

# **SPECIES CONSERVATION PRIORITIES IN THE TROPICAL FORESTS OF SOUTHEAST ASIA**



Occasional Papers of the IUCN Species Survival Commission (SSC)



International Union for Conservation of Nature  
and Natural Resources

INTERNATIONAL UNION FOR CONSERVATION OF NATURE  
AND NATURAL RESOURCES

SPECIES SURVIVAL COMMISSION

ROLE OF THE SSC

The Species Survival Commission (SSC) is composed of about 150 full members and over a thousand scientists and other experts organized into more than 75 specialist groups. This volunteer network serves as a primary source of the scientific and technical information required for the conservation of endangered and vulnerable flora and fauna, and recommends and promotes measures for their conservation.

OBJECTIVES OF THE SSC

To insure the maintenance of biological diversity by monitoring the status of species and populations, by developing action plans and promoting and implementing such plans, by interacting with a network of volunteers devoted to conservation concerns, and by advising and making policy recommendations to governments, other agencies and organizations.

Subobjective no. 1: To maintain an international network of volunteers and a forum for the exchange of views and scientific information on species and populations of conservation concern.

Subobjective no. 2: To cooperate with the IUCN Conservation Monitoring Centre (CMC) in developing a data base on the status of, and trade in, wild flora and fauna and in assessing and disseminating such information to CITES and elsewhere for conservation action.

Subobjective no. 3: To develop and review conservation action plans and priorities for species and populations.

Subobjective no. 4: To promote implementation of conservation action plans and to respond to related issues.

Subobjective no. 5: To provide studies, advice and policy recommendations to governments, other agencies and organizations in respect to conservation and management of species and populations.

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*Cover Photo*

The Sumatran rhinoceros (*Dicerorhinus sumatrensis*) is symbolic of species conservation priorities in the tropical forests of southeast Asia. The smallest and most distinctive of the five rhinoceros species, it survives in tiny remnant populations in a number of countries and is perhaps the most endangered large mammal in the region.

# **SPECIES CONSERVATION PRIORITIES IN THE TROPICAL FORESTS OF SOUTHEAST ASIA**

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the IUCN Species Survival Commission (SSC)

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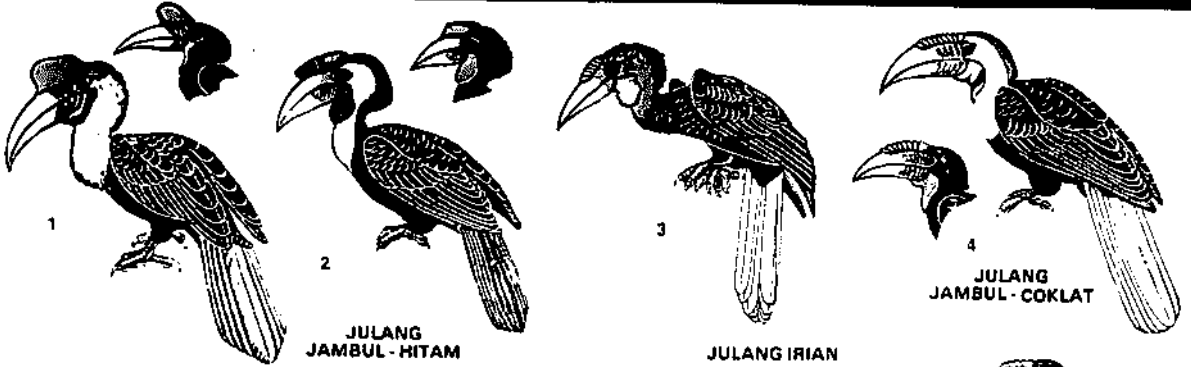
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# RANGKONG INDONESIA



1  
JULANG SULAWESI  
EKOR - PUTIH

2  
JULANG  
JAMBUL - HITAM

3  
JULANG IRIAN

4  
JULANG  
JAMBUL - COKLAT



5  
KEKERENG  
EKOR - ABU



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KANGKARENG  
HITAM



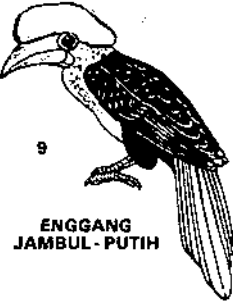
10  
JULANG SULAWESI  
EKOR - HITAM



6  
JULANG  
SUMBA



8  
KANGKARENG  
PERUT PUTIH



9  
ENGGANG  
JAMBUL - PUTIH



11  
RANGKONG BADAK



12  
RANGKONG BESAR



13  
ENGGANG RAJA

- |                               |                                |
|-------------------------------|--------------------------------|
| 1. Julang Sulawesi Ekor-Putih | 10. Julang Sulawesi Ekor-Hitam |
| 2. Julang Jambul-Hitam        | 11. Rangkong Badak             |
| 3. Julang Irian               | 12. Rangkong Besar             |
| 4. Julang Jambul-Coklat       | 13. Enggang Raja               |
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| 9. Enggang Jambul-Putih       |                                |

Poster produced by the Indonesia Directorate of Nature Conservation (PPA) depicting the hornbill species found in the country (designed by J. Wind).

# Introduction

This contribution on Species Conservation Priorities in the Tropical Forests of Southeast Asia is the first in a new series entitled *Occasional Papers of the IUCN Species Survival Commission (SSC)*. These papers are intended to provide an outlet for special reports on issues of concern to SSC, and for the proceedings of symposia held at regional SSC or related meetings. This booklet falls into the latter category, and represents the results of a symposium held on October 4, 1982 at the 58th SSC Meeting in Kuala Lumpur, Malaysia. It includes six chapters on species conservation in the tropical forests of Peninsular Malaysia, the Malaysian states of Sarawak and Sabah, and Indonesia, Thailand and Burma, and places special emphasis on key endangered species occurring in this region. As it turns out, the four countries in question are the best known in southeast Asia, and the absence of other southeast Asian countries from this report (e.g., Vietnam, Laos, Kampuchea) points to some of the gaps in our knowledge of this region and the need for further investigation and basic survey work.

It is clear from these six chapters that the problems facing wildlife in southeast Asia are similar to those in most other parts of the developing world. Loss of habitat is the primary concern, with poaching a serious factor for certain species as well. Conflicts with local human populations are also an issue, especially for species like the elephant, which can do substantial damage in agricultural areas.

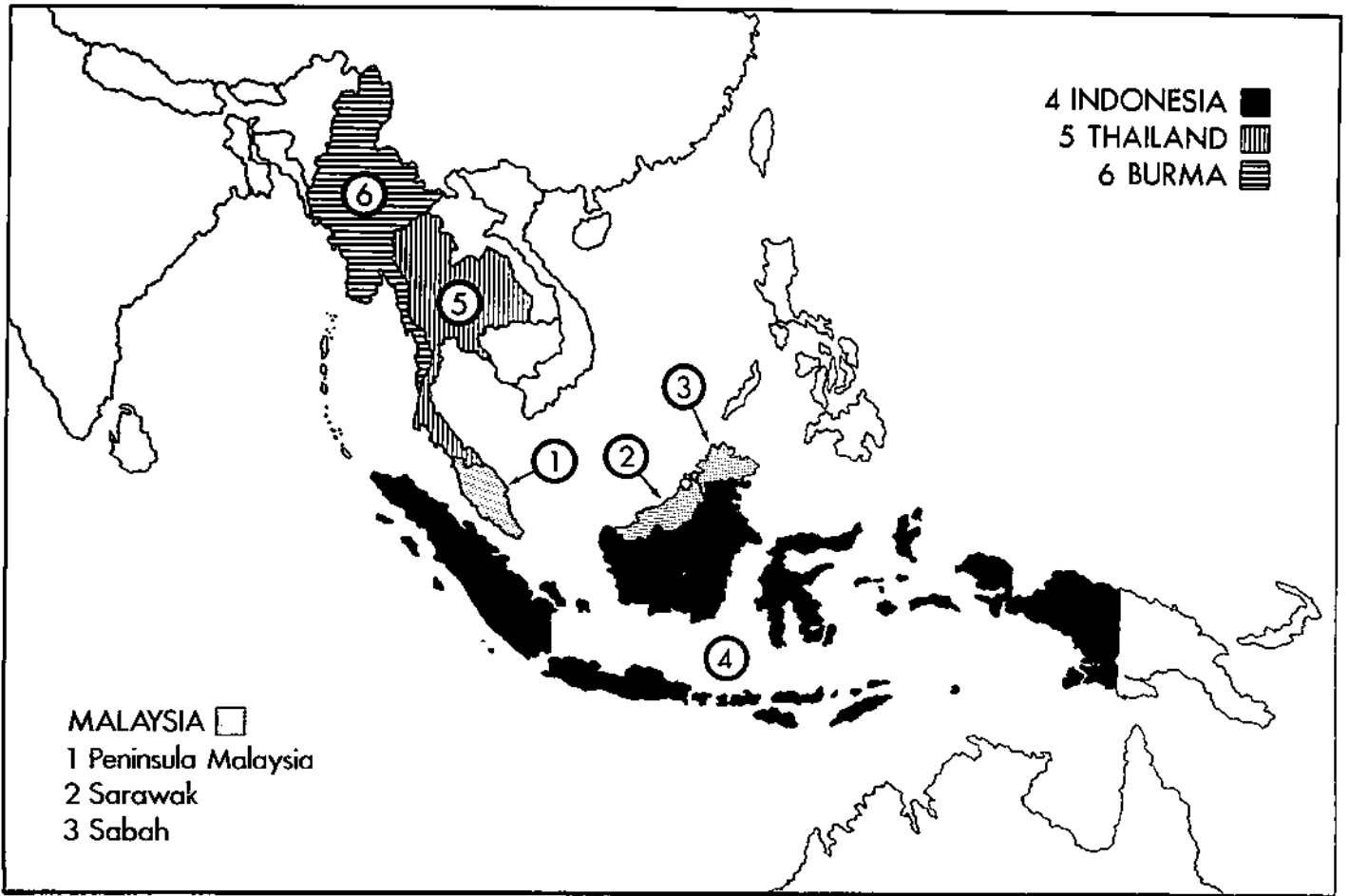
It is also obvious that our view of species conservation still focuses on the large, conspicuous and spectacular species, and especially on large mammals such as the elephant, the tiger, the orang-utan and the rhinos. Although this may seem limited in scope given the great diversity of life in this region, these animals are frequently among the most endangered and their symbolic value cannot be overestimated. Indeed, many of the species discussed in these articles have great value as symbols of the natural heritage of the countries in which they occur, and are worthy of protection on aesthetic grounds alone. It is also important to note that if these species can be protected in areas of suitable tropical forest habitat, many other smaller, less conspicuous species occurring in these same protected areas will survive as well — and, more often than not, it is the large and spectacular species that are most effective in calling attention to the entire conservation issue.

A number of these species also have great economic value, and are important resources to local people. The elephant is essential for the timber industry in Burma, the marine turtles provide a source of protein for many coastal peoples, and wild cattle represent a reservoir of genetic diversity for domestic stock. The economic importance of a growing tourist industry aimed at observing the fauna and flora of the world's tropical forests is also worthy of note, and it is usually the large and spectacular species that attract the most tourists.

Finally, it should be clear from the papers in this volume that all of the species discussed are integral components of the tropical forest ecosystems in which they occur, and that species and habitat conservation must always go hand in hand.

On behalf of the SSC Chairman, Mr. Grenville Lucas, we take great pleasure in launching this new SSC series, and hope that it will make a significant contribution to saving the species diversity of southeast Asia and our entire planet. We would also like to take this opportunity to extend our thanks to Department of Wildlife and National Parks of Malaysia, and especially to the Director General, Dr. Mohd. Khan bin Momin Khan for his outstanding efforts in organizing and hosting the 58th SSC Meeting.

Russell A. Mittermeier  
William R. Konstant





# Peninsula Malaysia

## Species Conservation Priorities in the Tropical Rain Forests of Peninsula Malaysia

Mohd. Khan B. Momin Khan  
Sivananthan T. Elagupillay  
and Zolkifli Bin Zainal

### Introduction

Peninsula Malaysia (131,582 km<sup>2</sup>) has some of the oldest rainforests in the world and is home to some of the world's richest and most unique animal and plant treasures. There are some 200 species of mammals, 600 species of birds, 130 species of snakes, 3,000 species of trees, 8,000 species of flowering plants, scores of amphibians and reptiles, and thousands of insects and invertebrate species.

Conservation in Peninsula Malaysia has evolved over periods of plenty and periods of scarcity of natural resources. During periods of plenty laws were lax, resulting in wasteful utilization of wildlife. Up to the time of the first salaried game warden in 1927, wildlife laws were enforced by volunteers or officers of the land office who were involved mainly in the issue of game licenses.

The incredibly low value put on the lives of animals contributed to the tragic extinction of the Javan rhinoceros in 1932 and the precarious situation of the Sumatran rhinoceros, which is still listed as an endangered species together with the tiger and the seladang. Strong and effective conservation legislation was slow in coming into force. Although current laws appear satisfactory to curb losses from poaching and trade in wildlife, the effects of habitat loss have proved to be a very serious cause of mortality. Approaches to the problems have changed from simple emphasis on law enforcement to a combination of research and management, extension programs, and establishment of national parks and wildlife reserves.

The need to expand and strengthen the developing economy has resulted in the clearance of vast stretches of virgin forest. In the last two decades Malaysia's forests have rapidly diminished and been replaced by agriculture and human settlements. Still, approximately 49% of the total land area in Peninsula Malaysia remains forested.

Steven (1968) spent two years in Peninsula Malaysia collecting data for a report on wildlife conservation. He noted the occurrence of mammals at different elevations and concluded that 52% are found below 330 meters, 81% are restricted to altitudes of less than 660 meters, 10% occur at higher elevations, and only 9% appear able to exist at all altitudes. Fifty-three per cent of all mammals are confined to primary forest, 25% live in primary or tall secondary forest, 12% live in primary or secondary forest or can subsist in cultivated areas, and 10% live in cultivated or urban areas.

Burgess (1971) described the effects of logging on hill dipterocarp forests in his study of approximately 40 hectares of average lower hill forest in the state of Trengganu. It was found that in this area only 35% of the stand disturbed by logging activity remained undamaged. Of the rest, 10% was felled for timber and 55% was destroyed in the extraction operation.

The effects of forest clearance on Malaysian mammals were studied by Harrison (1969), who found that the number of species decreased markedly in the transition from primary to secondary forest to scrub to grassland. The decrease in native mammalian diversity was on the order of 30 to 10 to 4 species, respectively.

### Species Conservation in Peninsula Malaysia

*Sumatran Rhinoceros (Dicerorhinus sumatrensis)*. Although numbers of Sumatran rhinos appear to have increased by about 30 individuals within Peninsula Malaysia between 1979 and 1982 (Table 1), only two areas, namely Endau Rompin and Tamara Negara (Fig. 1), have large and contiguous populations. It should be noted that the rhinos in Endau Rompin are reproducing, though at a slow rate of one animal every two years. The population has produced at least 3 young during the period 1975-1981. In other areas, rhino populations remain isolated and are threatened with extinction unless they can be translocated to safer areas.

Table 1. Estimated numbers of Sumatran rhinos in Peninsula Malaysia

Region	Numbers	
	1979	1982
<i>South</i>		
Endau-Rompin	8-15	20-25
G. Belmut	—	2-3
Mersing Coast	—	2-3
<i>North Central</i>		
Taman Negara	4-6	8-13
Ulu Lepar	2-4	3-5
Sg. Depak	2-4	3-5
Kuala Bolah	2-4	3-5
Krau Reserve	—	0-2
Bkt. Gebok	—	1-2
<i>West Coast</i>		
Sg. Dusun	2-4	4-6
<i>Northwest</i>		
Ulu Selama	—	3-5
Ulu Belum	2-4	3-5
Kedah Boarder	—	0-1
	30-50	52-80

*Malayan Tiger (Panthera tigris)*. In 1954, Locke estimated the Malayan tiger (Fig. 2) population to be about 3,500, but it has

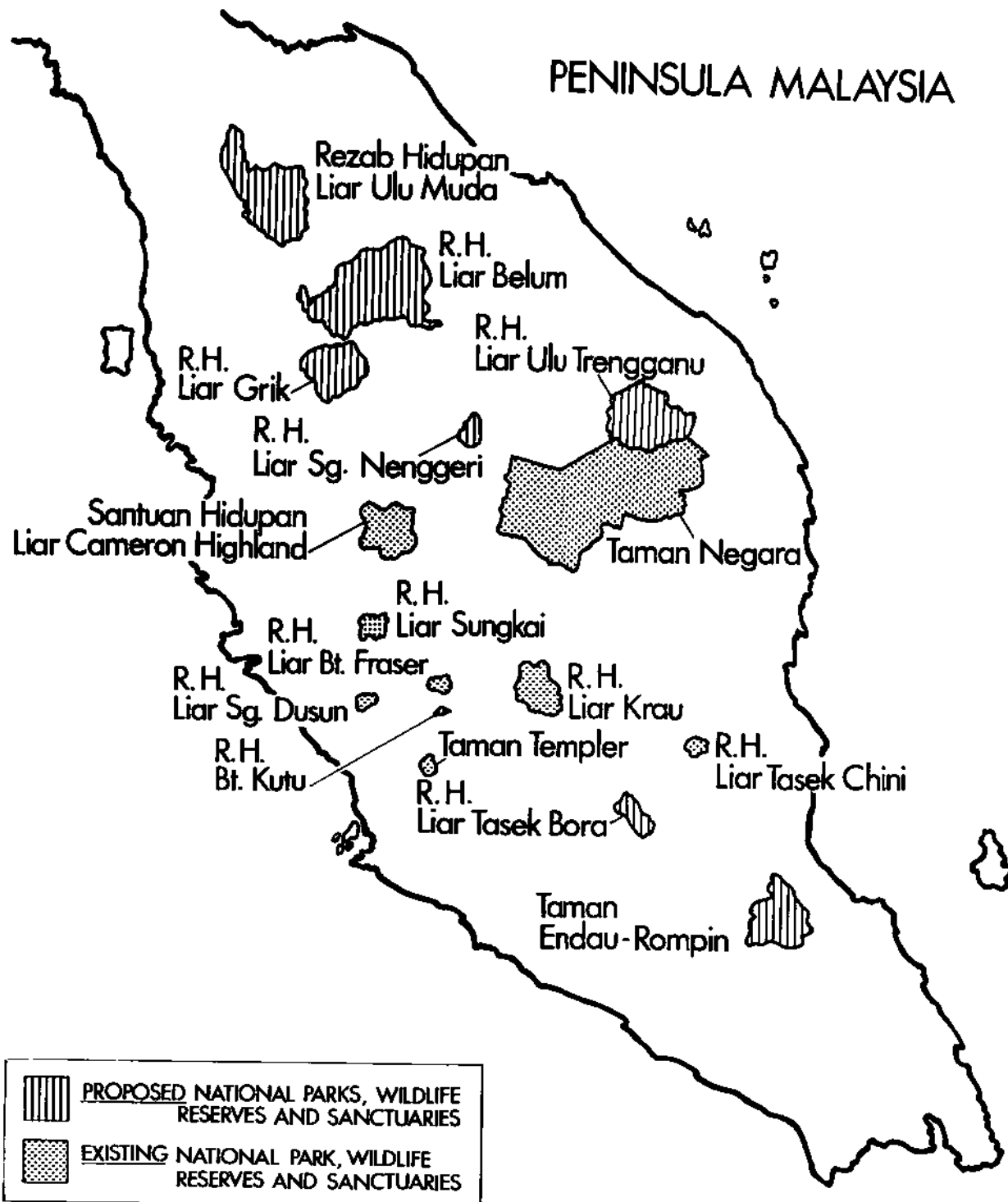


Fig. 1: Map of Peninsula Malaysia showing the location of existing and proposed national parks, wildlife reserves and sanctuaries.

now dwindled to about 250, based on work carried out by the Wildlife Department over the last four years. The tiger, which once inhabited the whole of Peninsula Malaysia, is now mainly found in the existing primary and secondary forest of Perak, Kelantan, Trengganu and Pahang.

*Seladang (Bos gaurus)*. While it is difficult to manage populations of Sumatran rhinoceros and tiger, the situation for the seladang (gaur or wild cattle, Fig. 3) appears more hopeful. Its requirements are relatively simple: pasture, water, minerals and cover. In the last survey by the Wildlife Department in 1980, there was evidence of an increase in the seladang population (Table 2).

Table 2. Seladang population in Peninsula Malaysia as of 1980

Areas	Numbers	
	1977	1980
National Parks and Reserves	150	150
Ulu Tengganu	25	29
Sungai Nenggiri	40	53
Ulu Lepar	56	96
Maran	—	5
Lepar Hilir	—	10
Endau Rompin	25	25
Ulu Sering	10-12	10-12
Grik Wildlife Reserve	40	40
Belum Wildlife Reserve	60	60
	400	472

A detailed study in Ulu Lepar showed that the seladang preferred riverine habitat, with 70% being found at 0-7 m.

*Elephant (Elaphas maximus)*. Like the tiger, the elephant (Figs. 4-5) once roamed freely throughout Peninsula Malaysia, but is now restricted to remaining forests in the states of Kelantan, Trengganu, Pahang, Perak, Johore and a few areas in Negeri Sembilan and Kedah. There are now about 700 elephants distributed in these states, including Taman Negara (Table 3).

Table 3. The elephant populations of Peninsula Malaysia

States	Numbers
Kelantan	134
Trengganu	54
Johore	77
Pahang	175
Perak	126
Negeri Sembilan	5
Taman Negara	100
	671

*Primates*. Southwick and Cadigan (1972) reported on the abundance of non-human primates (Figs. 6-9) in primary and secondary forests of Peninsula Malaysia. An assessment was made of group densities (animal/km<sup>2</sup>) of each species except the dark-handed gibbon (Table 4). Other source material includes Bernstein (1968), MacKinnon and MacKinnon (1978), Fleagle (1978)

and Chivers (1980). The total area of forest still remaining in 1958 was 84%, or 110,308 km<sup>2</sup>.

Table 4. Total population estimates of primates in Peninsula Malaysia in 1958

Species	Density of species		Total Population
	2° Forest	1° Forest	
<i>Macaca fascicularis</i>	1.54	0.37	415,000
<i>M. nemestrina</i>	0.13	- 1	80,000
<i>Presbytis cristata</i>	0.26	- 1	6,000
<i>P. melalophos</i>	2.95	2.22	962,000
<i>P. obscura</i>	0.64	0.74	305,000
<i>Hylobates lar</i>	0.89	1.11	144,000
<i>H. syndactylus</i>	0.51	1.11	111,000

Based on the same densities provided by Southwick and Cadigan (1972), Khan (1978) estimated the populations of the various species and indicated losses in numbers between 1958 and 1975 (Table 5). These estimates are based on 51% of the total land area still being under forest cover at that time.

Table 5. Total losses in non-human primate populations between 1957 and 1975

Species	Population in 1957	Population in 1975	Population loss	% loss
<i>Macaca fascicularis</i>	415,000	318,000	97,000	23.37
<i>M. nemestrina</i>	80,000	45,000	35,000	43.75
<i>Presbytis cristata</i>	6,000	4,000	2,000	33.33
<i>P. melalophos</i>	962,000	554,000	408,000	42.41
<i>P. obscura</i>	305,000	155,000	150,000	49.18
<i>Hylobates lar</i>	144,000	71,000	73,000	50.09
<i>H. syndactylus</i>	111,000	48,000	63,000	56.75

Recent studies by Marsh and Wilson (1981) indicate that the distribution of primates in Peninsula Malaysia is similar to that reported in earlier studies by Lim (1962), Medway (1969, 1970), Khan (1970) and Chivers (1974). Langurs (*Presbytis* spp.), macaques (*Macaca* spp.) and gibbons (*Hylobates* spp.) are still widely distributed all over Peninsula Malaysia. Only the slow loris (*Nycticebus coucang*) is thought to be rare.

*Birds*. An attempt was made to estimate minimum bird populations in 6 different habitats: urban gardens, coconut plantations, mangrove forest, secondary lowland forest, extraction tracks in logged forest and virgin jungle in reserves in Selangor (McClure, 1969; Table 6).

The rich diversity of the forest bird fauna of Peninsula Malaysia was surveyed (Wells, 1971) in Pasoh, Negeri Sembilan, Kuala Lompat, Pahang and Sg. Sat and Sg. Sepia of Taman Negara (Table 7).

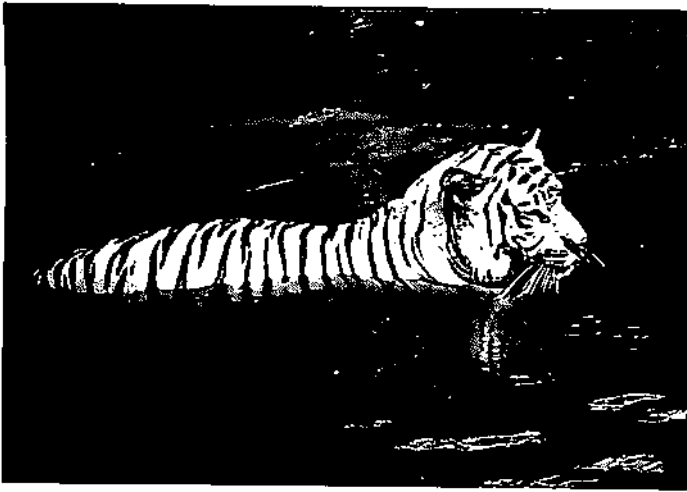


Fig. 2: The tiger, which once numbered about 3500, has now dwindled to about 250 (photo by R. A. Mittermeier).



Fig. 3: The seladang, largest of the wild cattle and one of Malaysia's priority species (photo by R. A. Mittermeier). The individual shown is a female.



Fig. 4: The Malaysian elephant population is now thought to number about 700 individuals (photo by R. A. Mittermeier).

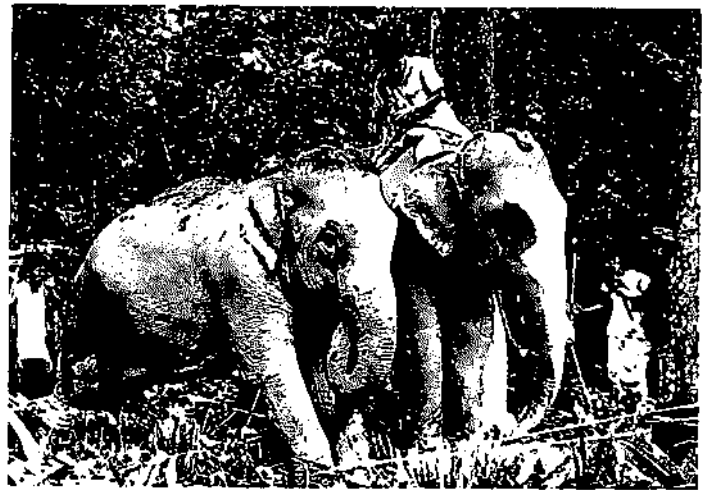


Fig. 5: The elephant catching unit of the Dept. of Wildlife and National Parks at work (photo by R. A. Mittermeier).

Table 6. Population estimates of birds according to habitat type (from McClure, 1969)

Location	Habitat Type	Birds per 40 hectares
Kuala Lumpur	Urban garden	1100
Subang	Secondary forest	450
Rintang Panjang	Coconut plantation, mangrove	800
Ulu Gombak Forest Reserve	Extraction track in logged forest	400
Ulu Gombak	Virgin Jungle reserve	400

Table 7. Record of species abundance of birds in each area (Wells, 1971)

Location	Area Size (km <sup>2</sup> )	Study Duration	# Species
Pasoh, Negeri Sembilan	10	2 years	175
Kuala Lompat, Pahang	2	3 days	141
Sg. Sat and Sg. Sepia, Taman Negara	3	6 days	127

Table 8. Density and area needs of hornbills

Species	Number of birds supported/200 ha (Kuala Lompat)	Estimated area needed to support 500 individuals (hectares)
Helmeted hornbill ( <i>Rhinoplax vigil</i> )	1	10,000 ±
Rhinoceros hornbill ( <i>Buceros rhinoceros</i> )	c. 1	10,000
Southern Pied hornbill ( <i>Anthracoceros convexus</i> )	2	5,000
Black hornbill ( <i>Anthracoceros malayanus</i> )	4	2,500
Bushy-crested hornbill ( <i>Anorrhinus galeritus</i> )	5	2,000

The total number of known lowland forest birds is 241 species. Observations at Kuala Lompat, Pahang, taken over an area of 194 hectares, provided data for estimates of the density of hornbills and of the area needed to support 5,000 individuals (Medway and Wells, 1971; Table 8).



Fig. 6: One of Peninsula Malaysia's two macaque species, the pig-tailed macaque (*Macaca nemestrina*) (photo by R. A. Mittermeier).

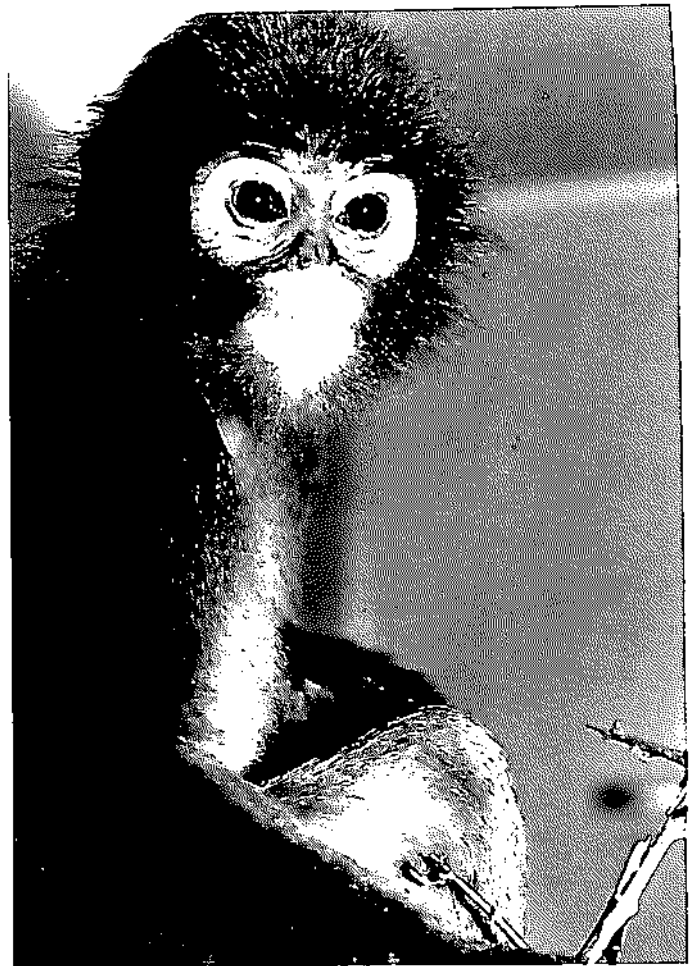


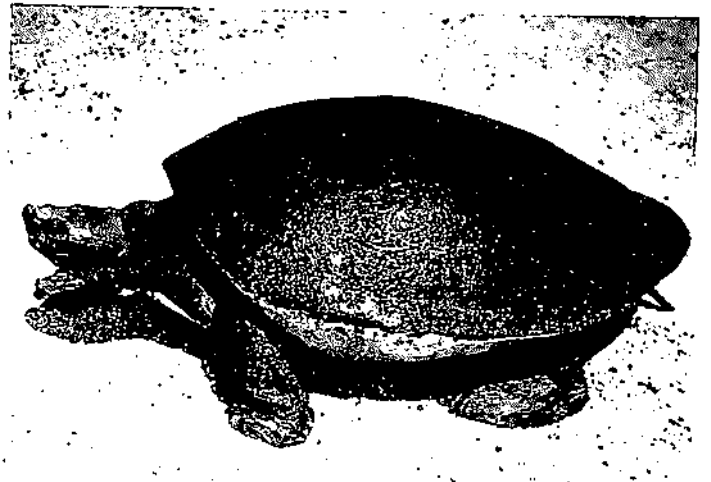
Fig. 7: One of Peninsula Malaysia's three langur species, the spectacled langur (*Presbytis obscura*) (photo by R. A. Mittermeier).



Fig. 8: The siamang (*Hylobates syndactylus*), largest of Peninsula Malaysia's nonhuman primate species (photo by D. J. Chivers).



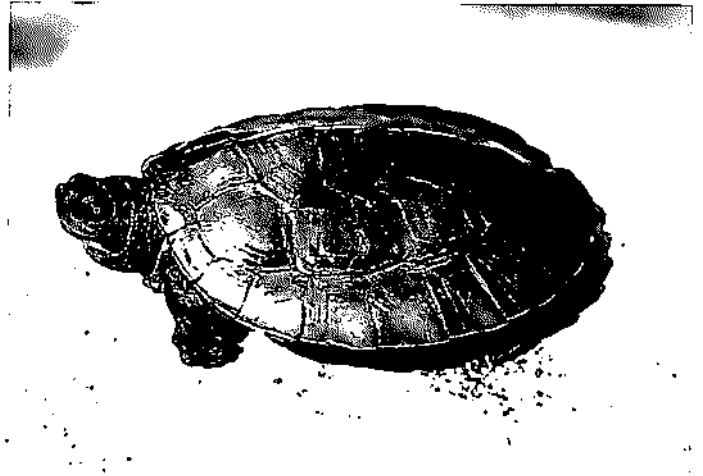
a.



b.



c.



d.

Fig. 9. The river terrapin (*Batagur baska*) is one of Malaysia's most endangered reptiles. Special hatcheries have been established in Kedah, Perak and Trengganu. These animals were photographed in the hatchery at Bota Kanan. (Photos by R. A. Mittermeier). a. Adult male *Batagur baska* (note the striking white eye). b. Adult female *Batagur baska*. c. Hatchling *Batagur baska*. d. Hatchlings awaiting release. e. Personnel of the Dept. of Wildlife and National Parks with a number of *Batagur baska* hatchlings to be released in the Perak River.



e.

**River Terrapin (*Batagur baska*).** Three river terrapin hatcheries were started in the states of Kedah, Perak and Trengganu at a total cost of one million dollars (Figs. 10-14). These projects will hopefully counter the declining numbers of river terrapins due to poaching of adults and the extensive collection of their eggs. More than 20,000 one year old terrapins have been released from such hatcheries since 1967.

**Deer.** Two deer farms are now also being developed in the Sungkai Game Reserve, Perak and the Krau Game Reserve, Pahang, like the river terrapin hatcheries at a cost of about one million dollars. The deer are raised in a semi-wild state in an effort to produce good breeding stock. From a few locally obtained animals the breeding stock has now increased to about 100 individuals.

### Conservation Action Priorities

Wildlife management in a strict sense is a relatively recent phenomenon in Peninsula Malaysia. Formerly, game departments functioned primarily as licensing agencies, while control of hunting and trade in wildlife was given low priority. Wildlife was shot and killed indiscriminately and the incidence of licensees taking more game than the allowed bag limits was high. A number of species have become endangered or extinct, and this is evidence of the absence of sustained conservation efforts.

The large number of firearms in the hands of hunters presents

a serious problem for wildlife conservation. In Peninsula Malaysia, wildlife species may be killed in defense of crops, life or property. Illegal possession of firearms carries the death penalty, but far too many people are currently licensed to carry firearms.

Corruption among enforcement officials is a serious problem. It must be corrected by better income and more attractive prospects in the wildlife service. In addition, close supervision and legal action against corrupt officers is essential. Violations, no matter how small, should be acted upon. To speed up action, minor offenses may be settled out of court, whereas serious offenses should all go to court and be dealt with accordingly.

Smuggling is serious because of the demand and the high commercial value of many species of wildlife. To curb smuggling, Malaysia became a party to CITES in 1978.

Apart from legislation directly pertaining to the protection of wildlife and national parks there are numerous laws that are not effectively enforced. In Peninsula Malaysia, river terrapins are governed by the river rights laws of each state. In pre-war days, when these laws were strictly enforced, terrapins were abundant. Nowadays, these laws are hardly enforced, which explains why the river terrapin is endangered.

We believe support for conservation to be a top priority. A variety of conservation-oriented programs already exist on radio and television networks, but films on conservation are mainly products of foreign countries. A more direct approach is necessary to illustrate local problems and what is being done in the field of conservation.

A special effort to gain the support of decision makers and politicians is the utmost priority in solving wildlife management problems. This approach is unfortunately slow, short-term results not being easily achieved. The support of the judiciary is indispensable, as it would be meaningless to impose fines which do not deter offenders. An effective system with adequate law enforcement officers equipped to perform their duties with confidence is essential.

The need for political stability routinely takes precedence over the need for wildlife reserves in developing nations. In the face of a rapidly expanding population there is no alternative but to exploit both renewable and non-renewable natural resources, since leaders perceive constraint on raising the standard of living unacceptable. Despite this, the concept of conservation is included in the ASEAN (Association of Southeast Asian Nations) program for the environment, through the actions of high-ranking government officials and ministers. Under conservation the importance of national parks, trade in wildlife, legislation, training, information exchange and wildlife management research are given prominence. Representatives from the Department of Wildlife and National Parks of each country participate in meetings, workshops and field trips, and assistance and advice from international organizations like UNEP and IUCN are sought when needed. In the past, a lack of sound management research has resulted in undesirable decisions, based on incomplete data analyses. This has often had a serious effect on wildlife. For example, improperly scheduled hunting seasons have resulted in heavy mortality of pregnant animals and their young. It is important that management research be increased as most, if not all, conservation action must be based on a thorough knowledge of the biology of animals and their roles in the ecosystems.

Mining activities presently occur in about 1% of the total land area of Peninsula Malaysia, but are not regulated under a general landscape quality program for the entire country due to the prohibitive costs of establishing such a program.

Shifting cultivation presents a serious problem in wildlife management. While it is beneficial to some species of wildlife, it is

detrimental to most because of habitat loss. Shifting cultivation, of necessity, is quite extensive in this region. In practice, the first few crops provide good harvests, but declining fertility within only a few years necessitates relocation. It takes several years before an abandoned cultivated area becomes naturally fertile again; which explains why extensive areas are needed for shifting cultivation. While waiting for the crops to be harvested, wildlife and wild plant products take their place.

The elephant problem in Peninsula Malaysia was tolerable before palm oil became a major industry. Continuing loss of habitat, coupled with the elephants' preference for oil palm have resulted in a serious confrontation between this species and man. More research is required to produce an effective means of elephant control. A trapping scheme solved the Bengka crop depredation problem, which at the time was very serious. The scheme is applied in places where there is no available forest for elephants. Electric fences are also being widely used by planters and have proven an effective deterrent.

*Wildlife Plan.* A Wildlife Plan is essential for Malaysia. Such a plan must consider the variety of species present, their habitat and their potential uses. The species currently being managed are important by virtue of their status as endangered species, economically important species or serious pests. A more comprehensive Wildlife Plan is currently being prepared, aimed at conserving a representative cross-section of the diverse Malaysian flora and fauna. This comprehensive plan will be dependent upon existing governmental policies, yet will allow for appropriate action to be taken promptly in critical situations.

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Fig. 10: The white-handed gibbon (*Hylobates lar*), one of Malaysia's three gibbon species (photo by D. J. Chivers).



# Sarawak

## Species Conservation Priorities in the Tropical Forests of Sarawak, Malaysia

Kron Mide Aken  
and Michael Kavanagh

### Introduction

Sarawak is the largest of Malaysia's 13 states, occupying 124,450 km<sup>2</sup> of northwestern Borneo, approximately between 1° and 5° N latitude (Fig. 1). It is bounded to the north by the double enclave of Brunei (5,763 km<sup>2</sup>) and approximately 2,000 km of coastline. In the south and east it shares roughly 2,250 km of frontier with the Indonesian states of West and East Kalimantan, and a further 125 km with the Malaysian state of Sabah.

Geologically, Sarawak consists largely of relatively young, very deep sedimentary rocks that have been subjected to complex and localized folding; although more ancient formations, even pre-Permian, are found in the extreme west (Fitch, 1960).

Approximately 28,900 km<sup>2</sup> of the state (23%) lies below the 30 m above sea level contour, forming a coastal plain of varying width, with a number of isolated outcrops. The soils here are mainly gley and peat formations, most of which are poorly drained and naturally covered with various types of swamp forest (Anon., 1968). Above the 30 m contour, skeletal and podzolic soils predominate, being loamy sands to clays and typically very shallow where the land is steep. Much of this area is very rugged hill country, even steeply mountainous in places. The vegetation is chiefly mixed dipterocarp forest, with *kerangas* (heath forest) occur-

ring in areas of coarse, sandy soils (see Whitmore, 1975 and Table 1).

Land above 610 m, with more montane forest formations (20% of the state), is mainly to be found in northeastern Sarawak, culminating in the Kelabit Uplands and the state's highest peak, 2,425 m, named Gunung Murud. Nearby, Gunung Mulu rises to 2,378 m.

In Sarawak's 1980 census 1,294,753 people were counted (Dept. of Statistics Information, Sarawak). The most recent ethnic breakdown of 1970 gives the Malay/Melanau people as comprising 24% of the population, other native peoples as 45%, and the Chinese and non-natives as 31%. The significance of these figures is that the Malay/Melanau and non-native 55% of the population are mainly urban and coastal peoples who do not depend on hunting as a source of protein. The remaining 45%, sometimes referred to as *Dyaks*, are mainly rural people, many of whom practice hunting for food and cultural purposes (e.g., to collect feathers) with shotguns, spears and blowpipes (Figs. 2-3). They include the Bidayuh of western Sarawak, the Ibans, Kayans and Kenyahs of the center of the state, and smaller tribes from the north, such as the Kelabits, Muruts, Punans and Penans. Many of these people dwell in traditional longhouses and practice shift-



Fig. 1: A penan man using a blowpipe and poison darts to hunt for small game (photo by M. Kavanagh).



Fig. 2: Two Kelabit hunters of Sarawak's Fourth Division skinning a freshly shot Hose's langur (*Presbytis hosei*) (photo by M. Kavanagh).

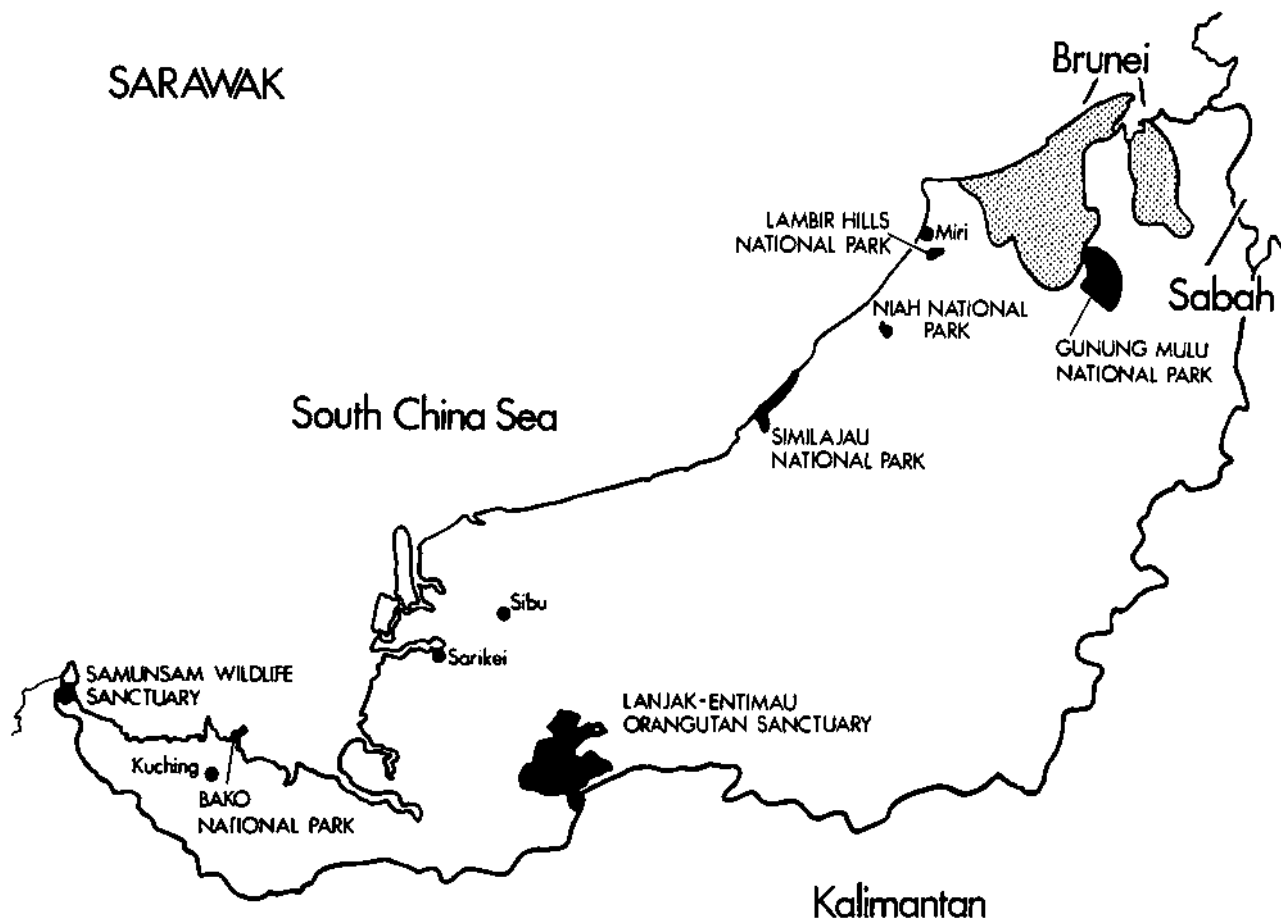


Fig. 3: Map of Sarawak showing the location of National Parks and Wildlife Sanctuaries.

ing cultivation of hill *padi* (with other crops) over wide areas. Nomadic hunter-gatherer groups may still be found among the Punans and Penans.

Throughout the state, the "Dyaks" have the right to practice their shifting cultivation wherever the land is neither specifically owned by some person or organization, nor gazetted as a government reserve. This means that they can farm in more than half of the area of Sarawak. Apart from their right to farm, they also enjoy "native customary rights," whereby they may hunt, fish and collect such forest products as rattan, fruit and timber for their housing. Generally, this is done in the forests fairly close to the longhouses, but it also occurs as much as three or four days journey upriver by non-motorized boat.

The net result of all this is that wildlife conservation is not an easy task. Shifting cultivation and wildlife conservation are often in competition for land; and the government usually has to abrogate or reduce native customary rights — often with extensive compensation — in order to obtain areas for national parks or wildlife sanctuaries. Once an area is gazetted as a park or sanctuary, constant patrolling is necessary against both poachers and encroachment by shifting cultivators.

Sarawak has a very limited road system. A single, largely unpaved trunk road from the extreme west to Brunei is scheduled for completion during 1983. However, the rivers will continue to form the basis of the transportation network for many years to come. A regular air service is available and air travel into the interior is subsidized by the government.

Under the Forest Ordinance of 1954 and its subsequent amendments, the Sarawak Forest Department administers 24.3% of the

Table 1. Principal forest types and other land use in Sarawak

	Sq. Km.	% of land area
<i>Forested land</i>		
Mangrove & nipah swamp	1,738	1.4
Other swamp forests	14,738	12.0
Mixed dipterocarp forests	74,189	60.2
Kerangas (heath forest)	3,660	2.9
	94,325	76.5
<i>Non-forest land</i>		
Settled agricultural & non-agricultural	4,730	3.8
Shifting cultivation & unused land	24,198	19.7
	28,928	23.5
Total land area	123,253	100.0
(Water	1,197	)

Source: Anon. (1982).

state as permanent forest in the form of forest reserves, protected forests and communal forests (Table 1). All are intended to be managed on a sustained yield basis. Forest reserves and protected forests, and all that they contain, are the property of the state gov-

ernment and may be exploited for timber under a licensing system. In addition, any inhabitant of Sarawak may enter any protected forest (subject to the control of the Director of Forests) to hunt, fish and collect minor forest products. Communal forests are specifically intended for more local exploitation by the people of the immediately surrounding area. These people have the sole right to utilize the forest, which they normally maintain and control, and which cannot be licensed for commercial timber extraction. It is the case, however, that "minor forest produce" is invariably understood to include wood for domestic use only.

National parks and wildlife sanctuaries are also controlled by the Director of Forests (who doubles as the Chief Game Warden), being administered on his behalf by the National Parks and Wildlife Office of the Sarawak Forest Department. They are the most fully protected areas in the state, the main practical difference between them being that parks are intended to include recreation and tourism. These protected areas, constituted under the National Parks Ordinance of 1956, the Wild Life Protection Ordinance of 1958 and their subsequent amendments, provide for certain hunting and collecting rights to be exercised, if so specified in the Government Gazette. Since there is no legal provision for buffer zones, these must be located within the protected area boundaries if they are to be managed as part of the area. The Wild Life Protection Ordinance also makes provision for the legal protection of listed species (see Table ), to be enforced by means of fines and jail sentences.



Fig. 4: The proboscis monkey (*Nasalis larvatus*), a large and striking primate restricted to Borneo (photo by R. A. Mittermeier).

### Species Conservation in Sarawak

The National Parks and Wildlife Office (NPWO) has a staff of 57, of whom only 6 are graduates, plus 3 foreign volunteers. The current emphasis of the office is to administer the existing



Fig. 5: The proboscis monkey *Nasalis larvatus*, a large and striking primate restricted to Borneo (photo by R. A. Mittermeier).



Fig. 6: Nipa-mangrove association in the Samunsam Wildlife Sanctuary, one of the main strongholds of the proboscis monkey in Sarawak (photo by R. A. Mittermeier).



Fig. 7: Bako National Park, an attractive national park located near the capital city of Kuching (photo by R.A. Mittermeier).

parks and sanctuaries and to gazette more land under these categories. It is therefore not surprising that a relatively small amount of survey information is available, much of it emanating from joint projects with scientists outside the department (e.g., Anderson, et al., 1982; Kemp and Kemp, 1974; WWF, 1982). Consequently, data on the effects of widespread shifting cultivation are usually conspicuously lacking in wildlife sanctuaries, even in comparison with settled land in Peninsula Malaysia.

Survey information does exist for hornbills (*Bucerotidae*; Kemp and Kemp, 1974) and the proboscis monkey (*Nasalis larvatus*; Salter and MacKenzie, 1981). Of the 8 hornbill species in Sarawak, only the pied hornbill (*Anthracoceros coronatus*) is regarded as vulnerable, as it prefers the coastal habitat. The coastal part of the state is precisely that which has been most cleared for agricultural development. The proboscis monkey (Figs. 4-7) has a disjunct distribution along the coast and a total population that is estimated at about 2,000 animals, far fewer than previously thought (IUCN, 1978), 90% of which are found in areas that are open to human exploitation.

Of the other species listed in the *Red Data Books* (ICBP, 1981; IUCN, 1978, 1982), orangutans (*Pongo pygmaeus*) are found in and around Lanjak-Entimau Orangutan Sanctuary. Although they have yet to be quantitatively surveyed, the available evidence shows that they cover a wide area and suggests that they are present in good numbers (WWF, 1982; NPWO unpublished reports, 1983; *contra* Davies, 1983). Elsewhere, they are found only in highly accessible, disjunct pockets of unprotected forest where they are unlikely to survive for very long. The Bornean tarsier (*Tarsius bancanus borneanus*) appears to be more widespread than previously thought (e.g., Medway, 1977), being present in Gunung Mulu National Park and Lamjak-Entimau (Anderson, et al., 1982; WWF, 1982), as well as, for example, Semenggoh Forest Reserve, Bako National Park and Niah National Park (Niernitz, 1979).

Very little is known about the distributions of the clouded leopard (*Neofelis nebulosa*), marbled cats (*Felis marmorata* and *F. badia*), or the flat-headed cat (*F. planiceps*). The Sumatran rhinoceros (*Dicerorhinus sumatrensis*), relatively common in the 1930's, may well be extinct in Sarawak, and the banteng (*Bos javanicus*) persists only in remote parts of the north and east, if at all.

The most up-to-date information for Sarawak's eight bird species that are listed in the *Red Data Book* may be found in ICBP (1981) and Smythies (1981). Likewise, up-to-date information about threatened reptiles may be found in IUCN (1982), to which it may be added that the false gharial (*Tomistoma schlegelii*) is still hunted, quite legally. A population of false gharials, as yet unsurveyed in detail, would be protected if current plans to establish Sarawak's only lake, Loagan Bunut, as a national park are successful. The first steps in this direction have been taken by the Forest Department.

Conservation education is in its early stages at all levels of Sarawakian society. However, certain species may be occasionally protected by specific customs and taboos. For example, orangutans are not hunted by most of the people of the upper Batang Ai river basin immediately to the south of Lanjak-Entimau. In consequence, they persist there, even in areas of secondary forest adjacent to cultivation where other primary forest species are almost totally absent. The same is not true in nearby areas where orangutans are equally protected by law, but not by tradition (unpublished survey information, NPO/WWF, 1983). For the majority of the people of Sarawak, wildlife conservation is of little or no interest, except where declining yields have become a matter for regret (see Aken, 1982).

With three-quarters of the state still forested, habitat destruc-

tion is not the immediate problem that it is in some other parts of southeast Asia, but this situation is unlikely to persist for long. At the present time, rural people and several development agencies are competing to use forested land, with many legitimate claims that can result in forest degradation and destruction.

Table 2. Protected areas in Sarawak

	Sq. Km.	% of the area of the state
<b>Production forests</b>		
Forest reserves	7,602	6.1
Protected forests	22,536	18.1
Communal forests	55	<.1
	30,193	24.3
<b>Parks &amp; Sanctuaries</b> (with dates of gazettelement)		
1. Bako National Park (1957)	27	<.1
2. Gunung Mulu National Park (1974)	529	0.4
3. Niah National Park (1974)	31	<.1
4. Lambir Hills National Park (1975)	69	<.1
5. Similajau National Park (1979)	71	<.1
6. Samunsam Wildlife Sanctuary (1979)	61	<.1
7. Lanjak-Entimau Orang-utan Sanctuary (1983)	1,688	1.4
8. Gunung Gading National Park (1983)	54	<.1
	2,530	2.0

Source: Anon. (1982); WWF (1982).



Fig. 8: Juvenile silver leaf monkey (*Presbytis cristata*) from Sarawak (photo by R. A. Mittermeier).

National parks and wildlife sanctuaries cover only 2% of the state and of those, only one exceeds 1,000 km<sup>2</sup> (Table 2). Should the existing parks and sanctuaries ever become completely isolated from the surrounding forests, they will certainly be inadequate to conserve more than a small proportion of Sarawak's plant and animal species. Species that naturally occur at low densities (such as many forest trees and large animals) and those which normally experience severe population fluctuations will be most at risk (Diamond, 1975). An additional problem for Sarawak is that swamp forests (about 17.5% of current forest cover) are effectively unrepresented among the existing parks and sanctuaries.

Finally, the state presently lacks appropriate regulations for the enforcement of CITES, to which Malaysia is a party, although the Wild Life Protection Ordinance (Table 3) provides the necessary enabling legislation. Specific proclamations must be gazetted before, for example, the trades in crocodile or pangolin derivatives can be controlled.

### Conservation Action Priorities

It is recognized that the management plans for Gunung Mulu

Table 3. Animals listed on the First Schedule of the Wild Life Protection Ordinance

#### Protected animals:

1. <i>Nasalis larvatus</i>	proboscis monkey
2. <i>Pongo pygmaeus</i>	orang-utan
3. <i>Dicerorhinus sumatrensis</i>	Sumatran rhinoceros
4. <i>Egretta sacra</i>	reef egret
5. <i>Bulbulcus coromandus</i>	cattle egret
6. <i>Ciconia stormi</i>	Storm's stork
7. <i>Leptoptilos javanicus</i>	lesser adjutant
8. <i>Haliaeetus leucogaster</i>	white-bellied sea-eagle
9. <i>Ichthyophaga ichthyaetus</i>	grey-headed fishing eagle
10. <i>Sterna sumatrana</i>	black-naped tern
11. <i>Sterna anaethetus</i>	bridled tern
12. <i>Ducula bicolor</i>	pie imperial pigeon
13. <i>Chelonia mydas</i>	green turtle
14. <i>Eretmochelys imbricata</i>	hawksbill turtle
15. <i>Dermochelys coriacea</i>	leatherback turtle
16. <i>Berenicornis comatus</i>	white-crested hornbill
17. <i>Anorrhinus galerius</i>	bushy-crested hornbill
18. <i>Rhyticeros corrugatus</i>	wrinkled hornbill
19. <i>Rhyticeros undulatus</i>	wreathed hornbill
20. <i>Anthrococeros malayanus</i>	black hornbill
21. <i>Anthrococeros coronatus</i>	pie hornbill
22. <i>Buceros rhinoceros</i>	rhinoceros hornbill
23. <i>Rhinoplax vigil</i>	helmeted hornbill
24. <i>Polyplectron malacense</i>	Malaysian peacock pheasant
25. <i>Argusianus argus</i>	great argus pheasant
26. <i>Dugong dugon</i>	dugong
27. <i>Lanthanotis borneensis</i>	earless monitor lizard
28. <i>Tarsius bancanus</i>	Horsfield's tarsier
29. <i>Neofelis nebulosa</i>	clouded leopard
30. <i>Nycticebus coucang</i>	slow loris
31. <i>Hylobates muelleri funereus</i>	Bornean gibbon
32. <i>Hylobates muelleri muelleri</i>	Bornean gibbon
33. <i>Hylobates muelleri abbotti</i>	Bornean gibbon

#### Other animals the export of which is forbidden except under licence:

1. Apes and monkeys
2. Bears
3. Deer

n.b. The numbering of the listed animals follows that of the Ordinance but the scientific names have been up-dated where necessary.

National Park and Lanjak-Entimau Orangutan Sanctuary require implementation, and that similar management work is required for the remaining parks and sanctuaries. Work is proceeding in these areas, but an equal priority is to develop a master plan for the statewide conservation of representative habitat types. This will result in recommendations for more protected areas and for the incorporation of other types of permanent forest estate into the system to minimize fragmentation.

In this connection, NPWO is pursuing several concurrent lines of approach, partly in conjunction with WWF Malaysia (Project 3212). Firstly, potential protected areas are being surveyed on an opportunistic basis and proposed, if appropriate. Secondly, work has begun on the overall master plan as a basis for strategy. Thirdly, NPWO is encouraging greater integration of wildlife management practices with production forestry in forest reserves and protected forests (Aken, 1982).

Limited faunal surveys are being conducted as part of the above approach, but large parts of the interior, especially in the almost uninhabited east-central highlands, have yet to be tackled. A habitat-oriented, rather than species-oriented approach is currently most appropriate overall, but Lanjak-Entimau Orangutan Sanctuary was created largely to provide for that particular species, and the need for an area of deltaic mangrove for proboscis monkey protection is an immediate priority. Should a viable population of banteng or even rhinoceros be found in the state, NPWO would take steps to meet the species' conservation requirements, as necessary.

In addition, certain species are widely hunted and require management on a sustained yield basis over as big an area as possible. In effect, this will mean the implementation of closed seasons and perhaps certain hunting and trapping restrictions. NPWO is therefore taking steps to collect the relevant basic information, including quantified data on hunting practices, yields and the reproductive patterns and demography of the species concerned. It is anticipated that the studies will confirm the bearded pig (*Sus barbatus*) as the most hunted animal, with deer (*Tragulidae* and *Cervidae*) also being very important sources of protein in the rural areas.

Revision of the regulations gazetted under the Wild Life Protection Ordinance, especially for the purpose of controlling the wildlife trade, is also a current priority for NPWO, but for technical and constitutional reasons, this may take some time.

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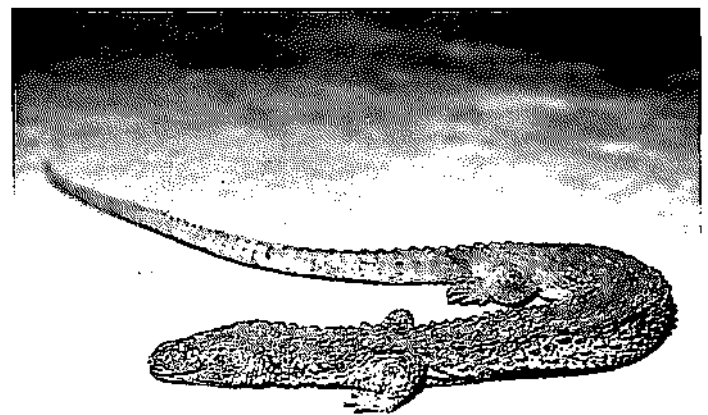


Fig. 9: The Bornean earless monitor (*Lanthanotis borneensis*), a very rare lizard first discovered in Sarawak (photo by R. A. Mittermeier).

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# Sabah

## Species Conservation Priorities in the Tropical Forests of Sabah, East Malaysia

John Payne

### Introduction

Sabah (Fig. 1), occupying 76,000 km<sup>2</sup> of the northern part of the island of Borneo, is the second largest of the thirteen states in the federation of Malaysia. Geologically, Sabah consists largely of relatively young sedimentary formations. The terrain is hilly throughout the interior and western regions, and Mount Kinabalu, which rises to 4101 m above sea level, is the highest peak in southeast Asia.

Sabah can be divided broadly into five regions. In western Sabah there are high hill ranges divided by fertile valleys and plains which are cultivated by the oldest indigenous inhabitants of Sabah. Central Sabah is dominated by rugged, sparsely inhabited highlands 300-1,000 m in altitude. Most of Sabah's remaining primary forest with high timber stands occurs here. In the northeast are plains and low hills with predominantly poor, sandy soils. There are old indigenous communities along all major rivers.

In the southeast is an area of mixed topography on old volcanic rocks with fertile soils. This was the region to undergo the first extensive, large-scale plantation farming in Sabah. The eastern central part of Sabah consists mostly of flat or rolling terrain less than 300 m in altitude. Almost all of this region, previously uninhabited by man, was logged during the 1960's and 1970's, and is now the region of rapid, large-scale agricultural development. All major towns and settlements are in the western valleys and plains, with the exception of three on the east coast. Public roads link all the main western communities. There is one east-west road from Kota Kinabalu to Sandakan, and a second road will soon be completed in the southern part of the state. There is an extensive road network in eastern Sabah, built and maintained largely by logging companies and agricultural estates.

Natural habitats in Sabah can be divided very broadly into three main classes: mangrove and fresh water swamps, evergreen dipterocarp forest, and montane forest. Along most of the east coast and parts of the west coast are swamps, mostly mangrove, and, further inland, permanent or seasonal fresh water swamps. Apart from the locally distinct floral communities in freshwater swamps, animals of interest here are the proboscis monkey (*Nasalis larvatus*), a Bornean endemic, and the estuarine crocodile (*Crocodylus porosus*). Only a very small fraction of the mangrove is afforded total protection in the form of "Virgin Jungle Reserve," a class of protected forest reserve intended primarily to preserve representative samples of forest formations. Local people traditionally cut mangrove trees for domestic purposes and for sale, but this is a localized activity. Extensive areas are now cut under license primarily for chip or particle board. (Fig. 2)

The natural vegetation on land from sea level to about 1,000 m is evergreen dipterocarp forest. The majority of the largest trees present (more than 180 cm in girth and 30 m tall) belong to the family Dipterocarpaceae. There is great diversity both within and

between the various dipterocarp formations. It is these forests which yield timber and which have been the major sources of Sabah's wealth over the past three decades. Logging is "selective," unless the land is designated for agricultural development, in which case all growth is felled and burnt. In practice, selective logging involves removal of approximately 10 big trees from each hectare (the actual number is highly variable), with accompanying, unintentional destruction of about half of the remaining plants.

In Silabukan Forest Reserve, eastern Sabah, a 0.5 hectare plot of primary forest was found to contain about 118 tree species



Fig. 1: Clear cutting of mangroves in Sabah chip wood production (photo by R. A. Mittermeier).

(more than 30 cm in girth). An equivalent area of forest investigated 20 years after logging contained 43 species, of which 18 were secondary species which grew up after logging had opened the tree canopy. Some tree species may go extinct over wide areas after logging, unless sufficient seedlings remain and grow into productive trees. At present, the only studies of forest regeneration refer to common, commercially valuable species. According to Forest Department estimates, more than 30% of Sabah's forests were logged in the period 1971-1980. There is no doubt that, ultimately, the great majority of Sabah's forest cover will consist of logged dipterocarp forest. Thus, a conservation priority is investigation of the effects of logging on the survival of the flora of dipterocarp forests. It is heartening to find that logging in itself does not seem to lead to the extinction of any mammal or bird species; it is the pattern and extent of logging which are important. Animals are mobile, however, whereas plants are not and it is likely that at least some plants are highly sensitive to the

changes in microclimate occurring after logging.

On the hills and mountains higher than 1,000 m in altitude are montane forests which contain few or no big trees of the family Dipterocarpaceae. Most montane forests occur in western Sabah, where two fine conservation areas provide protection for most, if not all of the montane flora and fauna characteristic of north-western Borneo. Kinabalu National Park (76,800 ha.) contains two separate major peaks (Kinabalu, 4,101 m; Tambuyukan, 2,580 m), dipterocarp forest, both sedimentary and ultrabasio-derived rocks, and an astoundingly diverse flora and fauna, with many species endemic to the Park region. The Crocker Range Protection Forest Reserve (129,815 ha) consists of a long, narrow range of hills rising to a maximum of about 1,500 m.

There are two authorities in Sabah whose policies include a commitment to conservation of the native flora and fauna. The Sabah Forest Department is responsible for management of forest reserves, which cover nearly 50% of Sabah's land area. All but 5% of the Forest Reserve area is classed as "commercial": liable to be logged. The Wildlife Section (officially still known by the rather dated name of Game Branch) of the Sabah Forest Department is responsible for conservation of mammals, birds and other large vertebrate animals throughout Sabah, except in the national parks (see below). The most important existing law referring to protection of wild animals outside national parks is the Fauna Conservation Ordinance of 1963, and its amendments. It is concerned mainly with rules for hunting and collecting wild animals. With a total staff of just over 30 expected to cover 98.5% of Sabah, it is difficult for the Wildlife Section to carry out much more work than its three main long-standing obligations: (1) enforcement of the law, (2) maintenance of the orangutan rehabilitation center (and more recently, a new conservation education center) at Sepilok Forest Reserve, and (3) protection of agriculture from damage by elephants.

A separate organization, Sabah National Parks, is responsible for management of five parks, two on the mainland (Kinabalu and Tawau Hills National Parks) and three island parks (Tunku Abdul Rahman, Palau Tiga and Turtle Islands National Parks; Fig. 1).

### Species Conservation in Sabah

Without detracting from the value of national parks in protecting montane, island and marine communities, it should be ap-



Fig. 3: A young orang kept at the Sepilok Forest Reserve rehabilitation station outside Sandakan. The orang is a major tourist attraction for Sabah, and the Sepilok Forest Reserve serves as both a home for displaced orangs and a focus for conservation education. Surveys are needed to identify areas with good orang populations in permanent forest reserves. Danum Valley may prove to be the most important long-term conservation area for the species (photo by R. A. Mittermeier).

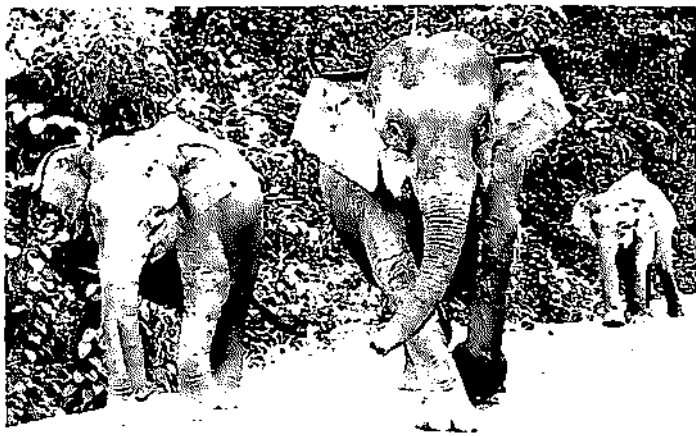


Fig. 2: A group of elephants from Sabah charging the Faunal Survey of Sabah vehicle (photo by John Payne/WWF - Malaysia). The elephant is Sabah's problem species. Hundreds of elephants are in areas designated for agriculture. Ultimately, Silabukan-Lumerau will probably be the most important conservation area for elephants in Borneo.

parent that the policies and actions of the Forest Department are of prime importance in the conservation of the dipterocarp forests, and therefore their fauna. In Sabah, it is primarily the Assistant Chief Game Warden who recommends conservation measures for the fauna of the dipterocarp forests. In 1978, the newly appointed Warden, Patrick Andau, initiated a survey of the status of mammals and birds throughout Sabah. With sponsorship from WWF Malaysia in providing technical assistance, a faunal survey of Sabah was carried out between 1979-81 (Davies and Payne, 1982). A major, but not unexpected finding of the survey was that four large mammal species — Sumatran rhinoceros (*Dicerorhinus sumatrensis*;), elephant (*Elephas maximus*; Fig. 3), banteng (*Bos javanicus*), and orangutan (*Pongo pygmaeus*; Fig. 4) — require special conservation measures if they are to survive in the long-term. It also became apparent that it is the pattern of planned agricultural development, rather than selective logging, which will have the most adverse effects on these, as well as some other species. The current status of each of the four threatened species (all but the elephant protected by law) is presented below.



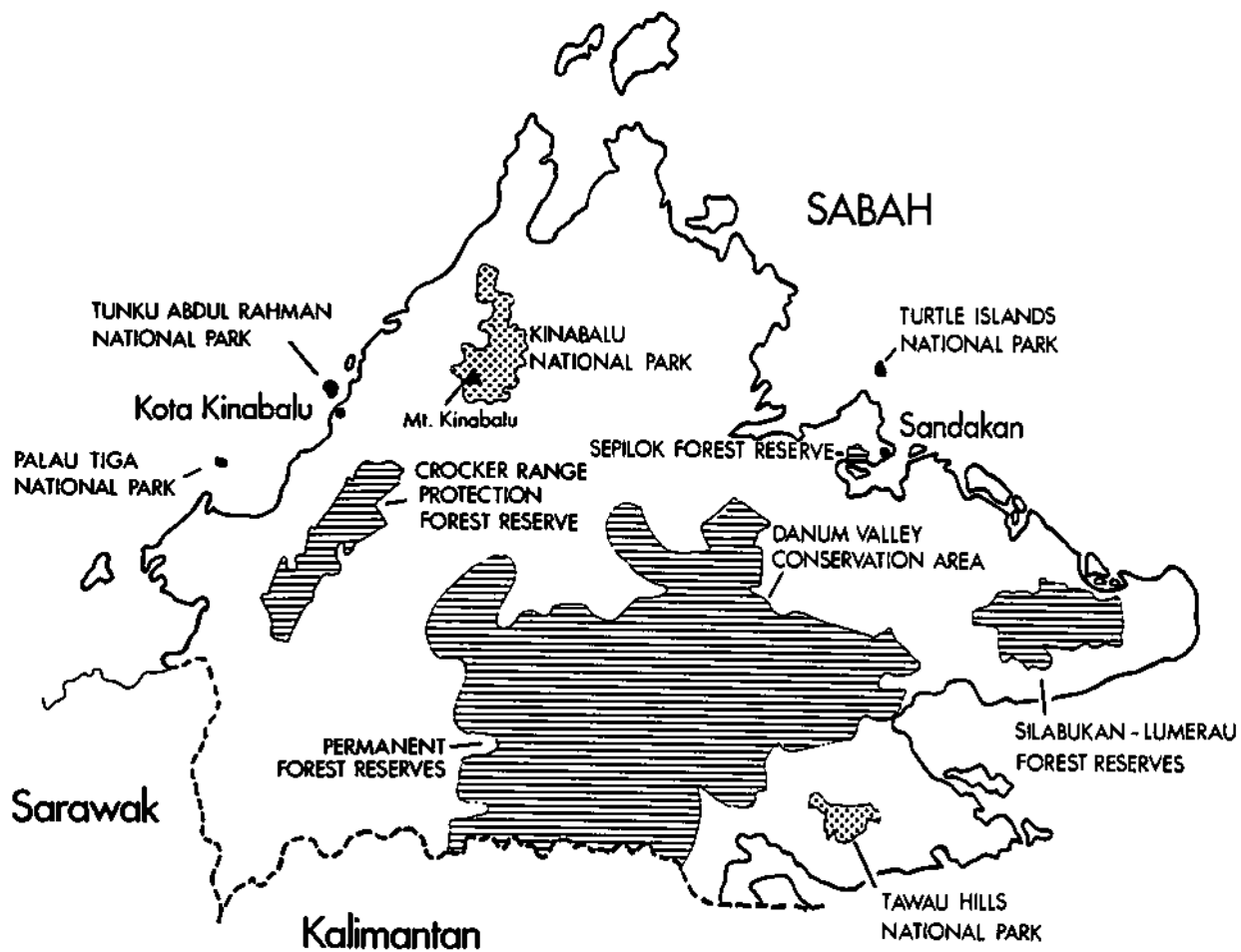


Fig. 4: Map of Sabah showing the location of National Parks and Forest Reserves.

*Sumatran Rhinoceros.* There are scattered relics of a once widespread rhinoceros population in several parts of Sabah, mostly in the eastern half of the country. The southern-central part of Sabah has never been adequately investigated, so the rhino situation there remains unknown, but for the remainder of Sabah only one area still supports a potentially viable breeding population. This is the area represented by the Silabukan and Lumerau Commercial Forest Reserves. Adjacent areas contain some rhinos, but all such areas are to be converted to cocoa and oil palm plantations.

*Elephants.* Elephants have a restricted distribution in Sabah, occurring in the southern and eastern portions of central Sabah. They have not existed in northern or western Sabah in recent times, and have been virtually exterminated in the southeast during this century as a result of agricultural development. Current agricultural development policy is such that by the end of this century there will be only two separate blocks of forest large enough to support viable elephant populations. These are the Silabukan-Lumerau Forest Reserve block and the vast area of forest on predominantly rugged terrain in central Sabah. It is expected that the Permanent Forest Reserves will remain as protected areas. The current estimate of the total Sabah elephant population is between 500 and 2,000 individuals, and of these

more than half live in areas designated for agricultural development. Logged forest contains many more known elephant food plants than primary forest, so there is reason to hope that some of the elephants displaced by agriculture will move from their traditional ranges into the Silabukan-Lumerau Forest Reserve block and those areas which reportedly will remain as permanent forest preserves. The distribution of elephants in these latter areas appears to be very sparse and patchy, however, and mainly along the larger rivers.

*Banteng.* The banteng, widely known as *tembadau* in Sabah, occurs in scattered concentrations throughout much of eastern Sabah; the species has been almost exterminated in the western half of the country. Discounting the threat of illegal hunting, banteng usually thrive in areas of traditional shifting cultivation and logging, as a result of the great increase in the abundance of grasses. But, like elephants, they are only abundant in the flatter, fertile areas designated for agriculture.

*Orangutan.* The Faunal Survey of Sabah indicated that population densities of orangutans are high (1 or more individuals/km<sup>2</sup>) only in primary dipterocarp forests at less than about 400 meters above sea level. Unfortunately, it is these forests which have been logged most heavily, and much is due to be converted to agriculture. The situation in the better protected areas is either precarious

or unknown. For example, orangutans exist in parts of Kinabalu National Park and Crocker Range Protection Forest Reserve, but at extremely low population densities, and they are hunted in some areas for food. Equally alarming is that they are unaccountably scarce or absent in certain regions; they appear to be completely absent from Tawau Hills National Park and are very rare throughout much of Silabukan-Lumerau Forest Reserve.

Before finally summarizing recent conservation achievements and suggesting future plans, a note on the importance of hunting to the survival of the above-mentioned species is important. The rhinoceros is now so rare in Sabah as a result of hunting, that any further deaths due to poaching will significantly reduce any chance for its survival in Borneo. The only known breeding population in all of Borneo is in the Silabukan-Lumerau Forest Reserve, yet this area is relatively accessible, and logging commitments made before the importance of the area was recognized in 1980 mean that roads will reach its core sometime this decade. Two rhinos are known to have been poached in Sabah in 1981 and one shot in 1982 (only one of these in the Silabukan-Lumerau Forest Reserve). For elephant conservation, in contrast, hunting has no significance. More elephants lose their habitat as a result of planned agricultural development than are shot annually for crop protection. According to available records over the past ten years, an average of 10 elephants are shot legally per year and perhaps one illegally.

For banteng also, loss of habitat will be the most important factor in population decline. However, illegal hunting is a major threat as well, and has the potential to exterminate populations from proposed conservation areas (see below).

Twenty years ago, hunting was correctly judged to be a major drain on the then existing orangutan population in Sabah. Since then, logging and habitat loss have replaced hunting as the most significant threats for this species.

### Conservation Action Priorities

Sabah's existing national parks make a fine contribution to the conservation of montane and island communities. However, the prevailing opinion in Sabah, outside the national parks organization, is that parks are for recreation and not for conservation. For a long time to come, therefore, the onus will be on the Forest Department to manage and conserve dipterocarp forests where so much of the native flora and fauna occur.

Not surprisingly, our knowledge of the distribution and ecological requirements of northern Borneo's lowland flora is inadequate to assess which species may be endangered. With regard to trees, available data would suggest that very few and possibly no species occur exclusively in east central and southeast Sabah where agriculture will replace forest. There are three areas which are expected to be most important for conservation of the lowland dipterocarp communities:

1. *Sepilok Forest Reserve* (4,000 ha) is the best investigated lowland forest in Sabah.
2. *Silabukan-Lumerau Forest Reserves block*. Negotiations are underway to reserve 9,300 ha of primary forest in the middle of this block. This would provide for the conservation of a total plant community and also serve as a temporary holding area for Sumatran rhinos displaced by intensive logging in the surrounding forest. If the plan is successful, this would form the core of a single 123,000 ha block of forest reserve.
3. *Danum Valley*. This area of primary forest has in the past been proposed as a game sanctuary (permissible under current legislation, although no sanctuaries yet exist) and as

a national park. Along with a substantial portion of Sabah's remaining dipterocarp forest, this area lies within the 100-year logging concession of the Sabah Foundation. This organization has a unique advantage, from the conservation viewpoint, over all other governmental and non-governmental organizations in Sabah, in that it can plan for decades in advance, rather than the usual period of 5 years maximum. Sabah Foundation has agreed to retain an area of 42,755 ha of primary forest in the Danum Valley region for wildlife conservation and water catchment protection. An important feature of the Danum Valley conservation area is that it contains several different primary forest formations within a huge surrounding buffer zone of logged forest.

Silabukan-Lumerau Forest Reserve is vital to the conservation of both rhinoceros and elephant in Borneo. In August 1982, the Forest Department allotted 122,980 ha of the existing commercial forest reserve for rhino conservation. This means that logging licenses can still be issued but that there is a stronger case than previously to disallow extensions of land for agriculture.

The large block of permanent forest reserves (Fig. 1) will form an extremely important conservation area, mainly because of its vast size. If present plans are successfully carried out, there will be two large cores of primary forest within the block: Danum Valley and a steep, remote area further west known as Gunung Letung ("the slow loris mountain"; about 50,000 ha), which also lies within Sabah Foundation's concession. It is necessary that more wildlife surveys be carried out in this region, with the highest priority being to investigate the distribution and population status of orangutans.

Two more conservation areas have been proposed for Sabah. The first is about 5,000 ha of coastal swamp and mangrove forest containing proboscis monkeys and crocodiles. The second is 510 ha of logged lowland forest which contains a high density of banteng.

Hopefully, this complex of protected areas will ensure the survival of Sabah's superb wildlife heritage.

#### Literature Cited

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Fig. 5: A bornean gibbon (*Hylobates muelleri*) in the Sepilok Forest Reserve (photo by R. A. Mittermeier).

# Indonesia

## Species Conservation Priorities in the Tropical Forests of Indonesia

John Mackinnon  
Ismu Sutanto Suwelo

### Introduction

Indonesia (Fig. 1) is one of the world's treasure houses of species diversity. Made up of some 13,000 islands stretching 6000 km, the country covers a total land area of 1,919,443 km<sup>2</sup> and spans two major biogeographical regions, the Oriental and the Australasian. The human population is the fifth highest in the world, with more than 150,000,000 inhabitants, and some of the islands such as Java, Bali and Madura are quite densely populated. On the other hand, the large islands of Sumatra, Kalimantan and Irian Jaya, which constitute about 75% of the land area of the country, are still relatively sparsely populated.

Over 1500 species of birds, 500 mammals and several thousand tree species occur in Indonesia, and the country has within its borders perhaps the most unusual mix of faunal elements anywhere on earth. The islands of Sumatra, Kalimantan (the Indonesian part of Borneo), Java and Bali are known collectively as the Sunda Islands or Great Sunda because of their shared position on the shallow Sunda Continental Shelf, which is no more than 200 m in depth and connects them with the Asian mainland. This connection was above water during the last glacial age and consequently the fauna of these islands is largely Asiatic, consisting of monkeys, apes, rhinos, tigers and sambar deer. The climate is also hot and humid, with the original vegetation being mainly rain forest. To the east of Bali are the Lesser Sundas or Nusa Tenggara, which are under the influence of Australia, both in terms of fauna and flora and in climate. The first marsupials appear in Sulawesi and the Maluku, apes and big cats are absent, and birds such as lorries and cockatoos begin to replace the Asian species. The climate has a pronounced dry season and overall is generally drier than in the Greater Sundas (Vecvers-Carter, 1978).

The survival of Indonesia's great species diversity is a matter of world as well as national concern, and with Indonesia's rapid population growth and speedy loss of forest and marine habitat, these valuable genetic resources, many of which are or could be used by man, are severely threatened.

The Government of Indonesia has recognized the need for conservation in order to promote the cultural and economic development of the Indonesian people in harmony with their natural environment. Government policy states that all forms of natural life and examples of all Indonesian ecosystems must be preserved for the benefit of future generations, with special emphasis on protection of the air, water, soil, plant, fish and animal resources upon which people depend (Sumardja, et al., 1984).

Conservation in Indonesia is under the jurisdiction of the Directorate of Nature Conservation and Wildlife Management (PPA), which was established within the Ministry of Agriculture in 1971 and is based in Bogor. Conservation has been achieved through the maintenance of a system of protection forests to protect water sources and soils on steep or high land, the maintenance of the system of strict nature reserves (*Cagar Alam*) and game reserves (*Suaka Margasatwa*), and the adoption of a number of laws and regulations controlling the exploitation of living resources including logging regulations, game laws, protected species laws and others (Sumardja, et al., 1984).

Faced with a multitude of conservation problems, and especially with the immediate need to preserve fuelwood and timber supplies and safeguard important river catchments, the Government of Indonesia has approved a major increase in conservation areas and protection forests. It is now planned that 30% of the land surface of Indonesia will be retained under permanent forest cover and that nearly half of this forest will be in nature reserves. Already the total area protected has risen dramatically from 4 million hectares in 1977 to a total of 11,267,540 hectares in 299 locations as of March, 1982 (Sumardja et al., 1984). Some of the most important protected areas in Indonesia are indicated in Fig. 1, and a more detailed look at protected areas on the island of Java is provided in Fig. 3.

### Species Conservation in Indonesia

Selection of new reserves is done with the intention of including viable large areas of all distinct habitat types in the country. Thus, species will be conserved *in situ* by protection of their habitat. Geographical distribution and habitat preference data have been compiled for all mammal and bird species occurring in Indonesia, and there is not a single species of bird or mammal which does not have a major reserve planned within its estimated distribution. The distribution ranges of plants are not so accurately known but it is thought that here too all species will be present in at least one reserve. Most species will be contained within more than one reserve. The needs for species specific management projects are in this way greatly reduced. Eventually when island biogeographical effects play their part in trimming down the number of species surviving in isolated reserves it will be necessary to monitor populations of indicator or extinction-prone species and where necessary introduce active management such as artificially maintaining high species immigration levels between neighbouring reserves. In the meantime, however, the priority is on getting the reserves declared and physically

established, paying attention at the species level only to those species which are not adequately protected by the protection of their habitat in reserves. These species include:

1. *Migrating species* who spend only part of their time in Indonesia and whose survival therefore depends on many factors both outside Indonesia and its reserves - e.g. migratory birds, whales, turtles etc.
2. *Resident but wide ranging species with large home ranges* - e.g. elephants, tigers, eagles, fruit bats, waterbirds who often cannot be contained or restricted within reserve boundaries.
3. *Rare species* which are represented at such low densities or which have such restricted distributions as to survive at dangerously low population levels.
4. *Species endangered by changed ecological conditions* particularly by newly introduced competitors, predators or pests.

5. *Species endangered by overexploitation* such as hunting or trade which could be exterminated despite protection of their habitat because of the impossibility of adequately guarding all the reserves.
6. *Riverine species* endangered by changes in water condition resulting from human development.

The scale of these species specific needs for attention is still quite large and the Indonesian Government has established a special Subdirectorate of Species Conservation in the Directorate of Nature Conservation to deal with these problems.

### Conservation Action Priorities

#### 1. Migrating Species

Migrating birds visiting Indonesia fall into 3 main categories.

- a. Montane passerines such as wagtails, warblers, thrushes

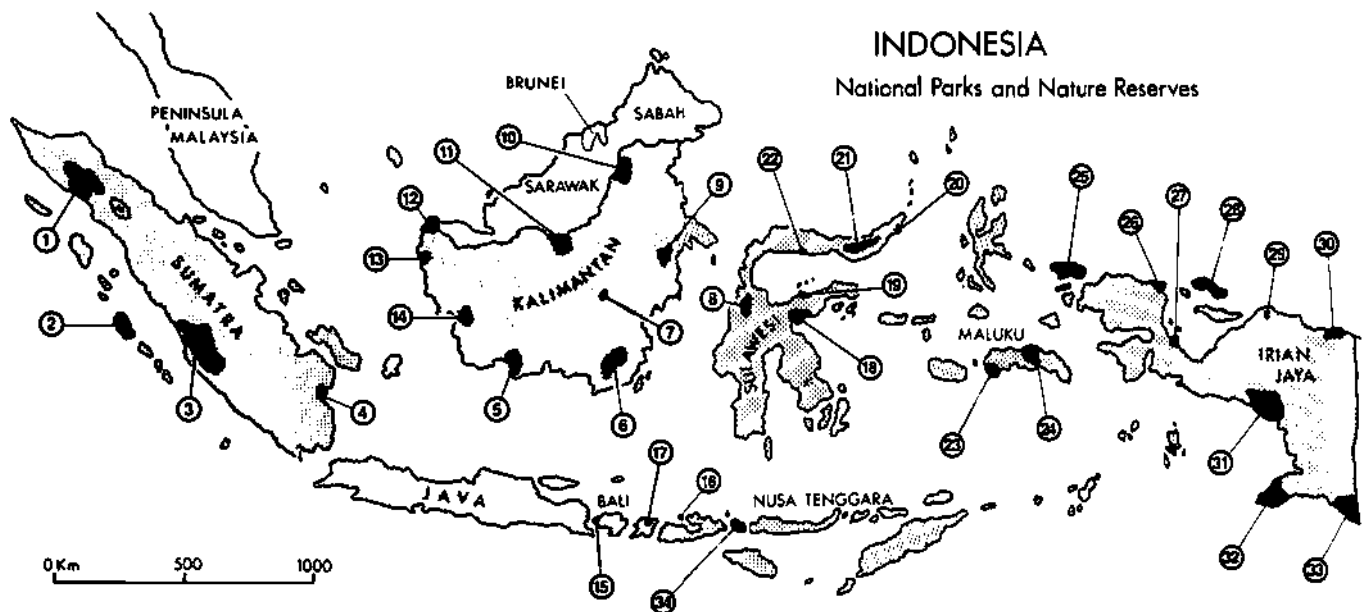


Figure 1: Map of Indonesia showing the location of national parks and nature reserves (modified from a publication by the Indonesian Directorate General of Tourism).

- |   |  |
|---|--|
| 1. Gunung Leuser National Park            | 19. Tanjung Api Reserve  |
| 2. Siberut Reserves                       | 20. Tangkoko-Batuangus-Dua Saudara Reserves                        |
| 3. Kerinci Seblat Reserve                 | 21. Dumoga Bone Reserves   |
| 4. Way Kambas Reserve                     | 22. Panua-Tanjung Panjang Reserves                                 |
| 5. Tanjung Puting Reserve                 | 23. Palau Kasa — Palau Pombo Marine Reserves                       |
| 6. Pleihari-Martapura Reserve             | 24. Manusela Reserve   |
| 7. Padang-Luwai Reserve                   | 25. Raja Ampat Island Reserves                                     |
| 8. Lore Lindu Reserve                     | 26. Gunung Meja Reserve  |
| 9. Kutai Reserve                          | 27. Peg. Wandiwol/Wandamen Reserve and Cendarawasih Marine Reserve |
| 10. Hulu-Bahau-Sungai Malinau Reserve     | 28. Palau Biak — Superiori Reserves                                |
| 11. Bukit Raya Reserve                    | 29. Memberamo Pegunungan Foja Rouffaer Reserves                    |
| 12. Hutan Sambas Reserve                  | 30. Cyclops Mountains Reserves                                     |
| 13. Mandor Reserve                        | 31. Lorentz Reserve  |
| 14. Gunung Palung Reserve                 | 32. Palau Dolok Reserve  |
| 15. Bali Barat Reserve and Marine Reserve | 33. Rawa Biru — Wasur Reserve                                      |
| 16. Pulo Moyo Reserve                     | 34. Komodo National Park   |
| 17. Gn. Rinjani Reserve                   |  |
| 18. Morowali Reserve                      |  |

etc. whose habitat needs in Indonesia are apparently adequate and no measures are being taken.

b. Waterbirds e.g. ducks, rails, pelicans etc. which are being heavily hunted in many riceland areas but for which some extensive water areas will be included in reserves and for which no other management is feasible beyond legal protected status for rare species e.g. pelicans.

c. Coastal waders for which some areas of coastline are being included in reserves but many important estuaries are outside reserves and face the possibility of pollution etc. No management is at present envisaged but it would be worthwhile to plot out the main migration routes and identify the most important stopping and feeding areas to try and get these protected where necessary.

## 2. Resident Species with Wide Ranges

There are several species that fall into this category but in most cases these are common species which are often serious pests coming out of forests and reserves to eat agricultural crops e.g. some parrot species, macaque monkeys, commensal rats, wild pigs, fruit bats etc. In these cases attention for control or discouragement of these animals from coming into agricultural areas is needed but they do not constitute a species survival problem. In the case of elephants and tigers however, they do.

In Sumatra, elephant and tiger conflicts with the expanding rural population are increasing in frequency and the matter has been greatly publicized in news media to the point that the Minister of Agriculture is calling for control projects. This is a very difficult and sensitive area of conservation and several drafted project proposals have failed to reach the necessary support or funding to be implemented, but it is an area of high government priority, and some projects to help reduce the friction between these large, dangerous but very important species and rural human population are urgently needed.

## 3. Rare Species

Indonesia has a number of rare species - local endemics with very small distributions, for example the Javan rhinoceros, Bali starling, Bawean deer, Sumatran hare, the Mentawai primates and widespread species which occur at low population density, for example the Sumatran rhinoceros, and orang-utan.

In some cases large reserves have been established that contain all or most of surviving populations e.g. Bali Barat Reserve for the Bali starling, Siberut reserve for the endemic primates, Kerinci-Seblat for the Sumatran hare, Ujung Kulon for the Javan rhinoceros, and Bawean island for the Bawean deer but in addition some attempts are being made to foster rare species by captive breeding *ex situ* e.g. Bawean deer, and Bali starling. Also the formation of additional wild populations is currently planned by ranching of Bawean deer on Madura island, the possible reintroduction of Javan rhinoceros into Sumatra, and the rehabilitation and translocation schemes for orang-utans.

## 4. Species Endangered by Changed Ecological Conditions

Indonesian examples are the endemic fish in many lakes where exotic species (e.g. *Tilapia*) have been introduced or where water hyacinths are changing local conditions.

Seed eating birds face competition from introduced munias and sparrows. The warty pig of Java faces artificially enhanced competition from the wild boar. Wildlife on all small islands are threatened by rats and cats which have been introduced.

Such problems are often extremely difficult to tackle. It is not

usually possible to remove the exotic species which is causing problems and the classic conservation method for such situations is to release the endangered species on a 'clean' island as a refuge and/or captive breeding. The Javan warty pig project currently in operation will be a good test case to see what can be done in such instances in Indonesia.

## 5. Species Endangered by Over-Utilization

There are several Indonesian species endangered by overhunting or trade such as rhinoceros, wild cats, the babirusa, the anoa, crowned pigeons, birds of paradise, megapodes, some parrot species, marine turtles, crocodiles, giant clams, butterflies and many species of trees and orchids. All these endangered species are already or could be put on the protected species lists, but law enforcement in Indonesia is so difficult that this is itself no guarantee of actual protection.

Improvements to the protected species lists, improvements to control, improvements to reserve guarding, improvements of game legislation, implementation of CITES, ratification of the migrating species convention etc., all play a part in tackling these problems as does conservation education and extension work. Some management or breeding projects can be effective and in many cases the development of wildlife based industries undertaken on a sustained yield basis can in fact help to save species by giving them a value and giving people a long-term interest in their survival. Thus plans are underway to promote primate ranching, crocodile rearing, butterfly farming and parrot breeding projects which will help satisfy demands for such products as well as provide badly needed income sources to rural peoples without placing undue strain on wild populations.

## 6. Riverine Species

It is extremely difficult to protect whole rivers in nature reserves as they are so heavily used as arteries of communication, sources of irrigation, fishing areas etc. by local people. Almost no attention has been paid so far to the plight freshwater species in Indonesia but there are undoubtedly many endangered reptiles, fish, molluscs and crustaceans in the river and lake systems. Pollution and dangerous fishing methods such as the use of poisons and explosives have decimated fish population in many rivers. As fresh water rivers have high levels of local endemism many species may be lost. There are few obvious solutions to these problems but it is as well to draw more attention to the problems of this neglected group of species. It would be worthwhile to collect more information on the distribution of fresh water species so that those with very limited distribution can be identified and at the same time monitor the levels of biotic degradation in the different waterways so that the scale of this threat can be assessed.

A number of conservation action projects are currently underway, planned or already completed in Indonesia, and these are summarized in the following list:

### A. General Programs of Sub-Directorate of Species Conservation

- |   |            |
|---|------------|
| 1. Inventorization of species distribution and status | continuing |
| 2. Field monitoring of species status                 | continuing |
| 3. Revisions to protected species lists               | continuing |
| 4. Establishment of new reserves for rare species     | continuing |

### B. In Situ Management Activities

- |  |   |            |
|--|---|------------|
| 5. Maintenance of artificial grazing areas | Ujung Kulon, Meru Betiri, Pangandaran and Baluran | continuing |
|--|---|------------|

6. Cutting <i>Arenga</i> palms to promote tree sapling regeneration for rhinoceros	Ujung Kulon	planned
7. Thinning of teak forests for Bawean deer	Bawean Island	continuing
8. Clearing of brush from maleo nesting areas	Sulawesi	experiments completed
9. Control of egg predators at turtle nesting beaches	various	occasional
<b>C. Rehabilitation and Captive Breeding for release into Wild</b>		
10. Orang-utans	Ketambe (completed), Bohok, Kutai, Tanjung Pating	ongoing
11. Gibbons	Pangandaran, Tanjung Pating	occasional
12. Bawean deer	Madura	ongoing
13. Bali mynah	Bali Barat	ongoing
14. False ghanvials	Sekundur.	started
<b>D. Translocation Projects</b>		
15. Sumatran tigers	Sumatra	planned
16. Elephants	Way Kambas, Sumatra	ongoing
17. Javan rhinoceros	Sumatra	feasibility study started
18. Orang-utans	Manapura Pleihari	planned
<b>E. Captive Breeding/Rearing for Sustained Yield Harvest</b>		
19. Crocodiles	Irian Jaya	started
20. Marine turtles	Bali/Sukamade	started
21. Macaque monkeys	Jakarta	started
22. Maleo birds	N. Sulawesi	feasibility study completed
23. Birdswing butterflies	Irian Jaya	planned
24. Cockatons	Ambon	planned
25. Orchids	Bogor	started
<b>F. Conservation-Oriented Research Projects on the Ecology of Rare Species</b>		
26. Orang-utan	Ranun, Ketambe, Tanjung Pating	1971 ongoing
27. Javan rhinoceros	Ujung Kulon	1967 ongoing
28. Sumatran rhinoceros	Gn. Leuser	1977 ongoing
29. Bawean deer	Bawean Island	1977-79
30. Marine turtles	various	ongoing
31. Crocodiles	Irian Jaya	1979-80
32. Javan gibbons	Ujung Kulon	1977-79
33. Sulawesi endemic fauna	Tangkoko-Batuangus	1977-79
34. Banteng	Ujung Kulon, Pangandaran, Baluran	various
35. Mentawai primates	Siberat island	various
36. Proboscis monkeys	Kalimantan	various
37. Rafflesia flowers	Sumatra, Java	occasional
38. Komodo lizards	Komodo	1970-71
<b>G. Field Monitoring of Species Status</b>		
39. Bali tiger	Bali Barat	1978
40. Sumatran tiger	Sumatra	1977
41. Javan rhinoceros	Ujung Kulon	annual
42. Crocodiles	Irian Jaya	1979-80
43. Javan gibbon	W. Java	1978
44. Proboscis monkeys	Kalimantan	occasional
45. Rafflesia flowers	Java/Sumatra	1981
46. Fresh water dolphins	Mahakam	c. 1980
47. Fresh water sawfish	Irian Jaya	1980
48. Sumatran rhinoceros	Sumatra	various
49. Bali starling	Bali Barat	regular
50. Timor monitor lizard	Timor	1981
51. Kelasa fish	Sumatra	c. 1981
52. Marine turtles	various	various

53. Banteng	Ujung Kulon	occasional
54. Javan warty pigs	Java	ongoing
55. Kangean leopards	Kangean	1982
56. Bandasea birds	Banda Sea	1981

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## SEBAGIAN SATWALIAH YANG DILINDUNGI DI INDONESIA

I. MAMALIA DARAT



- |                   |                  |                 |
|-------------------|------------------|-----------------|
| 1. NIPIS          | 21. BALANUS MADU | 31. DARIPUSA    |
| 2. KUSIA          | 22. MUSA BAWEAN  | 32. RUSA BAWEAN |
| 3. LANGUR BUNDA   | 23. BAWEAN       | 33. BAWEAN      |
| 4. LANGUR         | 24. MAMAU        | 34. RUSA        |
| 5. PANGSING       | 25. MACAN TULU   | 35. MACAN DARAT |
| 6. LANGUR SUMATRA | 26. BUKIT        | 36. BUKIT       |
| 7. BUKIT          | 27. BUKIT        | 37. BUKIT       |
| 8. BUKIT          | 28. BUKIT        | 38. BUKIT       |
| 9. BUKIT          | 29. BUKIT        | 39. BUKIT       |
| 10. BUKIT         | 30. BUKIT        | 40. BUKIT       |
| 11. BUKIT         | 41. BUKIT        | 42. BUKIT       |
| 12. BUKIT         | 43. BUKIT        | 44. BUKIT       |
| 13. BUKIT         | 45. BUKIT        | 46. BUKIT       |
| 14. BUKIT         | 47. BUKIT        | 48. BUKIT       |
| 15. BUKIT         | 49. BUKIT        | 50. BUKIT       |

**a.**  
**Figure 2: A series of five posters depicting protected species of Indonesian wildlife. These posters also give a good impression of Indonesia's tremendous wildlife diversity. Included in the series as the following:**  
**a. Land mammals**  
**b. Reptiles and marine mammals**  
**c. Land birds**  
**d. Water birds**  
**e. Primates**



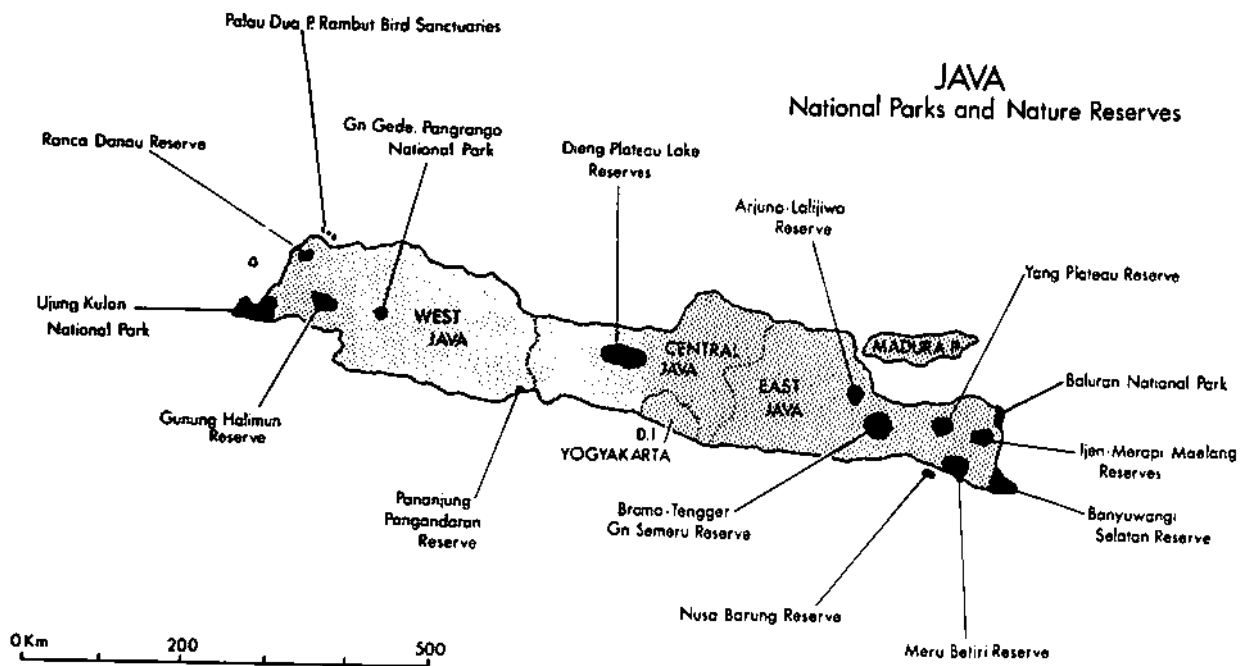
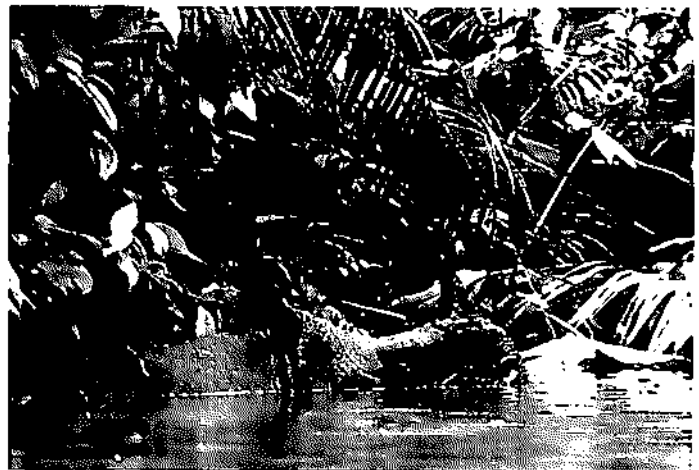


Figure 3: Map of the island of Java showing the location of national parks and reserves (modified from a publication by the Indonesian Directorate General of Tourism).



b.



c.

Figure 4: Several endangered species from Java.

- a. The Javan gibbon (*Hylobates moloch*), a Javan endemic that is probably the rarest of all gibbons (photo by R. A. Mittermeier).
- b. The Javan leaf monkey (*Presbytis aygula*), another primate species found only on Java (photo by R.A. Mittermeier).
- c. Adult male Javan rhino (*Rhinoceros sondaicus*) from Ujung Kulon National Park at the extreme western tip of Java. Once found over a large area of southeast Asia, this species now occurs with certainty only in this one park (photo by M. Kappeler).

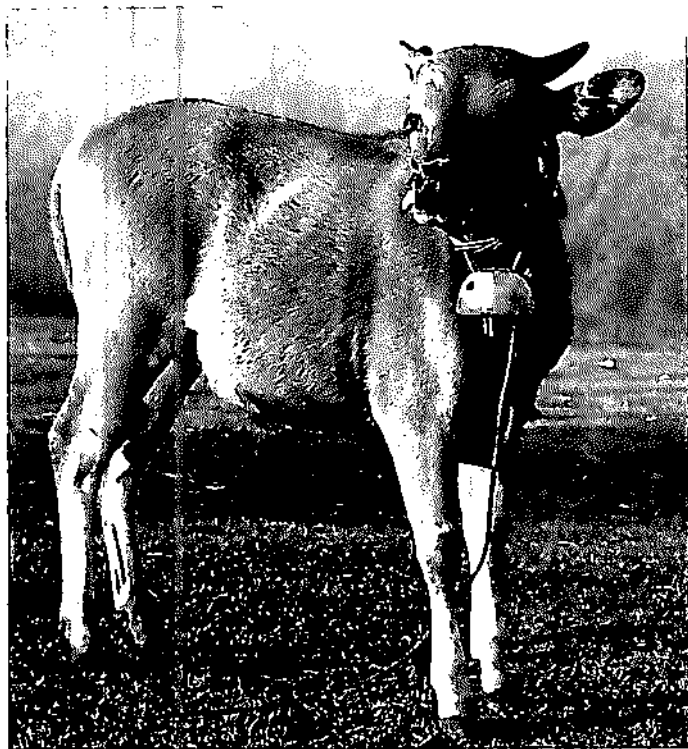




a.



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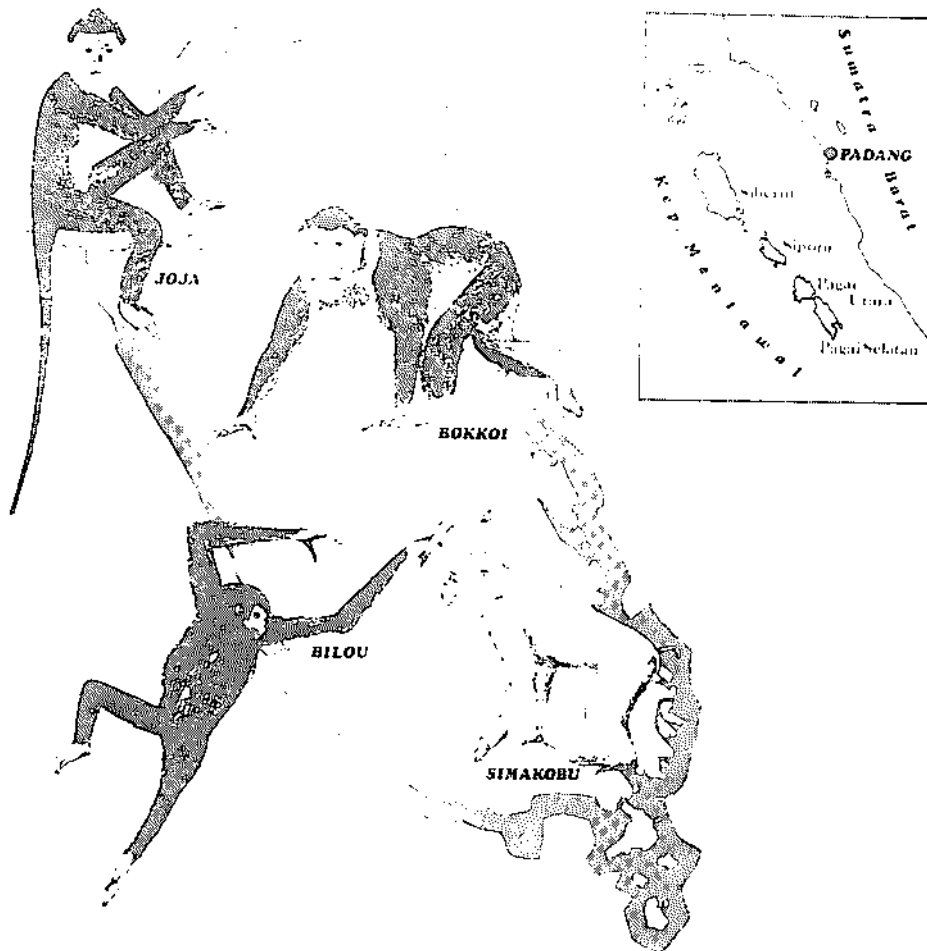


d.

**Figure 5: Animals from Bali.**

- a. & b. The wide-ranging crab-eating or long-tailed macaque (*Macaca fascicularis*) is common on the island of Bali, and is often found in close proximity to human habitations. Temple monkeys are a tourist attraction on the island (photos by R.A. Mittermeier).
- c. A domesticated banteng (*Bos javanicus*) from Bali. This species is native to southeast Asia, and wild populations still occur in a number of countries (photo by R.A. Mittermeier).
- d. Green turtle (*Chelonia mydas*) being carried to a holding pen on Bali. This species is sought after for its meat (photo by R.A. Mittermeier).

# LINDUNGI KAMI



**MENTAWAI ADALAH SATU-SATUNYA  
TEMPAT DI DUNIA DIMANA KAMI BERADA  
JADI, SAYANGILAH KAMI  
DENGAN MEMBANTU USAHA P. P. A.**

a.

Figure 6: Primates from the Mentawai Islands off the west coast of Sumatra. The Four Mentawai primate species are endemic to these islands, and all are listed in the IUCN *Red Data Book*.

- a. Poster produced by the Indonesian Directorate of Nature Conservation (PPA) and WWF depicting the four Mentawai primates: the *joja* (*Presbytis potenziani*), and *bokkoi* (*Macaca pagensis*), the *bilou* (*Hylobates klossii*), and the *simakobu* (*Simias concolor*).
- b. The Mentawai Islands leaf monkey (*Presbytis potenziani*). Plate from the original description of the subspecies *Presbytis potenziani siberu* by Chasen and Kloss (*Proc. Zool. Soc. London*, 1927).
- c. The pig-tailed langur or *simakobu* (*Simias concolor*), a genus endemic to the Mentawai Islands. This unusual species is most closely related to the proboscis monkey of Borneo, and is perhaps the most endangered Mentawai primate. Plate from the original description of the subspecies *Simias concolor siberu* by Chasen and Kloss (*Proc. Zool. Soc. London*, 1927).
- d. Juvenile pig-tailed langur (*Simias concolor*) (photo by A. Mitchell).
- e. Juvenile *bokkoi* or Mentawai macaque (*Macaca pagensis*) (photo by A. Mitchell).



b.



c.



d.



e.



a.



b.



c.



d.

**Figure 7: Wildlife of Sulawesi, an island with a unique mix of Oriental and Australasian faunal elements.**  
 a. The anoa (*Bubalus depressicornis*), a species of wild cattle endemic to Sulawesi (photo by R.A. Mittermeier).  
 b. Limestone cliffs near Ujungpandang in southeastern Sulawesi, habitat of the moor macaque (*Macaca maura*), one of seven macaques endemic of Sulawesi (photo by R.A. Mittermeier).  
 c. The crested macaque or "Celebes black ape" (*Macaca nigra*), from northeastern Sulawesi. This is the best known of the Sulawesi macaques and is often kept in captivity (photo by R.A. Mittermeier).  
 d. Juvenile *Macaca tonkeana*, another Sulawesi macaque species (photo by R.A. Mittermeier).  
 e. Poster produced by the Indonesian Directorate of Nature Conservation and WWF depicting the unique fauna of Sulawesi.





a.



b.



c.



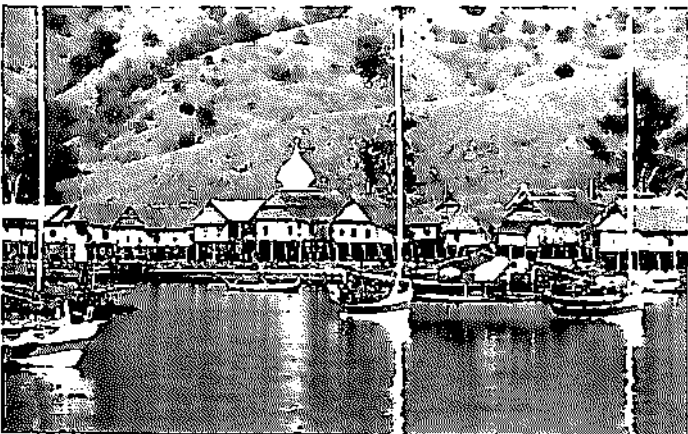
d.



e.



f.



g.



h.

**Figure 8: The Komodo monitor (*Varanus komodoensis*), world's largest living lizard. This species is found only on the islands of Komodo, Rintja, Padar, western Flores and a handful of tiny islands in the vicinity, and is protected in Komodo National Park (photos by R.A. Mittermeier).**

- a, b & c. Komodo monitors in the wild on the island of Komodo.**
- d. Komodo monitors feeding on a goat used to attract the lizards for tourist viewing.**
- e. View of Komodo monitor habitat on the island of Komodo.**
- f. View of Komodo at sunset showing the mountainous nature of the terrain.**
- g. The village of Komodo, part of the Komodo Biosphere Reserve.**
- h. Tourists climbing up from Komodo village in search of the giant lizards.**

# Thailand

## Species Conservation Priorities in Thailand

Jira Jintanugool  
Ardith A. Eudey  
Warren Y. Brockelman

### Introduction

Thailand covers an area of about 541,000 km<sup>2</sup> extending between 6° and 20°N latitude in mainland Southeast Asia. The country encompasses diverse kinds of ecosystems and spans the Indo-Chinese, Indo-Malaysian, and Indo-Burmese subregions of the Oriental biogeographical region. The wildlife is diversified, but most species are not very abundant, which may be a consequence, in part, of their evolutionary history. The details of geographical distribution and habitat preference remain to be compiled for most vertebrates, including mammal and, to a lesser extent, bird species. Inventories of floristic communities are in progress, and efforts are being made to identify plants of potential use to the human population.

As is true of other developing countries in the tropics, Thailand is attempting to conserve its wildlife and forest habitats in the face of increasing exploitative pressures, both internal and external. According to government inventories, the forest cover of Thailand declined from more than 53% in 1961 to only 28% in 1981. The rate of forest destruction may have been nearly 10% a year during much of the last decade. Slash and burn agriculture and illegal logging, especially of teak and other tropical hardwoods, contributed significantly to this rate. In Thailand there are six major hilltribe populations, altogether consisting of more than 300,000 people, who practice shifting cultivation. Not only hilltribe peoples, but also ethnic Thais, have cleared large areas of forested land, which may be abandoned entirely after only a few years of use. A variety of timbering activities as well as irrigation and hydroelectric projects, highway construction, resettlement programs for hilltribe peoples and others, mineral exploration, and even recreation increase the pressure on forests and wildlife.

Illegal hunting or poaching of wildlife constitutes another serious problem. Traditional food hunting continues in areas near villages, but it is not nearly as detrimental to animal populations as the more modern type of hunting for sale. "Market hunting" is very difficult to control because of the sophistication of weapons available to hunters. The ready availability of modern forms of transportation and firearms results not only in wild animals being subjected to heavy slaughter, but also in forests being cleared and burned at an alarming rate to increase the area for cultivation as squatters do not hesitate to move in and settle down even in reserved forests.

Commercial exploitation for international trade also severely reduced certain populations of wild animals, for example, macaque monkeys, especially stump-tail macaques (*Macaca arctoides*). A ban on the commercial export of all macaque species went into effect in 1976.

Pesticides and insecticides are used freely in Thailand. In some places the widespread use of insecticides on crops has caused the

death of fish and other aquatic fauna, as well as birds. Such use also destroys predators and beneficial insects.

### Species Conservation in Thailand

Early efforts in Thailand to protect wildlife were species-oriented. In 1921 a Wild Elephant Act was enacted, and in 1931 there were unsuccessful attempts to establish protection for the cows of wild water buffalo and some other large mammals. However, wild animals were reported to be still plentiful in every part of Thailand before World War II. Soon after the war, the impact of a rapidly expanding human population, declining economic wealth, and greater numbers of firearms and vehicles, as described above, resulted in both wildlife and their habitats being severely reduced. The Royal Forest Department and some societies, including the Siam Society, were responsible for the passage in 1960 of the Wild Animal Preservation and Protection Act B. E. 2503, which came into effect on January 1, 1961.

The Act established two major groups of wild animals: Reserved and Protected. These categories form the basis for the regulation of traffic in wildlife, to which a heavy commitment was made by private enterprise in Thailand, and are reflected in the schemes for captive breeding and restocking that are included within the Thai conservation strategy. These activities are under the jurisdiction of the Wildlife Conservation Division, Royal Forest Department.

Reserved wild animals are those considered to be rare or endangered, and are not permitted to be captured or hunted or even kept in possession except for educational or scientific purposes or for exhibition at zoological gardens. Nine species are included in this group: Javan rhinoceros (*Rhinoceros sondaicus*), Sumatran rhinoceros (*Dicerorhinus sumatrensis*), kouprey (*Bos sauveli*), wild water buffalo (*Bubalus bubalis*), Eld's deer (*Cervus eldi*), Schomburgk's deer (*Cervus schomburgki*), hog deer (*Axis porcinus*), goral (*Naemorhedus goral*) and serow (*Capricornis sumatraensis*; Table 1; Fig. 1).

Schomburgk's deer was endemic to Thailand and is now extinct; the last buck was shot in 1913. Of the rhinos, the Javan is believed to have been wiped out, while a few Sumatran are presently reported in some remote areas of the country. Villagers of Sisaket Province, in the northeast, reported having seen five kouprey near the Kampuchean border in August, 1982; it is believed that some animals moved to Thailand during the rainy season. Two subspecies of Eld's deer are found in Thailand, *Cervus eldi siamensis* and *Cervus eldi thamin*. The *siamensis* subspecies may have been extirpated in the wild, but small numbers of the *thamin* subspecies are reported to exist in areas near the Burmese border. The range of the goral is limited to remote parts of northern Thailand; a few goral were recently reported in Mae Tun Wildlife Sanctuary. It is doubtful if any hog deer still exist



Table 1. Reserved wild animals of Thailand

## List of Reserved Wild Animals

1. Javan Rhinoceros (*Rhinoceros sondaicus*)
2. Sumatran Rhinoceros (*Dicerorhinus sumatrensis*)
3. Kouprey (*Bos sauveli*)
4. Wild Water Buffalo (*Bubalus bubalis*)
5. Eld's Deer (*Cervus eldi*)
6. Schomburgk's Deer (*Cervus schomburgki*)
7. Hog Deer (*Axis porcinus*)
8. Serow (*Capricornis sumatraensis*)
9. Goral (*Naemorhedus goral*)

\*Schedule of Reserved Wild Animals, the Wild Animals Reservation and Protection Act B.E 2503

within the former range of the species. However, a number of hog deer are being kept in captivity. The only known wild water buffalo population occurs in Huai Kha Khaeng Wildlife Sanctuary, where approximately 50-80 animals survive. Poaching is presently the main problem threatening this relict group of wild cattle. The least threatened species in the reserved category seems to be the serow, which ranges throughout every region of the country, mainly in limestone mountains and can be found in every wildlife sanctuary.

The Protected group of wild animals is composed of two categories (Table 2). The first category legally includes wild animals whose flesh is not usually used as human food, or which are not usually hunted for sport, or which destroy plant pests, or which should be protected for their natural beauty or for increasing their population numbers. Capturing live animals of this first category is permissible, but killing of these animals is not allowed except by collecting permit issued only for educational or scientific purposes. There are presently 184 vertebrate taxa declared as Protected Wild Animals of the First Category: 35 mammal, 131 bird, and 14 reptile (Table 2). Since venomous snakes pose a threat to the human population in agricultural areas, protection for reptiles is difficult to obtain, and, as a consequence, large numbers of snakes continue to be exported annually.

Protected wild animals of the second category are considered to be those that are palatable for human consumption or that are traditionally hunted for sport. Hunting of these animals can be done by securing a license. There are presently 35 vertebrate taxa declared as Protected Wild Animals of the Second Category: 12 mammal, 22 bird, and one amphibian (Table 3). Gaur (*Bos gaurus*) and banteng (*Bos banteng*), sambar deer (*Cervus unicolor*) and barking deer (*Muntiacus muntjak*), tiger (*Panthera tigris*) and leopard (*Panthera pardus*) are among the mammals historically included in the second category.

In Thailand the breeding program for wild animals has two objectives. Some species of rare animals, for example, Eld's deer, banteng and fireback pheasant (*Lophura diardi*), are being bred in captivity for restocking in areas where they have been depleted; no release has yet been made. A number of hog deer are being kept in captivity for study and breeding purposes; some animals introduced onto an island in the southeast are breeding successfully. Likewise, reports of sightings of kouprey on the Thai-Kampuchean border have resulted in expeditions by the Wildlife Conservation Division to capture for propagation and study individuals of this wild cattle species which was believed to have been hunted to extinction in Thailand during this century. No capture has yet been made. In contrast, animals such as sambar deer and peafowl (*Pavo muticus*) are being maintained in captivity to increase their numbers and to study the requirements for commercially farming them.

Table 2. Protected wild animals of Thailand

## Schedule 1. List of Protected Wild Animals of the first category

No.	Protected Wild Animals of the first category
<b>MAMMALIA</b>	
1	Flying Squirrels of genera <i>Hylopetes</i> and <i>Pteromyscus</i>
2	Giant Flying Squirrels of genus <i>Petaurista</i>
3	Prevost's Squirrel ( <i>Callosciurus prevostii</i> )
4	Langurs of genus <i>Presbytis</i>
5	Kitti's Hog-nosed Bat ( <i>Craseonycteris thonglongyai</i> )
6	Wrinkled-lipped Bat ( <i>Tararida plicata</i> )
7	Large Indian Civet ( <i>Viverra zibetha</i> )
8	Small Indian Civet ( <i>Viverricula malaccensis</i> )
9	Large Spotted Civet ( <i>Viverra megaspila</i> )
10	Otter Civet ( <i>Cynogale bennetti</i> )
11	Gibbons of genus <i>Hylobates</i>
12	Asiatic Wild Elephant ( <i>Elephas maximus</i> )
13	Otters of genera <i>Lutra</i> , <i>Lutrogale</i> and <i>Amblyonyx</i>
14	Flying Lemur ( <i>Cynocephalus variegatus</i> )
15	Giant Squirrels of genus <i>Ratufa</i>
16	Mongoose of genus <i>Herpestes</i>
17	Back-striped Weasel ( <i>Mustela strigidorsa</i> )
18	Siberian Weasel ( <i>Mustela sibirica</i> )
19	Malaysian Weasel ( <i>Mustela nudipes</i> )
20	Asiatic Brush-tailed Porcupine ( <i>Atherurus macrourus</i> )
21	Common Porcupine ( <i>Hystrix brachyura</i> )
22	Brush-tailed Porcupine ( <i>Atherurus angustiramus</i> )
23	Marbled Cat ( <i>Felis marmorata</i> )
24	Leopard Cat ( <i>Felis bengalensis</i> )
25	Flat-headed Cat ( <i>Felis planiceps</i> )
26	Jungle Cat ( <i>Felis chaus</i> )
27	Slow Loris ( <i>Nycticebus coucang</i> )
28	Macaques of genus <i>Macaca</i>
29	Pangolins of genus <i>Manis</i>
30	Malayan Tapir ( <i>Tapirus indicus</i> )
31	Clouded Leopard ( <i>Neofelis nebulosa</i> )
32	Golden Cat ( <i>Felis temmincki</i> )
33	Fishing Cat ( <i>Felis viverrina</i> )
34	Binturong Bear Cat ( <i>Arctictis binnurong</i> )
35	Hog Badger ( <i>Arctonyx collaris</i> )
36	Ferret Badger ( <i>Melogale personata</i> )
37	Yellow-throated Marten ( <i>Martes flavigula</i> )
38	Banded Linsang ( <i>Prionodon linsang</i> )
39	Spotted Linsang ( <i>Prionodon pardicotor</i> )
40	Banded Palm Civet ( <i>Hemigalus derbyanus</i> )

**AVES**

1	Cormorants of family Phalacrocoracidae
2	Spot-billed Pelican ( <i>Pelecanus philippensis</i> )
3	Painted Stork ( <i>Ibis leucocephalus</i> )
4	Black Stork ( <i>Ciconia nigra</i> )
5	White-necked Stork ( <i>Ciconia episcopus</i> )
6	Black-necked Stork ( <i>Xenorhynchus asiaticus</i> )
7	Ibises of family Threskiornithidae
8	Hill Partridges of genus <i>Arborophila</i>
9	Long-billed Partridge ( <i>Rhizothera longirostris</i> )
10	Ferruginous Wood Partridge ( <i>Caloperdix ocella</i> )
11	Bamboo Partridge ( <i>Bambusicola fytchii</i> )
12	Roulroul ( <i>Rollulus roulroul</i> )
13	Pheasants of genus <i>Lophura</i>
14	Hume's Pheasant ( <i>Syrmaticus humiae</i> )
15	White-breasted Waterhen ( <i>Amauromis phoenicurus</i> )

No. Protected Wild Animals of the first category

AVES (Continued)

16	Sarus Crane ( <i>Grus antigone</i> )	75	Broad-billed Sandpiper ( <i>Limicola falcinellus</i> )
17	Lapwings of genus <i>Vanellus</i>	76	Curlew Sandpiper ( <i>Calidris furruginea</i> )
18	Thick-knees of family Burhinidae	77	Asian Dowitcher ( <i>Limnodromus semipalmatus</i> )
19	Munias and Weavers of family Ploceidae	78	Drongos of family Dicruridae
20	Red-billed Ground Cuckoo ( <i>Carpococcyx renauldi</i> )	79	Koel ( <i>Eudynamys scolopacea</i> )
21	Coucak or Crow Pheasant of genus <i>Centropus</i>	80	Thrushes of genera <i>Zoothera</i> and <i>Turdus</i>
22	Kingfishers of family Alcedinidae	81	Common Sandpiper ( <i>Actitis hypoleucos</i> )
23	Laughing Thrushes of genus <i>Garrulax</i>	82	Wagtails and Pipits of family Motacillidae
24	Hoopoe ( <i>Upupa epops</i> )	83	Greater Adjutant Stork ( <i>Leptoptilos dubius</i> )
25	Silver-eared mesia ( <i>Leiothrix argentauris</i> )	84	Lesser Adjutant Stork ( <i>Leptoptilos javanicus</i> )
26	Grey-headed Parakeet ( <i>Psittacula finschii</i> )	85	Great Barbet ( <i>Megalaima virens</i> )
27	Treepies of genus <i>Dendrocitta</i>	86	Tits of family Paridae
28	Great Hornbill ( <i>Buceros bicornis</i> )	87	Coppersmith Barbet ( <i>Megalaima haemacephala</i> )
29	Indian Pied Hornbill ( <i>Anhracoceros albirostris</i> )	88	Wandering Tattler ( <i>Heteroscelus incanus</i> )
30	Black Hornbill ( <i>Anhracoceros malayanus</i> )	89	Night Jars of family Caprimulgidae
31	Racket-tailed Treepies ( <i>Crypsirina temia</i> )	90	Black-billed Roller ( <i>Coracias benghalensis</i> )
32	Babblers, Thrushes, Mesia, Cutia, Barwing, Sivas, Yuhinas, and Sbias of genera <i>Pellorneum</i> , <i>Trichastoma</i> , <i>Malacopteron</i> , <i>Stachyris</i> , <i>Macronous</i> , and <i>Chrysomma</i>	91	Dollar Bird ( <i>Eurystomus orientalis</i> )
33	Parrots of genus <i>Psittacula</i>	92	Nuthatches of family Sittidae
34	Maggie Robin ( <i>Copsychus saularis</i> )	93	Pittas of family Pittidae
35	White-rumped Shama ( <i>Copsychus malabaricus</i> )	94	Knots and Stints of genus <i>Calidris</i>
36	Forktails of genus <i>Enicurus</i>	95	Swifts, Tree Swifts, Swallows, and Martins of family Apodidae, Hemiprocnidae, and Hirundinidae
37	Rock Thrush of genus <i>Monticola</i>	96	Gulls and Terns of family Laridae
38	Warblers of subfamily Sylviinae	97	Malkohas of genus <i>Phaenicopheus</i>
39	Black-collared Starling ( <i>Sturnus nigricollis</i> )	98	Bulbuls of family Pycnonotidae
40	Sunbirds of family Nectariniidae	99	Little Grebe ( <i>Podiceps ruficollis</i> )
41	Crested Jay ( <i>Platylophus galericulatus</i> )	100	Open-billed Stork ( <i>Anastomus oscitans</i> )
42	White-winged Black Jay ( <i>Platymurus leucopterus</i> )	101	Parrotbills of genus <i>Paradoxomis</i>
43	Flowerpeckers of family Dicaeidae	102	Black-tailed godwit ( <i>Limosa limosa</i> )
44	Robins of genera <i>Phoenicurus</i> , <i>Rhyacornis</i> , <i>Thamnotaea</i> , <i>Hodgsonius</i> , and <i>Cinclidium</i>	103	Bar-tailed godwit ( <i>Limosa lapponica</i> )
45	Red-breasted Parakeet ( <i>Psittacula alexandri</i> )	104	Comb Duck ( <i>Sarkidiornis melanotos</i> )
46	Cuckoo Dove of genus <i>Macropygia</i>	105	White-winged Wood Duck ( <i>Cairina scutulata</i> )
47	Red Turtle Dove ( <i>Streptopelia tranquebarica</i> )	106	Pigeons of genus <i>Treron</i>
48	Spotted-necked Dove ( <i>Streptopelia chinensis</i> )	107	Jambu Fruit Pigeon ( <i>Ptilinopus jambu</i> )
49	Zebra Dove ( <i>Geopelia striata</i> )	108	Brown-throated Tree Creeper ( <i>Certhia discolor</i> )
50	Emerald Dove ( <i>Chalcophaps indica</i> )	109	Frogmouths of family Podargidae
51	Rufous Dove ( <i>Streptopelia orientalis</i> )	110	Spectacled Barwing ( <i>Actinodura ramsayi</i> )
52	Cutia ( <i>Cutia nipalensis</i> )	111	Cochoas of genus <i>Cochoa</i>
53	Trogon of family Trogonidae	112	Pintail Parrot Finch ( <i>Erythrura prasina</i> )
54	Ioras and Leafbirds of family Chloropscidae	113	Broadbills of family Eurylaimidae
55	Hill Myna ( <i>Gracula religiosa</i> )	114	Minivets of family Campophagidae
56	White-eyes of family Zosteropidae	115	Turnstone ( <i>Arenaria interpres</i> )
57	Orioles and Bluebirds of family Oriolidae	116	Barbets of genus <i>Megalaima</i>
58	Sanderling ( <i>Crocethia alba</i> )	117	Brown Dipper ( <i>Cinclus pallasi</i> )
59	Rail Babbler ( <i>Eupetes macrocerus</i> )	118	Hérons, Bitterns, and Egrets of family Ardeidae
60	Red-winged Crested Cuckoo ( <i>Clamator coromandus</i> )	119	Green Peafowl ( <i>Pavo muticus</i> )
61	Cuckoos of genus <i>Cacomantis</i>	120	Scimitar of genus <i>Pomatorhinus</i>
62	Cuckoos of genus <i>Cuculus</i>	121	Ruff and Reeve ( <i>Philomachus pugnax</i> )
63	Cuckoos of genus <i>Chrysococcyx</i>	122	Pied Imperial Pigeon ( <i>Ducula bicolor</i> )
64	Drongo Cuckoo ( <i>Surniculus lugubris</i> )	123	Peacock pheasants of genus <i>Polyplectron</i>
65	Owls of family Strigidae	124	Sivas of genus <i>Minla</i>
66	Anhinga ( <i>Anhinga anhinga</i> )	125	Barn Owl ( <i>Tyto alba</i> )
67	Hornbills of family Bucerotidae	126	Greenpies of genus <i>Cissa</i>
68	White-eyed River Martin ( <i>Pseudocheilidon sirintarae</i> )	127	Golden-crested Myna ( <i>Ampelicens coronatus</i> )
69	Bee-eaters of family Meropidae	128	Shrike babblers of genera <i>Pteruthius</i> and <i>Gampsorhynchus</i>
70	Larks of family Alaudidae	129	Blue-rumped Parrot ( <i>Psittinus cyanurus</i> )
71	Flycatchers and Niltavas of subfamily Muscicapinae	130	Hanging lorikeets of genera <i>Loriculus</i>
72	Brown Barbet ( <i>Calorhamphus fuliginosus</i> )	131	Helmeted Hornbill ( <i>Rhinoplax vigil</i> )
73	Nicobar Pigeon ( <i>Caloenas nicobarica</i> )	132	Great Argus Pheasant ( <i>Argusianus argus</i> )
74	Sandpipers and Shanks of genus <i>Tringa</i>	133	Hawks, Kites, Buzzards, Goshawk, Shikra, Eagles, Vultures, Harriers, Ospreys, Falconats, Falcons, Hobby and Kestrels of Order Falconiformes
		134	Woodpeckers of family Picidae
		135	Plovers in genera <i>Charadrius</i> and <i>Pluvialis</i>
		136	Blue Whistling Thrush ( <i>Myophonus caeruleus</i> )

No. Protected Wild Animals of the first category

AVES (Continued)

- 137 Ashy Wood Swallow (*Artamus fuscus*)
- 138 House Crow (*Corvus splendens*)
- 139 Large-billed Crow (*Corvus macrorhynchus*)
- 140 Black-headed Shrike (*Lanius schach*)
- 141 Pied Starling (*Sturnus contra*)
- 142 Jerdon's Starling (*Sturnus burmannicus*)
- 143 Common Myna (*Acridotheres tristis*)
- 144 Crested Myna (*Sturnus javanicus*)
- 145 Owls of genera *Ketupa* and *Bubo*

- 16 Leathery Turtle (*Dermochelys coriacea*)
- 17 Giant Asiatic Tortoise (*Testudo emys*)
- 18 Pacific Ridley's Turtle (*Lepidochelys olivacea*)
- 19 Elongate Tortoise (*Testudo elongata*)
- 20 Roughneck Monitor (*Varanus rudicollis*)

AMPHIBIA

- 1 Crocodile Salamander (*Tylotriton versucosus*)

\*Ministerial Regulation No. 14 (B.E. 2525) Issued according to the Wild Animals Reservation and Protection Act B.E. 2503

REPTILIA

- 1 Flying Lizard of genus *Draco*
- 2 Garden Lizard of genus *Calotes*
- 3 Spiny Lizard of genus *Acanthosaura*
- 4 Angle-headed Lizard of genus *Goniocephalus*
- 5 Oriental Water Lizard (*Physignathus cocincinus*)
- 6 False Gavial (*Tomistoma schlegelii*)
- 7 Gecko of genus *Cyrtodactylus*
- 8 Flying Gecko of genus *Ptychozoon*
- 9 Hawksbill Turtle (*Eretmochelys imbricata*)
- 10 River Turtle or Four-toed Turtle (*Batagur baska*)
- 11 Spiny Hill Turtle (*Geoemyda spinosa*)
- 12 Impressed Tortoise (*Testudo impressa*)
- 13 Green Turtle (*Chelonia mydas*)
- 14 Loggerhead Turtle (*Caretta caretta*)
- 15 Big-headed Turtle (*Platysternum megacephalum*)

Table 3. Protected Wild Animals of Thailand

Schedule 2. List of Protected Wild Animals of the second category

No. Protected Wild Animals of the second category

A. MAMMALIA

- 1 Gaur (*Bos gaurus*)
- 2 Mouse Deer of genus *Tragulus*
- 3 Siamese Hare (*Lepus siamensis*)
- 4 Sambar Deer (*Cervus unicolor*)
- 5 Dugong (*Dugong dugong*)
- 6 Banteng (*Bos banteng*)
- 7 Tiger (*Panthera tigris*)
- 8 Leopard or Panther (*Panthera pardus*)
- 9 Asiatic Black Bear (*Selenarctos thibetanus*)
- 10 Malayan Sun Bear (*Helarctos malayanus*)

## สัตว์ป่าสงวน

สัตว์ป่าสงวน (Reserved Wild Animal) หมายถึงสัตว์ป่าที่หายาก มี ๑ ชนิดคือ เนื้อสมัน สองหรือสาม กวางผา เลียงผา เนื้อทราย กระซู่ แรด กูปรี และควายป่า

ตามพระราชบัญญัติสงวนและคุ้มครองสัตว์ป่า พ.ศ. ๒๕๐๓ ห้ามมิให้ผู้ใดล่าหรือมีไว้ในครอบครอง เว้นแต่จะเป็นการกระทำเพื่อการศึกษา หรือ วิจัยทางวิชาการ หรือเพื่อ กิจการสวนสัตว์สาธารณะ ซึ่งจะต้องได้รับหนังสืออนุญาตจากอธิบดีกรมป่าไม้


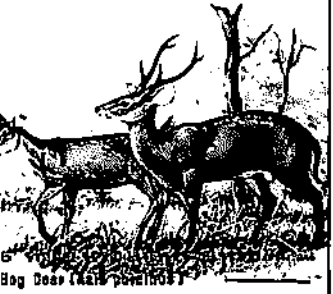
 Schomburgk's Deer ( <i>Cervus schomburgki</i> )			
 ๓ กวางผา Goral ( <i>Naemorhedus goral</i> )	 ๑ เลียงผา Serow ( <i>Capreolus bedfordi</i> )	 ๑ เนื้อทราย Hog Deer ( <i>Apis porcinus</i> )	 ๑ แรด Sumatran Rhinoceros ( <i>Rhinoceros sondaicus</i> )
 ๑ แรด Javan Rhinoceros ( <i>Rhinoceros sondaicus</i> )	 ๑ กูปรี Kouprey ( <i>Bos sauveli</i> )	 ๑ ควายป่า Wild Buffalo ( <i>Bubalus bubalis</i> )	 ๑ แรด Sumatran Rhinoceros ( <i>Rhinoceros sondaicus</i> )

Fig. 1: Poster produced in Thailand depicting the country's nine Reserved Wild Animals. These include Schomburgk's deer, Eld's deer, goral, serow, hog deer, Sumatran rhinoceros, Javan rhinoceros, kouprey and wild buffalo.

## MAMMALIA (Continued)

- 11 Barking Deer (*Muntiacus muntjak*)  
 12 Fca's Barking Deer (*Muntiacus feae*)

## B. AVES

- 1 Grey Heron (*Ardea cinerea*)  
 2 Purple Heron (*Ardea pupurea*)  
 3 Dusky Grey Heron (*Ardea sumatrana*)  
 4 Francolin (*Francolinus pintadeanus*)  
 5 Green-legged Tree Partridge (*Arborophila charltonii*)  
 6 Finches and Buntings of family Fringillidae  
 7 Red Jungle Fowl (*Gallus gallus*)  
 8 Night Heron (*Nycticorax nycticorax*)  
 9 Ducks, Garganeys, Pintails, Pochards, Shelducks, Shovellers, Teals, and Wigeon of family Anatidae  
 10 Painted Snipe (*Rostratula benghalensis*)  
 11 Snipes of genus *Capella*  
 12 Thick-billed Green Pigeon (*Treron curvirostra*)  
 13 Bronze-winged Jacana (*Metopidius indicus*)  
 14 Mountain Imperial Pigeon (*Ducula badia*)  
 15 Pale-capped Pigeon (*Columba punicea*)  
 16 Green Imperial Pigeon (*Ducula aenea*)  
 17 Rails and Crakes of family Rallidae  
 18 Curlews and Whimbrel of genus *Numenius*  
 19 Watercock (*Gallicrex cinerea*)  
 20 Moorhen (*Gallinula chloropus*)  
 21 Purple Gallinule (*Porphyrio poliocephalus*)  
 22 Pheasant-tailed Jacana (*Hydrophasianus chirurgus*)

## C. AMPHIBIA

- 1 Asiatic Giant Frog (*Rana blythii*)

Each year a quota is set for the numbers and species of Protected wild animals to be hunted and traded. In 1981, 12 bird taxa of the first category and six bird taxa of the second category were so listed, (Table 3), but no mammals or reptiles.

In January 1983, Thailand ratified CITES and became the 79th member country effective as of April 21, 1983. In order to guard against the smuggling of wildlife from Thailand to non-CITES countries, which continues to be a serious problem, the Wildlife Conservation Division maintains two checkpoints, at the airport and at the harbor in Bangkok. Three more checkpoints will be established, at the borders with Laos and with Malaysia, and at Chiangmai International Airport.

## Habitat-Oriented Conservation Activities

The Wildlife Act of 1960, in recognition of the need to maintain critical habitat for species survival, also provided for the creation of protected areas for wild animals (wildlife sanctuaries). The Wildlife Conservation Division has jurisdiction over the sanctuaries. The first sanctuary, Salak Phra, in the province of Kanchanaburi in west-central Thailand, was established in 1965. Since then, 23 more sanctuaries have been set up. The total area included within the sanctuaries is somewhat less than 2 million hectares, or almost 4% of the country's area (Figure 1).

The first national park of Thailand, Khao Yai, spanning the provinces of Nakhon Rachasima, Saraburi, Nakhon Nayak and Prachinburi in central Thailand, was declared in 1963, following enactment of the National Parks Act of the previous year.

TABLE 3. HUNTING AND TRADING QUOTA OF PROTECTED WILD ANIMALS FOR 1982

The Wildlife Conservation Committee has determined the limit for numbers of protected wild animals to be hunted and traded per licensee for 1982. The export of these protected animals will, therefore, not exceed these limited numbers.

## A. Hunting and Trading Quota of Protected Wild Animals of the First Category.

No.	Animal Taxon	Bag Limits	Trading Limits
1	White-breasted waterhen ( <i>Amaurornis phoenicurus</i> )	5	30
2	Laughing thrushes of genus <i>Garrulax</i>	5	20
3	Parrots of genus <i>Psittacula</i> excluding Red-breasted parakeet ( <i>Psittacula alexandri</i> ) and Large parakeet ( <i>Psittacula eupatria</i> )	15	60
4	White-rumped shama ( <i>Copsychus malabaricus</i> )	5	10
5	Spotted-necked dove ( <i>Streptopelia tranquebarica</i> )	10	20
6	Zebra dove ( <i>Geopelia striata</i> )	10	50
7	Hill myna ( <i>Gracula religiosa</i> )	5	30
8	Koel ( <i>Eudynamis scolopacea</i> )	2	10
9	Great barbet ( <i>Megalaima virens</i> )	2	10
10	Pintail parrot finch ( <i>Erythrura prasina</i> )	10	50

## B. Hunting and Trading Quota of Protected Wild Animals of the Second Category.

No.	Animal Taxon	Bag Limits	Trading Limits
1	Francolin ( <i>Francolinus pintadeanus</i> )	5	10
2	Snipes of genus <i>Capella</i>	10	20
3	Thick-billed green pigeon ( <i>Treron curvirostra</i> )	10	30
4	Watercock ( <i>Gallicrex cinerea</i> )	20	50
5	Moorhen ( <i>Gallinula chloropus</i> )	20	50
6	Purple gallinule ( <i>Porphyrio poliocephalus</i> )	10	40

The national parks, which are under the jurisdiction of the National Parks Division, Royal Forest Department, are intended, in contrast to the wildlife sanctuaries, to provide a place for recreation in addition to protecting local flora and fauna. At present there are 42 national parks, including several marine parks, encompassing a total of more than 2.3 million hectares, or about 4.5% of Thailand's area (Figure 2).

Many of the protected areas contain excellent forest and other habitats for wild animals. The survival of relatively intact ecosystems frequently can be attributed to the location of these areas in regions peripheral to human development. All efforts are be-



Fig. 2: Map of Thailand showing the location of existing Wildlife Sanctuaries and Nature and Wildlife Education Centers.

ing made by the Royal Forest Department to protect the sanctuaries and national parks, but each area appears to have its own set of conservation problems, as discussed below. Based on surveys conducted by the Royal Forest Department, there seem to be good forests and other habitats for wild animals remaining, that if brought under the jurisdiction of the sanctuaries or national parks would increase the reserved areas to about 10% of the total area of Thailand. Within the Royal Forest Department there is some debate over whether the more effective conservation strategy involves strengthening protection for already existing reserves or declaring as much remaining area as possible part of the reserve system before human encroachment occurs.

Within the wildlife sanctuaries and national parks, hunting, timbering and mining are prohibited. Other activities are strictly regulated. However, hydroelectric and irrigation projects increasingly are threatening protected areas. Salak Phra, the first sanctuary, lost much of its wildlife richness as a consequence of the construction of Srinakarin Dam. Elsewhere in western Thailand, the proposed Nam Choan Dam, to be financed with the assistance of the World Bank, threatens to disrupt the migrations of large mammals such as elephant between Huai Kha Khaeng and Thung Yai sanctuaries and open up the latter to human exploitation.

Research on wildlife in Thailand is aimed at producing management techniques or at adding to our general knowledge about species. Several projects to identify species and numbers of animals and habitat requirements have been initiated in protected areas. Both Thai scientists and foreign scientists are involved in these activities. Thai researchers have concentrated on the study of bird populations, including the shore birds found at Songkhla Lake in southern Thailand. Foreign researchers, in cooperation with Thai students or Thai counterparts in the Royal Forest Department, have concentrated on the study of primate populations (see below).

Many efforts are being made to make the Thai public aware of the value of their natural heritage and of how to enjoy nature. The Wildlife Conservation Division has set up Nature and Wildlife Education Centers in seven sanctuaries, representing every part of Thailand (Figure 1). The National Parks Division also is improving its visitor centers in the national parks.

### Conservation Action Priorities

The comments which follow address the problem of developing effective local conservation strategies and were prepared by Brockelman and Eudey as a consequence of their field work on primates in Khao Soi Dao and Huai Kha Khaeng Wildlife Sanctuaries, respectively.

As in neighboring countries, there are a large number of endangered species in Thailand, some of which have been identified above. The Species Survival Commission (SSC) has the same ultimate goal as the other IUCN Commissions. Our particular responsibility is to help identify the species and habitats in need of urgent attention and establish some priorities for action. This should be followed up with project proposals. We are now rethinking how species and project priorities should be set to arrive at some useful recommendations for Thailand. What should be the criteria?

The first and most obvious criterion for the SSC is the *degree of endangerment of the species*. Critically endangered species should receive more attention than vulnerable species.

A second criterion is the *probable effect of the proposed action*. Is the anticipated effect small or large, localized or widespread, measurable or highly diffuse? Is the probable effect high per dollar spent? This is clearly important. For example, the Sumatran rhinoceros is highly endangered in Thailand; as such, it is classified as a Reserved Animal, and its survival is prob-

lematical. It is doubtful if \$50,000 spent on this species would have any effect; spending a comparable amount to conserve elephants, which are also endangered but more abundant, would seem to hold more promise.

A third criterion is the *feasibility of the project* — can it, in fact, be carried out? Feasibility depends on many factors, such as:

1. Available infrastructure, for administrative and managerial support.
2. Local enthusiasm and cooperation.
3. Availability of capable principal investigators.
4. Logistical and/or scientific feasibility.

The probable effect of the project and its feasibility, to a large degree, depend on another consideration, the *strategy of conservation*. By this, we refer to areas of action such as the following:

1. Protection: creation of guard stations or procurement of equipment.
2. Field information: population inventory and habitat survey.
3. Research: ecological study.
4. Management and technical training assistance.
5. Education: dissemination of information on population and habitat significance on appropriate levels.
6. Socioeconomic action involving local residents near reserved areas.

Each of these areas of action has probable effect on, and a feasibility for, a given population or ecosystem. The efficacy of each action depends heavily on local circumstances and may vary even from one protected area to another within the same region. We can make some generalizations for Thailand. Equipment for protection is budgeted by the Thai government and, at this point in time, is not lacking; we do not feel that WWF or other outside agencies normally need assume this responsibility as it is not really efficient use of limited funds. Population inventory and habitat survey are badly needed in the greatly expanding system of sanctuaries and parks in Thailand, and some assistance in planning and actual execution of such activities may be essential. Research assistance may be useful in breeding or managing a few species, such as deer for rural economic development, or sea turtles. Education of persons living near sanctuaries and parks, especially children, is a valuable long-term investment, but it is doubtful if it will modify the immediate poaching and problems attendant upon shifting cultivation, which have largely socioeconomic causes and solutions. Education of high government officials is not such a priority in Thailand because conservation and protection are well supported by the law and the bureaucracy, but education of politicians may be critical because of the potential destruction of species and habitat by rapid technological development.

Nearly 10% of the territory of Thailand, as indicated above, may soon be included in the expanding protected area system. The problem now is how to most effectively maintain and strengthen this area. Socioeconomic action to us seems to be a neglected concern. We will illustrate our concept of the need for action in this area with experiences in two major reserved areas, both of which contain a diversity of endangered species.

*Khao Soi Dao Wildlife Sanctuary.* This area, which includes over 1,000 km<sup>2</sup> in southeast Thailand not far from the Kampuchean border, contains elephant, gaur, tiger, wild dog, silvered leaf monkey (*Presbytis cristatus*) and many other species. The very lush rain forests covering its mountains, valleys, and hills contain probably the most dense and extensive population of the pileated gibbon (*Hylobates pileatus* Figs. 4 & 5), making it a top priority for action for this reason alone. Although deforestation has been largely halted, poaching by local farmers continues in



Fig. 3: Map of Thailand showing the location of existing National Parks.

nearly all parts of the sanctuary, and the guards are unable to stop it anywhere except near the three or four stations at the edge of the sanctuary (and usually away from the forest). The forest is not patrolled.

What actions could further conserve the species in this sanctuary since existing protection is insufficient to do the job? Management planners might say that the first priority is more protection, i.e., more jeeps, guns, guard stations, radios and motorcycles. But researchers with several years' experience in Khao Soi Dao have concluded that a project oriented toward more protection capability would probably have little positive effect and might actually have adverse effects. The approximately 30 men stationed there are reasonably well-equipped, but there are too few men to man the existing stations and patrol the forest. It is not likely that their numbers will be increased because the budget is limited for manpower, and an increase cannot be affected by outside financial help. The critical factor may be relations with the local residents, who harvest plant and animal products within the forest. Experience over the years has shown that if strict enforcement is attempted, the local residents resist with a variety of tactics: appeal to local politicians or police to pressure the sanctuary officials, threats on the sanctuary headquarters, and actual shooting at the guards. What is to be done? To advocate that the Royal Forest Department become an occupying army would only worsen an existing insurgency problem in the region. Khao Soi Dao is now nearly a forest island surrounded by several thousand relatively poor farm families (and some not-so-poor rambutan orchards) that cannot be managed or regulated by force. What may be needed is a change in the concept of wildlife sanctuary. Every effort must be made to realize the considerable value of the sanctuary to science, education, and the benefit of the local residents who must make economic sacrifices to preserve it. No such effort is being made now, and we see little hope that local poaching will stop. There is no ethical mandate to stop it.



Fig. 5: Adult male pileated gibbon (*Hylobates pileatus*) in Khao Soi Dao Wildlife Sanctuary (photo by W. Y. Brockelman).



Fig. 4: Juvenile pileated gibbon (*Hylobates pileatus*) in Khao Soi Dao Wildlife Sanctuary (photo by W. Y. Brockelman).



Fig. 6: The stump-tailed macaque (*Macaca arctoides*), probably the most endangered of Thailand's macaque species (photo by R. A. Mittermeier).





Fig. 7: Forest destruction caused by shifting cultivation to the east of Huai Kha Khaeng Wildlife Sanctuary, Uthaithani Province. The area was covered with dry evergreen forest until about 200 years ago (photo by A. A. Eudey).

**Huai Kha Khaeng Wildlife Sanctuary.** This area is more than twice as large as Khao Soi Dao and encompasses monsoon deciduous and evergreen forest in lowland and mountain regions in the Dvana Range in west-central Thailand near Burma. Huai Kha Khaeng and the contiguous sanctuary of Thung Yai to the west total about 4,830 km<sup>2</sup> and constitute one of the largest remaining forested areas in Thailand. In the former the mammal fauna includes elephant, wild water buffalo, tapir (*Tapirus indicus*), serow, and many congeneric species, for example, banteng and gaur, tiger and leopard, Phayre's leaf monkey (*Presbytis phayrei*) and silvered leaf monkey, and five species of macaques, including the stump-tail macaque (*Macaca arctoides*, Fig. 6), which appears to be endangered throughout its disjunct distribution in Asia. Only the lar or white-handed gibbon (*Hylobates lar*) is found in the region. Although research or conservation efforts may be based on a species approach (Eudey, for example, has been studying the ecology of sympatric macaques in Huai Kha Khaeng since 1973), the importance of this protected area, with an extremely patchy environment, lies in the complexity of its ecosystem. The area may have been a forest refuge or refugium in the Pleistocene during periods of decreasing temperature and precipitation induced by glacial advances at more northern latitudes.

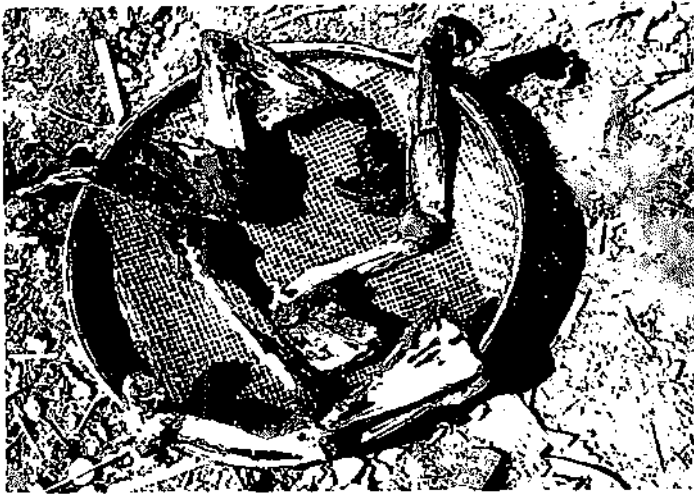
The region is remote (few Thais in Bangkok have ever visited the province of Uthaithani in which most of the sanctuary is found), yet easily accessible for research (and for poaching). Although the presence of human occupation in the general area and hunting of wildlife can be documented in the archaeological record to about 14,000 years ago, contemporary encroachment by

the human population is recent.

Since its declaration in 1972, some effort has been made to employ local residents in the actual running of the sanctuary; a settlement of former hunters even has been incorporated into sanctuary headquarters. Initially Karen hilltribe men, the local people most knowledgeable of the forest and animals, were employed as guides and general assistants, but their numbers have dwindled and no effort is being made to recruit them now. A resettlement scheme for Karen south of the sanctuary may even increase the amount of poaching done by these people. Meo villages occur within the sanctuary. Some of the villages engage in insurgency and some in opium-growing. Throughout the Meo area shifting agriculture is destroying primary forest and wildlife is being threatened by subsistence hunting (Fig. 7 & 8). Increasing communication and cooperation with hilltribe peoples seem essential for strengthening of the sanctuary.

Patrol of the forest against hunting does occur, and this is one sanctuary where, because of its size, an increase in guard stations and acquisition of more sophisticated weapons is necessary. Hunting may be commercially motivated or for sport by people equipped with modern weapons.

Expansion of the boundaries of the sanctuary to the east and south is essential to include habitat critical for bovids. A plywood concession to the east makes the boundary artificial and excludes an area of important salt licks from legal protection. Habitat of wild water buffalo is outside the present boundary in the south. Minor and major irrigation and hydroelectric projects, if executed, will increase the accessibility of the sanctuary to the human population, necessitating more protection. In this context, educa-



**Fig. 8:** Signs of subsistence hunting of protected wild animals by Meo hilltribe peoples. In the basket are limb bones of a colobine monkey, probably Phayre's leaf monkey (*Presbytis phayrei*), which has been smoked over a fire, and on the ground is the hair of a white-handed gibbon (*Hylobates lar*) (photo by A. A. Eudey).

tion of politicians as to the consequences for conservation of their decisions about technological development seems critical.

These two examples illustrate that the local conditions that determine an appropriate conservation strategy may vary greatly from place to place. Intimate knowledge of how each system works appears essential. Only persons with local field and cultural ex-

perience, including many on our commission, have the knowledge necessary to formulate effective proposals. Thus, we must concern ourselves not merely with deciding on species priorities, but also with helping to formulate and decide on new strategies. All too often strategies are formulated and evaluated on the basis of abstract philosophy or theories currently in vogue.

In Thailand, virtually every visiting consultant and expert in conservation has noted the difficulty of conserving protected areas and recommended, with the best of intentions, increased training, management planning, administration, and equipment for protection. These are, of course, all important. With the best possible management planning, the limiting factors early on should be identified and remedied in the plans, but in practice planners seem to advocate more of the same — guard stations, guns, and other equipment. The needed fundamental changes are seldom recommended except as a very low priority. The scope of conservation management planning, as it has grown largely out of Western experience, is not broad enough to include the needed solutions.

In Thailand, we advocate re-examining the objectives of wildlife conservation and the uses of reserved areas. We feel it is time to address the socioeconomic problems that appear to be worsening and that are limiting progress in conservation.

In conclusion, we advocate that the SSC, while using species and habitats as starting points, broaden the scope of concern to include the identification of locally limiting problems and the most promising and effective strategies to overcome them. In this, the collaboration of other commissions in designing proposals will be of critical importance.



**Fig. 9:** The slow loris (*Nycticebus coucang*), a nocturnal prosimian found in Thailand and a number of other Southeast Asian countries (photo by R. A. Mittermeier).

# Burma

## Species Conservation Priorities in Burma

John Blower

### Introduction

Burma (Fig. 1), with a total area of 676,756 km<sup>2</sup>, extends from latitude 10° N in the extreme south, to latitude 28° N on the northern border with Tibet, a total distance of some 2093 km. Between these two extremes there exists an ecological spectrum of almost unique variety, ranging from tropical rainforest and coral reefs in the south to temperate forests of conifers, oaks and rhododendrons in the far north, where snow-capped mountains up to 5792 m mark the eastern extremity of the Himalayas.

High mountain ranges form a continuous barrier along the western border with India and Bangladesh, extending southward parallel with the coast nearly to the Irrawaddy Delta. In the northeast the border with China follows the high crest of the Irrawaddy-Salween divide, then bulges out eastward to enclose the Shan Plateau, a vast area of rugged mountain country bordering with Laos and Thailand. Between these mountain barriers to the west and east lies the fertile, heavily populated basin of the Irrawaddy, with its largest tributary, the Chindwin, joining it from the northwest. Burma's other great river, the Salween, flows south through neighboring Yunnan and then cuts through the Shan Plateau in deep, heavily forested gorges before finally reaching the sea in the Gulf of Martaban. Further south, Tenasserim extends in a long mountainous arm bordering with Thailand down to the Kra Isthmus.

Apart from the northern uplands of Kachin State, the climate of Burma is tropical monsoonal, with a rainy season coinciding with the southwest monsoon from May to October and a generally well marked dry season from November to April. There are, however, important local variations, with mean annual rainfall ranging from as little as 762 mm in parts of the central Dry Zone to over 6350 mm in Tenasserim.

The population is about 33 million with an average density ranging from less than 10 per km<sup>2</sup> in some of the peripheral mountain areas to nearly 350 in the very heavily populated Rangoon Division, and over 116 in the Irrawaddy Delta, giving an overall density of about 46 per km<sup>2</sup>, which is well below the average for southeast Asia. The annual population growth rate has been fairly constant in recent years at about 2.2%. Agriculture, including timber production, employs two-thirds of the work force and 76% of the population still lives in rural areas.

The officially quoted figure of 57% overall forest cover in Burma is somewhat out of date. The report of the FAO/UNEP Tropical Forest Resources Assessment Project (FAO/UNEP, 1981), based on analysis of Landsat satellite imagery, estimated about 47% forest cover in 1980, including all types of woody growth such as scrub woodland and bamboo in addition to high forest. The annual rate of deforestation through shifting cultivation and other causes was estimated at around 101,175 hectares per year.

Forests may be broadly divided into four main categories:

1. *Tropical moist forest*, which includes the evergreen dipterocarp rainforest of the high rainfall areas in Tenasserim, Kachin State, and Upper Chindwin; the semi-evergreen forests of Arakan and parts of North Burma, and the extensive moist deciduous forests, which are of great importance for production of teak and other commercial hardwoods. It also includes the various types of tidal and fresh water swamp forests.
2. *Tropical dry forest*; mixed deciduous forests including *indaing* — characterized by the presence of *Dipterocarpus tuberculatus*, dry teak forest and other types of rather open, stunted woodland found in the drier areas.
3. *Montane sub-tropical forests*; typically including *Quercus*, *Castanopsis* and pines (*Pinus merkusii* and *P. insularis*) in mountain areas from 915-1524 m, and sometimes higher.
4. *Montane temperate forests*; occurring between 1524 and 3659 m, and characterized by *Quercus*, *Castanopsis*, *Schima*, pines (*P. excelsa* and *P. wallichiana*), and at highest elevations in north Burma, *Tsuga*, *Abies*, *Betula* and rhododendrons.

### Species Conservation in Burma

Most of Burma lies within the Indochinese Zoogeographic sub-region of the Oriental region, with the Arakan and Chin Hills in the Indian sub-region, and the high mountains of the extreme north, with their typically Himalayan species, in the Palearctic region.

Large mammals such as elephant (*Elaphas maximus*), gaur (*Bos gaurus*), banteng (*Bos javanicus*), sambar (*Cervus unicolor*), barking deer (*Muntiacus muntjak*), tiger (*Panthera tigris*) and leopard (*P. pardus*) are widely distributed in the less disturbed forested regions of most of Burma apart from the far north. But in the absence of factual data their status is uncertain. Two species of rhinoceros formerly occurred in Burma, of which the Javan rhinoceros (*Rhinoceros sondaicus*) is already extinct and the Sumatran (*Dicerorhinus sumatrensis*) probably so.

Among other larger mammals, the distributions of which are more localized, are hog deer (*Cervus porcinus*), musk deer (*Moschus moschiferus*), thamin (*Cervus eldi*) — in the drier areas of central Burma, tufted deer (*Elaphodus cephalophus*) from the northeast border with Yunnan, and two species of mouse deer (*Tragulus napu* and *T. javanicus*) in Tenasserim. There are also three species of goat-antelope; takin (*Budorcas taxicolor*) — which occurs only in the north of Kachin State, serow (*Capricornis sumatraensis*) and goral (*Nemorhaedus goral*). Tapir (*Tapirus indicus* Fig. 2) were formerly found in mainland Tenasserim ap-

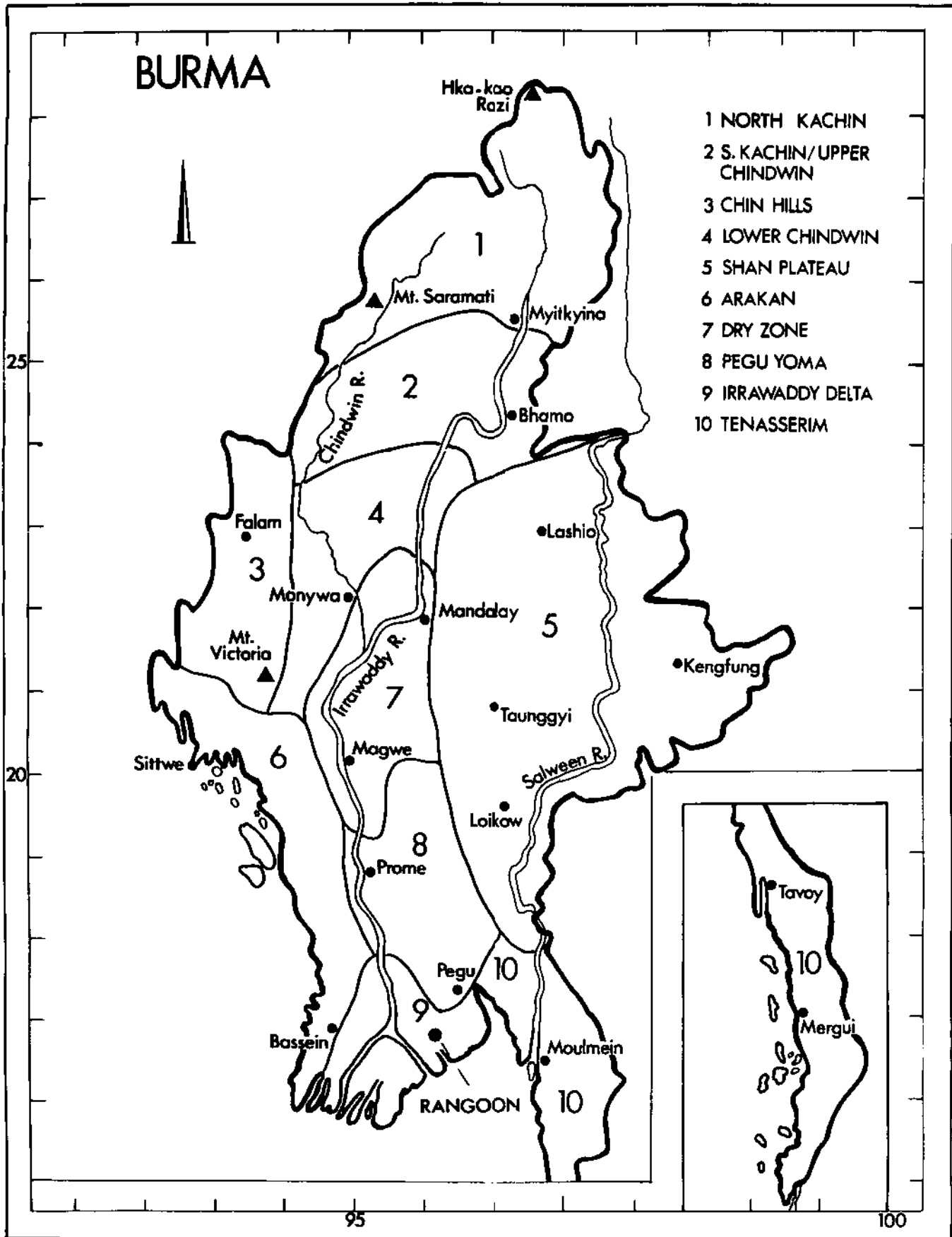


Fig. 1: Map of Burma showing major geographical subdivisions, towns and rivers.

proximately as far north as latitude 18° N. but whether their present range extends so far north is uncertain.

Carnivores include two species of bear (*Helarctos malayanus*; Fig. 3) and *Selenarctos thibetanus*), clouded leopard (*Neofelis nebulosa*), wild dog (*Cuon alpinus*), Asiatic jackal (*Canis aureus*) and, in northern Kachin State, red panda (*Ailurus fulgens*), and possibly wolf (*Canis lupus*).

Among primates, several species of *Macaca* and *Presbytis* are fairly widely distributed, and there are also two gibbons, the hoolock (*Hyllobates hoolock*) of Upper Burma and the white-handed gibbon (*H. lar*) of Tenasserim.

Marine mammals and reptiles occurring in coastal waters and riverine estuaries include the now very rare dugong (*Dugong dugon* Fig. 4), the salt water crocodile (*Crocodilus porosus*) and possibly five species of marine turtle, of which the commonest are the green turtle (*Chelonia mydas*) and probably the olive ridley (*Lepidochelys olivacea*) (although the latter has in the past been confused with the loggerhead (*Caretta caretta*) and the relative status of the two species is unclear).

About one thousand bird species have been recorded from Burma (Smythies, 1953), this relatively high species diversity being due to the fact that the country extends into two zoogeographic regions, each with different bird faunas. The forests of Tenasserim contain many Malesian species, whereas in the central and northern part of the country the bird fauna has Indian and Chinese affinities. A large number of Himalayan species occur in the montane forests of north and west Burma. There are relatively few endemic species (Sayer, 1983).

There is, as yet, little information on the status, distribution and ecology of individual species, though there is no evidence that any major species is seriously endangered, apart from vultures, which have practically disappeared from most of Burma in recent years.

The main threats to bird life are the conversion of wetlands to agriculture, the habitat of waterfowl and waders including the large numbers of migratory species which winter in Burma, hunting and trapping, especially of pheasants and peafowl, and the use of agricultural pesticides such as Endrin, which is a serious threat to scavengers and seed-eaters. The principal conservation needs for birds are the protection of sufficient areas of natural habitat, especially wetlands, and research to obtain data on the status and distribution of individual species, particularly those which are either rare or endemic to Burma.

Wildlife conservation has hitherto been the responsibility of the Forest Department. Apart from the Reserved Forests which total 90,673 km<sup>2</sup>, or approximately 13.5% of the total land area, there are 14 wildlife sanctuaries. However, most are relatively small, their aggregate area being only 4,728 km<sup>2</sup>, or approximately 0.7% of the total land area.

Apart from the inadequate size of existing protected areas, both individually and in aggregate, they also fail to provide representative coverage of several important biota, including the northern temperate forests, the evergreen dipterocarp forests of Tenasserim, and coastal areas including the Irrawaddy Delta and the Mergui Archipelago with its coral reefs.

Under existing legislation, which dates from the pre-World War II colonial era, the fauna in wildlife sanctuaries is protected but the habitat is not, with the result that many areas and species have suffered serious damage. Moreover, in most cases effective protection of wildlife has not been possible due to shortage of Forest Department staff.

Wildlife in Reserved Forests enjoys a certain degree of legal protection and may not be hunted without a special permit. But here again, effective law enforcement is difficult due to staff short-



Fig. 2: The Malayan tapir (*Tapirus indicus*) an endangered species from Burma (photo by R. A. Mittermeier).



Fig. 3: The sun bear (*Helarctos malayanus*), one of two bear species found in Burma (photo by R. A. Mittermeier).

ages and the large numbers of firearms in the hands of the military and para-military People's Militia.

In 1981, the Government, with assistance from FAO/UNEP, introduced a new Nature Conservation and National Parks project with the object of ensuring more effective protection of flora, fauna and natural landscapes, including establishment of national parks and other protected areas. Preliminary surveys of over twenty potential sites have been completed (June, 1983), and several have been identified as suitable for establishing national parks, nature reserves or sanctuaries. Other areas, particularly in northern Burma, still remain to be surveyed.

### *Species Conservation Action Priorities*

The most urgent priorities are the conservation of large mammals, particularly elephants, marine turtles and the saltwater crocodile. In the almost total absence of reliable data on the present status of wildlife populations in Burma it is impossible to give anything other than a very subjective impression of the degree to which individual species may or may not be endangered.

*Elephant (Elaphus maximus)*. The elephant is of major economic importance to Burma for extraction of teak and other hardwoods, which are one of the country's main sources of foreign exchange. There are approximately 5,400 captive elephants in Burma, most of which are employed in the timber industry. However, the annual reproductive rate among timber elephants is on-

ly about 5.3 per 100 breeding females, which, allowing for mortality, is insufficient to maintain this population without influx from the wild. Consequently, it is necessary to continue the capture of wild elephants at an average rate of about 120 per year.

Estimates of the wild elephant population in Burma range from 3,000 to 6,000, but observations in the limited areas covered so far by our surveys indicate that the lower figure is probably the more realistic. Mortality in capture operations is officially admitted to be about 20%, and may even be higher. There is also a significant amount of illegal capture and smuggling of elephants to Thailand, and also poaching for ivory (38 animals are known to have been successfully smuggled to Thailand in recent months and a further 11 were intercepted en route and confiscated). Therefore, while it is not yet possible to give any reasonably accurate estimate of actual numbers, it is certain that the overall annual offtake from legal and illegal capture and poaching is appreciable.

In nearly all the areas so far surveyed the elephant population has been found to be appreciably lower than previous official estimates. It is therefore reasonable to assume that the overall population is also considerably lower than the official figure of about 6,000, and that with continuing offtake, known and unknown, numbers are steadily declining.

#### ACTION REQUIRED:

1. Field research to obtain data on the present status and distribution of wild elephants and to monitor future trends;
2. Based on results of the above, to establish elephant ranges or nature reserves of sufficient size wherein viable populations can be effectively protected;
3. Study of the management of captive elephants, with a view to increasing the birth rate to a level where the population can be self-sustaining;
4. Progressive reduction in numbers of capture permits issued, combined with law enforcement to control poaching, illegal capture and smuggling.

*Rhinoceros (Dicerorhinus sumatrensis)*. This species formerly occurred in Kachin State, Upper Chindwin, Arakan, Mongmit/Mandalay Division, Kayah State and Tenasserim, but there have been no recent confirmed reports of its survival in any of these areas and it may already be extinct.

The only areas where it has been reported to occur during the past 20 years are the Tamanthi Wildlife Sanctuary in Upper Chindwin and Shwe-u-daung Sanctuary on the border between Mongmit and Mandalay Divisions. However, both these areas have been subject to extensive insurgent activity, and it is doubtful that any rhino still survive. Surveys of both areas are planned for the 1983/84 dry season.

#### ACTION REQUIRED:

1. Surveys of Tamanthi and Shwe-u-daung Wildlife Sanctuaries and any other appropriate areas to determine whether or not any rhinoceros survive;
2. Subject to confirmation of their survival in any area, to plan and implement effective conservation measures without delay (including possible upgrading of the area concerned to National Park or Nature Reserve status).

*Thamin (Cervus eldi thamin)*. The Burmese subspecies of this deer is confined to the drier areas of central Burma, and there have also been unconfirmed reports of its occurrence in Paan Division to the east of the Salween, near the Thai border. Although fully protected by law, thamin are widely hunted, but fortunately appear able to withstand hunting pressure moderately well and

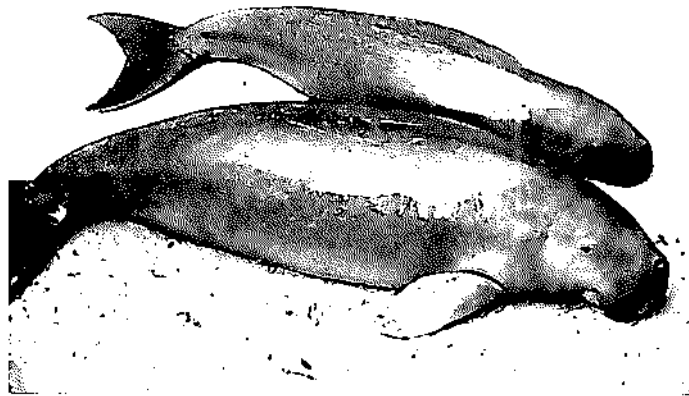


Fig. 4: The dugong (*Dugong dugon*), now very rare in Burman coastal waters (photo by R. A. Mittermeier).

also to adapt to habitat changes. However, their range has been considerably reduced, and although they are spottily distributed throughout much of Shwebo Division and elsewhere in central Burma, the only population which can be regarded as truly viable is in the Kyatthin Wildlife Sanctuary in Shwebo Division. There are believed to be about 2,000 thamin there and a few hundred in the somewhat larger, but much degraded Shwezettaw Wildlife Sanctuary to the west of the Irrawaddy in Minbu Division.

Thamin are vulnerable, but not yet endangered, though conservation measures are needed if they are to survive in the long-term.

#### ACTION REQUIRED:

1. Enlargement of the Kyatthin Wildlife Sanctuary with realignment of boundaries to exclude villages presently contained within;
2. Upgrade the status of Kyatthin to Nature Reserve with provision of sufficient staff to protect it;
3. Full protection of thamin elsewhere, with severe penalties for illegal hunting; and
4. A research program on thamin ecology.

*Wild Cattle (Bos spp.)*. Gaur (*Bos gaurus*) and banteng (*Bos javanicus*) occur throughout much of Burma in areas where there is still good forest cover and little human disturbance, gaur generally preferring more hilly country than the banteng. Although theoretically protected, both species are heavily hunted and are becoming increasingly scarce. Both are vulnerable, if not endangered.

#### ACTION PRIORITIES:

1. Establish one or more national parks or nature reserves of adequate size wherein there are viable populations of these species and provide sufficient staff to protect them (the proposed Alaungdaw Kathapu and Pegu Yoma National Parks would be very suitable for this purpose);
2. Enforce the law to stop the killing of these animals for meat, especially by the Army and the People's Militia;
3. Survey to ascertain status and distribution as a basis for further conservation planning.

*Tiger (Panthera tigris)*. Burma is the only country where the tiger occurs that it is not protected by law. When the present law was introduced (1936), tiger were still plentiful in Burma, causing considerable damage to domestic livestock and constituting a serious menace to human life in certain areas. Consequently,

they were at that time regarded as "vermin" and were not placed on the protected list.

The situation today is very different. There are a few isolated areas such as the proposed Alaungdaw Kathapa National Park where tiger are still relatively plentiful. But in most areas they are now rare, as has been clearly shown by recent field surveys, which revealed very few signs of tigers. This is probably due both to scarcity of prey species such as the heavily hunted sambar, and also to hunting, trapping and poisoning of the tigers themselves. Tiger skins are readily obtainable in Bangkok where they fetch as much as US \$1,000 apiece. Most of these have come from Burma where they have been trapped, shot or poisoned with the highly toxic and widely available agricultural pesticide Endrin.\*

Tiger in Burma are not yet seriously endangered, but they will be, as elsewhere in southeast Asia, unless positive steps are taken for their conservation.

#### ACTION PRIORITIES:

1. Place the tiger on the fully protected list of wildlife, except in cases of proven man-killing, with severe penalties for hunting or possession of skins;
2. Establish national parks or reserves in areas where there are still good populations of tigers and prey species;
3. Conduct an education campaign to convince the public that tigers are a beautiful and increasingly rare species, important in Burmese culture and tradition, and that they will inevitably disappear unless protected.

*Saltwater Crocodile (Crocodylus porosus)*. Formerly widely distributed in estuaries and tidal swamps of Arakan, the Irrawaddy Delta and Tenasserim, crocodiles have been heavily hunted for skins and are now very seldom seen. Another major factor in their decline has been the loss of habitat due to extensive clearing of mangroves for rice cultivation. There are, however, apparently still viable populations in the Irrawaddy Delta where the People's Pearl and Fisheries Corporation (PPFC) collects an average of about 500 hatchlings a year for their crocodile farm in Rangoon. Also, there are still possibly viable populations in less disturbed coastal areas of Arakan and Tenasserim where there are still extensive areas of suitable habitat among the tidal creeks and mangrove swamps.

The PPFC has proposed that Meinmahla Kyun, an estuarine island about 130 km<sup>2</sup> in area in the Irrawaddy Delta, be declared a sanctuary for this species. The crocodile population is, however, very small with no sign of breeding. Restocking from the crocodile farm will therefore probably be necessary.

#### ACTION PRIORITIES:

1. Full legal protection for this species, except for the collection of a limited number of hatchlings by PPFC under permit;
2. Heavy penalties for possession of crocodile skins;
3. Establishment of Meinmahla Kyun as a sanctuary for protection of crocodiles with restocking as necessary;
4. Surveys in Arakan and Tenasserim to obtain data on status and distribution, and identify suitable conservation areas.

*Marine Turtles*. The five species of marine turtles reportedly occurring in Burmese coastal waters are as follows:

- Green turtle (*Chelonia mydas*) — Commonest species on Thamihla Kyun.

- Olive ridley (*Lepidochelys olivacea*) — Fairly common off the Irrawaddy Delta.
- Loggerhead (*Caretta caretta*) — Status uncertain, but reported to be fairly common in the Delta region.
- Hawksbill (*Eretmochelys imbricata*) — Rare.
- Leatherback (*Dermochelys coriacea*) — Very rare.

There are turtle nesting beaches along the coast and on certain offshore islands in Arakan, the Irrawaddy Delta and Tenasserim, of which the most important appear to be Thamihla Kyun (Diamond Island) off the mouth of the Bassein River, Kadonly and Gayedgyi Islands off the mouth of the Bogale River, and Aung Bok in the South Moscos Islands (Tenasserim).

Both Thamihla Kyun and the Moscos Islands are legally established Wildlife Sanctuaries, but nearly all the turtle eggs laid are taken from the former by the PPFC and from the latter by a local contractor with a Forest Dept. license. Eggs are also taken from all other known nesting sites.

Past records show that at the beginning of this century 1.5-2 million eggs a year were being harvested from Thamihla Kyun. The average annual offtake today is only about 150,000, a 90% reduction. Many former nesting beaches are no longer visited by any turtles. Apart from egg collection, mature turtles are taken by fishermen, reportedly including PPFC trawlers which catch them in their nets. Hawksbill turtles are killed for their "tortoise shell".

From the enormous reduction in the number of eggs collected from Thamihla Kyun and elsewhere and the fact that many of the formerly well known nesting beaches are now unused, it is clear that turtle populations have declined markedly and that two species, the leatherback and the hawksbill, are endangered while the other three species must be considered seriously threatened. Leatherbacks are so rare that their occurrence should perhaps be considered accidental.

#### ACTION REQUIRED:

1. Establish Thamihla Kyun and South Moscos as effective wildlife sanctuaries and stop all collection of turtle eggs. South Moscos has been proposed as a future national park and has been approved in principle. Its designation as a park will, however, have to wait introduction of new legislation;
2. Declare Kadonly Kyun a wildlife sanctuary and provide sufficient staff, boats, etc., to protect it and the other two sanctuaries mentioned above. It appears that Kadonly Kyun attracts mainly olive ridley and the other two islands mainly green turtle;
3. Enlist cooperation of PPFC in not trawling in areas immediately seaward of sanctuaries and in releasing any turtles accidentally caught in nets; and
4. Survey by experienced marine biologist to determine the status and distribution of marine turtles in Burmese waters and to recommend further conservation action.

*River Terrapin (Batagur baska)*. This endangered species still occurs in the Irrawaddy Delta and is reported to nest on certain of the offshore islands and sandbanks, including Kadonly Kyun, which has been proposed as a wildlife sanctuary. However, both the terrapin itself and the eggs are taken wherever they are found. The species is now very rare in Burmese waters and without effective conservation measures is likely to become extinct within the foreseeable future.

#### ACTION REQUIRED:

1. Full protection of both the terrapin and its eggs;
2. Establishment of Kadonly Kyun as a wildlife sanctuary;
3. Survey by a marine biologist to determine status and distribu-

\*Note: The Government of Burma has recently prohibited further importation of Endrin and less toxic pesticides are being introduced in its place.

tion (combined with a marine turtle survey) and to recommend further conservation action, including a possible hatchery on Kadonly Kyun or elsewhere.

### Conclusion

Burma is a country of unusual ecological diversity, rich in a wide variety of flora and fauna. But, as elsewhere, the natural environment is increasingly threatened by shifting cultivation, illegal hunting, uncontrolled use of highly toxic pesticides and other harmful influences resulting from steady growth of the human population. Satellite monitoring shows that forest cover, though still greater in proportion to the total land area than in most south-east Asian countries, is diminishing at a steady rate. The Javan rhinoceros has already become extinct here, and other species, including the economically important elephant, marine turtles and saltwater crocodile, are seriously threatened.

The Government, having realized that effective conservation action is urgently needed, has, with UNDP/FAO assistance, initiated a nature conservation program which will include new legislation and establishment of national parks and other protected

areas. Several suitable sites have already been identified in addition to the 14 wildlife sanctuaries already in existence.

Provided that viable populations of those species known to be threatened or endangered are effectively protected, together with sufficiently extensive areas of their habitat, their survival should be assured. Otherwise, they will inevitably go the same way as the Javan rhinoceros.

Though much work yet remains to be done, particularly in field research to determine the status and distribution of individual species, the broad basis for an effective nature conservation program now exists. Continued external assistance will be needed for some years, but ultimate responsibility for implementation of this program necessarily rests with the Burmese government.

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Table 1. Burma  
 Biogeographical Subdivisions Showing Distribution of Protected Areas, Existing and Proposed

Map Ref. No.	Designation	Major rare, vulnerable or endangered species	Protected Areas		Area (km <sup>2</sup> )
			Existing	Proposed	
1.	NORTH KACHIN	Takin, musk deer, wolf, red panda, elephant, rhinoceros (?), tiger, several pheasant species	Nil	Nil	
2.	SOUTH KACHIN/ UPPER CHINDWIN	Elephant, gaur, tiger, rhinoceros (?), Sarus crane	TAMANTHI W.S. PIDAUNG W.S.	2150 705	Nil
3.	CHIN HILLS	Elephant (scarce), gaur, tiger	Nil		NAIMI TAUNG (Mt. Victoria) N.P. 363 KYAUKPANDAUNG N.P. 132
4.	LOWER CHINDWIN	Elephant, thamin, gaur, banteng, tiger, wild dog	KYATTHIN W.S.	268	ALAUNGDAW KATHAPA N.P. 1606
5.	SHAN PLATEAU	Elephant, gaur, banteng, tiger, wild dog, Sarus crane	MAYMYO W.S. SHWE-U-DAUNG W.S. TAUNGGYI W.S.	127 207 16	INLE AND MONGPAI N.R. 41
6.	ARAKAN (RHAKINE)	Elephant, gaur, banteng, tiger, wild dog, salt-water crocodile	Nil		Nil
7.	DRY ZONE	Thamin, gaur, banteng (in foothills), wild dog	SHWEZETTAW W.S. WETHTIGAN W.S. MINWUN TAUNG W.S.	552 5 206	POPA MOUNTAIN PARK 96
8.	PEGU YOMA	Elephant, gaur, banteng, tiger, wild dog	Nil		PEGU YOMA N.P. 1461 MOHINGYI N.R. 104 GYOBYU RECREATIONAL AREA 34
9.	IRRAWADDY DELTA	Marine turtle, saltwater crocodile, river terrapin, Irrawaddy dolphin (?)	THAMIHILA W.S. (Diamond I.)	1	MEINMAHLA KYUN W.S. 130 KADONLAY KYUN W.S. 3
10.	TENASSERIM	Elephant, gaur, banteng, Fea's muntjak, marine turtle, salt-water crocodile, Argus pheasant	KAHILU W.S. KELATHA W.S. MULAYIT W.S. MOSCOS W.S.	161 25 139 49	LAMPI N.P. 233 PAKCHAN N.R. 1451

Note: N.P. = National Park, N.R. = Nature Reserve, W.S. = Wildlife Sanctuary.