable stocks of economically important species;

   - pools of genetic material and safe refuges for species, especially endangered ones;

   - sites of ecological, aesthetic or cultural interest;

   - reference sources for scientific research;

   - areas for environmental education.

   They shall, in particular, take all measures possible in their power to preserve those areas which are of an exceptional character and are peculiar to their country or the Region as well as those which constitute the critical habitats of endangered or rare species, of species that are endemic to a small area and of species that migrate between countries of Contracting Parties.

2) Protected areas established pursuant to this Agreement shall be regulated and managed in such a way as to further the objectives for the purpose of which they have been created. Contracting Parties shall, wherever possible, prohibit within such protected areas activities which are inconsistent with such objectives.

3) Protected areas shall include

a) National Parks

i) This expression denotes natural areas that are sufficiently largely to allow for ecological self-regulation of one or several ecosystems, and which have not been substantially altered by human occupation or exploitation.

ii) National Parks shall be placed under public control, their boundaries shall not be altered nor shall any portion of any National Park be alienated except by the highest competent authority.

iii) National Parks shall be dedicated to conservation and to scientific, educational and recreational uses and the common welfare of the people.

b) Reserves

i) This expression denotes areas set aside for the purpose of preserving a specific ecosystem, the critical habitat of certain species of fauna or flora, a water catchment area or for any other specific purpose relating to the conservation of natural resources or objects or areas of scientific, aesthetic, cultural, educational or recreational interest.

ii) After reserves have been established their boundaries shall not be altered nor shall any portion of such reserves be alienated except by the authority establishing them or by higher authority.

iii) Reserves shall be dedicated to the purposes for which they have been created and, in the light of the national interests of the Contracting Parties, any activity inconsistent with such purposes shall be prohibited.

4) Contracting Parties shall, in respect of any protected area established pursuant to this Agreement

a) prepare a management plan and manage the area on the basis of this plan;

b) establish, wherever appropriate, terrestrial or aquatic buffer zones that shall be located around protected areas and which, in

the case of marine areas, may include coastal land areas or watersheds of rivers flowing into the protected area; in such buffer zones all activities that may have harmful consequences on the ecosystems that such areas purport to protect shall be prohibited or regulated and activities which are consistent with the purpose of the protected area shall be promoted.

5) Contracting Parties shall, in respect of any protected area established pursuant to this Agreement, endeavour to

   a) prohibit the introduction of exotic animal or plant species;

   b) prohibit the use or release of toxic substances or pollutants which could cause disturbance or damage to protected ecosystems or to the species they contain;

   c) to the maximum extent possible, prohibit or control any activity is likely to cause disturbance or damage to the ecosystem or species that such protected areas purport to protect.

6) Contracting Parties shall co-operate in the development of principles, objectives, criteria and guidelines for the selection, establishment and management of protected areas in the Region with a view to establishing a co-ordinated network of protected areas throughout the Region, giving particular attention to those of regional importance. An Appendix containing such principles, objectives, criteria and guidelines shall be drawn up in the light of the best scientific evidence as adapted to the conservation requirements of the Region and shall be adopted by a meeting of Contracting Parties.

7) In addition to the establishment of the protected areas referred to in paragraph 3 of this Article, Contracting Parties shall promote, through the adoption of appropriate measures, the conservation of natural areas by private owners, community or local authorities.

Article 14

Impact Assessment

1) The Contracting Parties undertake that proposals for any activity which may significantly affect the natural environment shall as far as possible be subjected to an assessment of their consequences before they are adopted, and they shall take into consideration the results of this assessment in their decision-making process.

2) In those cases where any such activities are undertaken, the Contracting Parties shall plan and carry them out so as to overcome or minimize any assessed adverse effects and shall monitor such effects with a view to taking remedial action as appropriate.

Chapter V

National Supporting Measures

Article 15

Scientific Research

The Contracting Parties shall individually or in co-operation with other Contracting Parties or appropriate international organizations, promote and, whenever possible, support scientific and technical programmes of relevance to the conservation and management of natural resources, including monitoring, research, the exchange of technical information and the evaluation of results.

Article 16

Education, Information and Participation of the Public, Training

1) The Contracting Parties shall endeavour to promote adequate coverage of conservation and management of natural resources in education programmes at all levels.

2) They shall circulate as widely as possible information on the significance of conservation measures and their relationship with sustainable development objectives, and shall, as far as possible, organize participation of the public in the planning and implementation of conservation measures.

3) Contracting Parties shall endeavour to, individually or in co-operation with other Contracting Parties or appropriate international organizations, develop the programmes and facilities necessary to train adequate and sufficient scientific and technical personnel to fulfil the aims of this Agreement.

Article 17

Administrative Machinery

1) The Contracting Parties shall identify or maintain the administrative machinery necessary to implement the provisions of this Agreement, and, where several governmental institutions are involved, create the necessary co-ordinating mechanism for the authorities dealing with designated aspects of the environment.

2) They shall endeavour to allocate sufficient funds to the task necessary for the implementation of this Agreement, as well as sufficient qualified personnel with adequate enforcement powers.

Chapter VI

International Co-operation

Article 18

Co-operative Activities

1) The Contracting Parties shall co-operate together and with the competent international organizations, with a view to co-ordinating their activities in the field of conservation of nature and management of natural resources and assisting each other in fulfilling their obligations under this Agreement.

2) To that effect, they shall endeavour

   a) to collaborate in monitoring activities;

   b) to the greatest extent possible, co-ordinate their research activities;

   c) to use comparable or standardized research techniques and procedures with a view to obtaining comparable data;

   d) to exchange appropriate scientific and technical data, information and experience, on a regular basis;

   e) whenever appropriate, to consult and assist each other with regard to measures for the implementation of this Agreement.

3) In applying the principles of co-operation and co-ordination set forth above, the Contracting Parties shall forward to the Secretariat

a) Information of assistance in the monitoring of the biological status of the natural living resources of the Region;

b) Information, including reports and publications of a scientific, administrative or legal nature and, in particular, information on

- measures taken by the Parties in pursuance of the provisions of this Agreement;

- the status of species included in Appendix 1;

- any other matter to which the Conference of the Parties may give special priority.

Article 19

Shared Resources

1) Contracting Parties that share natural resources shall co-operate concerning their conservation and harmonious utilization, taking into account the sovereignty, rights and interests of the Contracting Parties concerned in accordance with generally accepted principles of international law.

2) To that end, they shall, in particular

a) co-operate with a view to controlling, preventing, reducing or eliminating adverse environmental effects which may result in one Contracting Party from the utilization of such resources in another Party;

b) endeavour to conclude bilateral or multilateral agreements in order to secure specific regulation of their conduct in respect of the resources concerned;

c) as far as possible, make environmental assessments prior to engaging in activities with respect to shared natural resources which may create a risk of significantly affecting the environment of another sharing Contracting Party or other sharing Contracting Parties;

d) notify in advance the other sharing Contracting Party or the other sharing Contracting Parties of pertinent details of plans to initiate, or make a change in, the conservation or utilization of the resource which can reasonably be expected to affect significantly the environment in the territory of the other Contracting Party or Contracting Parties;

e) upon request of the other sharing Contracting Party or sharing Contracting Parties, enter into consultation concerning the above-mentioned plans;

f) inform the other sharing Contracting Party or other sharing Contracting Parties of emergency situations or sudden grave natural events which may have repercussions on their environment;

g) whenever appropriate, engage in joint scientific studies and assessments, with a view to facilitating co-operation with regard to environmental problems related to a shared resource, on the basis of agreed data.

3) Contracting Parties shall especially co-operate together and, where appropriate, shall endeavour to co-operate with other Contracting Parties, with a view to

a) the conservation and management of

- border or contiguous protected areas;

- shared habitats of species listed in Appendix I;

- shared habitats of any other species of common concern;

b) the conservation, management and, where applicable, regulation of the harvesting of species which constitute shared resources

- by virtue of their migratory character, or

- because they inhabit shared habitats.

Article 20

Transfrontier Environmental Effects

1) Contracting Parties have in accordance with generally accepted principles of international law the responsibility of ensuring that activities under their jurisdiction or control do not cause damage to the environment or the natural resources under the jurisdiction of other Contracting Parties or of areas beyond the limits of national jurisdiction.

2) In order to fulfil this responsibility, Contracting Parties shall avoid to the maximum extent possible and reduce to the minimum extent possible adverse environmental effects of activities under their

jurisdiction or control, including effects on natural resources, beyond the limits of their national jurisdiction.

3) To that effect, they shall endeavour

   a) to make environmental impact assessment before engaging in any activity that may create a risk of significantly affecting the environment or the natural resources of another Contracting Party or the environment or natural resources beyond national jurisdiction;

   b) to notify in advance the other Contracting Party or Contracting Parties concerned of pertinent details of plans to initiate, or make a change in, activities which can reasonably be expected to have significant effects beyond the limits of national jurisdiction;

   c) to enter into consultation concerning the above-mentioned plans upon request of the Contracting Party or Contracting Parties in question;

   d) to inform the Contracting Party or Contracting Parties in question or emergency situations or sudden grave natural events which may have repercussion beyond national jurisdiction.

4) Contracting Parties shall, in particular, endeavour to refrain from actions which might directly or indirectly adversely affect wildlife habitats situated beyond the limits of national jurisdiction, especially habitats of species listed in Appendix I or habitats included in protected areas.

Chapter VII

International Supporting Measures

Article 21

Meeting of the Contracting Parties

1) Ordinary meetings of the Contracting Parties shall be held at least once in three years, in as far as possible in conjunction with appropriate meetings of ASEAN, and extraordinary meetings shall be held at any other time, upon the request of one Contracting Party provided that such request is supported by at least one other Party.

2) It shall be the function of the meetings of the Contracting Parties, in particular

a) to keep under review the implementation of this Agreement and the need for other measures, in particular the Appendices;

b) to adopt review and amend as required any Appendix to this Agreement;

c) to consider reports submitted by the Contracting Parties in accordance with Article 28 or any other information which may be submitted by a Party, directly or through the Secretariat;

d) to make recommendations regarding the adoption of any Protocol or any amendment to this Agreement;

e) to establish working groups or any other subsidiary body as required to consider any matter related to this Agreement;

f) to consider and undertake any additional action, including the adoption of financial rules, that may be required for the achievement of the purposes of this Agreement.

Article 22

Secretariat

On the coming into force of this Agreement the Contracting Parties shall designate the Secretariat responsible for carrying out the following functions:

a) to convene and prepare the meetings of Contracting Parties;

b) to convene diplomatic conferences for the purpose of adopting Protocols;

c) to transmit to the Contracting Parties notifications, reports and other information received in accordance with this Agreement;

d) to consider inquiries by, and information from, the Contracting Parties, and to consult with them on questions relating to this Agreement;

e) to perform such other functions as may be assigned to it by the Contracting Parties;

f) to ensure the necessary co-ordination with other competent international bodies and in particular to enter into the such administrative arrangements as may be required for the effective discharge of the Secretariat's functions.

Article 23

National Focal Points

In order to facilitate communications with other Parties and the Secretariat, the Contracting Parties shall designate an appropriate national agency or institution responsible for co-ordinating matters arising from consultations and channeling communications between Contracting Parties or with the Secretariat.

Chapter VIII

Final Clauses

Article 24

Adoption of Protocols

1) The Contracting Parties shall co-operate in the formulation and adoption of Protocols to this Agreement, prescribing agreed measures, procedures and standards for the implementation of this Agreement.

2) The Contracting Parties, at a diplomatic conference, may adopt Protocols to this Agreement.

3) The Protocols of this Agreement shall be subject to acceptance and shall enter into force on the thirtieth day after the deposit with the Depositary of the Instruments of Acceptance of all the Contracting Parties.

Article 25

Amendment of the Agreement

1) Any Contracting Party to this Agreement may propose amendments to the Agreement. Amendments shall be adopted by a diplomatic conference which shall be convened at the request of the majority of the Contracting Parties.

2) Amendments to this Agreement shall be adopted by a consensus of the Contracting Parties.

3) Acceptance of amendments shall be notified to the Depositary in writing and shall enter into force on the thirtieth day following the receipt by the Depositary of notification of the acceptance by all the Contracting Parties.

4) After the entry into force of an amendment to this Agreement any new Contracting Party to this Agreement shall become a Contracting Party to this Agreement as amended.

Article 26

Appendices and Amendments to Appendices

1) Appendices to this Agreement shall form an integral part of the Agreement;

2) Amendments to an Appendix:

   a) Any Contracting Party may propose amendments to an Appendix at a meeting of the Contracting Parties;

   b) Such amendments shall be adopted by a consensus of the Contracting Parties;

   c) The Depositary shall without delay communicate the amendment so adopted to all Contracting Parties.

3) The adoption and entry into force of a new Appendix to this Agreement shall be subject to the same procedure as for the adoption and entry into force of an amendment to an Appendix as provided for in paragraph (2) of this Article, provided that, the new Appendix shall not enter into force until such time as the amendment to the Agreement enters into force.

Article 27

Rules of Procedure

The Contracting Parties shall adopt rules of procedure for their meetings.

Article 28

Reports

The Contracting Parties shall transmit to the Secretariat reports on the measures adopted in implementation of this Agreement in such form and at such intervals as the meetings of Contracting Parties may determine.

Article 29

Relationships with Other Agreements

The provisions of this Agreement shall in no way affect the rights and obligations of any Contracting Party with regard to any existing treaty, convention or agreement.

Article 30

Settlement of Dispute

Any dispute between the Contracting Parties arising out of the interpretation or implementation of this Agreement shall be settled amicably by consultation or negotiation.

Article 31

Ratification

This Agreement shall be subject to ratification by the Contracting Parties. The Instruments of Ratification shall be deposited with the Secretary-General of the ASEAN Secretariat, who shall assume the functions of Depositary.

Article 32

Accession

1) After the entry into force of the Agreement, any Member State may accede to this Agreement, subject to prior approval by the Contracting Parties to this Agreement.

2) Instrument of accession shall be deposited with the Depositary.

Article 33

Entry into Force

1) This Agreement shall enter into force on the thirtieth day after the deposit of the sixth Instruments of Ratification.

2) Thereafter, this Agreement shall enter into force with respect to any Contracting Party on the thirtieth day following the date of deposit of the instrument of accesior by that Contracting Party.

Article 34

Responsibility of the Depositary

The Depositary shall inform the Governments which have signed this Agreement:

a) of the deposit of instruments of ratification, acceptance or accession;

b) of the date on which the Agreement will come into force.

Article 35

Deposit and Registration

1) The present Agreement shall be deposited with the Depositary who shall transmit certified true copies thereof to the Governments of all Contracting Parties which have signed the present Agreement or acceded to it.

2) As soon as the present Agreement enters into force, the text shall be transmitted by the Depositary to the Secretary-General of the United Nations for registration and publication, in accordance with Article 102 of the Charter of the United Nations.

IN WITNESS WHEREOF the undersigned, being duly authorized by their respective Governments, have signed this Agreement:

DONE at.....on.....in a single copy in the English language.

APPENDIX 2

ASEAN Endangered and Threatened Species, under the ASEAN Agreement on Conservation of Nature and Natural Resources.

A. List of endangered species

NO.	SCIENTIFIC NAME	COMMON NAME
FAUNA		
1.	*Babyrousa babyrussa*	Babirusa
2.	*Balaenoptera musculus*	Blue whale
3.	*Balaenoptera physalis*	Fin whale
4.	*Batagur baska*	River terrapin
5.	*Bos gaurus*	Gaur or Seladang
6.	*Bos sauveli*	Kouprey
7.	*Bubalus mindorensis*	Tamaraw
8.	*Cairina scutulata*	White-winged wood duck
9.	*Capricornis sumatraensis*	Serow
10.	*Cervus eldi*	Eld's deer
11.	*Dermochelys coriacea*	Leatherback turtle
12.	*Dicerorhinus sumatraensis*	Sumatran rhinoceros
13.	*Ducula mindorensis*	Mindoro imperial pigeon
14.	*Felis temmincki*	Golden cat
15.	*Helarctos malayanus*	Malayan honey bear
16.	*Hylobates agilis*	Agile gibbon
17.	*Hylobates lar*	White-handed gibbon
18.	*Hylobates syndactylus*	Siamang
19.	*Nasalis larvatus*	Proboscis monkey
20.	*Neofelis nebulosa*	Clouded leopard
21.	*Panthera pardus*	Leopard
22.	*Panthera tigris*	Sumatran & Indochinese tiger
23.	*Pithecophaga jefferyi*	Philippine eagle
24.	*Pitta kochi*	Koch's pitta
25.	*Polyplectron emphanum*	Palawan peacock pheasant
26.	*Pongo pygmaeus*	Orang utan
27.	*Presbytis potenziani*	Mentawai langur
28.	*Rhinoceros sondaicus*	Javan rhinoceros
29.	*Rhinoplax vigil*	Helmeted hornbill
30.	*Simias concolor*	Snub-nosed monkey
31.	*Sotalia sinensis*	Chinese white dolphin
32.	*Sousa borneensis*	Indonesian white dolphin
33.	*Sula abbotti*	Abbott's booby
34.	*Tapirus indicus*	Tapir
35.	*Varanus komodoensis*	Komodo dragon
FLORA		
1.	*Rafflesia spp.*	Rafflesia

B. List of threatened species.

NO.	SCIENTIFIC NAME	COMMON NAME
FAUNA		
1.	*Accipiter gularis*	Japanese lesser sparrow hawk
2.	*Accipiter nisus*	European Sparrow hawk
3.	*Chilasa agestor agestor*	
4.	*Felis chaus*	Jungle cat
5.	*Felis minuta*	Leopard cat
7.	*Geomyda spinosa*	
8.	*Hylobates muelleri*	Grey gibbon
9.	*Icthyophaga icthyaetus*	Grey-headed fishing eagle
10.	*Macaca fascicularis*	Long-tailed or crab-eating macaque
11.	*Macaca nemestrina*	Pig-tailed macaque
12.	*Macaca philippinensis*	Luzon crab-eating macaque
13.	*Microhierax caerulescens*	Common falconet
14.	*Mimizuku gurneyi*	Giant scops owl
15.	*Otus brookii*	Rajah's scops owl
16.	*Otus spilocephalus*	Mountain scops owl
17.	*Presbytis cristata*	Silvered leaf-monkey
18.	*Presbytis melalophos*	Banded leaf-monkey
19.	*Presbytis obscura*	Dusky leaf-monkey
20.	*Prionodon pardicolor*	Spotted linsang
21.	*Pseudochelidon sirintarae*	White-eye river martin
22.	*Ratufa affinis*	Common giant squirrel
23.	*Ratufa bicolor*	Black giant squirrel
24.	*Sarkidiornis melanotos*	Comb duck
25.	*Selenarctos thibetanus*	Asiatic black bear
26.	*Spizaetus philippensis*	Philippine hawk eagle
27.	*Testudo elongata*	Elongated tortoise
28.	*Testudo emys*	Giant asiatic tortoise
29.	*Testudo impressa*	Impressed tortoise
30.	*Troides aeacus*	Birdwing butterfly
31.	*Troides cuneifer*	Birdwing butterfly
32.	*Troides helena*	Common birdwing
33.	*Trogonoptera brookiana*	Raja Brooke's birdwing
34.	*Tyto alba*	Common barn owl
35.	*Varanus dumerili*	Dumeril's monitor
36.	*Varanus rudicollis*	Harlequin monitor
37.	*Zeuxidia aurelius*	Satyrid butterfly

APPENDIX 3

Principles, Criteria and Guidelines for the Selection, Establishment and Management of a Network of Reserves

Principles

The ASEAN Region, covering the land and territorial waters of Indonesia, Malaysia, Philippines, Singapore, Thailand and lately Brunei Darrusalam, is one of the most important ecological regions in the world. As such, there is a need to establish a network of reserves as national parks, biosphere reserves, nature reserves or wildlife sanctuaries. This move is recognized as one of the most effective ways to conserve ecosystems and their constituent wildlife. The underlying principles therefore, in the selection, establishment and management of regional network of reserves are:

1. maintenance of the essential ecological processes and life-support systems
2. preservation of genetic diversity
3. maintenance of species diversity of plants and animals within their natural habitat
4. ensurance of sustainable utilization of resources
5. provision of opportunities for outdoor recreation, tourism, education and research to make the people recognize the importance of natural resources

Criteria

Selection and establishment of a reserve shall satisfy any or a combination of the following:

1. National/regional significance, urgency to maintain the essential ecological processes, and provide an *in situ* conservation of plant and animal genetic resources

2. Unique physiography such as outstanding geological features significantly illustrating geological processes, aesthetic and scientific values

3. Include terrestrial, coastal, marine and riparian habitats

4. Major migratory routes and pathways

5. Habitat of rare and/or endangered species of flora and fauna

6. High species diversity of flora and fauna or unique biotic community

7. Represent as many ecosystems in relation to life-support systems as possible

8. Exemplify the irreversibility of damages to resources such as: the extinction of useful plant and animal species, the loss of life-support systems, soil degradation, water balance and others

9. Manageable to ensure its protection

10. Showcase the presence of socio-cultural heritage to include traditional livelihood systems which ensure ecological balance

11. Possess anthropological and historical significance

Guidelines

There must be sound planning and management of the reserves. Particular attention should be given to the maintenance of the essential ecological processes, life-support systems, sustainable resource use and management, protection and preservation of biota and protection of unique and threatened species and their habitats.

1. Essentially, there are two ways of preserving genetic diversity, on-site (in-situ) and/or off-site (ex-situ).

2. The wild strains of domesticated and economically useful plants and animals shall be conserved and preserved.

3. The introduction of exotic species shall be prohibited.

4. Endangered species of flora and fauna shall be given special protection.

5. Animals belonging to higher tropic levels shall be given special protection.

6. Coastal marine and riparian and other types of habitats that are used by migratory and local shorebirds or waterfowls as feeding, nesting, and roosting sites shall be identified and the necessary protection measures shall be enforced.

7. A network of protected areas for migratory and wide-ranging animals shall be established at the regional level through bilateral and multilateral cooperations.

8. Portions or major migratory routes shall be identified and preserved.

9. Floodplains shall be managed for wildlife.

10. Boundaries of national parks/refugees/santuaries shall be delineated to a more manageable area/size with no or minimum detriment to the biotic community therein.

11. The minimum critical size and optimum distribution of protected areas shall be determined.

12. Zoning of areas shall be a component of the management plan for the network of reserves.

13. An ecological and economic assessment of sustainable utilization of wildlife stock farming and game-ranching (alone or in-mix herd) shall be made.

14. Disturbed watersheds shall be restored by revegetation and by application of other protective measures.

15. Legal provisions for the protection of parks under national legislation shall be given priority.

16. A thorough Environmental Impact Assessment on the effects of man-made channelization/impoundment to natural habitats shall be required.

17. Exploitation and other energy-draining activities along migratory routes shall be regulated.

18. Strict enforcement of regulations on the possession, distribution, use and sale of chlorinated hydrocarbon pesticides shall be implemented.

19. A regular inventory and monitoring of resources in the network of reserves shall be made an internal part of the management plan.

20. Socio-cultural considerations shall be given emphasis in the planning and management of the reserves.

21. Protective measures for anthropological and historical sites shall be made.

22. Interpretation programs for the guidance of visitors and tourists shall be prepared.

23. Facilities for education, recreation and tourism shall be provided.

APPENDIX 4

National parks and reserves of ASEAN countries

A. Proposed national parks and reserves of Brunei Darussalam

No.	Name	Area (ha)
1.	Tasek Merimbun National Park	10,900
2.	Batu Apoi National Park	48,854
3.	Peradayan Nature Reserve	1,463
4.	Labu-Selirong Wildlife Sanctuary	17,289
5.	Pulau Berambang Nature Reserve	1,937
6.	White Sands Nature Reserve	350
7.	Bukit Teraja Nature Reserve	7,900
8.	Sungei Ingei Wildlife Sanctuary	19,412
9.	Ulu Mendaram Wildlife Sanctuary	12,070
10.	Pelong Rocks Wildlife Sanctuary	2
11.	Pulau Punyit Wildlife Sanctuary	?
12.	Louisa Reef Wildlife Sanctuary	?

B. National Parks of Indonesia

No.	Name	Province(s)	Area (ha)	Date declared
1.	Gunung Leusser	Aceh/N. Sumatra	792,635	1980
2.	Ujung Kulon	W. Java	78,619	"
3.	Gunung Gede Pangrango	W. Java	15,000	"
4.	Baluran	E. Java	25,000	"
5.	Komodo	E. Nusa Tenggara	75,000	"
6.	Kerinci Seblat	W.& S. Sumatra, Jambi, Bengkulu	1,484,650	1982
7.	Bukit Barisan Selatan	Lampung, Bengkulu	365,000	"
8.	Kepulauan	W. Java	110,000	"
9.	Bromo Tengger Semeru	E. Java	58,000	"
10.	Meru Betiri	E. Kalimantan	50,000	"
11.	Bali Barat	Bali	77,727	"
12.	Tanjung Puting	C. Kalimantan	355,000	"
13.	Kutai	E. Kalimantan	200,000	"
14.	Lore Lindu	C. Sulawesi	231,000	"
15.	Dumoga Bone	N. Sulawesi	300,000	"
16.	Manusela	Maluku	189,000	"

C. National Parks and Reserves of Peninsular Malaysia

No.	Name	State	Area (ha)
1.	Taman Negara	Pahang, Kelantan Terengganu	434,351
2.	Sungkai	Perak	2,428
3.	Sanctuary Burung Batu Gajah	Perak	4.5
4.	Wang Pinang	Perlis	68
5.	Krau	Pahang	53,095
6.	Cameron Highlands	Pahang	64,953
7.	Sanctuary Burung Pahang Tua	Pahang	1,336
8.	Pulau Tioman	Pahang	7,160
9.	Endau Kluang	Johor	101,174
10.	Endau Kota Tinggi (W)	Johor	61,959
11.	Endau Kota Tinggi (E)	Johor	7,413
12.	Four Bird Islands	Johor	2
13.	Port Dickson Islands	Negeri Sembilan	0.5
14.	Fraser's Hill	Selangor	2,979
15.	Kuala Selangor	Selangor	44
16.	Bukit Kutu	Selangor	1,943
17.	Klang Gates	Selangor	130
18.	Pt. Nanas	Selangor	9
19.	Templer Park	Selangor	1,011
20.	Sungai Dusun	Selangor	4,330
21.	Sugai Puteh	Selangor	40

D. National Parks of the Philippines

No.	Name	Town(s), Province	Area (ha)	Date
1.	Agoo-Damortis	Agoo and Damortis, La Union	10,947	1965
2.	Aurora Memorial	Bongabon, Nueva Ecija and Baler, Quezon	5,676	1972
3.	Balbalasan-Balbalan	Balbalan, Kalinga-Apayao	1,338	1937
4.	Basilan	Lanitan, Basilan	3,100	1939
5.	Bataan	Hermosa, Orani, Samal, Abucay, Pilar, Balanga, Bagac and Morong, Bataan	29,853	1966
6.	Besang Pass	Cervantes, Ilocos Sur	304	1954
7.	Biak-na-bato	San Miguel, Bulacan	1,787	1982
8.	Bicol	Basud and Daet, Camarines Norte and Sipocot, Camarines Sur	5,201	1934
9.	Bulabog-Putian	Dingle and San Enrique, Iloilo	854	1961
10.	Bulusan Volcano	Casiguran, Barcelona, Bulusan, Irosin and Junon, Sorsogon	4,260	1931
11.	Callao Cave	Penablanca, Cagayan	192	1935
12.	Capas Death March Monument	Capas, Tarlac	1.54	

13.	Caramoan	Caramoan, Camarines Sur	347	1938
14.	Cassamata Hill	Bangued, Abra	57	1974
15.	Central Cebu	Balamban, Toledo and Cebu City, Cebu	15,394	1937
16.	Fuyot Spring	Ilagan, Isabela	819	1938
17.	Guadalupe-Mabagnao, Mainit Hot Spring	Carcar, Cebu	57.5	1972
18.	Hundred Islands	Alaminos, Pangasinan		1940
19.	Initao	Initao, Misamis Oriental	57	1978
20.	Kuapnit-Balinsa-sayao	Baybay and Abuyog, Leyte	364	1937
21.	Lake Butig	Butig, Lanao del Sur	68	1965
22.	Lake Danao	Ormoc City, Leyte		
23.	Lake Dapao	Pualas, Lanao del Sur	1,500	1965
24.	Lake Maujan	Naujan, Pola and Victoria, Oriental Mindoro	21,655	1956
25.	Lake Paoay	Paoay, Ilocos Norte	NS	1969
26.	Libmanan Caves	Libmanan,Camarines Sur	19.4	1934
27.	Luneta	Ermita, Manila		1964,1967
28.	Mado Hot Spring	Awang, Cotabato	48	1939
29.	Mahagnao Volcano	Burauen and La Paz, Leyte	635	1937
30.	Mainit Hot Spring	Compostela, Davao	1,381	1957
31.	Manleluag Spring	Mangatarem, Pangasinan	92	1940
32.	Mayon Volcano	Albay, Camalig, Guinobatan, Ligao, Libog, Malilipot, Tabaco, Albay	5,459	1938

33.	Mac Arthur Landing	Polo, Leyte	27.6	
34.	Manila Bay Beach Resort	Manila City, Pasay City, Paranaque, Rizal, Laguna		1954
35.	Minalungao	Gapan and Papaya, Nueva Ecija	2,018	1967
36.	Mt. Apo	Kidapawan, North Cotabato and Sta. Cruz, Guianga, Davao	72,954	1936
37.	Mt. Arayat	Arayat and Magalang, Pampanga	3,714	1933
38.	Mts. Banahaw - San Cristobal	San Pablo, Liliw, Nagcarlan, Rizal and Majayjay, Laguna and Lucena, Lucban, Sariaya, Candelaria and Dolores, Quezon	11,133	1941
39.	Mt. Canlaon	Bago, La Carlota, La Castellana, Murcia, Canlaon and San Carlos, Negros Occidental and Villahermoso, Negros Oriental	24,557	1934
40.	Mt. Dajo	Patikul, Talipan and Jolo, Sulu	213	1938
41.	Mt. Data	Benguet and Ifugao, Mt. Province	5,512	1936 1940

42.	Mts. Iglit-Baco	Sablayan, Occidental Mindoro and Bongabon, Oriental Mindoro	75,445	1970
43.	Mt. Isarog	Naga, Calabanga, Tinambac, Goa, Tigaon and Pili, Camarines Sur	13,433	1928
44.	Mt. Makiling	Los Banos, Laguna		1910
45.	Mt. Malindang	Misamis Occidental	52,262	1971
46.	Mts. Palaypalay - Mataas na Gulod	Ternate and Maragondon, Cavite and Nasugbu, Batangas	4,000	1976
47.	Mt. Pulog	Buguias, Kabayan, Kiangan and Kayapa, Nueva Vizcaya, Kabayan and Buguias, Benguet and Kiangan, Ifugao	11,550	1987
48.	Northern Luzon Heroes Hill	Santa and Narvacan, Ilocos Sur	1,316	1963
49.	Olongapo Naval Base Perimeter	Olongapo City, Zambales	9	1968
50.	Pagsanjan Gorge	Lumban, Laguna		1939 1976
51.	Pantuwaraya Lake	Saguiaran, Lanao del Sur	20	1965
52.	Quezon	Atimonan, Padre Burgos and Pagbilao, Quezon	983	1934 1940

53.	Quezon Memorial	Diliman, Quezon City	197	1954 1975
54.	Rajah Sikatuna	Bohol	9,039	1987
55.	Rizal (Dapitan)	Dapitan, Zamboanga	0.8	1910
56.	Roosevelt	Hermosa and Dinalupihan, Bataan	1485	1933
57.	Rungkunan	Ramain, Lanao del Sur	NS	1965
58.	Sacred Mountain	Marawi City, Lanao del Sur	94	1965
59.	Salikata	Lumba and Bayambao, Lanao del Sur	NS	1965
60.	Santa Cruz	Zamboanga City, Zamboanga		1975 1978
61.	Sohotan Natural Bridge	Basey, Samar	840	1935
62.	St. Paul Subterranean River	Palawan	3,901	1971
63.	Sudlon	Cebu City, Cebu	696	1936
64.	Taal Volcano	Taal, Batangas	4,537	1967
65.	Tirad Pass	Cervantes, Ilocos Sur		1938 1968
66.	Tiwi	Tiwi, Albay	44	1913
67.	Tongonan Hot Spring		272	1953
68.	Unnamed national parks, wildlife sanctuary and game reserve	Bulacan, Rizal, Laguna and Quezon		

E. National Parks and Wildlife Sanctuaries of Thailand

(1) List of national parks in Thailand, including total area and year of gazettment by royal decree. For marine parks, the land area is given in parentheses under the total area.

No.	Name	Province(s)	Area (ha)	Year
1.	Khao Yai	Nakhon Nayok, Saraburi, Nakhon Ratchasima, Prachinburi	216,863	1962
2.	Phu Kradeung	Loei	34,816	1962
3.	Khao Sam Roi Yot	Prachuab Khirikhan	9,808	1966
4.	Nam Nao	Petchabun	96,600	1972
5.	Tarutao	Satun	149,000 (26,000)	1974
6.	Khao Luang	Nakhon Si Thammarat	57,000	1975
7.	Doi Khuntan	Lamphun, Lampang	25,529	1975
8.	Namtok Phliu (Khao Sabup)	Chanthaburi	13,450	1975
9.	Thung Salaeng Luang	Phitsanulok, Petchabun	126,240	1975
10.	Phu Phan	Sakon Nakhon, Kalasin	66,470	1975
11.	Erawan	Kanchanaburi	55,000	1975
12.	Khao Chamao - Khao Wong	Rayong, Chanthaburi	8,368	1975
13.	Khao Khitchakut	Chanthaburi	5,870	1977
14.	Doi Inthanon	Chiang Mai	48,240	1978
15.	Lansang	Tak	10,400	1979
16.	Phu Rua	Loei	12,084	1979

17.	Chalerm Rattanakosin (Tham Than Lot)	Kanchanaburi	5,900	1980
18.	Ramkhamhaeng	Sukhothai	34,100	1980
19.	Sai Yok	Kanchanaburi	50,000	1980
20.	Thaleban	Satun	10,160	1980
21.	Mu Ko Ang Thong	Surat Thani	10,200 (1,800)	1980
22.	Khao Sok	Surat Thani	64,552	1980
23.	Tat Ton	Chaiyaphum	21,718	1980
24.	Doi Suthep-Pui	Chiang Mai	26,106	1981
25.	Ao Phangnga	Phangnga	40,000	1981
26.	Si Satchanalai	Sukhothai	21,320	1981
27.	Khao Sam Lan	Saraburi	4,457	1981
28.	Kaeng Krachan	Petchaburi, Prachuab Khirikhan	291,500	1981
29.	Mu Ko Surin	Phangnga	13,500 (3,300)	1981
30.	Khao Phanom Bencha	Krabi	5,012	1981
31.	Hat Nai Yang	Phuket	9,073 (2,200)	1981
32.	Mae Ping	Chiang Mai,Lamphun,Tak	100,300	1981
33.	Kaeng Tana	Ubon Ratchathani	8,000	1981
34.	Khao Laem Ya - Mu Ko Samet	Rayong	13,100 (800)	1981
35.	Wiang Kosai	Phrae, Lampang	41,000	1981
36.	Hat Chao Mai	Trang	23,088	1981
37.	Namtok Mae Surin	Mae Hong Son	39,660	1981

38.	Si Nakarin	Kanchanaburi	153,200	1981
39.	Thap Lan	Nakhon Ratchasima, Prachin Buri	224,000	1981
40.	Ton Krabak Yai	Tak	14,900	1981
41.	Pang Sida	Prachin Buri	84,400	1982
42.	Khao Pu - Khao Ya	Phatthalung, Trang	69,400	1982
43.	Mu Ko Similan	Phangnga	12,800 (1,400)	1982
44.	Khlong Lan	Kamphaeng Phet	30,000	1982
45.	Mu Ko Chang	Trat	65,000 (19,200)	1982
46.	Laem Son	Ranong, Phangnga	31,500 (4,800)	1983
47.	Hat Nopharat Thara - Mu Ko Phi Phi	Krabi	38,996 (6,400)	1983
48.	Phu Hin Rong Gla	Phitsanulok, Loei	30,700	1984
49.	Mu Ko Phetra	Satun	49,438 (2,600)	1984
50.	Phu Kao - Phu Phan Kham	Udon Thani, Khon Kaen	32,200	1985
51.	Mae Yom	Phrae, Lampang	45,475	1986
52.	Khao Lam Pi - Hat Thai Muang	Phangnga	7,200	1986
53.	Phu Chong Nayoi	Ubon Ratchathani	68,600	1987
54.	Mae Wong	Kamphaeng Phet, Nakhon Sawan	89,400	1987
55.	Namtok Chat-Trakan	Phitsanulok	54,300	1987
56.	Si Phangnga	Phangnga	24,608	1988

57.	Jae Sorn	Lampang	59,200	1988
58.	Huai Huat	Sakon Nakhon, Mukdahan, Nakhon Phanom	82,856	1988

(2) List of wildlife sanctuaries in Thailand with area and year of gazettment.

No.	Name	Province(s)	Area (ha)	Year
1.	Salak Phra	Kanchanaburi	85,855	1965
2.	Khlong Nakha	Ranong	48,000	1972
3.	Phu Khieo	Chaiyaphum	156,000	1972
4.	Khao Soi Dao	Chanthaburi	74,502	1972
5.	Huai Kha Khaeng	Uthai Thani, Tak	163,100	1972
6.	Lum Nam Pai	Mae Hong Son	119,400	1972
7.	Thung Yai Naresuan	Kanchanaburi, Tak	320,000	1974
8.	Khao Khieo - Khao Chomphu	Chonburi	14,470	1974
9.	Khlong Saeng	Surat Thani	115,620	1974
10.	Phu Luang	Loei	84,800	1974
11.	Phu Wua	Nong Khai	18,650	1975
12.	Khao Banthad	Phatthalung, Trang, Satun, Songkhla	126,720	1977
13.	Yot Dom	Ubon Ratchathani	20,255	1977
14.	Phu Miang - Phu Thong	Phitsanulok, Uttaradit	54,500	1977
15.	Khao Ang Ru Nai	Chachoengsao	10,810	1977
16.	Ton Nga Chang	Satun, Songkhla	18,200	1978
17.	Maenam Phachi	Ratchaburi	48,931	1978
18.	Mae Tuen	Tak	117,300	1978
19.	Doi Chiang Dao	Chiang Mai	52,100	1978
20.	Salawin	Mae Hong Son	87,500	1978

21.	Khao Phanom Dong Rak	Sisaket	31,600	1978
22.	Doi Pha Muang	Lampang, Lamphun	58,560	1980
23.	Doi Pha Chang	Phayao, Nan	57,675	1980
24.	Khlong Phraya	Krabi	9,500	1980
25.	Om Koi	Chiang Mai, Tak	122,400	1983
26.	Doi Luang	Phrae	9,700	1984
27.	Khao Sanam Priang	Kampaeng Petch	10,100	1985
28.	Mae Yuam	Mae Hong Son	29,200	1986