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Foreword

The Asian elephant is unique, being the only species of wild animal that, after a few months of teaching by man, behaves towards him with patience and understanding. It participates in man's religious, cultural, and social activities, lending dignity and grace as each occasion demands, as though it had learnt all about it in the jungle. The folklore and cultures of Asian countries are rich in tales and anecdotes, which confer on elephants a kind of superior intellect enabling them to live with people and yet not succumb to complete domestication.

This touching relationship between man and elephant in Asia from time immemorial sends strong conservation impulses through governments, decision-makers, and the general public. They would not consciously jeopardise the future of a much-loved animal, so it is up to conservationists to translate this sentiment into a commitment from politicians and planners to safeguard that future. The best laid plans for conservation in general will come to nothing if there is no political will to implement them.

From personal experience, I venture to say that such commitment can be expected if we provide politicians with attrac-

tive alternatives, supported by quantifiable data and, where appropriate, strengthened by tested practical solutions which they can use without seriously compromising national plans for economic development. Indeed, this is what the Asian Elephant Specialist Group (AESG) pledged to do when it was founded in 1978. All the research and field projects that we have promoted have been geared towards equipping ourselves with knowledge that can be shared with decision-makers and economic developers. The work of members of the group in India, Indonesia, Malaysia, Sri Lanka, and Thailand has enhanced the capacity to tackle such issues as elephant population biology, assessment of crop damage, prevention of human-elephant conflicts, and translocation, including well-planned elephant drives. Now, at the threshold of a new decade, we aim to sit with the decision-makers to help plot a course that will remove the threats to survival of this great animal. It is no mean task but, judging from the determination and dedication of our members, we believe that we have a good chance of success.

It is appropriate to recall how it all began, and, in particular, the pioneering efforts of the original 23-member Group led by

The Asian Elephant

An Action Plan for its Conservation

Compiled by
Charles Santiapillai and Peter Jackson
IUCN/SSC Asian Elephant Specialist Group



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Chairman J.C. Daniel, Curator of the Bombay Natural History Society, whose devotion to the cause has proved to be contagious. Seven countries in which the Asian elephant occurs were represented at first: Bangladesh, Burma, India, Malaysia, Nepal, Sri Lanka, and Thailand. Now the other six have entered the fold: Bhutan, Cambodia, China, Indonesia, Laos, and Vietnam, and we also now have representation in the Malaysian state of Sabah. In addition, due to the increasing pressure on wild animals to replenish stocks of working elephants, the AESG has drawn on the expertise of several zoos which support Species Survival Plans in their countries and have bred Asian elephants in captivity over a considerable period of time.

The concept of action plans began very early in SSC history and the first plans for the AESG were on a country-by-country basis, although within India, because of its size and the wide separation between elephant populations, there were initial recommendations for each State in which elephants occur. In addition to these action plans, which acted as catalysts in the group's representations to individual governments, the AESG also discussed elephant conservation problems through international meetings and workshops held in Sri Lanka, India (Jaldapara and Bandipur), and most recently in Thailand (Chiangmai in January 1988). All these activities were planned with a view to formulating a comprehensive action plan for the Asian elephant throughout its range in the wild, and the publication before you is the final result.

The AESG has been supported in this work by generous donations from the World Wide Fund for Nature (WWF), the United Nations Environment Programme (UNEP), the Dickerson Park Zoo (on behalf of the Asian Elephant Species Survival

Plan coordinated by the American Association of Zoological Parks and Aquariums), the Bristol, Clifton, and West England Zoological Society, and the Zurich Zoological Gardens. The assistance of all these organisations is very greatly appreciated.

It is appropriate to pay tribute to one of our founding members, the late Mr. S.P. Shahi. During his life in the Indian Forest Service, culminating as Chief Conservator of Forests of the State of Bihar, and during the years of his retirement until his death in 1986, Mr. Shahi played a major role in elephant conservation in India, especially in surveying and making recommendations for conservation of the seriously-endangered elephants in central India. His wisdom and experience is greatly missed.

Throughout the preparation of this action plan, our members have exhibited a strong family bond (like our elephants!) when it comes to working for the good of the Group, and I take this opportunity to thank them for their unstinted cooperation. Although I cannot mention all of them by name, I would be failing in my duty if I did not single out our indefatigable colleague and Executive Secretary, Dr. Charles Santiapillai. Only a person possessing such a zest for practical scientific achievement as Charles could have produced such a monumental work as the action plan now before you. We should strive to ensure that it will occupy a prominent place among the development plans of our respective countries, where our majestic elephant must continue to roam freely, safely, and with its head held high.

Lyn de Alwis

Chairman, IUCN/SSC Asian Elephant Specialist Group

Compilers' Note and Acknowledgements

At the IUCN/SSC Asian Elephant Specialist Group meeting in Bandipur, India, in 1985, the results of surveys, conservation, and research on elephant populations since the foundation of the Asian Elephant Specialist Group were reviewed in a series of papers (Jackson 1986). It was noted that large areas of elephant habitat were still unsurveyed. Representatives of the countries concerned were recruited to the group in order to produce an overall Action Plan. The draft containing their contributions was discussed at a group workshop in Chiangmai, Thailand, in January 1988, paving the way for the final document presented here.

The overall Action Plan is presented at the beginning of this work and includes general recommendations. Following chapters review the status of the elephant in 15 geographic units in 13 countries. Each chapter provides a review of the status of the elephant in a particular country, its distribution, and the number of elephants in the wild and in captivity. It then discusses some of the major conservation problems in the country, and the measures that have been taken to date.

The objective of the action plan is to protect as many elephants as possible in as wide a range of their habitats as is practical. This calls for the establishment of protected areas large enough to maintain viable populations of elephants, well removed from human settlement, wherever possible. Where

this is not possible, provision has to be made for elephant conservation and compatible human use in Managed Elephant Ranges (MER). Each country chapter contains recommendations for action to conserve elephants, and in the main Action Plan, these national recommendations are brought together, and continent-wide priorities for the Asian elephant are established.

The Action Plan was prepared largely on the basis of input from the members of the IUCN/SSC Asian Elephant Specialist Group, to whom we express our gratitude. The World Wide Fund for Nature (WWF) funded the major part of compilation and drafting, in part by making Charles Santiapillai available for this task while he was engaged in the WWF Indonesia Programme. The United Nations Environment Programme (UNEP) also supported publication of the Action Plan.

We are especially grateful to the following for their help: Simon Stuart, IUCN/SSC Species Programme Officer; Anton Fernhout and Pascale Moehrle, WWF-International; and Lyn de Alwis, Chairman of the Asian Elephant Specialist Group.

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We accept responsibility for any errors or omissions in the Action Plan.

Charles Santiapillai, Executive Secretary
Peter Jackson
IUCN/SSC Asian Elephant Specialist Group

Introduction

The Asian elephant is in grave danger. The surviving population of between 30,000 and 55,000 in the wild is only a tenth of that of the African elephant, on which so much attention has been focussed in recent years. While ivory poaching is the major threat to the African elephant, it is less so for the Asian species. Most important in Asia are habitat loss and the pressures of the human population, which have already reduced the Asian elephant's range to a small fraction of its past area. They are continuing to fragment and isolate elephant populations through the 13 countries in which they still live. Domesticated for several thousand years, the Asian elephant is still proving its value in forest industries. It has an important historical role in religion and culture throughout the region. Reconciling conservation of the Asian elephant with human interests has to be given the highest priority. This is the aim of this action plan.

The Asian elephant (*Elephas maximus*) is smaller than its African cousin, but it may still weigh over four tonnes and reach more than 3.5 metres in height. It is easily distinguished by its much smaller ears and its rounded back, as compared with the

saddle back of the African species. There are several other differences, including a single "finger" at the tip of the trunk, compared with two in the African species, and a double-domed forehead instead of a single dome.

The species have been placed in two separate genera, *Elephas* being the Asian genus, and *Loxodonta* the African. They are the sole survivors of many varied forms of prehistoric elephants traced back to a large pig-like animal called *Moeritherium*, which lived about 25 million years ago. Fossils have been found at Lake Moeris, near El Fayyum in Egypt. Modern elephants appear to have evolved about five million years ago, along with mammoths. Less than 20,000 years ago, mammoths still existed, and they were depicted by early man in cave drawings. Climatic change and overhunting have been implicated in their extinction.

Unlike African elephants, where both males and females have tusks, only Asian males carry them. Asian females have small tushes, which seldom show, but may protrude beyond the lips. The percentage of males carrying ivory varies by region, from only about seven percent in Sri Lanka to 90 percent in



Indian elephants socializing in Corbett National Park (Photo by Peter Jackson).



Indian elephant bath, Corbett National Park (Photo by Willy Dolder/WWF).

south India. Therefore, ivory poaching does not threaten the survival of the Asian elephant as much as it does that of the African species. Nevertheless, the lust for "white gold" has a serious impact, for when tuskers are killed before they have bred, their genes are lost forever and tusklessness could ultimately become the norm.

Regional variations in the number of tusked males may reflect the intensity of past ivory hunting, which has been going on for thousands of years. The Roman chronicler, Pliny, commented in 77 AD: "Large elephant teeth are now rarely found, except in India, the demands of luxury having exhausted all those in our part of the world." He was referring to the Mediterranean basin, where both African and Asian elephants were found, for sub-Saharan Africa, with its innumerable elephants, was then unknown.

All Asian elephants are forest animals requiring a shady environment, unlike the "bush" elephants of Africa, which are able to tolerate the sun. Therefore, conservation of forests is crucial to saving the Asian elephant. But they also require access to areas with permanent water and which provide grass, an important part of the diet.

Elephants have a complex social system with strong maternal bonds based on breeding groups of females and young. Herds form part of larger related groupings called "clans", which congregate from time to time. Mature males live singly or in small groups and have no permanent ties with the females, but they may associate with them while feeding as well as when mating.

Asian elephants may spend more than two-thirds of the day feeding, and may consume 150 kg of vegetation a day. They drink at least once a day if water is available. The area over which they move is dependent on the availability of food and water. Where both are plentiful throughout the year, elephants may move over relatively small distances, but elsewhere they may migrate hundreds of kilometres to find nourishment. A herd's dry season range may extend to double that used in the wet season.

Elephants live up to 60-70 years, and captive females of known age have given birth at 60. Apart from the tusks, which are enlarged incisor teeth, elephants have six molars in each half jaw, which move forward in progression. Only two pairs on each side of the jaw are in use at a time, and as they wear out they

fall from the front of the jaw and the next set comes into use. When the sixth set is worn out, death becomes inevitable because the elephant can no longer chew food. Very occasionally an elephant may have a seventh set of molars.

The association of the Asian elephant with man began in the misty past, thousands of years ago. Perhaps baby elephants, isolated from their herds, were tamed by forest people, who found they could be ridden and taught to obey commands. Ancient Hindu works refer frequently to elephants, and one of the most popular gods to this day is elephant-headed Ganesh, son of Siva, one of the most important of the Hindu pantheon, and Parvati. Ganesh is the God of Wisdom and Remover of Obstacles, evoked by Hindus at the beginning of any important undertaking, and at the beginning of books because he is said to be the scribe who wrote down the great epic of the Mahabharata. Hindu voyagers and settlers spread Ganesh worship through southeast Asia, and Ganesh temples and images are found in Thailand and Indochina, and in Java and Bali in Indonesia.

For Buddhists, too, the elephant has special significance. Gautama Buddha's mother, Maya, is said to have dreamt one night that a white elephant entered her side. Wise men told her that it was a sign she would give birth to a great man. The white elephant features in many Buddhist stories and has been revered for centuries.

Elephants continue to figure in pageantry. In Sri Lanka, a caparisoned tusker, escorted by other richly-decorated elephants, carries the reputed tooth of the Buddha in stately procession at the annual Kandy Esala Perahera. Many Hindu temples in south India maintain stables of elephants for ceremonial occasions.

From ancient times an elephant corps formed part of many armies in India and other parts of southern Asia. When Alexander the Great invaded the sub-continent in 326 B.C., he was so impressed by the elephants deployed by the opposing armies of King Paurav that he formed elephant corps. Their use spread in Europe, where Greeks, Romans, Egyptians, and Carthaginians adopted the idea. Perhaps the most famous elephant event in the ancient world was Hannibal's great trek across the Alps to outflank the Romans. Although most of his elephants are believed to have been African, his favourite appears to have been Asian, probably having been captured in Syria.

Elephants played their part during the World War II Burma campaign against the Japanese. British Field Marshall Lord Slim wrote later:

"It was the elephants' dignity and intelligence that gained our respect. To watch an elephant building a bridge; to see the skill with which the great beast lifted the huge logs and the accuracy with which they were placed into position, was to realize that the trained elephant was no mere transport animal, but indeed a skilled sapper (military engineer).... Without them our retreat from Burma would have been even more arduous and our advance to its liberation slower and more difficult."

For over a century, elephants have been the mainstay of forest industries because of their strength and skill in handling logs. Despite a decline in numbers as machines have taken over,

some 5,400 still serve Burma's timber industry, and they are widely employed in forestry in other countries. They can work in rugged country where vehicles cannot operate without destructive roads. Elephants are used to patrol national parks and for transport in difficult country. For many tourists, the highlight of a visit to India and Nepal is a ride on an elephant, which can safely take them into the jungle for close-up views of tigers, rhinos, buffalos, and wild elephants.

Prior to the large scale modification of its habitat by man, the range of the Asian elephant extended from the Euphrates-Tigris river systems in the west through Asia south of the Himalayas to Indochina and most of southern China in the east. Today, the Asian elephant occurs in Bangladesh, Bhutan, Burma, Cambodia, China, India, Indonesia (Kalimantan and Sumatra), Laos, Malaysia (Peninsular Malaysia and Sabah), Nepal, Sri Lanka, Thailand, and Vietnam and is classed as "Endangered" (IUCN 1988). The former and present distributions of the species are depicted in Figure 1.

The total population of Asian elephant in the wild is estimated to be between 34,000 and 54,000. Country populations vary from less than 100 in Bhutan and Nepal (mainly vagrants and migrants from India) to possibly over 20,000 in India and 10,000 in Burma. The continental and national population estimates are given in Table 1.

The conservation of the elephant in Asia is of international significance. Given the broad habitat requirements of the species, any conservation programme for the elephant will also confer protection for a number of other species living with the elephant. The Asian elephant is thus a "flagship" species, whose conservation will ensure the maintenance of biological diversity and ecological integrity on a large scale.

Because elephants require much larger areas of natural range than any other terrestrial mammal in Asia, they are usually one of the first species to suffer the consequences of habitat fragmentation and destruction. In some places agriculture and settlement is resulting in continuous contraction of elephant

Table 1. Population estimates of the Asian elephant.

Country	Numbers	
	Minimum	Maximum
Bangladesh	200	350
Bhutan	60	150
Burma	3,000	10,000
Cambodia	2,000	2,000
China	150	300
India	17,310	22,120
Indonesia		
Kalimantan	100	500
Sumatra	2,800	5,000
Laos	2,000	3,000
Malaysia		
Peninsular Malaysia	800	1,000
Sabah	500	2,000
Nepal	50	90
Sri Lanka	2,700	3,200
Thailand	1,300	2,000
Vietnam	1,500	2,000
Total	34,470	53,710

habitat. Because of its great size and large appetite, the elephant cannot coexist with people in areas where agriculture is the dominant form of land use and the conversion of forested areas for agriculture has had serious consequences. In extreme cases, elephants have been confined as so-called "pocketed herds" in small patches of forest. These elephants, surrounded by an inhospitable human landscape, represent an extreme stage in the human-elephant conflict. Crop-raiding is frequent and there are often human deaths (Olivier 1980). Such situations can create adverse public reaction to conserving elephants and require urgent attention. At the same time, the concentration of elephants into limited areas may give a false impression of an increase in the local population, even though the overall population may be on the decline.

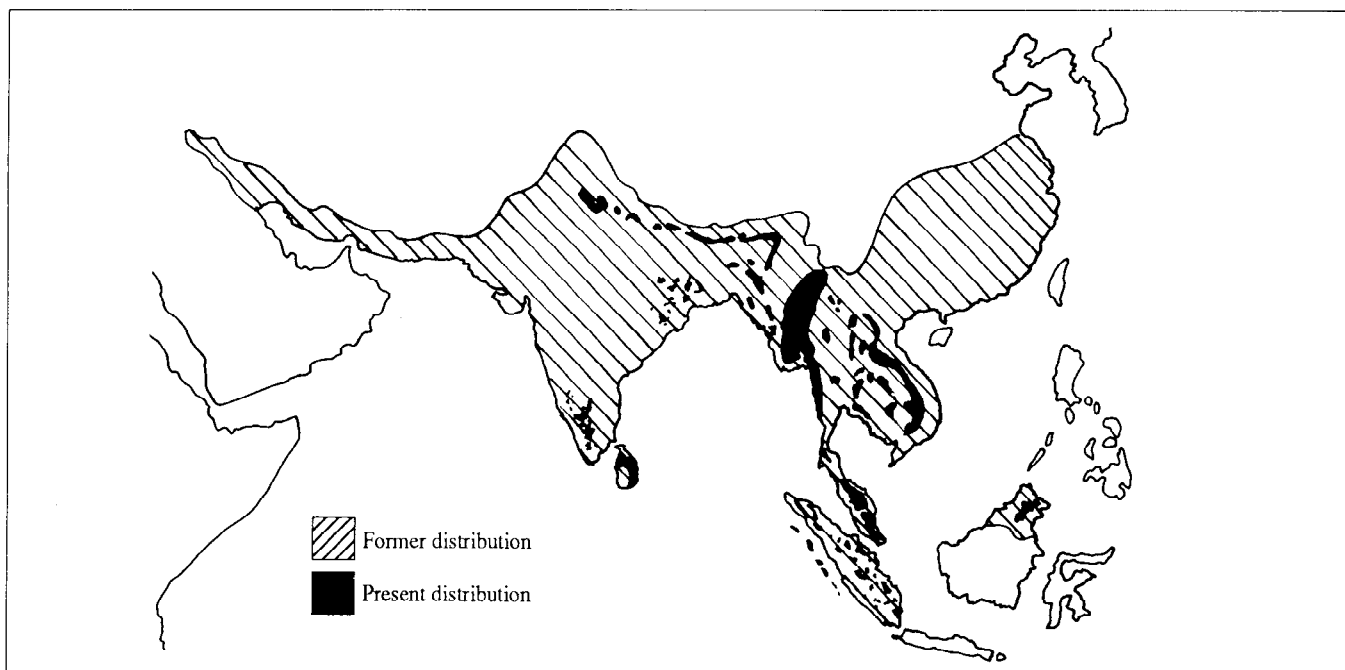


Figure 1. Former and present distribution of the Asian elephant.

1. The Asian Elephant Action Plan

Objective

The objective of the Asian Elephant Action Plan is to conserve as many elephants as possible, throughout their range, while minimizing conflict with people. This objective has to be achieved in the context of continued increase in human population, rising living standards, and the need for land for agriculture and settlement.

It will not be possible to save all Asia's wild elephants, but losses can be kept to a minimum if economic development plans take into account the needs of elephants, and planning for elephant conservation takes into consideration the needs of local people.

Conservation of the elephant in Asia depends on the political will and concerted action of the governments involved. Without political will and commitment, the implementation of many of the conservation recommendations outlined here will be impossible. Government commitment and action must be based on sound ecological, economic, and cultural arguments for conservation of elephants in the light of their positive and negative impacts on the environment.

National Conservation Strategies Should Include Elephant Conservation

The World Conservation Strategy (WCS) jointly published in 1980 by IUCN, UNEP (United Nations Environment Programme), and WWF (World Wide Fund for Nature) recommended the preparation of National Conservation Strategies (NCS). Among countries with Asian elephants, Nepal, Sri Lanka, and Vietnam have completed strategies, Bangladesh and India are preparing them, and Laos may soon do so. Malaysia is preparing state-by-state strategies. Other countries with elephants should follow suit. Provision for elephant conservation should be included in an NCS because the long-term survival of the Asian elephant needs to be a part of overall environmental conservation plans.

Conservation and development programmes need to be integrated in such a manner as to reduce conflict. This can only be brought about by policy makers at the highest levels. Elephant conservation should not be viewed as preoccupation with a single species. It should be considered a practical means to enhance the country's overall conservation programme, because elephants can only be conserved by ensuring the integrity of their forest habitats with all other species found there.

National Elephant Conservation and Management Strategies

In addition to including elephants in their National Conservation Strategies, governments in Asia with elephants should develop National Elephant Conservation and Management Strategies. These strategies should include all the major aspects addressed in this Action Plan. They should include a system of assessing national conservation priorities, as demonstrated in Chapter 14 on Sumatra. India has announced "Project Elephant", which will broadly follow the ecological approach used in Project Tiger.

The IUCN/SSC Asian Elephant Specialist Group is available to advise governments and conservation organisations on the preparation and implementation of such strategies through the IUCN Asian Elephant Conservation Centre, which has been established at the Indian Institute of Science in Bangalore. The Centre is preparing a model strategy for the benefit of Asian governments.

Enforcement of National Laws Protecting Elephants and their Habitat

Existing laws to conserve elephants and their habitats need to be fully enforced, and they should be supplemented wherever necessary to ensure the fullest protection. As has been stated, protection of elephants is especially valuable because it simultaneously covers the interests of a vast range of species and areas.

Establishment of Managed Elephant Ranges (MER) and Protected Areas

Every country should develop a network of protected areas for elephant conservation. Such areas are of critical importance. They need to be of sufficient size and ecological diversity to accommodate flourishing populations of elephants. It is not sufficient to maintain a so-called "Minimum Viable Population" (MVP), as this does not have the ability to withstand natural hazards and fluctuations in elephant populations. The objective should be to maintain an elephant population in a protected area at least double the MVP.

Protected areas provide necessary sanctuaries for elephants from human activities. They should be part of larger Managed

Elephant Ranges (MER) to provide sufficient space for elephant movements. In a Managed Elephant Range, priority is given to the requirements of elephants, but compatible human activities are permitted, such as sustained-yield forestry, slow-rotation shifting cultivation, controlled livestock grazing, and subsistence hunting. Priority has to be given to elephant requirements. Controlled logging can contribute to making good habitat for elephants, as regrowth and secondary vegetation often provide excellent food resources and can maintain larger elephant densities than primary forest. MERs are complementary to, and not a substitute for, protected areas.

National and International Corridors to Facilitate Elephant Migration

Where it is not possible to establish sufficiently large individual protected areas for an elephant population, forest corridors should be maintained to facilitate migration between protected areas. Land-use planning should recognise established migration routes and protect them from incompatible forms of development and settlement. Maintenance of migration corridors will minimize conflicts between elephants and people. It will also prevent the isolation of herds, and improve the genetic viability of the overall population.

International cooperation is required where migration routes cross frontiers. The elephant migration routes along the foothills of the eastern Himalayas from North Bengal to Arunachal Pradesh through Bhutan and Assam, which require national and international action are an example. It is particularly important that migration routes are not disrupted, or very serious conflicts between elephants and people may result, involving some of the largest remaining Asian elephant populations.

Mitigating Conflict Between Elephants and People

Ideally, reserves should be designed to provide for elephant needs so that the stimulus to move elsewhere is minimised. However, in present conditions, elephants are likely to clash with human interests in many places. Depredation of crops (such as oil palm, rubber, cereals, millets, and sugarcane) costs millions of dollars every year in some countries, and manslaughter by elephants is a serious problem. Elephants kill about 100-200 people each year in India alone. The elephant will be accepted by local people only if its impact on human interests can be minimised.

Elephant movements can be controlled by the use of barriers of various kinds to exclude them from areas used by people or to keep them in reserves. Natural barriers are to be preferred, such as belts around protected areas or Managed Elephant Ranges, where crops which would attract elephants are not grown. Nor should there be water sources which elephants would use. A belt of at least one kilometre of land inhospitable to elephants should be maintained in order to minimise conflict with people. Crops such as tea and oilseeds are suitable for planting, as they are unpalatable to elephants.

Other types of barrier may be used, such as:

- Trenches, provided they are in solid soils and well maintained, otherwise elephants will soon make breaches. But trenches seldom survive rainy seasons, and maintenance costs are high.
- High voltage electric fencing, which gives a sharp non-lethal shock. This can be very effective and relatively cheap compared with other methods. Several thousand kilometres have been erected in Malaysia and it has been calculated that, over a period of five years, they may save crops valued at as much as 70 times the cost of installation. Such fences need sound maintenance and monitoring to ensure that they are in working order.
- Steep-sided canals which elephants cannot enter. Crossings for elephants can be constructed at carefully selected points, bearing in mind known elephant movements and preferences.
- In emergencies, trained elephants can be used to chase marauders away.

Adult male elephants have been observed to raid crops more frequently than females and to damage more crops in each raid. Most instances of manslaughter are also by male elephants.

If there is no other option but to capture or destroy crop-raiding elephants, only adult males should be removed. The effect of culling males from the population will not only reduce conflict to a greater extent than removing females, but will also have the least impact on the population's fertility and growth.

Where a small number of elephants are in regular conflict with people, they should be translocated or captured and domesticated, if there is work for them. If none of these solutions is possible, the elephants have to be shot.

Compensation Schemes

Compensation and insurance for crop damage can be organised on a limited basis. Due to numerous practical problems in paying compensation, this cannot be a permanent solution.

Guidelines for Minimising Elephant Depredation

The World Bank Technical Paper "Managing Elephant Depredation in Agricultural and Forestry Projects" by Dr. John Seidensticker is a valuable source of guidelines for minimising elephant depredation. Important recommendations are:

- A pre-project design assessment should be conducted, in association with local wildlife authorities, to predict the response of elephants to a proposed project. This provides a basis for incorporating measures into the project to avoid major conflicts.
- Final project design should include features that prevent elephants from entering production areas, but ensure local



Banana plants destroyed by elephants in India (Photo by Peter Jackson).

elephants access to critical resources, or provide these through habitat enrichment.

- Emphasis in project design should be placed on passive elephant management features. These can include minor modification in infrastructure, either to facilitate or block elephant movements, and the creation of buffer zones to separate production areas and forest refuges.
- Project activities should be scheduled to ensure that groups of elephants are not isolated or “pocketed” in production areas. Such elephants can be very dangerous and destructive.
- A strong local institutional support base is required for successful elephant management.
- Local wildlife management authorities should be provided with necessary technical and financial assistance.

Translocation of Elephants

Elephants may have to be translocated from areas which are being developed or where they have become pests. Herds have been successfully driven to new habitats in India, Indonesia, and Sri Lanka. Advance planning is necessary to route the elephants through suitable corridors and to make barriers to prevent their return.

Chemical immobilisation and transport is possible under strict veterinary supervision, but even so entails risks for the elephants and people involved.

Elephants may be captured for domestication or for zoos, but, in both cases, the number that can be absorbed is very small.

Control of Poaching

Poaching for ivory is primarily a threat to tuskers, and thereby to the genetic health of elephant populations. Recent evidence

also suggests severe poaching of elephants for their hide in Burma. The hides are apparently traded to China, some of them through northern Thailand. There is also poaching for meat in some areas and of live animals, which are illegally employed or smuggled. Adequate staff, funds, and equipment should be allocated to anti-poaching units. Creation of paramilitary units should be considered. Intelligence units should be established to uncover poaching networks, and cooperation with police and other civil authorities should be ensured.

Provision for Elephants in Development Areas

In some cases, development areas, such as those covered by irrigation and hydroelectric power projects, can become elephant refuges. Protection of catchment areas, which is vital to the long-term viability of reservoirs, is compatible with the presence of elephants, which benefit from the presence of permanent water.

Enforcement of CITES Regulations on Trade in Asian Elephant Ivory and Hide

Governments should enforce regulations under the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) concerning the trade in Asian elephant products. The demand for ivory is leading to the elimination of tuskers from some populations in Asia, while the recently developed industries in China using hide for bags, shoes, belts, and other items represent a grave threat to elephants of all ages and sexes.

The following actions are essential to the control of the ivory trade:

- All countries should be Parties to CITES. Burma, Bhutan, Cambodia, Laos, and Vietnam, which are not yet signato-



A tranquilized Malayan elephant being fitted with a radio-collar in Taman Negara National Park (Photo by R.C.D. Olivier/WWF).

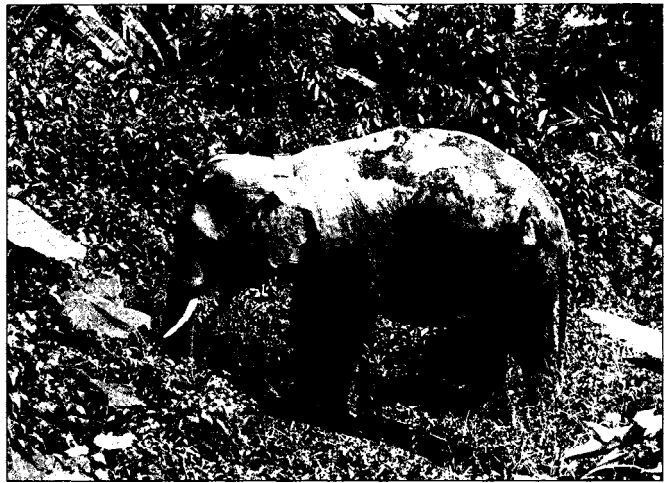
ries to CITES, should adhere as soon as possible in the long-term interest of their elephants.

- All Parties to CITES should ensure that they have domestic legislation to implement the convention.
- Adequate funds, staff, and facilities should be made available to enforce CITES regulations.
- Customs and wildlife staff should be trained to administer CITES regulations and to recognize ivory, hide, and other elephant products.
- Stocks of ivory with traders should be registered and frequently inspected to ensure that they are not used as a cover for illegal trade.
- Countries with ivory and hide industries should conduct detailed studies of the industries and trade in raw ivory and hide and artifacts. They should develop and implement policies that will eliminate illegal trade in ivory and hide and enforce adequate controls on legal trade. The traditional craft of ivory carving should be kept within acceptable limits.
- Research should be intensified to find practical methods of differentiating between African and Asian ivory.
- Controls on domestic ivory and hide commerce should be enacted and enforced to match CITES international provisions.
- Countries which still use African ivory for local carvers should ensure that it is not used as a cover for illegal trade in local ivory from poached Asian tuskers.
- Education campaigns on the value of elephants should be carried out to win the support of all sections of the community for suppression of illegal ivory and hide trade. This is an appropriate activity for non-governmental organisations.

Field Action: Management of Priority Elephant Populations

The fragmentation of wild elephant habitat requires management plans that take into account a range of population sizes. Each country needs national management goals for conserving its elephants. Where possible, elephants should be managed to provide a single population of at least 2,000 animals. This number has the potential for continued evolution based upon natural selection. However, most elephant populations are smaller, and the recommendations that follow have been devised for four basic population size categories which require different levels of management effort.

The population size categories used in this Action Plan relate to the so-called “effective population size”. The **effective population size** is roughly the number of animals within the population that are breeding and passing on genes to the following generation. Imbalances in the sex ratio of adults results in a decrease in the effective population size. Sex ratio imbalances



A Malayan elephant with a radio collar stands after tranquilization in Taman Negara National Park (Photo by R.C.D. Olivier).

are common in Asian elephant populations because mortality factors, mainly poaching, favour the loss of males. Estimates of “effective population size” are made, as a first approximation, on the basis of the formula:

$$N_e = 4 (Mb \times Fb) / (Mb + Fb)$$

where N = total population size; Mb = the number of actual breeding males; Fb = the number of actual breeding females; and N_e = the effective population size.

The ratio of N_e/N gives an estimate of the extent to which the effective population size (hence gene pool size) deviates from the census population size. Taking a hypothetical example of a large elephant population of 2,000 animals, it is likely that only 50% of these (i.e. 1,000 animals) will be adult. Assuming an adult **male:female** sex ratio of between 1:3 and 1:5, the above formula gives an “effective population size” (N_e) for such a population of 2,000 animals of between 555 and 750 animals.

The number of 500 animals as a minimum N_e for a viable population is based upon current estimates of the effective population size, at which loss of genetic variation by drift might just be balanced with **repl**.acement through new mutations. This is a working estimate which will continue to be evaluated in new research. Hopefully, it is not an underestimate, but with the long generation time of elephants there will be opportunity to make revisions as more is learned on this subject.

Careful attention should be paid to the demography, age structure, sex ratio, mortality, fecundity, and trends in each population to avoid demographic catastrophe or accelerated loss of genetic variability. It follows that the highest priority should be given to maintaining the integrity of known populations of 2,000 or more elephants.

Populations of 500-2,000 animals will require minimal genetic intervention in the next 100 years (about five elephant generations). Every effort should be exerted to maintain or allow an increase in these populations, and consideration should be given to the introduction of new genetic material (one breeding bull per generation is considered adequate). These populations can be managed as part of a national or regional population to achieve the goal of a naturally reproductive population of 2,000+ animals.

Populations of less than 500 animals also need to be managed as part of **meta-populations**, with movement of animals or genetic material each generation. These populations are extremely vulnerable to demographic problems and may require intervention to alter sex ratios, family sizes, or age structure.

Populations of more than 2,000 elephants

Nilgiris-Bandipur-Nagarhole-Nilambur-Eastern Ghats, South India. Inter-state cooperation in managing the area should be improved in order to maintain forest corridors and improve anti-poaching measures. Habitat should be conserved and rehabilitated by controlling exotic weed plants which suppress natural vegetation, and resettlement of people (e.g. Chetties living on marshlands in Mudumalai).

Bhutan-Arunachal Pradesh-North Assam, northeast India. Forest should be conserved, particularly in the foothill areas where agricultural encroachment is taking place on the southern fringe of the Himalayas. It is important to maintain the forest corridor along the foothills from North Bengal to Arunachal Pradesh via Bhutan and Assam. Even so, it may not be possible to conserve sufficient habitat to maintain a contiguous population of more than 2,000 elephants.

Meghalaya, northeast India. Sufficient habitat is not likely to be conserved to maintain a contiguous population of over 2,000 animals. It is most probable that the population will be fragmented. Pockets of fewer than 500 elephants should be managed overall as a meta-population.

Indo-China Annamite mountain ridge (Vietnam, Laos, and Cambodia). A survey should be made to establish the size, extent, and fragmentation, if any, of this population. Protection of the habitat is essential.

Populations of between 1,000 and 2,000 elephants.

Nagaland-Assam (south of Brahmaputra, northeast India). There are now about 1,900 elephants in this area, but it is unlikely that the population can be maintained at such a high level. Elephant range in Kaziranga National Park (whose area is proposed to be extended to 940 km²) and adjacent Karbi Anglong district should be consolidated by creation of a 200 km² sanctuary in the Mikir Hills. The population should be managed as a population of 1,000+ animals (i.e. exchanging some bulls every 20 years with other populations). Forest corridors to Burma should be maintained.

Myitkynas-Bhamo in Burma. This region is estimated to have viable populations of elephants. Large tracts of forest should be conserved to ensure their survival.

Between the Irrawaddy and Chindwin valleys. This area is fertile and has a rich diversity of wildlife, including elephants. However, the fertility of the land invites conversion to agriculture. If this occurs, forest corridors need to be established to link elephant populations with those in the north.

Western hill ranges in Burma. The extent and degree of connections between elephant populations (including connec-

tions with those in India and Bangladesh) needs to be assessed. It is possible that these elephants form part of a larger population of well over 2,000 animals. **Offtake** of young for domestication should only be carried out at a level that the wild population can withstand in the long term. Protection of habitat is essential.

Areas of Thailand-Tenasserim adjoining Burma. It is important to maintain forest protection and avoid fragmentation, and maintain corridors with any other elephant populations in Burma. Regional planning should be introduced in Thailand. A trans-frontier park with Burma should be considered.

South and southeast Sri Lanka. Plans to establish forest corridors to link the system of national parks in the south and south-east of the country should be carried out. This would ensure that a contiguous population of over 1,000 animals survives. The population needs management to reduce conflicts between elephants and people.

Riau, Sumatra (Indonesia). A population of over 1,000 animals is unlikely to be maintained and the elephants should be managed in future as fragmented populations of less than 500 animals. At least three reserves are required to maintain a viable population.

Populations of between 500 and 1,000 elephants

Northern India and adjacent Nepal. Barely 500 animals are present in this area and the population could easily decline as a result of agricultural expansion into its habitat. The population is therefore better managed in the future as a small population numbering less than 500 animals. Conservation of a forest corridor from Chilla to Motichur is of crucial importance. **Grazier** communities should be translocated. Eradication of weeds in elephant habitat is important.

Nelliampathis-Anamalais-Palani hills (South India). About 800-1,000 elephants may occur in this region, just south of the Palghat gap. The hill ranges of Nelliampathis, Anamalais and Palanis form a continuous elephant habitat and hydroelectric schemes have disrupted elephant movements. Efforts should be made to facilitate elephant use of traditional migration routes.

Pegu Yoma, Burma. Surveys are needed to investigate connections between elephants here with other populations in Burma and in Thailand. They are probably part of a much larger population.

Lampung, Sumatra (Indonesia). A population of more than 500 animals is unlikely to survive. The elephants should therefore be managed as two small populations in the Way Kambas Game Reserve and in the Barisan Selatan National Park. Similar considerations apply to elephant populations in **Aceh** (in northern Sumatra) where two separate populations, each comprising less than 500 animals, survive. Management is required to retain their genetic diversity, such as translocation of bulls in each generation.



An Indian elephant at work (Photo by Peter Jackson).

Populations of less than 500 animals

Periyar-Varushanad hills in South India. The major conservation problem is poaching, which has reduced the number of tuskers and led to a biased sex ratio in favour of females. This population should be managed as one numbering less than 500 animals, and anti-poaching forces should be augmented.

Each country should review its list of populations of fewer than 500 elephants. The effective population size is calculated as four times the number of breeding males multiplied by the number of breeding females, divided by the sum of the breeding males and breeding females. Populations of 500 animals will always have an effective population size of less than half that number and this will be further reduced if the sex ratio becomes distorted or if the contribution of adults to breeding is very unequal. Even populations of more than 500 animals might have distortedly low effective population sizes, and should be managed accordingly.

Poaching of adult males is significantly distorting the sex ratio in some populations, with the result that the effective population size (those animals actually contributing genes to the population) is reduced and the rate of genetic drift (the loss of genetic material through events other than by natural selection) is increased. These two factors threaten the long-term

survival of the Asian elephant as a species. The species will gradually lose the ability to respond to environmental change by adaptation. These changes dictate that the principles of small population biology will play an essential role in the conservation and survival of the Asian elephant in the wild.

Country management plans should include the following elements:

- Assessment of the current population, reliability of census data, and data on the sex ratios of adults and age structure of each population.
- Assessment of remaining habitats where evidence from various sources suggests that elephant populations could be increased.
- Plans for genetic management.
- Careful consideration of management procedures that lead to minimal human-elephant conflict.

Following the principles of small population biology, each country should manage its small, fragmented populations as a single large population through translocations within the group. If the total country population is less than 2,000 animals (e.g. Cambodia, China, Malaysia, and Nepal), international coop-

eration in exchanging animals is recommended. Bhutan and Vietnam have less than 2,000 elephants, but these form parts of larger populations in India and Laos respectively. Part of the population in Bangladesh may be contiguous through India with those in Burma.

Doomed Populations

Doomed populations are those which have no future because **they are too** few in number, have poor or no breeding potential, or will lose their habitat to development projects. Doomed elephants can be translocated to suitable habitat where there are elephant populations well below the carrying capacity, or they can be removed for domestication.

Management of Domestic and Captive Asian Elephants

In countries where domesticated elephants are needed for work or ceremonial purposes, and recruits are customarily captured from the wild, strenuous attempts should be made to encourage reproduction amongst the domesticated elephants by both natural and artificial means, so as to reduce the need to capture wild elephants.

Governments should encourage collection and analysis of data on their domestic elephants.

The IUCN Asian Elephant Conservation Centre should compile information on elephant management for dissemination among those using domestic elephants.

The Centre should develop an international format for **registering/licensing** domestic elephants to facilitate monitoring of breeding, veterinary care, translocation, economic analysis, enforcement of work regulations etc. Countries with domestic elephants should establish databases on their domestic elephants and provide data to the secretariat.

Cytogenetic and molecular genetic analysis of domesticated elephants of known wild provenance may facilitate the exploration of subspeciation and unique racial strains in elephants. This information will be useful for setting conservation action priorities, and when examining questions of future trade and breeding, as well as for its purely scientific value.

Research

Elephant management should be based on scientific research and principles, both in the wild and in captivity. Much research is needed into the implications of minimum viable population size and of imbalanced sex ratios and their effects on fertility. Poaching and habitat loss have reduced the size of elephant populations to critical sizes in several areas and so the minimum viable unit for an elephant population needs to be established in relation to the area and quality of the remaining habitat. The highest priority research issues are:

Establishing standardised elephant census techniques. Current efforts to develop a rigorous, yet practical census methodology for elephants should be completed and then

introduced into each Asian country, thus ensuring that future data are **standardised**.

Imbalanced sex ratio in elephant populations. Long-term studies should address the implications of an imbalanced sex ratio, especially in elephant populations living in areas surrounded by cultivation and human settlements. A biased sex ratio in favour of the males can only exacerbate elephant depredation.

Practical methods of distinguishing African and Asian ivory. Practical means are required to distinguish ivory from African and Asian elephants. Research should also be carried out into the possibility of determining the geographic origins of tusks using genetic and mineralogical analytic techniques. This would help to identify the source of illegal ivory.

The effectiveness of elephant corridors. Reliable data on the usefulness of jungle/forest corridors as conduits for elephant movement are lacking. If these corridors do in fact aid the dispersal of elephants and function as a bolt-hole for the animals to move from a disturbed area into a less disturbed one, then they would be beneficial in areas where timber extraction is the dominant form of land use. Such corridors could also reduce the effects of inbreeding among small populations. Research should look into the effectiveness of corridors in permitting the movement of animals from one area to another.

Habitat evaluation. Research is needed to assess more accurately the area of habitat required by viable elephant populations, and also the quality of the habitat that elephants need. In particular, it is important to know what constitutes serious habitat degradation for elephants; what causes such degradation; and how it can be alleviated.

The effect of translocation on elephant populations. Techniques of elephant translocation have been developed, but there is very little information on how or whether translocated animals integrate with the local population. This information is fundamental if translocations are to be used as a means of maintaining the genetic variability of small populations. Some observations suggest that translocated animals move away from the release area. Translocated elephants should be **radio-collared** and tracked to establish whether translocation is a solution to saving small problem herds.

Monitoring of Better Known Elephant Populations

Some elephant populations in India, Sri Lanka, and Sumatra (Indonesia) have been the subject of considerable research. Research and monitoring of these populations should continue in order to provide a basis for management of other wild populations.

Support for Research Institutions

Institutions carrying out research on elephants should receive adequate financial support for their work, which is essential to elephant conservation.

The economic efficiency of Asian elephants in the timber industry is of great interest. Burma has successfully demonstrated that use of trained elephants in timber extraction is economically efficient and ecologically sensible. Trained elephants have also been used in logging and timber extraction operations in other Asian countries. However, research should be carried out to assess the value of using trained elephants in Sumatra (Indonesia) compared with the current use of heavy machinery. The proposal to use trained elephants in Sumatra for extracting timber has not yet been actively pursued by the government and merits serious attention.

Public Awareness

Programmes should be carried out to educate the public regarding the elephant. Publicity should be given to agricultural, resettlement and hydroelectric projects where elephant habitat would be affected, so that possible impacts can be evaluated before their implementation. This activity is well suited to non-governmental agencies.

Implementation of the Asian Elephant Action Plan

The success of the Action Plan will depend on how effectively each government implements the key recommendations. One of the most important objectives is that each country should de-

velop its own Elephant Conservation and Management Strategy. In Chapter 9, "Assessing Conservation Priorities (Indonesia: Sumatra)" provides an example of such a strategy. Each country should go through such a process to establish clear national priorities, and, having agreed upon such priorities, seek the necessary resources to put the strategy into action.

The cost of implementing the recommendations may be high and therefore calls for increased governmental financial allocations to elephant conservation in most Asian countries. But elephants are part of the heritage of all mankind, and other governments and conservation organisations should contribute funds and expertise to the conservation programme.

IUCN has established an Asian Elephant Conservation Centre at the Indian Institute of Science in Bangalore to coordinate and render services essential for conservation action to all concerned. The Centre is building an Asian elephant database and a directory of specialists. It is also preparing a Population Viability Analysis of Asian elephant populations to assist in preparation of management strategies.

There are powerful reasons for conserving elephants in Asia: they arouse public emotion and are therefore ideal animals to attract strong support for conservation. They may be economically important, as in Burma, where they are the backbone of the timber industry. They play a major role in natural ecosystems and in maintaining biodiversity across huge areas. If such a high profile species, that is as ecologically dominant, economically important, and culturally significant as the elephant, cannot be protected in Asia, what hope is there for less prominent species?

2. Bangladesh

Area: 144,020 km²

Human population: 114,700,000 (mid-1989 est.)

Total forest: 4,780 km² (3.3%)

Status of the Elephant in Bangladesh

The past and present distribution of the elephant in Bangladesh corresponds to forested areas, including moist deciduous, evergreen, mixed and semi-evergreen types. The elephant's ability to survive in marginal lands enables it to inhabit areas in Bangladesh that are too inaccessible to be of much use for human settlement in the foreseeable future. Its main stronghold is the Chittagong Hill Tracts (CHT) Forest Division—an extensive hilly region in the southeast bordered to the north by Tripura State (India), to the south by Arakan State (Burma), to the east by Mizoram (India), and to the west by Chittagong District. In addition, elephants occur in Mymensingh, Sylhet, Chittagong, and Cox's Bazaar Forest Divisions (Fig. 1).

Elephant Distribution

The elephant is now isolated in small pockets of Chittagong, Cox's Bazaar, and CHT Divisions and uses substandard habitat (Khan 1984). Mohammad Ali Reza Khan (1980) states that resident populations exist in the Reju-Teknaf Reserved Forest (RF) in Cox's Bazaar, Reju, and Teknaf Ranges, and in some portions of Bangkhali and Idgaon Ranges of the Cox's Bazaar Forest Division (FD); Jaldi RF and Patiya RF under Jaldi, Chunati, and Dohazari Ranges of Chittagong FD; Sangu RF, Matamuhuri RF, Rankheong RF, and Kassalong RF under Pharua, Pablakhali, Shishak, Bagaihat, Massalong, Laxmichari, Sitapahar East and West Ranges of CHT North and South FD.

Elephants move to and from neighbouring forested areas of Arakan State in Burma, and Assam, Meghalaya, Mizoram, and Tripura States in India. Elephants from the Tura and Garo Hill Ranges of Meghalaya occasionally enter Bangladesh through the patchy sal (*Shorea* spp.) forests of Balijhuri and Durgapur Ranges of Mymensingh FD. Those from Assam and Tripura enter into Hararganj and Patharia RF under Kulaura and Juri Ranges of Sylhet FD. The elephants from the Mizo and Arakan hills enter into Kassalong, Rankheong and Sangu-Matamuhuri RF of CHT North and South FD, and vice-versa.

Table 1. Number of wild elephants in Bangladesh (according to Gittins and Akonda 1982).

Locality	Minimum	Maximum
Patharia	10	15
Chittagong East		1
Chittagong South	5	8
Cox's Bazar North	30	40
Teknaf Peninsula	30	40
CHT North	96	104
CHT East	50	70
Sangu/Matamuhuri	60	70
Total	281	348

Number of Elephants in the Wild

Estimates of the number of wild elephants in Bangladesh vary from about 150 by Ranjitsinh (1978), who added that the number could even be less, to the other extreme of 348 (Table 1) estimated by Gittins and Akonda (1982). Khan (1980, 1984) put the number at about 200 (Table 2), 30% of which were thought to be non-resident. Most of the 250 elephants estimated in Bangladesh by Olivier (1978) were assumed to be visitors from Tripura, Mizoram, and Burma.

Number of Elephants in Captivity

More than 50 elephants were in captivity in Bangladesh in 1983 (Jackson 1983b). Half were used in the timber industry for hauling logs, while 30% were in circuses and 20% in the zoo.

Conservation Problems

Bangladesh has a rich mammalian fauna, with some 100 of the 500 species found in the Indian subcontinent (Prater 1971). But it is declining (Khan 1984), due largely to the conversion of forests to other land uses, which has virtually eliminated all the lowland forests. The elephant is among the large mammals most seriously affected by the large-scale habitat changes in Bangladesh.

Bangladesh

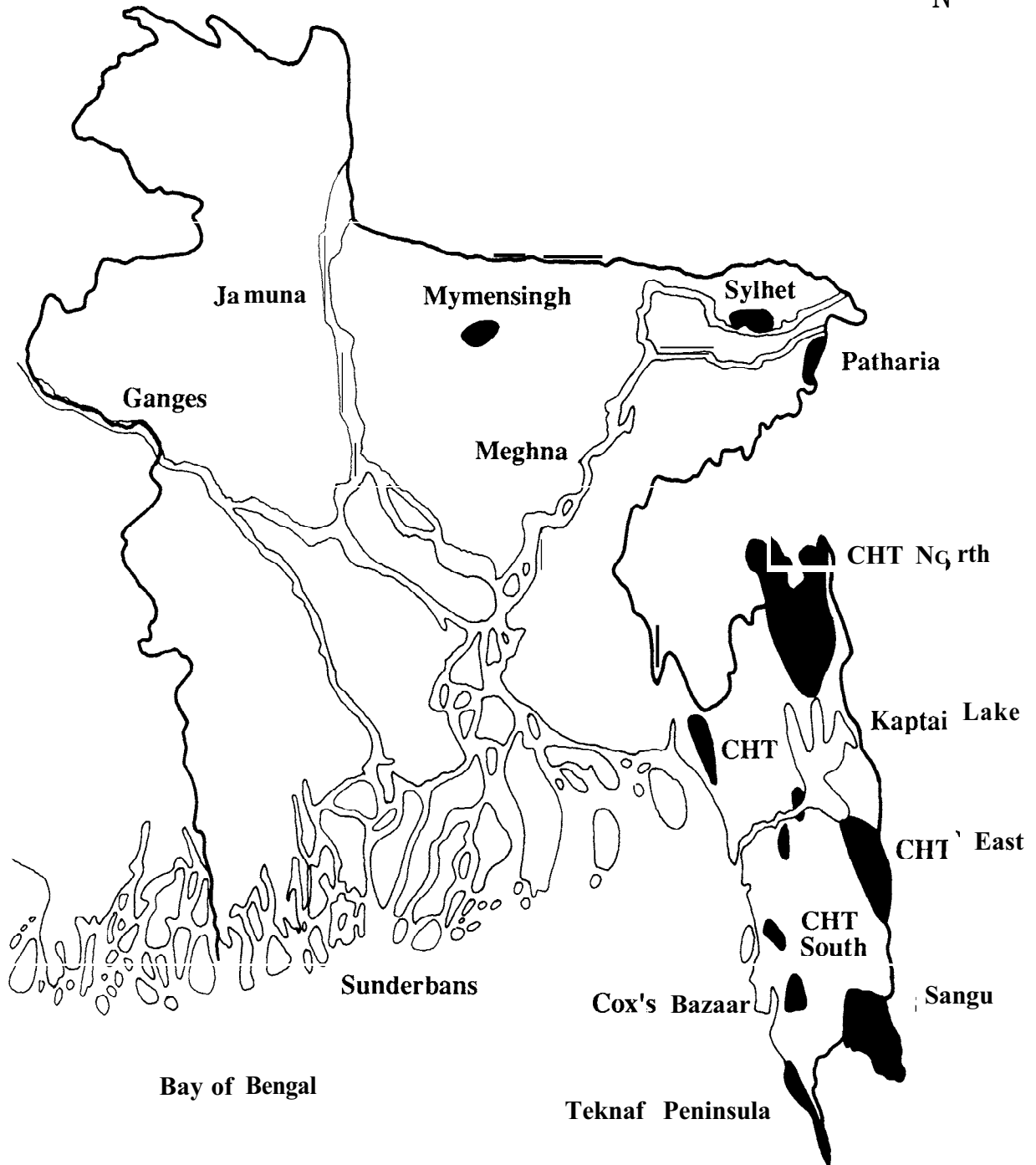


Figure 1. Forested areas in Bangladesh inhabited by elephants (CHT=Chittagong Hill Tracts).

Table 2. Number of wild elephants in Bangladesh (according to Khan 1980).

Locality	Min.	Max.	Comments
Cox's Bazaar	50	55	1,323 km ² , of which only 650 km ² are available
Chittagong FD	15	20	100 km ² area
Chittagong North	50	50	800 km ² , of which only 400-500 km ² are available
Sylhet FD	10	12	non-residents
Mymensingh FD	16	16	non-residents
CHT south	60	65	415 km ² , of which only 300 km ² are available
Total	201	218	

Elephant habitat is fast disappearing in Bangladesh as a result of a host of development programmes. An overriding threat to the elephant is the current practice of clear-felling forests for monocultures of teak, rubber, tea, and other plantation crops. Up to 1978, some 1,000 km² of forest were clear-felled for teak plantations (Siddiqi 1986). The consequences of clear-felling are evident in Bangladesh. Soil erosion is heavy, especially along the slopes of hills where natural forests have been replaced by extensive stands of teak.

In the past, teak was harvested once every 100 years in Bangladesh. This long-rotation management was compatible with elephant conservation. Now the cutting cycle is 60 years, and it might be reduced to 30-40 years in order to maintain profitability (Siddiqi 1986). Harvesting timber at such short intervals will undoubtedly cause serious disturbance to wildlife in general and particularly to elephants. If the disturbance persists, elephants would be forced to move out of the area as they did when the Kaptai dam was built, and during the liberation war in the early 1970s, when large numbers moved into Burma and India (Khan 1980).

Clear-felling has reduced the effective area of one of the prime elephant habitats in Bangladesh, Cox's Bazaar FD, by almost 50% from its original size of 1,323 km² (Green 1978, Khan 1980). Khan (1980) warns that current forestry working plans could result in there being no natural forest left in Bangladesh by the year 2000.

About 80% of the large mammals in Bangladesh live in forests managed by the Government Forest Department. But given the poor financial status of the country, the Government is not able to provide protection for many of its forests.

Elephants still inhabit the reserved forests of Sangu, Matamuhuri, Rankheong, Kassalong, and other reserves of CHT North and South FD, but, in the absence of effective Government control, management of these forests is far from satisfac-

tory and is entrusted to the forest-dwellers as opposed to officials from the Forest Department (Khan 1980). Ultimately, semi-subsistence agriculture and an upsurge in human numbers within these areas will constrict the life-support system of the elephants and other wildlife. The elephant is already under threat, and unless the root causes are addressed, the decline is certain to accelerate during the next decade.

Elephant-human conflict

Elephants raid crops occasionally in Cox's Bazaar, Chittagong, CHT North, and South FD (Khan 1980). Among the crops eaten are paddy, watermelon, cucumber, green chillies, and pine-apples, but teak, rubber, and tea are rarely attacked. Much of the crop-damage is caused by animals that move in from other areas. Human fatalities are relatively few. According to Khan (1980), six people were killed by elephants between May 1978 and July 1980.

Conservation Measures Taken

Despite the fact that Bangladesh is one of the poorest countries in the world, the Government has taken some steps to conserve the country's rich but dwindling wildlife. The emphasis has been on some representative samples of different ecosystems. But its efforts are hampered by a lack of trained personnel to plan and execute management programmes (Gittins and Akonda 1982).

In the past, game sanctuaries were established by the Forest Department. The main impetus for setting up conservation areas came after WWF expeditions to Bangladesh in 1966 and 1967. With the promulgation of the Bangladesh Wildlife (Preservation) Order (P.O. No. 23 of 1973) and the subsequent Bangladesh Wildlife Preservation (Amendment) Act of 1973, a legal framework was established for creation of national parks, wildlife sanctuaries, and game reserves (Sarker and Huq 1985). Presidential Order No. 23 was designed to protect wildlife within forested as well as non-forested areas throughout the country. Since 1973, four national parks, four wildlife sanctuaries, and one game reserve have been established and plans are afoot to set up three new wildlife sanctuaries.

According to Rahman (1982), a comprehensive scheme was approved by the Government in 1973 for the management of wildlife. This provided the basis for the establishment of the following conservation areas:

- 3 tiger sanctuaries in the Sunderbans,
- 1 elephant sanctuary in the Chittagong Hill Tract,
- game reserves in Cox's Bazaar,
- 2 game reserves in Sylhet,
- 1 game reserve in Comilla,
- 1 crocodile sanctuary in the Sunderbans, and
- 14 waterfowl protection centres in 12 districts.

However, over 15 years later it appears that this scheme has still to be fully implemented.

On the strength of Dr. Mohammad **Ali Reza** Khan's recommendation, the Government of Bangladesh has decided to establish another elephant sanctuary at Cox's Bazaar-Teknaf area, which is estimated to have up to 100 elephants, including 30 that are non-resident (Jackson 1983b).

Recommended Actions

- Indiscriminate clear-felling of forests should be replaced by a more discretionary, selective cutting system. Areas of forest already clear-felled should be replanted with mixed species and undergrowth to provide wildlife with adequate fodder and cover.
- Highest priority should be given to stopping clear-felling in the Cox's Bazaar-Teknaf-Regu area. About 200 km² in this area form a belt of evergreen and semi-evergreen forests inhabited by about 40 elephants, as well as other mammals such as hoolock gibbon (*Hylobates hoolock*), capped langur (*Presbytis pileatus*), and crab-eating macaque (*Macaca fascicularis*). It would be an ideal area to establish an elephant sanctuary. This area already has three new reserves: Himchari, Inoni, and The inkhali.
- Protection of the Reserved Forests in Sang-u, Matamuhuri, Rankheong, Kassalong, and other reserves in the Chittagong Hill Tracts (CHT) North and South FD (Khan 1980) should be given high priority.
- Alternative fuels, such as natural gas, should be provided to families living near reserves in order to reduce the need to collect fuelwood.
- Bamboo brakes and the slopes of hills containing reeds and tall grasses (other than sungrass) are favoured by elephants throughout the year and should be included within elephant reserves wherever possible.
- Anti-poaching measures should be improved by strengthening and training staff so that enforcement can be stepped up to end the illegal traffic in ivory.
- Adequate staffing of existing conservation areas by qualified, well-trained personnel should be ensured so that management of wildlife is on sound ecological lines.
- Adequate compensation should be given to farmers who suffer elephant depredation.
- The elephant population in the Cox's Bazaar-Teknaf-Regu Reserved Forest area should be studied in depth to assess the extent of crop depredation and recommend solutions.

3. Bhutan

Area: 46,600 km²

Human population: 1,500,000 (mid-1989 est.)

Total forest: 21,470 km² (46.6%)

Status of the Elephant in Bhutan

Bhutan shares some of India's elephants north of the **Brahmaputra** river. But, as elsewhere in the Indian sub-continent, numbers have declined in recent decades, due largely to loss of habitat through deforestation, establishment of tea plantations, construction of roads, villages, and military training areas, especially along the southern side of the border with India.

Elephant Distribution and Numbers

Elephant distribution in Bhutan is patchy and represents a fraction of that existing a few decades ago. All the existing elephant populations are along the border with India. They are recorded from **Manas** Wildlife Sanctuary, Namgyal Wangchuk Wildlife Sanctuary, Phipsoo Reserved Forest, Shumar Wildlife Reserve, and the **Dungsum** and **Mochu** Reserved Forests (Fig. 1). Traditionally, elephants have made seasonal migrations from thick forests in Bhutan to grasslands in India during the wetter, summer months from May to October, returning to their winter range in Bhutan from November to April (Olivier 1978). Crop depredation is common during the summer.

This traditional pattern of movement across the border is no longer possible in many areas. Extensive human encroachment and the establishment of villages on the Indian side of the border have blocked the movement of elephants between Bhutan and North Bengal. Development along the eastern border between Bhutan and India is likely to hinder the movement of elephants sooner or later unless prompt action can be taken to arrest deforestation.

There has never been a survey of the number of wild elephants in Bhutan. According to the **UNDP/FAO (1986)**, the elephant population that moves across the border is no more than 60. The reserves in Bhutan where elephants are known or are reported to occur total 1,450 km². These reserves, even assuming that their integrity remains assured, would protect no more than 150 resident elephants.

Conservation Problems

Unlike many of its neighbours, Bhutan has substantial areas of undisturbed natural environments. A high proportion of forest cover is still maintained despite threats from a growing human population. However, much of the land, especially on the steep hills, is prone to soil erosion. The government of Bhutan is aware of such problems and has taken a number of steps to prevent serious ecological disasters.

Forest destruction in certain parts of the country has reached "an alarming stage" (Fischer 1976), especially along the southern border with India, where the establishment of human settlements has encouraged encroachment into and destruction of forests. There has been considerable destruction of wildlife.

The number of qualified or trained personnel is woefully inadequate to man all the conservation areas. Only three reserves (**Manas**, Namgyal Wangchuk, and Phipsoo) have permanent field staff. Furthermore, given the low level of scientific expertise, the Forest Department has insufficient resources to translate many of its enlightened intentions into reality (Sargent 1985).

Despite the fact that there could be a viable population of elephants in Bhutan, none of the existing protected areas, with the exception of the combined Bhutan and Indian **Manas** reserves, is large enough to maintain a resident population of elephants. In view of this, it is very disturbing to note that, even as late as 1986, permits had been granted in India by the government of Assam for the capture of 28 elephants from areas adjacent to the Neoli wildlife sanctuary in Bhutan. The government of Assam continues to issue permits for the capture of wild elephants, and the mortality in such capture and training programmes can be as high as 20-50% (**UNDP/FAO 1986**).

Manas Wildlife Sanctuary, which elephants use seasonally, is facing a number of threats: (a) the spread of weeds such as *Mikania* and *Eupatorium*; (b) the establishment of a 1,200 ha sugarcane plantation at the western end, near Hile village; (c) plans to build a dam within the sanctuary are in abeyance, but if the project were revived, it would "virtually destroy the Bhutan Wildlife Sanctuary and seriously damage the Indian reserve" (Jackson 1981); (d) the proposed development of a bazaar at Domukh, which in the long run would lead to more

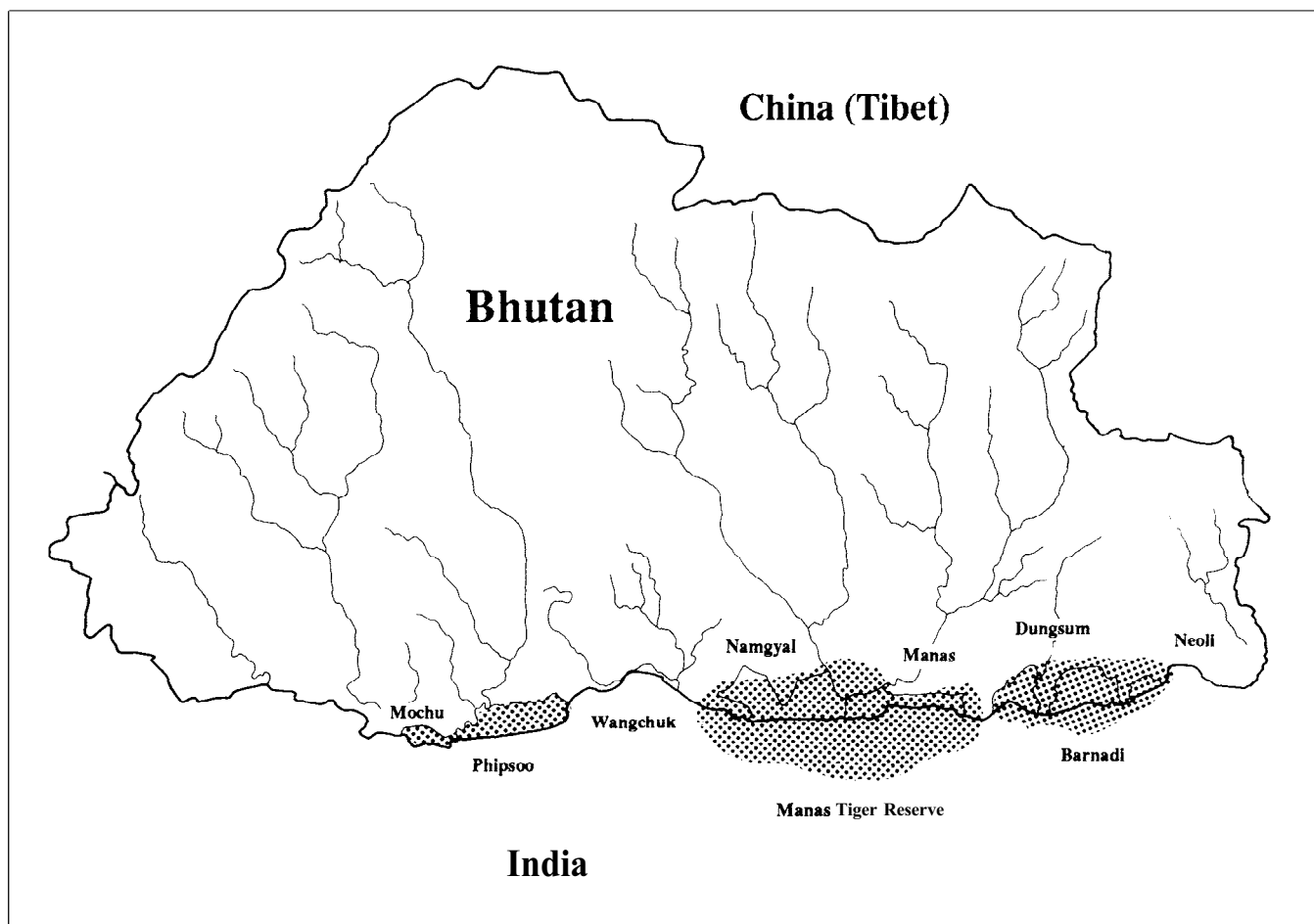


Figure 1. Distribution of elephants in Bhutan.

poaching within the sanctuary (Jackson 1981); (e) the deliberate setting of fires and the theft of timber, especially of valuable agar wood (*Aquilaria agallocha*), which is used medicinally and in the manufacture of incense (UNDP/FAO 1986); and (f) problems arising from political disturbances in neighbouring India.

Human population density is high in the fertile valleys and in the southwestern foothills. With a steadily increasing population, the associated increase in livestock and the demand for wood as building material will exert enormous pressure on protected areas in the years to come. While parks and reserves may be viable self-sustaining ecosystems, they are, nevertheless, prone to environmental disturbances from outside their boundaries.

Conservation Measures Taken

Nature conservation in Bhutan comes under the Ministry of Trade, Industry, and Forests, in which the Department of Forestry is responsible for administration. In the past, the Acts governing protected areas were the Bhutan Forest Act of 1969, the National Forest Policy of 1974 and the Wildlife Notification of 1974 (Mahat 1985). In 1985, the conservation of wildlife was given a boost when a new National Forest Policy, prepared at

the request of H.M. King Jigme Singye Wangchuk, emphasised the need to establish National Parks, Biosphere Reserves, and other protected areas throughout the country.

As a result of such timely action, almost 20% of the land area of Bhutan has been given conservation status.

Commercial logging is completely banned in Bhutan. Logging is under government control and the felling of trees is generally selective.

A programme of social forestry has been inaugurated to encourage the establishment of village plantations for fuel and building wood and thus reduce the pressure on the natural forests (Jackson 1981).

The proposal by India to build a dam within the Manas Wildlife Sanctuary has been dropped. This timely action has prevented substantial damage to both Indian and Bhutanese Manas reserves.

Recommended Actions

- The Manas Wildlife Sanctuary (565 km²) should be increased in size by incorporating the Namgyal Wangchuk Wildlife Reserve (195 km²) to form the Manas National Park. This area offers the best prospects for the long-term survival of the elephant in Bhutan, and would increase the

area available to them to about 3,400 **km**², since it adjoins the Indian **Manas** Tiger Reserve (2,840 **km**²). The entire conservation area could then be managed cooperatively by Bhutan and India.

- The 1,200 ha sugarcane plantation within the **Manas** Wildlife Sanctuary should be relocated well away from the sanctuary. Sugar-cane is very attractive to elephants, and there is a real danger of depredation. Protective measures, such as electric fencing, would be costly and need constant maintenance.
- The proposed sugarcane plantation in the Namgyal Wangchuk Wildlife Reserve, where the Army Welfare Association was allowed to clear 500 ha of forest, should also be reconsidered for the same reasons as those for relocating the plantation in the **Manas** Wildlife Sanctuary.
- The authorities in Assam State (India) should be pressed to ban the capture of wild elephants on the Indian side of the Neoli Wildlife Sanctuary. Only 60 elephants are thought to be there, and capture from such a small population is indefensible.
- Wildlife legislation should be made more comprehensive to deal effectively with trapping, trade, and traffic in wildlife. Bhutan should become a party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) as are the neighbouring countries of Bangladesh, China, India, and Nepal.
- Surveys should be carried out to select and establish more conservation areas suitable for elephants in southern Bhutan.
- Research studies should be initiated in protected areas in southern Bhutan to establish a database on the ecology and population dynamics of elephants and other large mammals which share their habitat, such as rhinoceros and tiger. Bhutanese nationals should be trained to carry out such work, and the data obtained should be used to enhance wildlife and protected area management.
- International cooperative programmes, in particular that of WWF, should help Bhutan to train staff to man the conservation areas. **Manas** is probably the highest priority for such assistance.

4. Burma

Area: 678,000 km²

Human population: 40,800,000 (mid- 1989 est.)

Total forest: 245,000 km² (36.1%)

Status of the Elephant in Burma

Burma has one of the largest remaining populations of Asian elephants (*Elephas maximus*) in the world. Estimated to number between 3,000 and 10,000, Burma's elephants represent between 25% and 50% of the mainland southeast Asian population. The elephant has always been the backbone of the Burmese timber industry, and about 50% of all timber is still extracted by elephants, which remain the most effective means of moving logs in hilly areas, as well as the least damaging environmentally (Blower 1980). The elephant was first given some degree of protection under the Elephant Preservation Act of 1879, and exploitation was controlled further with the establishment of a Kheddah Department in 1912 (Olivier 1978). Today, the elephant is still protected in Burma, but limited capture operations are permitted under the control of the Forest Department.

Elephant Distribution

Before disruptive and competitive land-use patterns were imposed on the Burmese landscape, the elephant enjoyed wide distribution and large numbers. This is still so, although the range is decreasing (Fig. 1).

Peacock (1933) considered the elephant to be far more common in northern than southern Burma, and this remains the case today. The five main areas of elephant abundance are: 1. the Northern Hills; 2. the Arakan Yoma (bordering Bangladesh/India); 3. the Pegu Yoma (Central Burma); 4. the Tenasserim Yoma (bordering Thailand); and, to a lesser extent, 5. the Eastern Yoma (Shan states) (Table 1, Figs. 1 and 2). Elephants are only sparsely distributed in the Shan states and Chin Hills, and are absent from the dry zone (FAO 1983).

Although elephants are reported to be relatively abundant in the northern third of Burma, their local distribution and numbers are poorly known. Within this region they occur (or formerly occurred) in three wildlife sanctuaries-Pidaung, Shwe-U-Daung, and Tamanthi-and the newly-constituted Alaungdaw Kathapa National Park.

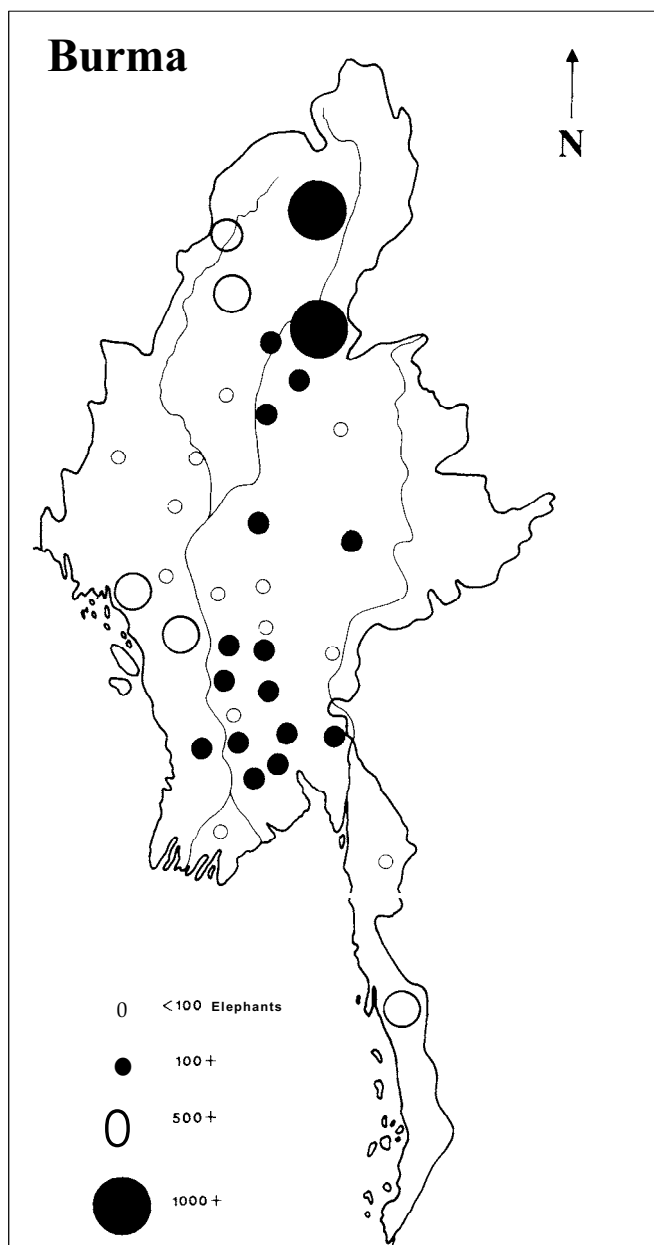


Figure 1. Approximate distribution and relative abundance of wild elephants in Burma. Redrawn from UNDP/FAO (1983). The symbols represent maximum estimates and are based on the questionnaire survey carried out by the Divisional Forest Officers in 1960/61 and 1980/81.

Table 1. Regional distribution of elephants in Burma (SRUB/MAF/WPSB 1982).

Region	Estimated Number
Western Hill Ranges	
Arakan Yoma	825
Chin Hills	252
Henzada/Bassein FD	190
Pegu Yoma	697
Tenasserim Yoma	450
Eastern Yoma	
Shan States	560
Northern Hill Ranges	
Myitkynia/Bhamo	1,637
Irrawaddy and Chindwin Valley	1,812
Mandalay and Shwebo FD	97
Total	6,520

FD = Forest Division

Table 2. Number of elephants captured from the wild in Burma.

Period	Number captured	Average per year	Authority
1910-1927	7,000	411	Olivier (1978)
1935-1941	1,286	214	Olivier (1978)
1962-1973	?	165	Olivier (1978)
1972-1982	1,171	117	Forest Dept.

Bamboo is one of the elephant's most preferred food items in Burma, and it is particularly abundant in the Arakan, Pegu Yoma, and Tenasserim regions. The total extent of the bamboo forests in these areas is 18,000 km² (SRUB/MAF/WPSB 1982). The Arakan is particularly rich in bamboo forests and so represents one of the largest elephant ranges in Burma. According to UNDP/FAO (1983), "The Arakan Yoma as a whole probably supports amongst the world's largest remaining populations of Asiatic elephant."

Three areas with elephant populations have been proposed for protection: Tanlwe to Ma-e Chaung, Taungup Pass to Sandoway Chaung, and the proposed Dipayon Wildlife Sanctuary. The first two areas probably each contain several hundred elephants. About 20-40 elephants are in the proposed Dipayon Wildlife Sanctuary (UNDP/FAO 1983), but, given its small size (14 km²), it is not likely to support a minimum viable population.

Pegu Yoma, with its heterogeneous fire climax teak stands, secondary vegetation, grassland, and bamboo (especially *Melocanna bambusoides*) provides an exceptionally good habitat for elephants (SRUB/MAF/WSPB 1982). An area of about 1,500 km² has been proposed by UNDP/FAO (1983) for development into the Pegu Yoma National Park.

Elephants also occur in the central and southern parts of the Tenasserim Yoma-the mountain chain that separates southern Burma from Thailand. An area of about 1,450 km² inhabited by elephants has been proposed by UNDP/FAO (1983) for development into the Pakchan Nature Reserve.

Number of Elephants in the Wild

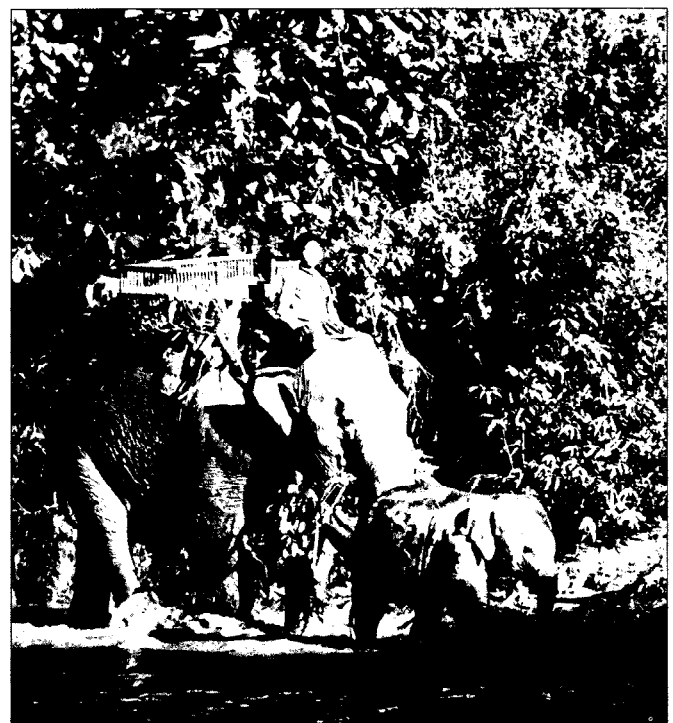
Estimates of the number of wild elephants in Burma have ranged between 3,000 and 10,000. The latest estimate made by the Forest Department is 6,520 (Table 1) but its reliability is questionable in the absence of detailed surveys. Caughley (1980) estimated the number of elephants in the wild at about

3,000. This estimate was based on population trends to be expected, given the known numbers of elephants that had been captured. Sukumar (1989) has suggested that the real figure could be much higher, around 10,000, based on the amount of habitat available and the minimum likely density of elephants. However, all the estimates are, at best, educated guesses.

Number of Elephants in Captivity

Prior to World War II, the Burmese timber industry used about 6,500 full-grown elephants in the extraction of teak and hardwood logs (U Toke Gale 1974). By the end of the war in 1945, there were only about 2,500 left. The timber elephants do not constitute a self-perpetuating population, and so must be augmented continuously by capture of wild animals. However, the capacity of the wild herds to supply enough animals is being progressively eroded (Caughley 1980) as suggested by the gradual decline in the rate of capture over the years (Table 2).

The Forest Department has set an arbitrary quota of 200 captures per year, but the actual offtake has recently been around 120 per year because not enough elephants could be



Elephants on trek in Burma (Photo by Jeffrey Sayer/WWF).

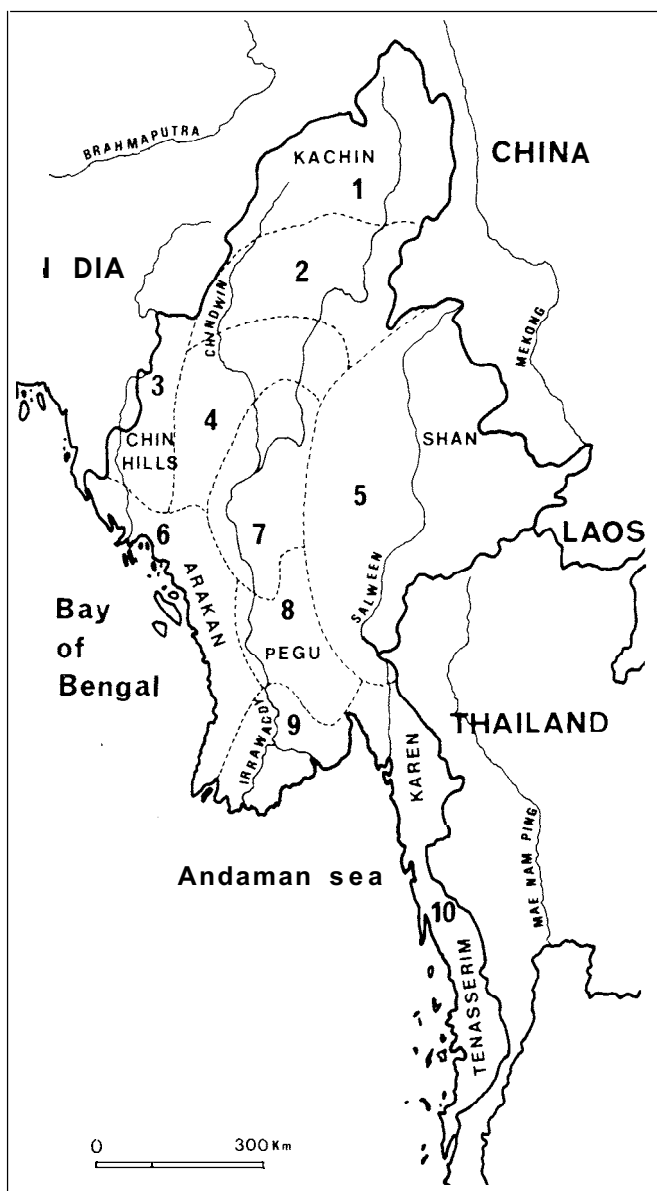


Figure 2. Ten biogeographic regions of Burma. 1. North Kachin. 2. South Kachin and Upper Chindwin. 3. Chin Hills. 4. Lower Chindwin. 5. Shan Plateau. 6. Arakan Yoma. 7. Dry Zone. 8. Pegu Yoma. 9. Irrawaddy Delta. 10. Tenasserim.

caught (Caughley 1980). Even this rate of capture is thought to be above the maximum sustainable yield. Furthermore, the **offtake** is from the most accessible portions of the wild population and is not distributed evenly over the population as a whole (UNDP/FAO 1983). As a consequence, both the number and range of wild elephants are thought to be decreasing.

Conservation Problems

In contrast to many other countries in southeast Asia, Burma's forests, wildlife, and natural resources have remained reasonably intact. The prospects for the long-term survival of the elephant could be good if effective protection of both the animal and its habitats were assured. However, despite the large land area and low human population, existing conservation areas are

insufficient in number and extent for the protection of Burma's varied wildlife resources (Blower 1980). In addition, the disturbed political situation affecting elephant ranges prohibits effective conservation measures for the time being.

The elephant is the mainstay of the Burmese timber industry. Therefore, its survival is a matter of concern, not only for conservationists, but for economic planners as well. Given the low birth rate of elephants in captivity, the population of timber elephants cannot sustain itself, and so must be augmented continuously by animals captured in the wild. Linear regression analysis by Caughley (1980) of Forest Department data suggested that, between 1960 and 1980, the population of wild elephants may have decreased at an average annual rate of 5.2%. The current average **offtake** of 120 animals per annum may therefore be untenable, as it is high enough to cause a decline in the number of wild elephants in Burma.

Wild elephants in Burma migrate from the hills to the lowlands during the dry season and retreat into the hills with the onset of the rains. Human settlements and the expansion of agriculture have reportedly blocked movements in the Arakan Yoma between the hills and the coast, but the extent of this problem elsewhere has not been documented (FAO 1983).

Poaching is widespread. It has been reported from the remote hill districts (Olivier 1978); from the eastern and western slopes of Arakan Yoma; lower Chindwin; Pegu Yoma; Shan States; Tenasserim district and Katha district (UNDP/FAO 1983). In Tenasserim district, poaching is carried out by Thais as well as by local people. Even armed security personnel are believed to be involved in elephant poaching, as it is lucrative.

Elephants are poached for their meat, hide, and tusks. Some animals are even smuggled to Thailand, where they fetch high prices. There have also been exports of live animals for zoos. Between 1968 and 1974, over 200 wild elephants were reported to have been killed for their ivory throughout the country, while in Tenasserim, a number of local elephant populations have been decimated by poachers (UNDP/FAO 1983). More recently, the trade in elephant hide to China through Thailand has become a very serious problem.

Crop raiding occurs in some areas, such as the western edge of the Arakan Yoma. On the other hand, there are areas, such as the Pegu Yoma, where, despite the fact that elephant habitat is surrounded by croplands, elephant depredation has not been reported (FAO 1983).

Conservation Measures Taken

In 1886, Britain annexed Burma and monopolised the extraction of timber, using elephants. The animal was first given legal protection in 1879, when its capture came under the control of the government. Under the Burma Forest Act of 1902, wildlife preservation became the responsibility of the Forest Department. According to this Act, wild animals were designated "forest produce", and rules were formulated to control hunting and fishing in reserved forests (Blower 1980). The Burma Wildlife Protection Act of 1936, which superseded the first comprehensive legislation introduced in 1927, is still in force today. Some wildlife sanctuaries constituted under this act

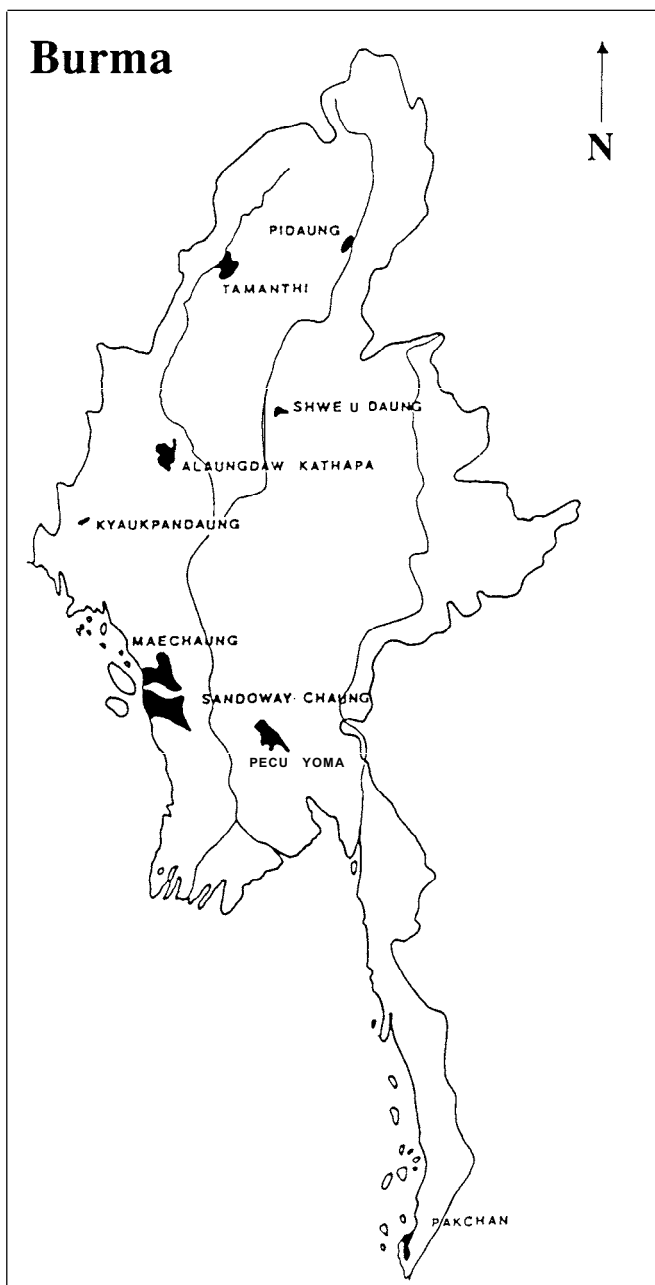


Figure 3. Protected areas in Burma (existing and proposed) where elephants are known to occur. Source: UNDP/FAO 1983.

(Pidaung, Shwe-U-Daung, Tamanthi) contained elephants, but their present status is **unknown** (Fig. 3). In 1950, hunting was banned except under **licence**.

In an effort to ensure the preservation in perpetuity of adequately-sized, representative examples of the country's major ecosystems, the Burmese Government in 1980 enlisted the assistance of the United Nations (UNDP/FAO 1983) to help launch a Nature Conservation and National Parks Project.

As a result of this project, an area of about 1,500 km² in the Lower Chindwin, where elephants are present, has been declared the Alaungdaw Kathapa National Park, Burma's first National Park (Blower 1984). Other areas recommended for protection also support elephant populations.

The current Forest Department capture scheme has, in addition, five temporary elephant sanctuaries, which are exempt from capture operations. These sanctuaries will be subject to change when the capture scheme is revised.

Recommended Actions

The following recommendations are based on FAO (1983) and UNDP/FAO (1983).

- Comprehensive studies of the size and population trends of wild elephant populations and of the ecology of the elephant in Burma are needed to provide quantitative field data for long-term management. In particular, it is necessary to know the effect of the current capture programme on wild populations in order to formulate a rational elephant management plan.
- Managed Elephant Ranges (MER) should be established where sustained-yield forestry, slow rotation shifting cultivation, reservoirs, livestock grazing, and subsistence hunting of non-protected species would be permitted so long as they did not cause degradation of elephant habitat. At least four **MERs** are proposed: in Tenasserim, Pegu Yoma, Arakan Yoma, and north or south **Kachin/Upper** Chindwin.
- The implementation of an effective and representative protected area system in Burma, along the lines recommended by UNDP/FAO (1983) is a high priority for stabilising the elephant population. While this is a major undertaking, it is essential if Burma is to secure its important biological resources. Continued international assistance will be needed to establish the protected areas network.
- The annual capture of wild elephants for the timber industry should be limited to 2% of the most reliable estimate of the wild population (e.g. 60 animals out of 3,000). Capture should be distributed more evenly over the entire population and not confined to a few, easily accessible populations.
- Elephants in captivity should be studied with a view to improving capture techniques (especially to reduce the current high mortality), training, and management. There should be greater focus on improving the breeding of elephants in captivity so that the captive population becomes self-sustaining.
- Captive breeding of timber elephants should be encouraged by mixing the sexes at the annual rest camps in **March-April**, which is the peak mating period. This should be a national programme aimed at reducing to a minimum the capture of wild elephants, which may be unsustainable at present levels.
- A nationwide campaign is needed to prevent poaching of elephant for ivory and hide. The trade route of hide through northern Thailand should be closed down.
- All exports of live animals should be banned for whatever purpose, since the country does not have enough animals for the timber industry. Burma should also join CITES.

5. Cambodia

Area: 181,000 km²

Human population: 6,800,000 (mid-1989 est.)

Total forest: 126,550 km² (69.9%)

Status of the Elephant in Cambodia

At the height of its power (between the 11th and 13th centuries), the Khmer state stretched across a vast area of Indochina, incorporating southern Vietnam, Laos, and Thailand. It is therefore conceivable that, as McNeely (1975) points out, the Khmer empire then could have had the 200,000 war elephants claimed by medieval travellers. The elephant has occupied a place of pride in the country's social, cultural, and religious heritage. The animal has been widely used for transport and work. But, as in neighbouring countries, the elephant in Cambodia has declined both in range and numbers in recent times due to poaching, habitat destruction, and war. In 1958, a ban was placed on hunting elephants, except by special permit (Olivier 1978).

Elephant Distribution

In the past, elephants occurred all over Cambodia, from the Dangrek Mountain range in the north to the Chuor Phum Damrei or Elephant Mountains in the south. With the spread of human population and the conversion of forest to other land uses (chiefly slash-and-burn agriculture), the animal has all but disappeared from the central, low-lying alluvial plain surrounding the Tonle Sap, and in other agricultural areas, such as Kampong Cham, Batambang, Takev, and Prey Veng provinces.

The current stronghold of the elephant seems to be along the border with Vietnam (Fig. 1). Another area that is potentially rich elephant habitat is the Dangrek range of mountains along the northern border with Thailand. This range in southeastern Thailand is an important elephant area (Dobias 1987), and it is highly probable that some elephant movement still takes place between the two countries.

The Cardamom and Chuor Phnum Damrei (Elephant) Mountains in the west and southwest are two other areas where elephants are also likely to occur today. The area that stretches from Khao Soi Dao in Thailand eastward is covered with rain forest and is "probably the least disturbed habitat in continental southeast Asia" (McNeely 1975). The Mekong river acts as a powerful psychological barrier to many animals, including the

elephant. Therefore, it is useful to consider the elephant population east of the Mekong as distinct from the rest.

Number of Elephants in the Wild

There has never been a systematic survey in Cambodia to determine the number of elephants, even as a rough guide. The total number of wild elephants in 1969 has been put at about 10,000 (Olivier 1978). On the basis of a questionnaire survey that was carried out in 1983, the number is now thought to be much lower, about 2,000 (Jackson 1983b). However, these figures are no more than guesses.

Number of Elephants in Captivity

In 1975, there were 582 elephants in captivity (McNeely 1975).

Conservation Problems

The 30-year Indochina war took a heavy toll of human life and destroyed vast tracts of forest and its wildlife. The indiscriminate use of defoliants and herbicides by the U.S. armed forces in an attempt to flush out the Vietcong seriously damaged large areas of forest along the border with Vietnam, some of them irreparably.

One of the legacies of the war is the prevalence of firearms and consequently a high level of hunting, both official and unofficial. As a result, many forest blocks have been impoverished of their wildlife (MacKinnon and MacKinnon 1986).

A serious conservation problem is the virtual absence of qualified, experienced wildlife personnel to manage efficiently the country's protected areas. During the Khmer Rouge regime of Pol Pot, almost all the technicians either were killed or fled the country. There were no qualified biologists left and no courses in biology were conducted in the local universities (MacKinnon 1986).

Another problem involves security, especially along the border with Thailand, where the presence of insurgents makes surveys difficult and dangerous.

The effect of Cambodia's chronic political turbulence on the elephants is difficult to assess. Although formal protection measures have broken down, vast areas of the country have been depopulated, leaving early secondary vegetation, which is favoured by elephants. The elephant might also have benefitted from the almost total halt in development projects.

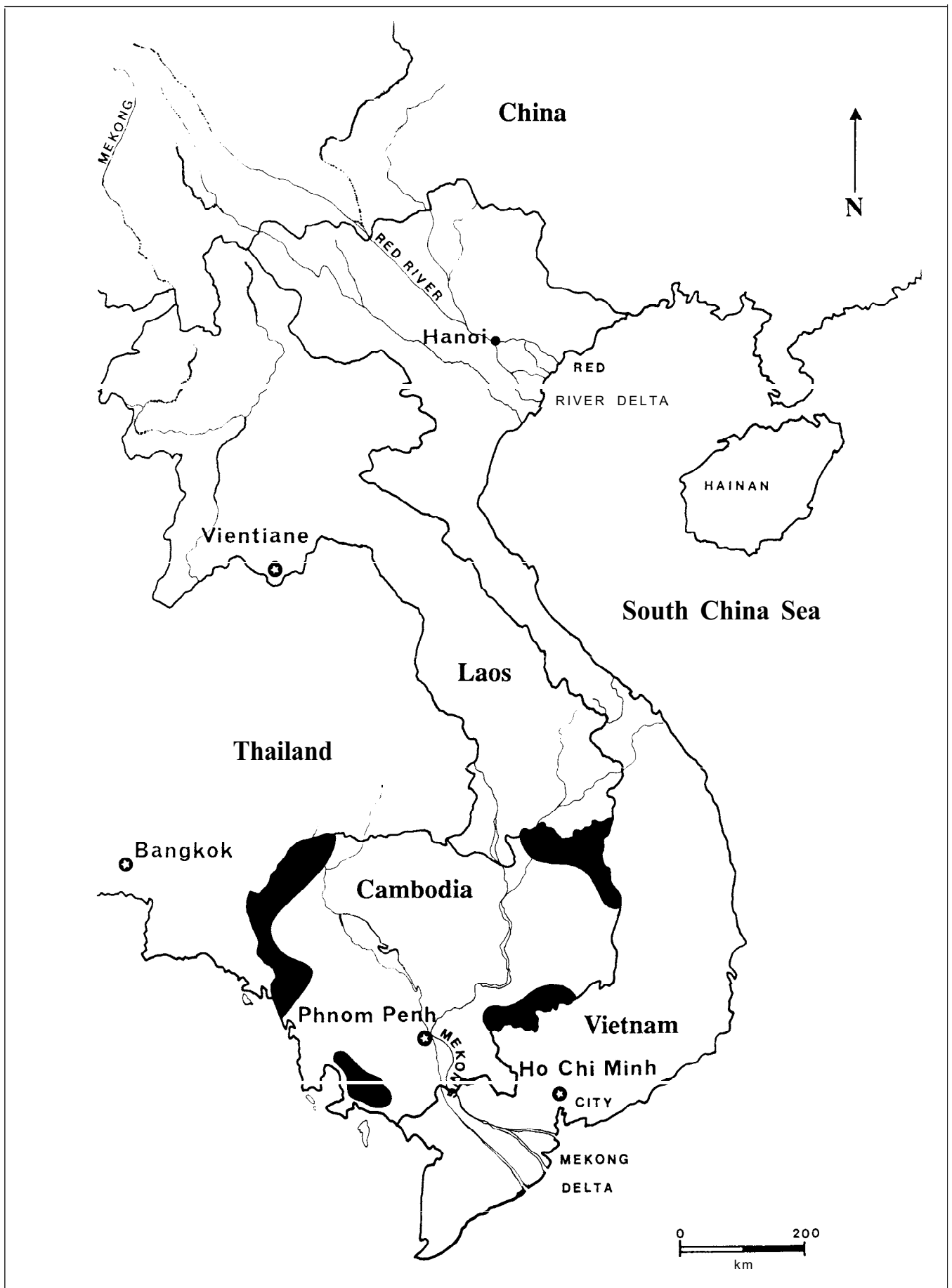


Figure 1. Principal elephant areas in Cambodia.

Conservation Measures Taken

Most protected areas in Cambodia lack protective infrastructure, largely because of the political turbulence and because there is little money and few trained personnel. Given an economy that is struggling to make ends meet after the devastating Indochina war and subsequent turmoil, it would be naive indeed to expect the country to invest its meagre resources in nature conservation. Nevertheless, Cambodia is embarking on modest programmes to re-establish protected areas and train guards and park staff (MacKinnon and MacKinnon 1986).

Together with Laos and Vietnam, Cambodia has signed a Draft Agreement of International Cooperation for species conservation projects in Indochina, which recommends that each country give legal protection to all shared species considered as endangered and protected by law in either of the other two countries. The elephant, on account of its large home range, moves across the national frontiers and so should benefit from the cooperative agreement.

Recommended Actions

- Surveys should be carried out as soon as possible to identify key elephant areas and populations in Cambodia. In the absence of such surveys, no serious measures can be taken to protect elephants. Surveys should concentrate initially on **the Elephant Mountains, Dangrek Mountains, and Hodrai-**

sou. The results of such surveys should be used to design protected areas and for management.

- A comprehensive survey should be carried out in the six existing protected areas to demarcate boundaries, establish staff requirements, inventory fauna and flora, and develop detailed management plans and legislation.
- High priority should be given to the establishment of the Phnom Aural reserve to protect the full range of habitats in the Cardamom Mountains (MacKinnon and MacKinnon 1986).
- Because elephant range in Cambodia extends into Laos and Vietnam, serious consideration should be given to the possibility of establishing a trans-frontier reserve incorporating the proposed Lomphat and Hodrai-sou reserves in Cambodia and the National Park in Vietnam, which should be expanded to the Cambodian border by including the adjacent protection forests. The entire plateau to the south of Attapeu in Laos, bordering Hodrai-sou, should also be included.
- Cambodia should seek international assistance to **re-establish** its conservation capability. Training of Cambodians in wildlife management should be a particularly important component of such assistance.
- Cambodia should become a party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

6. China

Area: 9,579,000 km²

Human population: 1,103,900,000 (mid-1989 est.)

Total forest: 1,288,800 km² (13.5%)

Status of the Elephant in China

In contrast to the situation in countries such as Burma, India, Sri Lanka, or Thailand, where the elephant has always played a significant role in religion and culture, the elephant was considered more of a nuisance in China. No attempt was made either to tame elephants or hunt them for sport, except by aboriginal tribes who sold ivory to the Chinese or paid it as taxes to the government (Olivier 1978). Elephants continue to be killed for their ivory for the handicraft industry, and for other parts, such as skin, bone, and gall bladder for use in traditional medicine (Zaifu 1987).

Today, the elephant, which survives in only a minuscule area bordering Burma and Laos, has complete legal protection in China (Zaifu 1987).

Elephant Distribution

The elephant once enjoyed a much wider distribution and numbers in China than it does today. Its range could have extended as far north as the Yellow river (Olivier 1978). There is evidence to suggest that elephants were in fact once numerous in the Yangtze Valley, where they were hunted for ivory and hides by non-Chinese (Laufer 1925). They seem to have held on in the Yangtze basin until the end of the 10th century A.D. (Olivier 1978).

Since then, rapid loss of habitat as a consequence of agricultural expansion has led to the disappearance of the elephant from all but a small part of the southern province of Yunnan (Zaifu 1987). Yunnan had a great reputation as an elephant area. Marco Polo referred to it as "swarming with elephants and other wild beasts" (Olivier 1978). As early as 200 B.C., the tribes that lived in the Yunnan area were referred to as an "elephant-riding nation" and almost every family kept an elephant to ride, haul timber, or to plough the field (Olivier 1978).

Today, the elephant is confined to the southern part of Yunnan, bordering Burma and Laos, where, according to Zaifu (1987), it is found in the counties of Jinghong, Yingjiang, Mengla, Ximeng, and Lancang (Fig. 1). The habitat here is a **mixed** forest of broad-leaved trees, bamboos, and grasslands.

Table 1. Number of wild elephants in China.

County	Number	Authority
Mengla	170	Zu Zaifu 1987
Jinghong	50	Zu Zaifu 1987
Ximeng	10	Zu Zaifu 1987
Lancang	20	Zu Zaifu 1987
Yingjiang	10	Zu Zaifu 1987
Total	260	

There are abundant food resources at all levels for elephants. Elephants live at an altitude range of 600-1,000 m in the dry season (November-April) and move to higher altitudes of 1,100-1,400 m with the arrival of the rains in May (Zaifu 1987).

Number of Elephants in the Wild

Lack of visibility in tropical humid forests in Yunnan makes it extremely difficult to estimate elephant numbers. The problem is further compounded by the fact that a large proportion of them are migrants from neighbouring Burma and Laos (Yang Yuan-Chang, pers. comm.). The estimates currently available must therefore be considered tentative at best. Olivier (1978) estimated the total number of elephants in Yunnan to be under 100. While one recent estimate put the number at about 250 (± 50) (Zaifu 1987; see Table 1), Yang Yuan-Chang (pers. comm.) considers that there are no more than 150, mostly migrants from Laos.

Number of Elephants in Captivity

Although elephants were captured and trained by tribal people in the south, it was only in 121 B.C. that the first tame elephant arrived at the court of Emperor Wu (Olivier 1978). Subsequent emperors, however, are known to have maintained thousands of elephants in captivity. The rapidity of the decline in numbers in the wild can be inferred by a reference to the 5,000 elephants kept during the time of the Mongol Kublai Khan (1214-1294 A.D.) compared to only about 60 during the period of the Manchus at the end of the 18th century (Olivier 1978). In 1834 there were 8-10 animals in the capital, but by 1901 there were none (Laufer 1925).

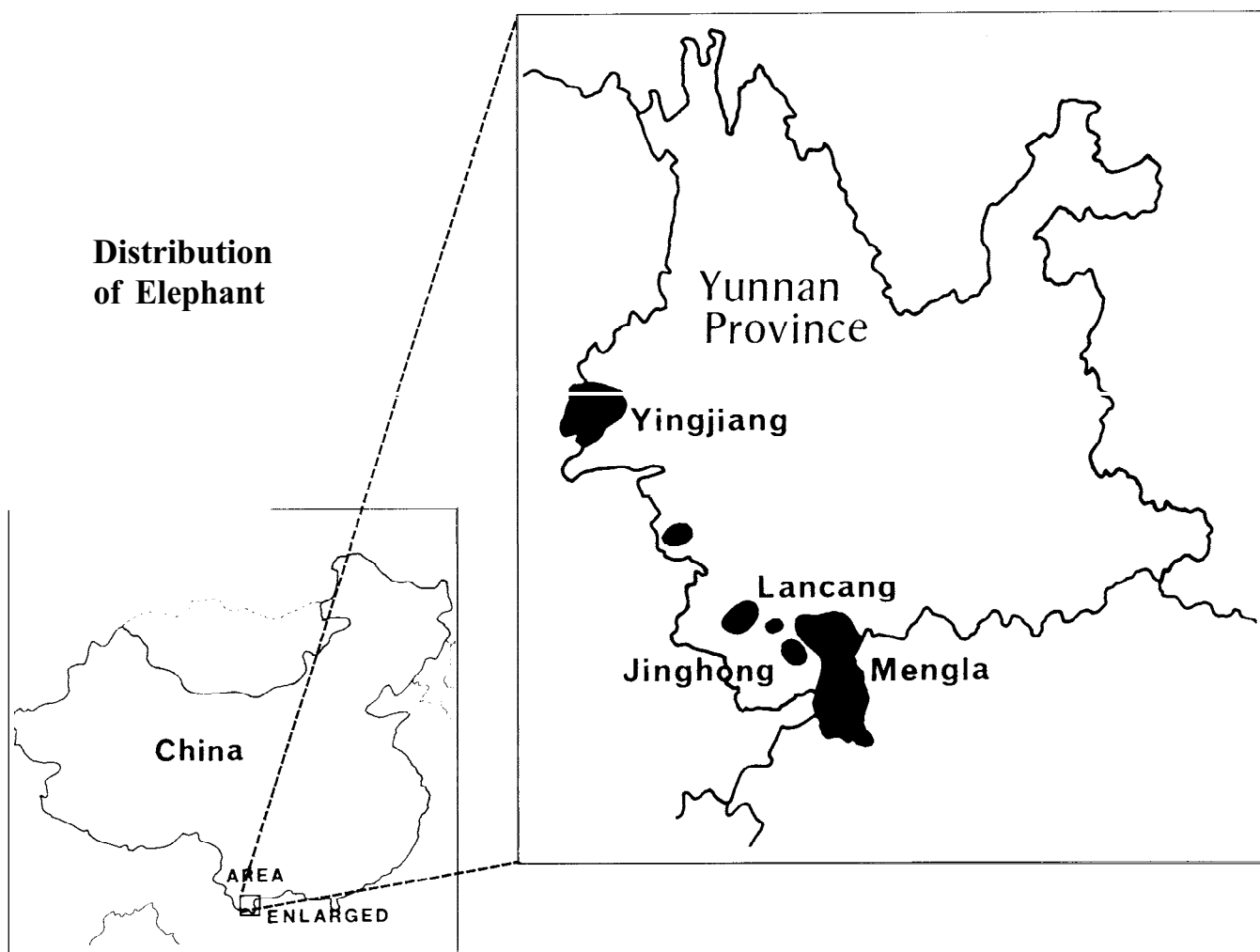


Figure 1. Conservation areas in Yunnan Province of China where elephants occur.

An Assessment of Conservation Problems

Conversion of forests to agriculture, logging, and firewood collection have been the main causes of deforestation in China. The elephant has been among the large mammals most affected by deforestation which is particularly serious in Xishuangbanna (Yunnan), the only remaining elephant range, where illegal logging, forest fires and shifting cultivation have recently destroyed about 33 km² a year. Thousands of people have settled there, establishing villages and felling trees for building and firewood (Smil 1983).

Elephant populations are small, scattered, and confined to areas dominated by man. Although 2,500 km² of forest have been set aside in southern Yunnan for conservation of elephants, secondary vegetation, which provides the major source of food for the animals, was not included in the area. Furthermore, the whole area is surrounded by croplands, plantations, and human settlements (Zaifu 1987), which are a temptation to elephants.

In the Xishuangbanna reserve (2,000 km²) in southern Yunnan the existing area of permanent agriculture within the reserve is said to be as high as 130 km² (Anon 1985a). The number of

people inhabiting the reserve increased from 12,000 in 1980 to 20,000 in 1985, partly due to natural increase but also due to immigration from other parts of Yunnan province (Anon 1985a).

The Menglun reserve was reported in 1985 to be threatened by destruction of wildlife by refugees from Laos and Vietnam who have been resettled in the area (Anon 1985a).

Allowing human settlements within protected areas has aggravated conservation problems. Hunting is still practiced by the people living inside the reserves as a traditional way of life. There is no shortage of homemade guns. Each household in the reserve normally possesses one or two guns (Anon. 1985a). Wildlife is hunted partly for food, but also to meet the demands of traditional Chinese medicine, which depends to a large extent on animal products (including skin, bone, and gall bladder of the elephant) for basic ingredients (Zaifu 1987).

Conservation Measures Taken

In an effort to protect the natural resources of tropical and subtropical areas in China, a short-term plan for the conservation of nature and natural resources is in preparation based on scientific surveys carried out in 1983 (Song 1985). An impor-

tant conservation measure was the establishment of the **Xishuangbanna Nature Conservation Area** in south Yunnan. It was **570 km²** when it was set up in 1959, but later it was enlarged to **2,000 km²** and includes 102 species of mammals, including the elephant (Song 1985; Zaifu 1987). The size of the elephant and gaur populations has increased since the establishment of the protected area (Song 1985).

Recommended Actions

- Research on the abundance, status, and movements of the elephant population, which is confined to Yunnan Province in China, is urgently required in order to institute effective management. This is especially important because of the amount of human settlement in elephant range.
- Inviolable core areas should be established in reserves, such as the Xishuangbanna Nature Conservation Area, where settlement and exploitation should be banned in order to avoid conflict between people and elephants.
- Strong anti-poaching measures should be introduced to stop the slaughter of elephants (and other wildlife) to meet the demand for wildlife products (e.g. skin, bone, and gall bladder of elephant) for China's traditional medicine. Ivory poaching is also a serious threat to the elephant population. Strict control of the use of widely available firearms is necessary. All firearms should be registered and their use carefully monitored.
- Pressure on natural forests for **fuelwood** should be relieved by providing local people with substitutes, such as kerosene, cooking gas, and coal.

7. India

Area: 3,166,828 km²

Human population: 835,000,000 (mid-1989 est.)

Total forest: 637,981 km² (20.1%)

Status of the Elephant in India

India has by far the largest remaining population of the Asian elephant (about 50% of the Asian total), but it is considered endangered (Daniel 1980b, IUCN 1988). About half are in the northeastern states (Fig. 1), principally Assam, Arunachal Pradesh, and Meghalaya (Lahiri-Choudhury 1985, Sukumar 1986). But throughout its range, the animal is increasingly threatened. The rapid rise and spread in human population has meant the gradual elimination of the elephant in many areas, the principal reason being loss of habitat. Elephant habitat is deteriorating so rapidly in some areas that in a few decades, unless prompt action is taken now, India will see a gross reduction in elephant range. The conversion of forests into large monoculture plantations (such as teak), shifting cultivation, hydroelectric projects, human encroachment (both legal and illegal), must, in the long run, constrict the life-support system of the elephant, though perhaps less quickly than in smaller countries in Asia.

Agriculture in former elephant habitat has resulted in serious crop depredation, and enormous numbers of "crop protection" guns have been issued to the farmers (Olivier 1978).

It is likely that the long-term future of the elephant in India lies within protected areas and in other large areas uninterrupted by human settlements, where rugged terrain and dense cover can provide protection against man.

Elephant Distribution

Before the large-scale human modification of its habitat, the elephant in India enjoyed a much wider distribution than it does today. It inhabited all but the most arid areas in the Indian sub-continent, having been recorded even from the dry tracts of Punjab and Saurashtra in the 4th century (Nair et al., 1980). The animal has steadily retreated eastwards as a result of changes, both natural and man-made, which have reduced forest cover. The historical and the present-day distribution of the elephant in India, according to Daniel (1980a), reflects the progressive deterioration of the environment.

Elephants once inhabited parts of Madhya Pradesh and the Bombay region as well (Olivier 1978). They were present in Rajasthan, from where they disappeared before 1885 (Digby 1971). In Central India, elephant range extended from Assam down to the Godavari river (Olivier 1978). The elephant population in the Western Ghats was distinct. Today, elephants have disappeared west of 84°E in the Central Peninsula and north of 16°N in western India (Daniel 1980a).

At present, between 17,000 and 22,000 elephants are confined to forested, hilly tracts of north, northeast, central, and south India (Sukumar 1986). Figure 1 shows the location of the following four major elephant areas in India:

- There is an isolated population of elephants in northern India, along the foothills of the Himalayas in Uttar Pradesh (Singh 1978). Two of the most important elephant areas in Uttar Pradesh (UP) are Corbett National Park and Landsdowne Forest Division. About a third of the total elephant population of UP is found in the sal (*Shorea robusta*) forests along the foothills of the Himalayas, the eastern part of the Doon Sivaliks and the western part of the Landsdowne Forest Division (Chilla Sanctuary) (Gupta 1985). The present distribution of the elephant covers 400 km² of sal forest between the rivers Yamuna and Sarda.
- In northeast India, the elephant occurs in a series of **fragmented** habitats that extend from the Himalayan foothills of Bhutan through northeast Bengal to the states of Assam, Arunachal Pradesh, Manipur, Mizoram, **Meghalaya**, and Tripura (Lahiri-Choudhury 1985). The river Brahmaputra separates the elephants in the region into northern and southern populations. The total extent of the forest cover in this region is 98,293 km².
- In Central India, elephants are found in the states of Orissa and Bihar, and the far south of West Bengal. The last area is insignificant, as it is known to have only two or three resident animals in the Ayodhya Hills. The largest population of elephants in Central India is in Orissa in an area of 20,000 km² of highly-fragmented deciduous forests, where there are estimated to be **1,300** (A.J.T. Johnsingh, pers. comm.; **Shahi** and Chowdhury 1985). In Bihar, elephants are distributed in three areas: Palamau, Singbhum, and Dalbhum (**Shahi** 1980).

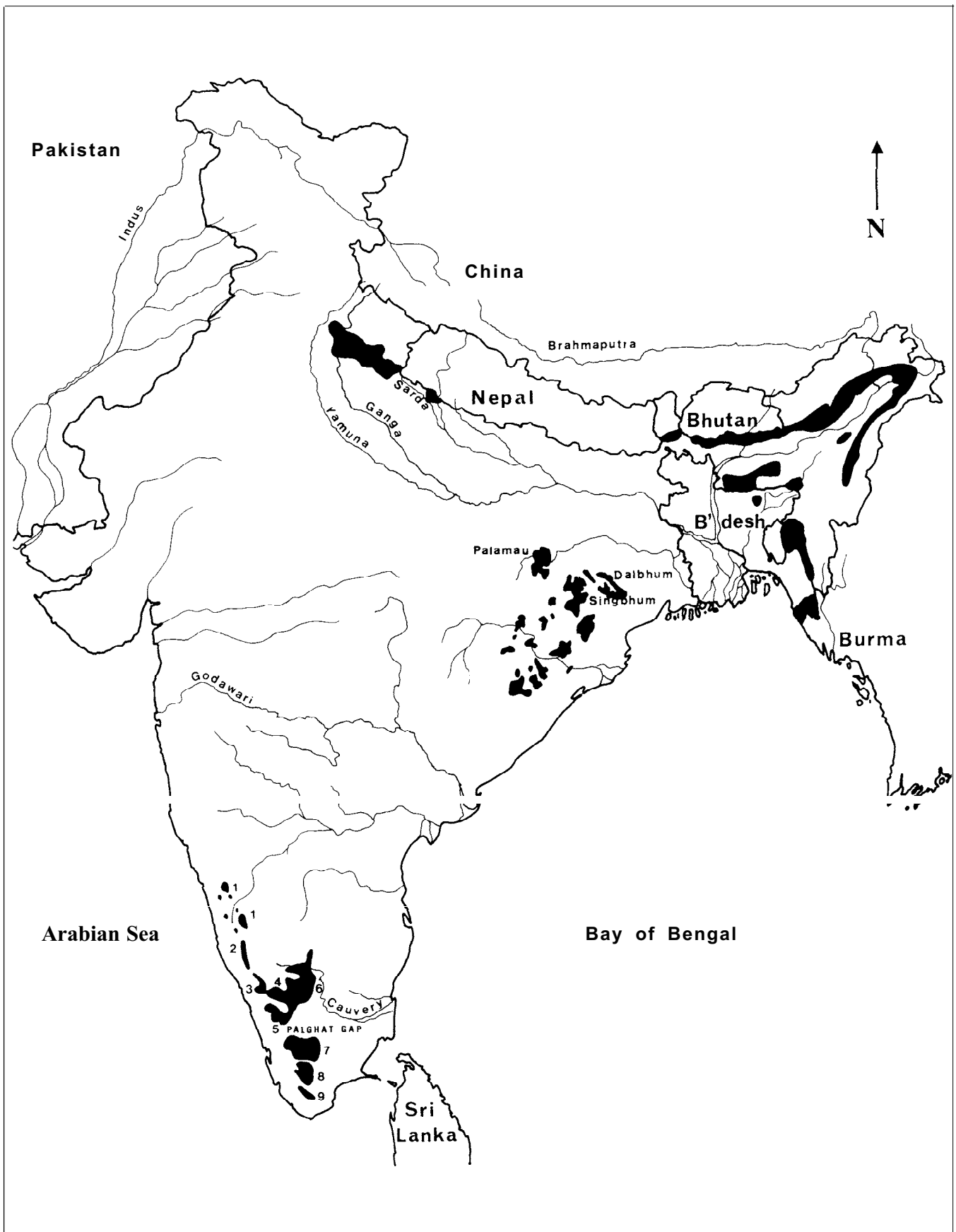


Figure 1. Approximate distribution of elephants in India. Sources: Lahiri-Choudhury (1980); Nair et al. (1980); Shahi (1980); Sukumar (1986). For key to numbers, see text.

Table 1. The number of wild elephants in India.

Region	State	Area	Number
Northwest	Uttar Pradesh	Corbett NP and Landsdowne FD	525
Northeast	West Bengal	non-specific	155
"	Arunachal Pradesh	non-specific	2,000-4,300
"	Assam	Manas Tiger Reserve	1,200
"	"	Darrang West and East	400
"	"	Dibrugarh	200
"	"	Kaziranga-Naga Hills	1,900
"	Meghalaya	Garro-Khasi Hills	2,500-3,500
"	"	Jainti-Cachar	250-325
"	Tripura	non-specific	120-150
"	Manipur	non-specific	?
"	Mizoram	non-specific	3
Central	Orissa	non-specific	2,000
"	Bihar	non-specific	310
South	Karnataka	North Kanara Crestline	100
"	Karnataka	Malnad-Bhadra	100-150
"	Karnataka/Kerala	North Wynad-Nagarhole	600-800
"	Karnataka/Kerala	Bandipur-Mudumalai-Nilgiris	1,200-1,500
"	Kerala/Tamil Nadu	Nilambar-Palghat Hills	300-500
"	Karnataka/Tamil Nadu	Eastern Ghats (south)	1,800-2,000
"	Kerala/Tamil Nadu	Anaimalais-Palani Hills	800-1,000
"	Kerala/Tamil Nadu	Periyar-Varushanad Hills	700-900
"	Kerala/Tamil Nadu	Agasthyamalai Hills	150-200
Total			17,310-22,115

Source: Sukumar (1986)

• In south India, elephants occur in the wild in the states of **Karnataka**, Kerala, and Tamil Nadu (Nair et al., 1980). The deciduous forests of south India provide the best habitat for elephants. The populations north and south of the Palghat Gap in Kerala seem to have been distinct for a long time. Sukumar (1985a, 1985b, 1986) identifies nine areas in the forested hills of the Western and Eastern Ghats inhabited by elephants (numbers relate to Fig. 1):

1. **North Kanara:** crestline of Karnataka Western Ghats, which is the northern limit of the elephants in South India.
2. **Malnad Plateau-Bhadra:** east of the North Kanara Crestline.
3. **North Wynad-Nagarhole-Kakankote:** the deciduous forests of Kerala that stretch from south of Cauvery river to the Kabbini river.
4. **Bandipur-Mudumalai-South Wynad-North and East Nilgiris:** the deciduous forests extending south from the Kabbini river to the slopes of the Nilgiri Hills constitute one of the finest elephant habitats in South India.

5. **Nilambur-Nilgiris west and south Palghat hills:** the semi-evergreen, evergreen forests, and shola-grasslands of Nilambur, New Amarambalam, Upper Bhavani-Kundah, Silent Valley, and Attapadi.
6. **Eastern Ghats:** the dry deciduous forests in this vast (7,000 km²) hilly region through which flows the Cauvery river.
7. **Nelliampathis-Anamalais-Palani hills:** a continuous elephant habitat south of the Palghat gap.
8. **Periyar-Elamalai-Varushanad hills:** the Periyar plateau that stretches from the southern end of the Anamalais to the Shencottah gap.
9. **Agasthyamalai-Ashambu hills:** the evergreen and semi-evergreen forests in the interior.

Number of Elephants in the Wild

According to estimates by the IUCN/SSC Asian Elephant Specialist Group in 1985, the minimum and maximum number of elephants remaining in the wild were 16,595 and 22,261 respectively. A more recent publication by Sukumar (1986) gives similar results and indicates that the total number could be



A family party of elephants in southern India (Photo by Peter Davidar/WWF).

anything between 17,310 and 22,115 (Table 1). The average crude density of elephants can vary from 0.04/km² in hilly habitats to 1-2/km² in the dry deciduous forests in the south.

Number of Elephants in Captivity

The tradition of maintaining elephants in captivity in India goes far back in history. The 17th century Emperor Jehangir was reputed to have had 12,000 elephants at a time when the total number of captive elephants in the Indian sub-continent has been put at 40,000 (Jardine 1836). Sukumar (1986) estimated that between 30,000 and 50,000 elephants might have been captured throughout the Indian sub-continent during the past 100 years. The fact that these estimates far exceed the number of elephants living in the wild today provides an indication of the enormous numbers that once existed. The offtake has been consistently very much higher in the northeastern part of India than in the south. This, according to Sukumar (1986), is due to the difference in the methods of capture in these two areas. In the northeast, it was the usual practice to capture almost entire herds in stockades in the so-called khedda, while in the south the standard practice was to capture single animals in pit traps. However, in Mysore, with the adoption of the khedda, about 2,000 elephants were captured in that state alone between 1874 and 1971 (Sukumar 1986).

Northeast India, with 1,460- 1,660 domesticated elephants, has the largest number in the country. Breeding in captivity is principally by allowing cows to mate with wild bulls. It is only very rarely that captive bull elephants themselves are known to have sired calves (Lahiri-Choudhury 1985). Most of the elephants are used in the timber industry or as draught animals. In northern India, the number of elephants in captivity is estimated to be between 500 and 750, while in south India there are between 300-350, of which 150 are used in forestry and 150-200 are kept by Hindu temples. In general, the captive population has declined over the past 25 years (Jackson 1983b).

Conservation Problems

The elephant is under threat from a variety of causes in the Indian sub-continent today. All the populations are threatened, but the degree of decline varies (Daniel 1980a). The direct and more obvious threats to elephants in the wild are poaching, capture (both legal and illegal) for domestication, and mortality due to outbreaks of epidemic diseases and drought. But the most potent threat to the long-term survival of the elephant in India is the conversion of forests to other land-uses.

Northern India

In northern India, poaching is not serious, but the deterioration of habitat represents an overriding threat to the elephant (Gupta 1985). Development programmes, such as large-scale agricultural projects, industries, hydroelectric and irrigation projects, have been responsible for fragmentation of the animal's habitat. Large areas of forest have been replaced by eucalyptus plantations. Between 1966 and 1976, one-third of the 1,660 km² of the most suitable elephant habitat was converted to monoculture plantation (Singh 1980).

Large-scale clearing of forests in Nepal along the Indian border in the 1980s resulted in the movement of a remnant population of elephants from Nepal into the Dudhwa National Park in the Lakhimpur-Kheri district of Uttar Pradesh (Gupta 1985).

In Uttar Pradesh, elephants have raided crops, and the public outcry was so intense that, in 1963, the state government issued permits to shoot marauding elephants and took the unprecedented step of temporarily removing the animal from the protected list (Gupta 1985). In all, 27 elephants were shot, while 12 escaped wounded.

The construction of the Chilla-Rishikesh Power Channel has divided the best elephant range in Uttar Pradesh into two blocks, thereby preventing the seasonal movement of elephants in the Ghori and Laldhang forest ranges in the Landsdowne division (Singh 1980; Gupta 1985).



Capture of a calf by noosing at Jaldapara, India (Photo by Peter Jackson).

Table 2. Elephants in captivity in northeast India.

State	Civil district	Estimate
Arunachal Pradesh	East & West Siang, Dibang Valley, Lohit, Tirap	1,000-1,100
Assam	Upper Assam (in Darang), Sibsagar etc., Lower Assam, Manas Tiger Reserve	400-500
Manipur		
Meghalaya		
Mizoram		
Nagaland		
Tripura	?	20
West Bengal	Jalpaiguri, Coochbehar	40
		Total 1,460-1,660

Source: Lahiri-Choudhury (1985)

In the past, elephants in the Corbett National Park used to move seasonally between the park and the adjoining block of reserved forests. But the establishment of the Ramganga reservoir inside the park has drastically affected the entire pattern of their seasonal movement. Consequently, the habitat is becoming damaged through over-use as large herds are forced to remain within the confines of the national park (Singh 1980).

The Rajaji Sanctuary in the Himalayan foothills is to be upgraded to National Park status, but its grasslands, which constitute a viable habitat for elephants, are being encroached by unsuitable *Phragmites karka* and *Parthenium* spp. (A.J.T. Johnsingh, pers. comm.).

Northeast India

The elephant population in northeast India inhabits a very wide area and so it is difficult to protect entire elephant ranges, given the meagre resources available (Table 2). The problem is further compounded by the rapid conversion of forests to monoculture plantations (e.g. tea), which has driven elephants out of their traditional habitats. In north Bengal, 20% of the forest had already been converted to plantations by 1980 (Lahiri-Choudhury 1980).

Of the three populations of elephant in north Bengal, the most seriously threatened is that west of the Torsa River because of the fragmented nature of its habitat. There has been an escalation in man-elephant confrontations due largely to the fact that elephant herds have been isolated or “pocketed” (Lahiri-Choudhury 1980, 1985).

In Tripura, one of the conservation problems is the loss of forests as a result of uncontrolled shifting cultivation, which occurs even inside government-controlled Reserved Forests. But the overriding threat to elephants in Tripura comes from government plans to convert Reserved Forests to cultivation

(Lahiri-Choudhury 1980). This would fragment elephant habitat and result in elephant herds becoming pocketed as in north Bengal.

Meghalaya is one of the most famous elephant areas in the northeast. The main conservation problem here is the lack of management of all but the Reserved Forests, which make up only 3.18% of the total area. Elephant habitats are becoming fragmented and the danger is the destruction of the habitat on a large scale by indiscriminate shifting cultivation (Lahiri-Choudhury 1980). The most seriously threatened population is in the Jainti Hills.

In Nagaland and Mizoram the most serious problem is poaching, including for meat, which is apparently a tradition in **Karbi** Anglong and North Cachar Hills districts of Assam, and to some extent even in Arunachal Pradesh and in the Khasi and Jainti hills of Meghalaya (Lahiri-Choudhury 1980).

A more subtle but potent threat to elephants in Nagaland is likely to come from the demands for more land for shifting cultivation, given that the human population in Nagaland has the highest rate of growth in India (Lahiri-Choudhury 1980). At present, the land used for shifting cultivation accounts for 34.7 1% of the total area, while irrigated cultivation accounts for only 2.23% of the land (Lahiri-Choudhury 1980).

Elephants continue to be captured illegally in Dibang Valley, **Lohit**, and Siang districts of Arunachal Pradesh. About 6,000 elephants were captured between 1961 and 1985 in Arunachal Pradesh, Assam, Meghalaya, Nagaland, Tripura, and West Bengal (Lahiri-Choudhury 1985). The Indian Board for Wildlife agreed to the capture of elephants in large numbers in Assam and Meghalaya (Lahiri-Choudhury 1985).

One of the major problems-if not the major problem-in northeast India south of the Brahmaputra is the absence of viable conservation areas, with the exception of Kaziranga National Park in Assam. Kaziranga is supposed to be 425 km²

in extent, but in reality it is only 378 km², which is inadequate to protect even a part of the home range of the estimated 800 elephants that live here and migrate to the Mikir Hills to the south during the monsoon. The Garampani Wildlife Sanctuary is woefully inadequate as an elephant reserve as its present size is only 16 km². The problem is even worse in west Meghalaya, where there are 2,500-3,500 elephants. The only two reserves here, Siju (5.18 km²) and Nongkhyllam (26 km²), are totally inadequate. According to Lahiri-Choudhury (undated): "Throughout the range of the Asian elephant, there is perhaps no other population of this size under such pressure and threat."

In Arunachal Pradesh, the habitat available to the elephant is shrinking year by year, being fragmented by the construction of roads and the establishment of human settlements in the valleys. There is also a move to settle people from the upper reaches in the narrow belt of moist deciduous forests, which is the home of elephants (Johnsingh 1985).

Invasion by political dissidents threatens the integrity of the Manas Tiger Reserve, an important part of the sub-Himalayan elephant corridor linking north Bengal with Arunachal Pradesh.

Central India

According to Johnsingh (pers. comm.) the major problem for the Central Indian population of elephants is large-scale shifting cultivation and fragmentation of habitat. In addition, the animals are threatened by conversion of forests to monoculture plantations, especially teak, and habitat destruction from mining for iron ore. In Bihar, the best elephant habitat is in the Singhbhum forests dominated by sal (*Shorea robusta*), where the habitat is being degraded through the mining of a large deposit (2,000 million tonnes) of iron ore (Lahiri-Choudhury 1985; Shahi 1980).

Orissa was reputed to have about 2,000 elephants in 20,000 km². But a survey in 1982/84 indicated that only some 1,300 elephants were present in about 12,000 km² of forest. As Shahi and Chowdhury (1985) point out, not all of the 1,300 elephants are secure. The two viable elephant habitats (Simlipal Tiger Reserve and Satkosia Gorge Sanctuary) together account for 4,147 km² and can support about 700 animals. The remaining habitat of 7,853 km² is reported to be deteriorating and, unless this trend is reversed, the area is unlikely to support the remaining 600 elephants.

Crop depredation by elephants is common in Bihar (where it is the main problem), Orissa, and West Bengal.

A small population (50 animals) inhabits an area of 110 km² of forest in the Lakhari valley, surrounded by a vast stretch of denuded forest (4,000 km²) in the Parilakmundi Forest Division in Orissa. This is the only forest with good cover left in Parilakmundi FD, and unless measures are taken now to conserve this area, the elephants are unlikely to survive for long (Shahi and Chowdhury 1985).

Elephants are poached for meat inside the Chandka Reserve in Orissa by tribal people (Dash 1983).

South India

The main conservation problems in south India appear to be elephant-human conflicts and ivory poaching. Both people and

elephants have suffered. The situation is further compounded by hydroelectric and irrigation schemes which have led to deforestation, not only of the areas flooded, but also of other areas allocated for the resettlement of displaced people. Elephant migration routes have been disrupted by these schemes. These changes in elephant ranges have led to the animals moving out in search of food in croplands, in the course of which people are sometimes killed.

A series of hydroelectric projects on the Kali river in the district of North Kanara are located within the Dandeli Wildlife Sanctuary and have been responsible for large-scale deforestation in the heart of the reserve (Nair et al., 1980).

Elephant herds have become confined to pockets of forests as a result of the Tunga-Bhadra hydroelectric project. Many such pockets of forests are too small to support elephants on a long-term basis (Nair et al., 1980).

A large reservoir on the Kabbini River in Kakankote forest, which used to be an important site for elephant capture, has cut the habitat into two and has handicapped the movement of elephants from Nagarhole and Kakankote forests in the north to the Bandipur forests in the south. But elephants swim across the river (Johnsingh, pers. comm.).

There are about 20 hydroelectric reservoirs and five powerhouses located inside the 940 km² Anaimalai (Elephant Hill) sanctuary, which have led to the fragmentation of the forest and blocked elephant movement (Nair et al., 1980; Sukumar 1986).

Large areas of forest have been converted to monoculture plantations of eucalyptus for the rayon and paper industries in south India. Just as the introduction of coffee and tea plantations by the British wiped out large populations of elephants in south India at the turn of the century, the monoculture plantations of teak, eucalyptus, rubber, and cardamom are squeezing large numbers of elephants out of south India today.

Crop-depredation by elephants is a serious problem in parts of south India. This is largely a man-made problem in that it results from the pattern of cultivation, which in most elephant habitat follows the valleys and low-lying areas, leaving the hill tops covered with forest. Elephants seem to eat practically everything cultivated, with the exception of such crops as mulberry, gingelly, niger, and turmeric (Sukumar 1986).

Elephants raid crops for a variety of reasons, but in south India one of the causes could well be the absence of bamboo, an important component in the diet of elephants. In the Eastern Ghats, bamboo has largely vanished and the undergrowth has been taken over by the exotic *Lantana*, which suppresses the growth of grass (Nair et al., 1980).

Large-scale illegal timber extraction has been a serious problem in the northern part of the Periyar Tiger Reserve in Kerala, which has over 500 elephants (Vijayan 1980). But the major problem now appears to be poaching (A.J.T. Johnsingh, pers. comm.).

Poaching of elephants for ivory is still a serious problem in south India. Almost all the large tuskers have been eliminated from Periyar Sanctuary (P. Vijayakumaran Nair, pers. comm.). Unlike Sri Lanka, where less than 6% of the males have tusks, 90% of the males in south India are tuskers, and the population is very vulnerable to poachers. Sukumar (1985a) estimates that between 1975 and 1983, about 100 to 150 tuskers were shot



Indian elephant at Periyar Wildlife Sanctuary (Photo by Peter Jackson).

annually in south India alone. Poaching is a major problem, especially in such conservation areas as the Periyar Tiger Reserve (Sukumar 1985a; Vijayan 1980), where 200 poachers were operating in the late 1970s. The slaughter has altered the sex ratio of the elephant population in the reserve, which is now biased heavily towards the cows (1:20).

A kg of ivory is sold in India for about U.S. \$125. At this rate, given the fact that there are at least 3,600 craftsmen practising their craft in ivory in Kerala and Mysore alone, the annual value of the poaching trade is estimated at U.S. \$225,000 (Sukumar 1985a). Ivory is legally imported into India from Africa for the carved ivory industry and has provided a cover for poached Indian ivory (Sukumar, pers. comm.).

Conservation Measures Taken

The late Prime Minister Indira Gandhi launched the National Wildlife Action Plan in 1983 to protect India's rich wildlife and to encourage public understanding, appreciation, and enjoyment of nature. The adoption of the plan was a milestone in India's conservation efforts. Among the priorities which this plan addresses are:

- establishment of a network of protected areas;
- management of protected areas and habitat restoration;
- wildlife protection in multiple-use areas.

The number of protected areas (wildlife sanctuaries and national parks) in India has risen from 131 in 1975 to 426 in 1989. The total area covered by the protected areas increased nearly fivefold from 24,000 km² to 110,000 km², which represents 3.3% of the total land area, or about 12% of the total forest area of India. The Wildlife Institute of India has proposed enlarging the network to 657 reserves covering 4.6% of India (World Conservation Monitoring Centre, Protected Areas Data Unit, pers. comm.).

The Forest Conservation Act 1980 was designed to **arrest** the large-scale habitat loss caused by deforestation.

India ratified the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1976. The Asian elephant is on Appendix I, which bans international commerce in its products, and thus the **export** of ivory is banned.

Among the specific measures taken in northern India the more significant are:

- There has been a welcome change in the planning policy of the Forest Department, which has not only brought an end to the conversion of first-growth forests to eucalyptus plantations, but also shifted the emphasis from a commercially-oriented forest management to a conservation-oriented management. This has resulted in overall selective timber-felling and a moratorium on clear felling (Gupta 1985).
- In Uttar Pradesh, elephants have enjoyed complete protection ever since the Wild Elephant Protection Act 1879 was promulgated, except for a brief period in the 1960s. New efforts are underway to establish the Rajaji National Park by linking up the Rajaji, Motichur, and Chilla reserves (Gupta 1985).
- The Forest Department has compensated the families of persons killed by elephants.

Among the conservation measures taken in the south, the most noteworthy are:

- The capture of elephants has been discontinued.
- A new conservation area, the Nilgiri Biosphere Reserve (5,520 km²), which protects elephant ranges north of Palghat Gap in Karnataka, Kerala, and Tamilnadu, has been established.
- The Kerala government has approved the money to set up an electric fence to keep elephants out of the entry point of the Parambikulam-Aliyar irrigation project, where the narrow and deep canal has become a death trap for elephants and other animals in the Parambikulam Wildlife Sanctuary in Kerala (The Hindu, 30 October 1986).
- The Karnataka state government has decided to prohibit tourist development on elephant migration routes across the Kabbini River between Bandipur and Nagarhole National Parks (Anon. 1983; A.J.T. Johnsingh, pers. comm.).

Recommended Actions

- The integrity of present reserves containing elephants should be maintained and their areas extended where possible to cover seasonal migration routes. The principal reserves include Manas and Kaziranga in Assam; Rajaji, Motichur, and Corbett in north India; Simlipal and Satkosia Gorge in

central India; and Periyar, Mudumalai, Bandipur, and Nagarhole in south India.

- Resources should be provided to strengthen anti-poaching measures. This is especially important in southern India, where ivory poachers have killed most big tuskers. Slaughter of young tuskers before they have bred will seriously damage the genetic composition of the elephant population.
- The traditional ivory trade should be strictly controlled to ensure that **authorised** stocks are not used as a cover for poached ivory.
- The integrity of elephant habitat outside Corbett and Rajaji National Parks should be preserved by resettling pastoral Gujar communities, and by maintaining the corridor between **Chilla** and Motichur.
- Migration by the large elephant population north of the Brahmaputra in northeast India should be facilitated by maintaining the forest corridor along the foothills of the Himalayas linking Assam, Arunachal Pradesh, Bhutan, and north Bengal. This will require a network of well-managed reserves and carefully designed multi-use zones, aimed at meeting the needs of local people without jeopardising wildlife resources.
- A forest corridor for migration of elephants between the **Manas** Tiger Reserve and the Jaldapara Sanctuary should be maintained.
- Elephants isolated outside reserves in Nagaland should be translocated to the Intangi Wildlife Sanctuary, and surrounding reserved forests in Dhansiri, **Kaki**, and Aisama should be given the status of wildlife sanctuaries.
- Core elephant habitats in West and East Siang Districts of Arunachal Pradesh should be given legal protection.
- Links between the **Kaziranga National Park** and the **Garampani** Sanctuary in Assam with the Intanki Wildlife Sanctuary in Nagaland **should be** maintained by improving conservation in the Karbi Anglong and North Cachar Hills Districts of Assam.
- The large elephant range covering some 10,000 **km²** in the Nagarhole-Nilgiris-Eastern Ghats area in south India should be completely protected from human land-use which interrupts elephant movements. The traditional corridor between Benne in Mudumalai Sanctuary (Tamil Nadu) and the Nilambur forests (Kerala) through Gudalur Division should be restored.
- Although capture of wild elephants should **be** kept to a minimum, indigenous skills in elephant capture, such as roping or *mela-shikar*, should be kept alive.
- Eco-development projects to meet the needs of the human population around key elephant areas are highly desirable to relieve pressure on forests.

8. Indonesia: Kalimantan

Area: 550,203 km²

Human population: 6,723,000 (1980)

Total forest: 449,680 km² (81.7%) (1983)

Status of the Elephant in Kalimantan

The origin of the elephants in Kalimantan, or for that matter in Borneo itself, is not clear. They are found only in northeast Kalimantan and adjoining Sabah, and, according to some, they originated from animals given to the Sultan of Sulu in 1750 by the East India Company and then liberated in North Borneo (UNDP/FAO 1977; Olivier 1978; MacKinnon and MacKinnon 1986). But there is a brief reference to elephants in Brunei in the 16th century (Medway 1965), and fossil evidence of elephants in the Pleistocene (Hooijer 1972), and so it is possible that they may represent a relict population. The peculiar distribution of wild elephants today, limited entirely to the northeast part of the island, seems to lend support to the hypothesis that the animals might have escaped from captivity (Olivier 1978). But it can also be argued that elephant distribution in Borneo may be limited by the availability of mineral resources (J. Payne, pers. comm.).

The elephant in Kalimantan has had legal protection since 1931 (van der Zon 1979).

Elephant Distribution

In Kalimantan, elephants occur only in the upper Sembakung river in the Tindung district (Olivier 1978) (Fig. 1). Today its refuge seems to be the proposed Ulu Sembakung Nature Reserve in East Kalimantan. This area of about 5,000 km² is situated in the Kabupaten Bulungan and consists largely of forests that extend from the lowlands at 130 m to over 2,000 m. The area is rich in wildlife that includes the orangutan, sun bear, and possibly the Sumatran rhino.

The number of elephants in Ulu Sembakung is not known. In the neighbouring state of Sabah, the total population of elephants is estimated to be between 500 and 2,000 (M.P. Andau, pers. comm.).

Conservation Problems

The forests of Kalimantan contain some of the richest stands of commercially valuable timber species of the family Dipterocar-

paceae. These resources have been and are being exploited extensively. Of the total 425,000 km² of forests, 39% are under timber concessions, while a further 34% have already been applied for or are in the process of being surveyed for timber extraction (UNDP/FAO 1981).

In the Ulu Sembakung area, where the only known population of wild elephants occurs, logging goes on in the lowlands. Together with saw-milling, this has given rise to widespread pollution of the rivers.

The cause of much forest destruction is inappropriate agriculture, practised not so much by the traditional shifting cultivator as by the transmigrants settled in the area (Santiapillai et al. 1989).

Conservation Measures Taken

The Ulu Sembakung reserve has been proposed, but has not yet been officially gazetted. Apart from specific legal protection of the elephant, no other conservation measures have yet been taken on behalf of the species in Kalimantan.

Recommended Actions

- A survey should be carried out to establish the current range and number of elephants in the wild. Without this basic information, it will be difficult to manage the population.
- The Ulu Sembakung reserve, where elephants occur, should be gazetted and given full protection. The boundaries should be set so as to incorporate the Sembakung river into the reserve, and the area should be expanded by linking the reserve with the Kayan Mentarang reserve to the south. Such an extension would provide an area large and diverse enough to ensure the long-term survival of the elephant in Kalimantan (Santiapillai et al. 1989).
- The Ulu Sembakung/Kayan Mentarang reserves in Kalimantan should be linked with the Tabin Reserve in Sabah to create a protected area large enough to conserve a viable population of elephants in northeast Borneo.
- A management plan should be prepared for Ulu Sembakung, which should include provision for training and deployment of staff, and ensuring that local people are not alienated by lack of sensitivity to their needs.

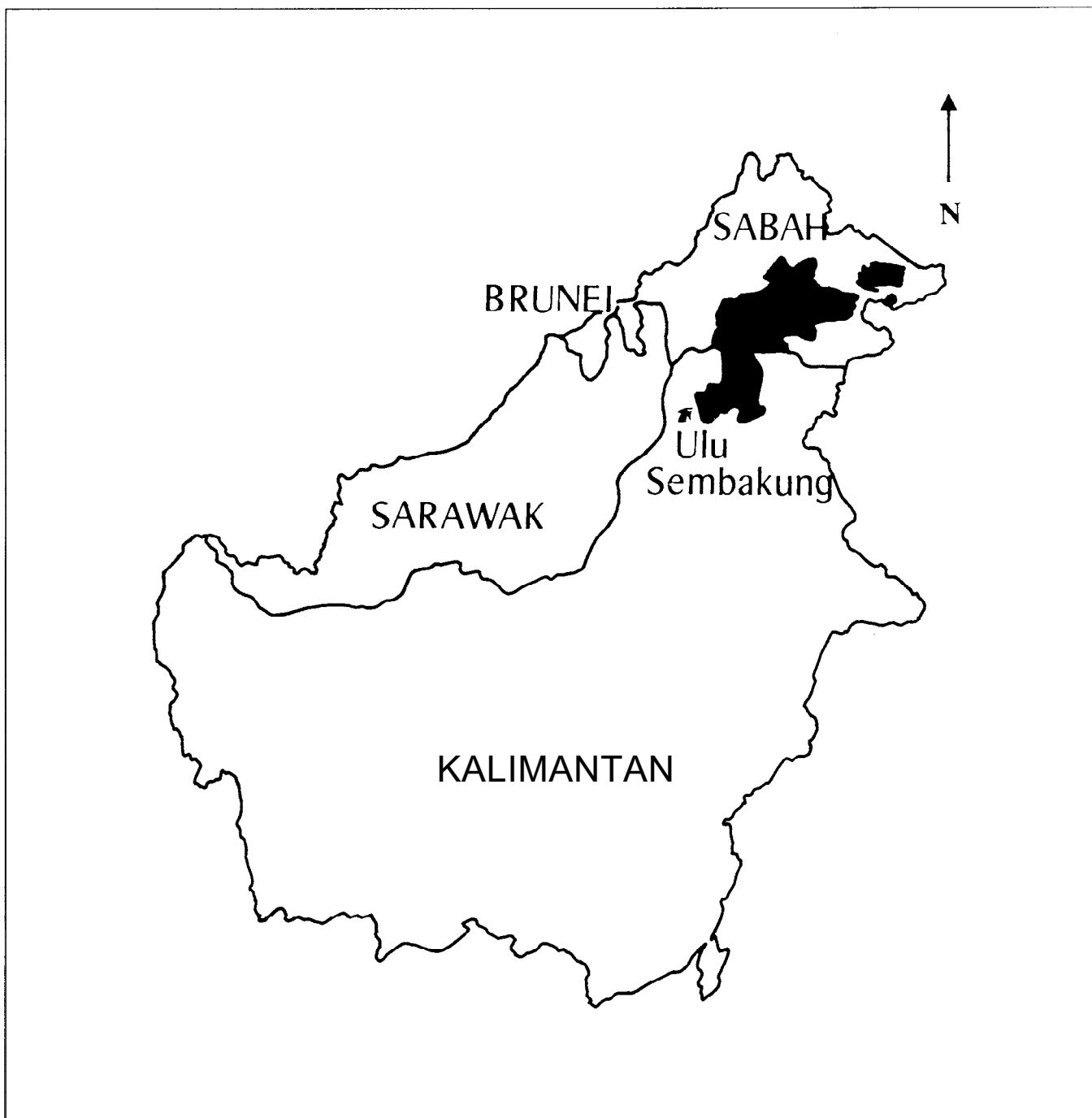


Figure 1. Elephant Distribution in Kalimantan (and neighbouring Sabah).

9. Indonesia: Sumatra

Area: 524,097 km²

Human population: 28,016,000 (1980)

Total forest: 302,080 km² (57.6%) (1983)

Status of Elephants in Sumatra

The Sumatran elephant (*Elephas maximus sumatranus*) is the smallest of the three subspecies of Asian elephant and is confined to the island. Prior to the large-scale destruction of its habitat, the elephant was widely distributed throughout Sumatra in a variety of ecosystems. It was found in primary forests at altitudes above 1,750 m in the Gunung Kerinci in West Sumatra (Frey-Wyssling 1933). However, its preferred habitats were always lowland forests. In the past, when the island had a more continuous forest cover than today, elephants made extensive migrations. These movements usually followed river courses where the canopy was broken, and included both hill forests as well as dipterocarp lowland forests. Elephants moved from the montane areas to the coastal lowland forests during the dry season and retreated into the hills once the rains came (van Heum 1929, Pieters 1938a). This strategy enabled the elephant to maintain relatively high numbers even in primary forests, where the absence of seasonal variation in rainfall and plant productivity usually results in very reduced biomass of terrestrial herbivores (Eisenberg 1980).

Poniran (1974) states that there must have been a large enough population of wild elephants in the northern province of Aceh in the 17th century to supply animals to the Aceh kings. The elephants were held in such a high esteem by the kings that in the event of an animal's death, its unfortunate mahout was ordered killed, stuffed inside the dead animal's stomach and thrown into the sea (van Heum 1929).

Substantial numbers of tuskers must have been present to provide ivory for export during the Dutch colonial period. Pieters (1938b) emphasised that during the many years he spent in Sumatra, he never once came across a male elephant without tusks. However, the ivory trade took a heavy toll of Sumatra's tuskers. Between 1879 and 1883, the average export of ivory from Sumatra per year was 1,000 kg.

In some areas in Sumatra elephants declined in number very rapidly. In Deli, near the city of Medan in the province of North Sumatra, elephants were numerous and their distribution extended to the coast in 1880, but by 1890 they were found only in the interior, and by 1929 they had been completely exterminated (van Heum 1929).

In an attempt to arrest this decline, the Sumatran elephant was given complete legal protection in 1931. This put an end to indiscriminate slaughter by trophy hunters. Today clear felling of forests for crops and human settlements is the main threat. The elephant is already threatened in Sumatra, and it is likely that its status will become even more precarious in the years to come.

Elephant Distribution

The elephant in Sumatra is discontinuously distributed in the eight provinces (Figs. 1 and 2). It occurs in discrete populations, 44 of which have been identified from surveys carried out by Blouch and Haryanto (1984) and Blouch and Simbolon (1985) under the WWF/IUCN Indonesia Programme, in collaboration with the Directorate General of Forest Protection and Nature Conservation (PHPA). Human population pressure and habitat loss have almost squeezed the animal out of two provinces, north Sumatra and west Sumatra. It is unlikely that the animal will survive for long in these two provinces, given the rapid pace of development.

The same factors are beginning to threaten the animal in other provinces. This situation is especially serious in Lampung, where, over the past two decades, forest cover has declined from 44% to 17% (Santiapillai and Widodo 1985), while the human population has increased from 1.6 to 4.6 million, largely due to the influx of settlers from the overcrowded islands of Java, Bali, and Madura (Scholz 1983). At the current annual rate of increase of 5.6%, the human population will double within 13 years.

Number of Elephants in the Wild

The dense and tangled vegetation of the tropical rain forest makes it difficult to arrive at even working estimates of elephant numbers, and so any assessment of the number of elephants in Sumatra is prone to underestimation. The first attempt at an estimate was by van Heum (1929), based on the amount of ivory exported from Sumatra. Van Heum estimated the total population at the turn of the century at 3,600, given an elephant density of one per 132 km². Blouch and Haryanto (1984) and Blouch and Simbolon (1985) estimated between 2,800 and 4,800 elephants in Sumatra (Table 1).

Between 35-40% of Sumatra's elephants occur in Riau province alone. The four southern provinces of Lampung, South Sumatra, Bengkulu, and Jambi account for between 40-50% of

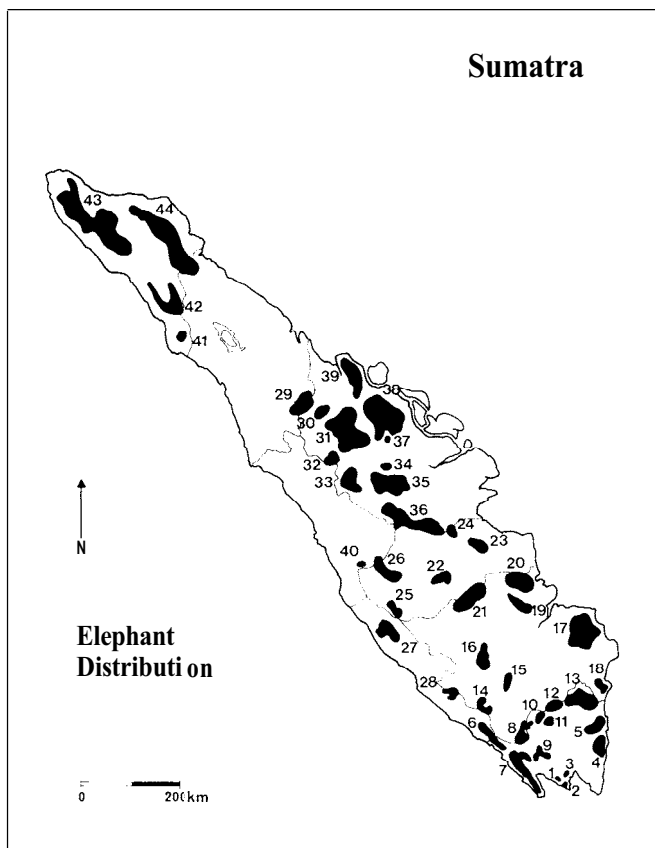


Figure 1. Elephant distribution in Sumatra. 1. Gunung Sulah. 2. Gunung Tanggang. 3. Gunung Betung. 4. Way Kambas. 5. Way Terusan. 6. North Barisan Selatan. 7. South Barisan Selatan. 8. Gunung **Raya**. 9. Gunung Rindingan. 10. Block 42. 11. Block 46. 12. Block 44. 13. Block 45 (Air Mesuji). 14. Tunggul **Buta**. 15. **Subanjeriji**. 16. Air Semangus. 17. Padang Sugihan. 18. Sungai **Pasir**. 19. Bentayan. 20. Air Medak. 21. Air Kepas. 22. **Intan Hepta**. 23. Mendahara **Ul**. 24. **Suban**. 25. Gunung Sumbing. 26. Batang Tebo. 27. Sungai Ipuh. 28. Bukit **Hitam**. 29. Torgamba. 30. **Tanjung Medan**. 31. North Central Riau. 32. Koto **Panjang**. 33. **Lipat Kain**. 34. Langgam. 35. South Central Riau. 36. Southern Riau. 37. Buntan. 38. Siak **Kecil**. 39. Lower Rokkan. 40. Sinkinjang. 41. Singkil. 42. Western Gunung Leuser. 43. Western **Aceh**. 44. Eastern **Aceh**. Source: Blouch and Haryanto 1984; Blouch and **Simbolon** 1985.

the total. The remainder occur largely in the province of **Aceh**. The relative sizes of the 44 populations are illustrated in Fig. 2. Of the 44 populations, 30% have less than 50 animals; 36% have between 50-100 animals; 25% have between 100-200 animals; and 9% have more than 200 animals.

Although to some extent these estimates depend on extrapolation from one area to another, they are nevertheless invaluable in setting up conservation priorities in Sumatra. Recommendations for long-term conservation of any species do not always require a precise quantification of the populations. Certain management decisions can be made only if the trends in population levels are known.

Elephants in captivity

When Sumatra was ruled by kings and sultans, there must have been a substantial number of elephants in captivity, as they were

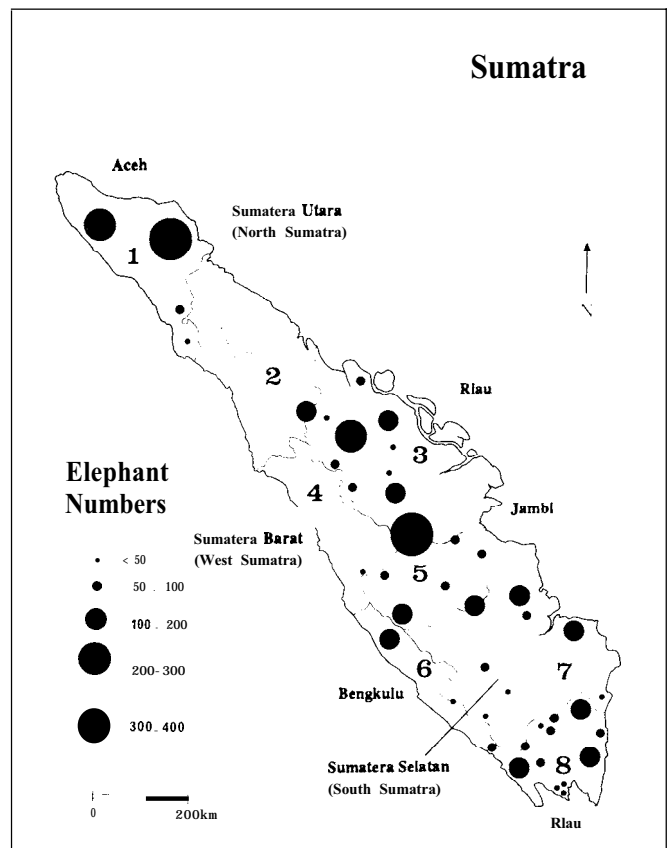


Figure 2. Relative size of elephant populations in Sumatra.

used in warfare and for ceremonial purposes. According to Van Heum (1929), calves were caught by killing their mothers. Trained elephants were also used in the capture of wild ones. With the decline of the sultans and the ascendancy of the Dutch colonial power, the capture and domestication of elephants died out.

The art has now been revived with the help of experienced Thai mahouts and their elephants. The first Elephant Training Centre was established near the Way Kambas Game Reserve (now a National Park) in 1986. Since then, two more have been established at Kreung Pase in **Aceh** Province and Sebang in Riau Province. By 1989 there were more than 50 elephants at the three centres.

Conservation Problems

An analysis of the conservation problems facing each of the 44 elephant populations is given in Table 2. The general nature of these problems is discussed below.

Forest conversion

A number of factors, both natural as well as man-made, continue to threaten the tropical rain forest habitats of the elephant in Sumatra. Forest fires, human resettlement, logging, agricultural expansion, shifting cultivation, and road building are some of the more common agents of forest destruction and frag-

Table 1. Elephants in Sumatra.

Province	Minimum	Maximum
Aceh	600	850
North Sumatra	a few	a few
Riau	1,100	1,700
West Sumatra	a few	a few
Jambi	200	500
Bengkulu	100	200
South Sumatra	250	650
Lampung	550	900
Total	>2,800	>4,800

Source: Blouch and **Haryanto (1984)**, Blouch and Simbolon (1985).

mentation. As a result, elephants are being confined to ever-shrinking habitats. In extreme cases, they have become pocketed and are prone to extinction (Terborgh 1974).

The most critical issue that confronts the long-term survival prospects of the elephant in Sumatra, however, is the current rate of growth of the human population. At the current rate, spurred by resettlement of people from crowded Java and Bali, Sumatra too will be over-crowded in a generation. As a result of the huge transmigration programme, conversion of forest for agriculture and settlement is the basic problem in elephant conservation in Sumatra.

In north Sumatra, a combination of high human population and the clearance of enormous tracts of forest for oil palm, rubber, and coconut plantations has virtually eliminated elephants.

In the mountainous province of west Sumatra too, competition for land has led to the near extinction of the animal.

Lampung has experienced some of the worst elephant problems because of rapid forest conversion.

In **Aceh**, almost all lowland forests under 1,500 m have been allocated for timber production (Blouch and Simbolon 1985). Elephants are being forced to move out of their preferred habitats in the lowlands to the more rugged and less attractive montane forests, from which they periodically return to raid crops.

The situation in Riau is even worse. Although about 3540% of Sumatra's elephants occur in this province, the areas designated for nature conservation are "woefully inadequate" (Blouch and Simbolon 1985). Unlike in **Aceh**, the elephants have no mountainous retreats in Riau when development programmes constrict their habitats. Being an oil-producing province, Riau is developing fast. Construction of roads and pipelines has fragmented the forests and isolated elephant populations. They provide easy access for illegal settlers, shifting cultivators, and poachers. Riau was also scheduled to receive 58,555 transmigrant families during the period 1984-1989, while there are plans to expand the existing oil palm plantations from 340 km² to 4,200 km² (Blouch and Simbolon 1985). One of the largest reserves, the Kerumutan Nature Reserve (1,200 km²), although once thought to have had elephants (UNDP/FAO 1982), does

not seem to have any today, as it lacks appropriate habitats (Blouch and Simbolon 1985).

Plantations

An area of 2,250 km² is under oil palm in Sumatra, while rubber plantations occupy 2,280 km² (Scholz 1983). Oil palm is very vulnerable to raids by elephants, and, in Sumatra, estates in the vicinity of elephant habitats have experienced constant depredation. Oil palm and rubber estates have greatly reduced the life-support systems of elephants in Sumatra. This is especially evident in the so-called "estate belt" of northeast Sumatra—an area of about 17,000 km². This belt, 370 km long and 45 km wide, extends from the town of Langsa in **Aceh** province in the north, through the eastern half of North Sumatra south to the Barumun river close to the border of Riau in the south (Scholz 1983).

Forests are still cleared to make way for oil palm plantations in Riau. In the long run, existing lowland forests should be far more valuable than oil palm plantations.

Transmigration

In an effort to relieve population pressure on the overcrowded islands of Java, Madura, and Bali, at least 2.5 million people have been resettled in the "outer islands" of Sumatra, **Kalimantan**, **Sulawesi**, and **Irian Jaya**, and the movement of 65 million additional people is planned for the next 20 years (Colchester 1986). In addition to government-assisted settlers, twice as many unassisted people reach these outer islands in search of a better life.

Figure 3 shows existing and planned areas for settlement of transmigrants in Sumatra. At least 26 areas of elephant-human conflict have been identified (Fig. 4), but the number is likely to grow once the scheduled programmes are completed, and a further 37 new areas of potential conflict are therefore predicted (Fig. 5).

The southern province of Lampung has been the target of most of the pioneers. Today 80% of the 4.6 million people in Lampung are migrants. Conflicts between elephants and settlers occur in six areas.

Logging

The tropical rain forests of Sumatra contain a very high proportion of commercially valuable timber species of the family Dipterocarpaceae. On average, these forests contain as much as 200 m³/ha of commercial-size trees (GOI/IIED 1985). In Sumatra, timber production means harvesting old growth timber from natural forests. The Department of Forestry has laid down strict limits on the exploitation of commercial species, stipulating a minimum diameter of 50 cm diameter at breast height (dbh) and a cutting cycle of 35 years, leaving more than 25 trees per ha of commercial species of 20 cm dbh or greater (GOI/IIED 1985). Commercially valuable dipterocarps, such as *Shorea* spp., take about 70 years to attain 60-70 cm dbh.

As long as timber extraction is carried out selectively and within strict limits, it can enhance the carrying capacity for elephants. Crude density of elephants in logged-over forests can be twice that in primary forests (Olivier 1978). In practice,

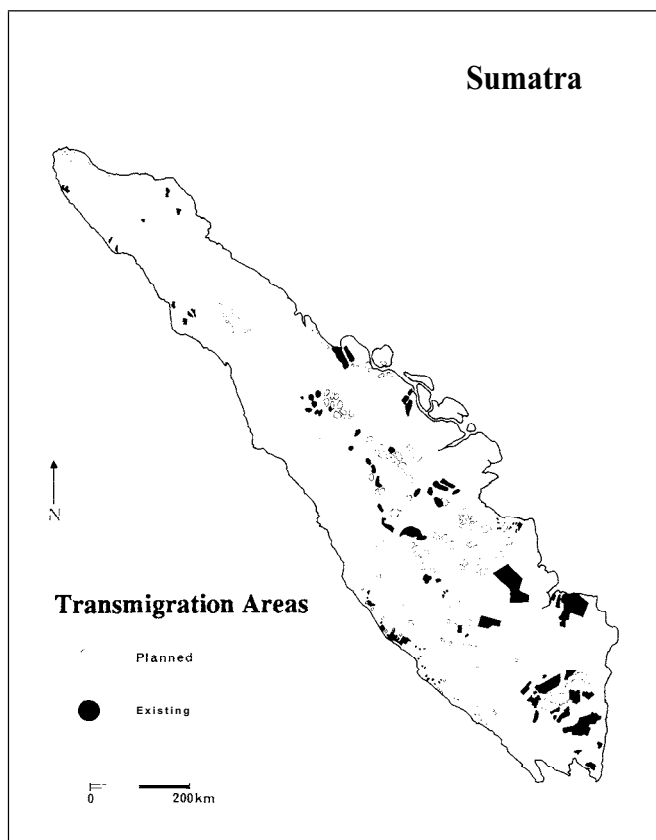


Figure 3. Location of existing and planned transmigration areas in Sumatra. Source: Blouch and Haryanto (1984); Blouch and Simbdon (1985).

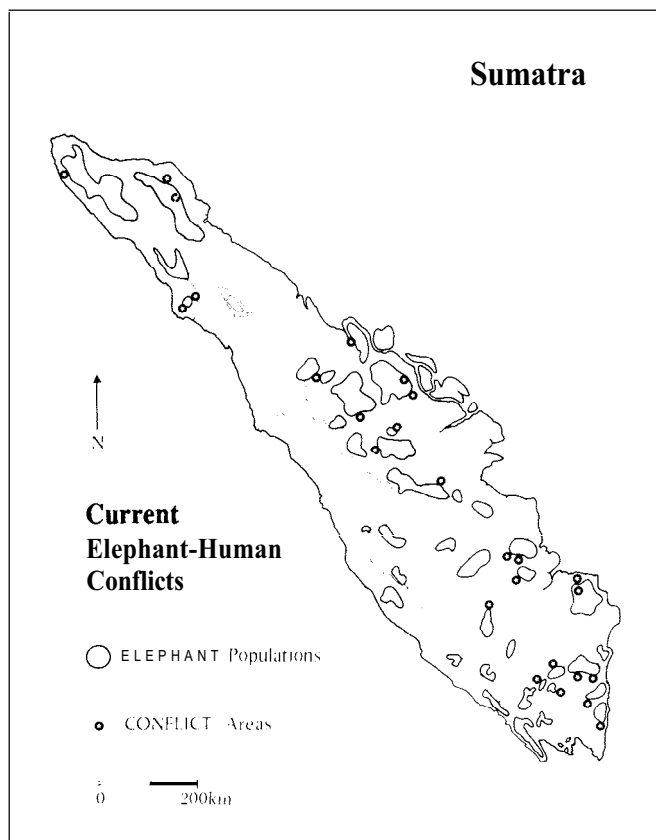


Figure 4. Areas of current conflict between elephants and people in Sumatra.

however, logging companies often cut trees well below the official limit of 50 cm dbh. Selective logging in Indonesia entails the removal of up to 20 trees/ha which can cause up to 40% damage to the residual stand (Kartawinata et al. 1981). Furthermore, elephants may not have any escape routes to move from a disturbed area to a mature forest, which may be some distance away from the logged area. The maintenance of unlogged strips along water courses to link logging areas with mature forests would be a practical solution to the problem (Shelton 1985).

Shifting cultivation

Shifting cultivators are generally blamed for much of the forest destruction in Indonesia. According to Myers (1980), they have been a major contributory factor to the loss of 15,000 km² of forest each year. However, much of the damage to the forests is caused by the new settlers rather than by the traditional shifting cultivators, who, in the past, operated on a sufficiently long rotation to allow good forest regeneration. The new settlers clear forest for crops, but, after two or three rapid rotations, the declining fertility of the soil and poor yields force them to move elsewhere. The land is taken over by *Imperata cylindrica* or “alang alang”, which is a coarse weed extremely difficult to eradicate once established, and which is unpalatable to most wild animals, including elephants. Sumatra accounts for the

greatest area of such damaged land in Indonesia (GOI/IED 1985).

Protection of Elephant Reserves

The protected areas such as Protection Forests, National Parks, Nature Reserves, Game Reserves, and Hunting Reserves that have elephants are listed in Table 3. This list was prepared from the data published by UNDP/FAO (1982). It is quite probable that some of these areas may no longer harbour elephants. For instance, according to UNDP/FAO (1982), the Kerumutan Baru Nature Reserve (1,200 km²) in Riau had elephants when the survey was carried out, but later surveys by Blouch and Simbolon (1985) indicated that elephants were no longer there.

Altogether, 44 elephant populations are known in Sumatra (Fig. 1). A summary of their conservation problems is given in Table 3.

The 28 protected areas from which elephants have been recorded cover 48,448 km² (Table 3). Not all these areas, however, represent prime elephant habitat. About 65% of the areas are mountainous and so are unlikely to support high elephant numbers. The home ranges of at least 17 of the 44 populations (Fig. 6) are within these protected areas, and they account for a maximum of 2,500 animals. The actual numbers may be much less. Hence, the existing protected areas, even assuming that their stability remains assured, would protect no

Table 2. An analysis of conservation problems facing elephant populations in Sumatra.

No.	Elephant population	Conservation problems	Recommended Actions
1.	Gunung Sulah	minor crop raids	monitor
2.	Gunung Tan Gunungang	minor crop raids	monitor
3.	Gunung Netung	minor crop raids	monitor
4.	Way Kambas	frequent crop raids	electric fencing
5.	Way Terusan	habitat fragmentation	control logging
6.	North Barisan	lowland forest loss	protection of habitat
7.	South Barisan	encroachment	protection of habitat
8.	Gunung Raya	encroachment	protection of habitat
9.	Gunung Rindingan	illegal logging	stop logging
10.	Block 42	crop raids/TM	control logging/MUF
11.	Block 46	crop raids/TM	control logging/MUF
12.	Block 44	crop raids/TM	control logging/MUF
13.	Block 45	fragmentation/TM	control logging/MUF
14.	Tunggal Duta	minor crop raids	monitor
15.	Subanjeriji	degraded habitat	upgrade and research
16.	Air Semangus	shifting cultivation	stop cultivation
17.	Air sugihan	timber loss/TM	protection and corridor
18.	sungai Pasir	fragmentation	capture/domesticate
19.	Bentayan	illegal logging	stop logging
20.	Air Medak	illegal logging/TM	stop logging
21.	Air Kapas	illegal logging/TM	stop logging
22.	Intan Hepta	logging/TM	MUF
23.	Mendahara Ulu	TM	stopped
24.	Suban	-	-
25.	Gunung Sumbing	settlers	relocate settlers
26.	Batang Tebo	-	
27.	Sungai Ipoh	-	monitor
28.	Bukit Hitam		monitor
29.	Torgamba	forest conversion	MUF
30.	Tanjung Medan	TM/habitat loss	capture/domesticate
31.	N.Central Riau	TM/habitat loss	MUF
32.	Koto Panjang	river development	establish reserve
33.	Lipat Kain		monitor
34.	Langgam	pocketed herd	capture/domesticate
35.	S. Central Riau	TM planned	stop planned TM
36.	Southern Riau	plantations	protect reserve
37.	Buantan	pocketed herd	capture/domesticate
38.	Siak Kecil	settlers	redraw boundary
39.	Lower Rokan	TM	stop shifting cultivation
40.	Sikinjang	coffee plantations	improve habitat
41.	Singkil	transmigration	capture/domes ticate
42.	Gunung Leuser W.	-	-
43.	Western Aceh	lowland forest loss	establish reserve
44.	Eastern Aceh	rubber plantations	electric fencing

TM = Transmigration

MUF = Multiple Use Forestry

Source: Blouch and Haryanto (1984), Blouch and Simbolon (1985)

more than 2,500 elephants. This might seem to be a reasonable number to conserve, but it is small for the size of Sumatra. Sri Lanka, which is one seventh the size of Sumatra, has about the same number of elephants in the wild.

The remaining 27 elephant populations out of the 44 inhabit production forests, which should be managed so that wildlife conservation is compatible with sustainable timber harvesting. Herein lies the key to the long-term survival of the elephant in Sumatra. Viable populations of elephants can be maintained within multiple-use forestry reserves.

Against this, one must look at the economic cost of maintaining the protected areas. Unless these areas are well protected, many will amount to little more than "paper parks". If the staff requirement in national parks of one man to 50 **km²** (as suggested by Parker 1984) is adhered to, the effective policing of the 28 protected areas listed in Table 2 would call for 968 men. At U.S. \$1,200 per head (a modest amount compared to the U.S. \$8,000 recommended for Africa by R.H.V. Bell in Parker 1984), the total investment amounts to U.S. **\$1,161,600**, which should be found in the budget of the Directorate General of

Table 3. Protected areas in Sumatra (present and proposed) with elephants.

Protected area (Province)	Status	Area (km ²)	Altitude (m)
1. Gunung Leuser (Aceh/N. Sumatra)	NP	9,464	100-3,149
2. Singkil Barat (Aceh)	PNR	650	0
3. Jantho (Aceh)	PNR	80	500-1,500
4. Gunung Selawah Agam (Aceh)	PF/PNR	120	600-1,762
5. Padang Lawas (N. Sumatra)	PHR	687	80-167
6. Sekundur and Langkat (N. Sumatra)	GR	2,139	100-3,021
7. Dolok Sembelin (N. Sumatra)	PF/PNR	339	150-1,604
8. Kerinci-Seblat (W. and S. Sumatra, Jambi , and Bengkulu)	NP	14,846	100-3,800
9. Bukit Sebelah and Batang Pangan (W. Sumatra)	PF/PNR	228	600-1,078
10. Bajang Air Tarusan (W. Sumatra)	PF/PNR	818	500-2,000
11. Kambang/Lubuk Niur (W Sumatra)	PF	1,000	500-2,726
12. Bukit Kembang Bukit Baling-Baling (Riau)	PNR	1,460	ZOO-1,090
13. Seberida (Riau)	PNR	1,200	0-20
14. Peranap (Riau)	PNR	1,200	120-492
15. Siak Kecil (Riau)	PGR	1,000	0-20
16. Air Sawan (Riau)	PGR	1,400	100-176
17. Bukit Tapan (Jambi)	NR	665	1,000-2,576
18. Gumai Pasemah (S. Sumatra)	GR	458	200-1,776
19. Gunung Raya (S. Sumatra)	GR	395	300-2,232
20. Rawa Hulu Rakitan (S. Sumatra)	GR	2,134	300-2,384
21. Bentayan (S. Sumatra)	GR	193	20-40
22. Subanjeriji (S. Sumatra)	HR	650	60-250
23. Padang Sugihan (S. Sumatra)	GR	750	0-20
24. Barisan Selatan (Lampung/Bengkulu/S. Sumatra)	NP	3,568	0-1,967
25. Bukit Gedang Seblat (Beng)	GR	487	300-2,363
26. Bukit Kayu Embun (Beng)	GR	1,060	200-2,447
27. Way Kambas (Lampung)	GR	1,235	0-50
28. Gunung Betung (Lampung)	PF	222	200-1,682
Total		48,448	

NP = National Park; PF = Protection Forest; PNR = Proposed **Nature** Reserve; NR = Nature Reserve; GR = Game Reserve; PGR = Proposed Game Reserve; HR = Hunting Reserve; PHR = Proposed Hunting Reserve

Source: **UNDP/FAO** (1982)

Forest Protection and Nature Conservation (PHPA). International organisations could play an important role here, for, if the necessary money and manpower are not available, it is unlikely that the recommendations given in this action plan will be implemented.

Assessing Conservation Priorities

It might appear that the number of protected areas (Table 3) taken in conjunction with the production forests is adequate to ensure the survival of a substantial number of elephants in Sumatra. However, the protection and management of these areas depends very much on the availability of trained PHPA personnel and adequate financial resources, both of which are

more often than not insufficient. As a result, there is a wide discrepancy in the degree of protection each area receives. Given the limited financial resources of the PHPA, it would be naive to expect that all these protected areas will get the level of funding they merit. Therefore, a system of priorities must be established.

Ranking of Elephant Populations

The joint meeting of the IUCN/SSC African Elephant and African Rhino Specialist Groups in 1981 developed a system for the quantitative assessment in relation to criteria for conservation action (Cumming and Jackson 1984), which is used here as the basis for the ranking of Sumatran elephant populations.

The criteria used are:

1. Biological importance, based on a) the genetic rarity of the species, b) its size, c) and the conservation significance of the area.
2. Conservation status, based on a) security of the area, b) administration and law enforcement, c) political climate, d) status of the habitat, e) pressures on the land, and f) threat from poachers.
3. National and economic importance, based on a) economic values that conflict with wildlife use, b) national conservation importance and investment, and c) tourism potential.

The scores range from 0-5 (except in the size of the populations, for which the scores range from 1-8).

Biological importance is the major criterion (Cumming and Jackson 1984). The individual scores for the three criteria for the 44 populations of elephant in Sumatra are given in Tables 4 to 7. When financial resources are limited, conservation action should be **focused** on maintaining the status of the populations/areas that score high in biological importance and conservation status, and/or improving the conservation status of those of high biological importance.

Table 4 underlines the high biological importance of the elephant populations in Way Kambas Game Reserve, Barisan Selatan National Park, and the Air Mesuji production forest in Lampung. It is significant that the Air Mesuji elephant popu-



Sumatran elephants in Way Kambas Game Reserve (Photo by Charles Santiapillai/WWF).

lation (85-125 in number), comes high in biological importance, despite current conflicts with transmigrants in this area. The lowland dipterocarp forests in northern Lampung, where this population is found, represent some of the best elephant habitat in Sumatra (crude density estimate of 0.47/km² is about the highest known in Sumatra) and should, therefore, be given high priority. The situation here is complex, and multiple-use management of Air Mesuji production forest might provide a way out of the current dilemma (Santiapillai and Widodo 1987).

In South Sumatra, the three most outstanding populations are those at Padang Sugihan, Air Medak, and Bentayan (Table 5). The population consists of 232 elephants that were driven into it from a transmigration project to the north in 1982 (Blouch and Haryanto 1984). The carrying capacity of the Padang Sugihan Game Reserve appears to be high, with a crude density estimate of 0.32/km² (Nash and Nash 1985). The habitat of the Air Medak population is a mixture of production forests comprising swamps, peat swamps, and lowland dipterocarps. A part of the forest scheduled for conversion has already been cleared and settled by transmigrants (Blouch and Haryanto 1984). The 193 km² Bentayan Game Reserve represents another high-quality elephant habitat. The elephant population is under severe pressure due to expanding human settlements. The biological importance of the population is enhanced by the fact that it occurs in "the only legally protected stand of undisturbed lowland dipterocarp forest on well-drained soil in southern Sumatra" (Blouch and Haryanto 1984).

The Gunung Sumbing and Bukit Hitam elephant populations in Jambi and Bengkulu respectively (Table 6) rank high in both biological importance and conservation status. The Bukit Hitam elephants are a part of the Kerinci-Seblat population, but they are threatened by the activities of over a thousand settlers who are "in the centre of the most important elephant habitat within the park" (Blouch and Haryanto 1984). The protection forests in which these elephants live are being encroached by coffee plantations.

Eight populations from Riau and Aceh rank high in biological importance (Table 7). These are north-central Riau, Koto Panjang, south-central Riau, southern Riau, Siak Kecil, western Gunung Leuser, western Aceh, and eastern Aceh. The existing reserves are inadequate to protect the number of elephants that

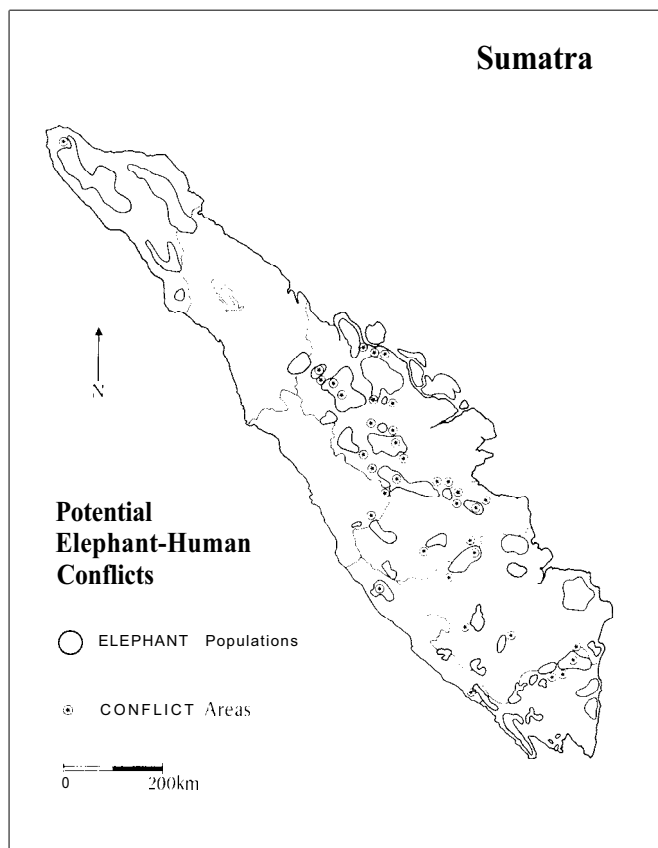


Figure 5. Areas of potential conflict between elephants and people in Sumatra.

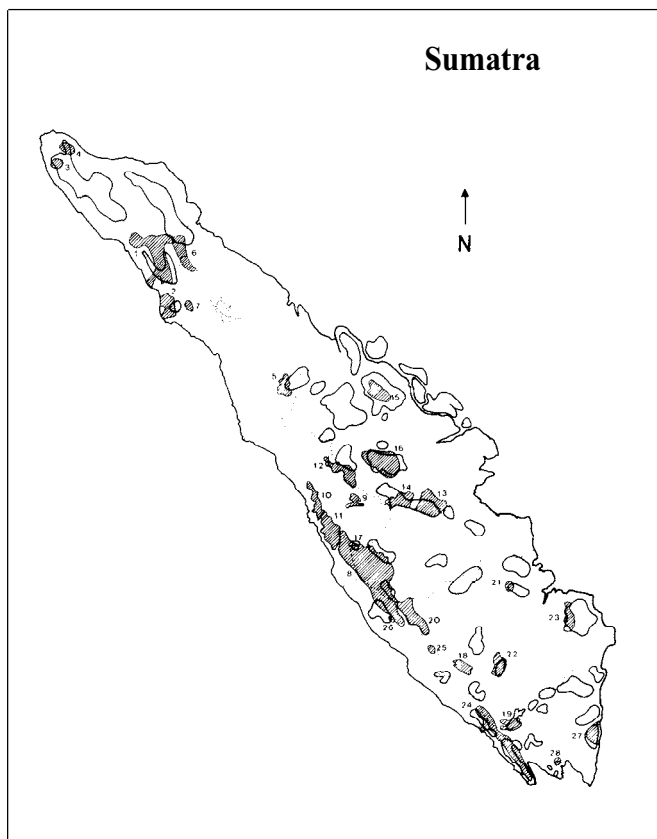


Figure 6. Protected areas (shaded) in Sumatra and the distribution of elephant populations. 1. Gunung Leuser. 2. Singkil Barat. 3. Jantho. 4. Gunung Selawah Agam. 5. Padang Lawas. 6. Sekundur and Langkat. 7. Dolok Sembelin. 8. Kerinci-Seblat. 9. Bukit Sebelah and Batang Pangan. 10. Banjang Air Tarusan. 11. Kambang/Lubuk Niur. 12. Bukit Kembang Bukit Baling-Baling. 13. Seberida. 14. Peranap. 15. Siak Kecil. 16. Air Sawan. 17. Bukit Tapan. 18. Gumai Pasemah. 19. Gunung Raya. 20. Rawa Hulu Rakitan. 21. Bentayan. 22. Subanjeriji. 23. Padang Suglhan. 24. Barisan Selatan. 25. Bukit Gedang Seblat. 26. Bukit Kayu Embun. 27. Way Kambas. 28. Gunung Betung. Note: According to R. Blouch (pers. comm.) the status of some of these areas has still to be resolved by PHPA, e.g. 2, 4, and 5 were not recognized as reserves; 13, 14, and 16 were at one time production forests. They were proposed in the UNDP/FAO 1982 report as candidates for future reserves.

occur in Riau province (Blouch and Simbolon 1985). Being an oil producing province, the survival of the elephants here is likely to be determined more by social and economic rather than ecological factors.

Ranking of Protected Areas

The system of ranking protected areas was developed along the lines suggested for Africa by Parker (1984). The 28 protected areas are ranked in an order of priority in Table 8. Seven criteria were considered in establishing the priorities. They are:

1. General faunal value (FAU);
2. General floral value (FLO);
3. Capital investment on the area (INV);
4. Administrative efficiency (ADM);

5. Stability (STA);

6. Demographic threat (DEM) where absence of high growth rate in the human population coupled with room for expansion scores over high human growth and chronic shortage of land;

7. Economic potential of the area (ECO).

Scoring was based on scale of 1-10. High faunal value is a measure of the species richness of the area, but it should not be inferred that areas which are given moderate or low scores are unimportant. The lowest score of 19 was that of the small proposed nature reserve Jantho with an area of only 80 km² in Aceh, yet, despite its score, it is good elephant habitat, although too small to support a viable population. The rank can be raised by enhancing administrative efficiency, capital investment, and tourism potential, or by reducing the demographic threat.

Given the limited financial resources available for nature conservation in Indonesia, it is important that they are used to maintain the status of prime areas that score high (Table 8). These include important conservation areas, such as the Gunung Leuser National Park, Way Kambas Game Reserve, Kerinci-Seblat National Park, Barisan Selatan National Park, etc. These areas are also of outstanding importance to other large mammals, including, apart from the elephant, the Sumatran rhinoceros (*Dicerorhinus sumatrensis*), the Sumatran tiger (*Panthera tigris sumatrae*) and the clouded leopard (*Neofelis nebulosa*). These areas require relatively fewer inputs to maintain or improve their status than the others and so should be given a high priority in Indonesia's National Conservation Strategy.

It must be emphasised that the ranking of protected areas is only a general guide to their relative significance. Inevitably, the ratings are somewhat specialised as they are made with the elephant in mind. Therefore, the system does not include areas such as Berbak Game Reserve (1,900 km²) in Jambi and the Kerumutan Nature Reserve (1,200 km²) in Riau where elephants have not been reported.



One-month old calf in Way Kambas Game Reserve, Sumatra (Photo by Alain Compost).

Table 4. Scores for Biological Values, Conservation Status, and National and Economic Importance, for Sumatran elephant in the province of Lampung. Total scores for each category (axis) are given under columns B, C, and E. The grand total is given under column GT.

No.	Locality	Biol.	Conservation	Economic	Totals			GT
		1 2 3	1 2 3 4 5 6	1 2 3	B	C	E	
1.	Mt. Sulah	4 1 2	1 0 3 2 1 5	5 3 1	7	12	9	28
2.	Mt. Tanggung	4 1 2	1 0 3 2 3 4	5 3 1	7	13	9	29
3.	Mt. Betung	4 1 2	2 0 3 4 2 5	5 3 3	7	16	11	34
4.	Way Kambas GR	4 4 3	3 4 5 5 3 5	5 2 5	11	25	12	48
5.	Way Terusan	4 2 3	1 1 3 1 2 4	4 2 1	9	12	7	28
6.	North Barisan Selatan N.P.	4 2 5	2 1 3 5 3 5	5 4 3	11	19	12	42
7.	South Barisan Selatan N.P.	4 4 5	2 2 3 4 2 4	5 4 3	13	17	12	42
8.	Gunung Raya	4 2 3	1 1 3 3 3 5	5 2 1	9	16	8	33
9.	Mt. Rindingan	4 2 3	1 1 3 4 2 4	5 4 1	9	15	10	34
10.	Block 42	4 1 2	0 1 3 1 1 4	4 2 1	7	10	7	24
11.	Block 46	4 2 2	0 1 3 2 1 4	4 2 1	8	11	7	26
12.	Block 44	4 2 2	0 1 3 1 1 4	4 2 1	8	10	7	25
13.	Air Mesuji	4 4 3	1 1 3 1 1 4	5 3 1	11	11	9	31

Table 5. Scores for Biological Values, Conservation Status, and National and Economic Importance, for Sumatran elephant in the province of South Sumatra. Total scores for each category (axis) are given under columns B, C, and E. The grand total is given under column GT.

No.	Locality	Biol.	Conservation	Economic	Totals			GT
		1 2 3	1 2 3 4 5 6	1 2 3	B	C	E	
14.	Tunggul Buta	4 1 1	0 1 3 2 2 4	4 4 1	6	12	9	27
15.	Subanjeriji	4 1 1	0 0 3 1 1 4	4 1 1	6	9	6	21
16.	Air Semangus	4 2 2	1 1 3 1 1 4	4 2 1	8	11	7	26
17.	Air sugihan	4 6 3	2 4 3 4 3 4	5 3 5	13	20	13	46
18.	Sungai Pasir	4 1 2	1 1 3 2 3 4	4 1 1	7	14	6	27
19.	Bentayan	4 2 4	1 2 3 4 3 5	5 5 3	10	18	13	41
20.	Air Medak	4 4 4	2 2 3 4 2 5	5 4 3	12	18	12	42
21.	Air Kapas	4 4 2	0 2 3 1 1 4	5 2 1	10	11	8	29

Table 6. Scores for Biological Values, Conservation Status, and National and Economic importance, for Sumatran elephant in the provinces of Jambi and Bengkulu. Total scores for each category (axis) are given under columns B, C, and E. The grand total is given under column GT.

No.	Locality	Biol.	Conservation	Economic	Totals			GT
		1 2 3	1 2 3 4 5 6	1 2 3	B	C	E	
22.	Intan Mepta	4 2 3	1 2 3 3 1 1	5 5 3	9	11	13	33
23.	Mendahara Ulu	4 2 3	0 1 3 2 2 1	5 2 1	9	9	8	26
24.	Suban	4 2 3	0 1 3 2 2 4	5 2 1	9	12	8	29
25.	Mt. Sumbing	4 4 4	3 3 3 5 3 4	5 5 3	12	21	13	46
26.	Batang Tebo	4 2 4	2 3 3 4 3 4	5 4 1	10	19	10	39
27.	Sungai Ipuh	4 4 3	2 1 3 4 2 1	5 4 1	11	13	10	34
28.	Bukit Hitam	4 2 4	2 1 3 5 3 4	5 5 1	10	18	11	39

Table 7. Scores for Biological Values, Conservation Status, and National and Economic Importance, for Sumatran elephant in the provinces of Aceh, Riau, and West Sumatra. Total scores for each category (axis) are given under columns B, C, and E. The grand total is given under column GT.

No.	Locality	Biol.	Conservation	Economic	Totals	GT
		1 2 3	1 2 3 4 5 6	1 2 3	B C E	
29.	Torgamba	4 4 1	0 0 3 1 1 2	4 2 1	9 7 7	23
30.	Tanjung Medan	4 1 1	1 0 3 1 1 2	4 2 1	6 8 7	21
31.	North Central Riau	4 6 1	1 1 3 1 1 2	4 4 1	11 9 9	29
32.	Kota Panjang	4 2 2	3 1 3 5 3 5	5 4 5	8 20 14	42
33.	Lipat Kain	4 2 1	3 1 3 5 4 1	5 4 3	7 17 12	36
34.	Langgam	4 1 1	0 0 3 1 1 4	4 1 1	6 9 6	21
35.	South Central Riau	4 4 3	3 1 3 5 3 4	5 5 3	11 19 13	43
36.	South Riau	4 6 4	3 1 3 5 3 1	5 4 3	14 16 12	42
37.	Buatan	4 1 1	0 0 3 1 2 2	4 1 1	6 8 6	20
38.	Siak Kecil	4 4 3	1 0 3 2 3 5	5 2 1	11 14 8	33
39.	Lower Roken	4 2 3	2 1 3 3 3 5	4 2 1	9 17 7	33
40.	Sikinjang	4 1 1	1 1 3 1 3 5	5 5 1	6 14 11	31
41.	Singkil	4 1 2	1 1 3 1 2 4	4 5 1	7 12 10	29
42.	West Gunung Leuser	4 2 5	2 3 3 3 2 4	5 5 5	11 17 15	43
43.	Western Aceh	4 6 5	2 3 3 5 3 4	5 5 3	15 20 13	48
44.	Eastern Aceh	4 6 5	2 3 3 4 3 1	5 5 3	15 16 13	44

Table 8. Priority ratings of protected areas where elephants are likely to occur.

No.	Protected Area	FAU	FLO	INV	ADM	STA	DEM	ECO	SCORE
1.	Gunung Leuser	10	09	08	05	06	05	08	51
2.	Way Kambas	09	06	08	07	08	03	09	50
3.	Kerinci-Seblat	10	10	07	04	08	05	06	50
4.	Barisan Selatan	10	09	08	05	05	04	07	48
5.	Sekundur & Langkat	10	09	04	06	06	04	07	46
6.	Gumai Pasemah	09	09	04	03	05	05	06	41
7.	Padang Sugihan	08	06	04	05	05	04	08	40
8.	Bukit Kayu Embun	10	09	04	01	05	05	04	38
9.	Bukit Gedang Seblat	10	09	04	01	05	05	04	38
10.	Dolak Sembelin	10	06	02	01	06	05	08	38
11.	Rawa Hulu Rakitan	09	06	04	04	05	04	05	37
12.	Bukit Kambang Bkt BB	10	07	02	01	06	06	05	37
13.	Kambang/Lubuk Niur	10	08	01	01	06	06	04	36
14.	Bentayan	08	10	04	04	05	02	02	35
15.	Gunung Raya	09	08	04	03	05	04	02	35
16.	Padang Lawas	09	05	02	01	06	05	07	35
17.	Singkil Barat	10	07	02	01	06	05	04	35
18.	Siak Kecil	10	06	02	03	03	03	06	33
19.	Bukit Tapan	08	07	05	01	04	04	03	32
20.	Bajang Air Tarusan	10	07	02	01	04	03	02	29
21.	Gunung Selawah Agam	08	07	02	01	05	03	03	29
22.	Subanjeriji	07	04	03	01	05	04	01	25
23.	Bukit Sebelah	08	05	02	01	04	02	03	25
24.	Seberida	09	06	02	01	02	02	02	24
25.	Gunung Betung	05	06	01	01	02	04	04	23
26.	Air Sawan	09	05	02	01	02	02	01	22
27.	Peranap	09	04	02	01	02	02	01	21
28.	Jantho	08	05	02	01	01	01	01	19

FAU=General faunal value; FLO=General floral value; DEV=Capital investment; ADM=Administrative efficiency; STA=Stability; DEM=Demographic threat; ECO=Economic potential.



Trained elephants and their mahouts in Sumatra (Photo by Alain Compost).

Recommended Actions

- Sumatra's elephants are facing extensive loss of habitat as a result of the settlement of people from Java, Bali, and Madura. This is resulting in considerable conflict over crop depredation. Extensive elephant habitats need to be conserved and locations for settlements carefully chosen in order to limit the conflicts.
- National policies should be aimed at sustainable utilization and conservation of production forests and their genetic resources. The economic and environmental aspects of forest development are not necessarily in conflict and can be kept in balance in the production forests. The logging cycle should never be less than 50 years. Forests within a logging concession should be cut in a checkerboard pattern (Shelton 1985). For example, in a forest reserve managed on a 50-year rotation, a block amounting to one fiftieth of the reserve could be logged each year. If alternate blocks were left unlogged until the second 25 years, there would always be at least 25 blocks of 25 to 49 year-old logged forest distributed evenly throughout the reserve. These blocks would be adjacent to more recently logged blocks, which would thus have a nearby refuge and source of seeds and animal colonizers. Such a system provides the best opportunity for the management and conservation of elephant outside the protected areas in Sumatra.
- A large proportion of the elephant's geographic distribution in Sumatra coincides with the chain of volcanic mountains (the Bukit Barisan) along the west coast (Fig. 1). These forests should be conserved, as they are vital not only as habitats for elephants, but also as the watersheds and water catchment areas which determine the yield and quality of water supplies for much of Sumatra.
- Vigilance should be maintained to ensure that ivory poaching does not become a threat to elephants in Sumatra. Although not a problem at present, it could become a problem if demand increased.

- Highest priority should be given to the conservation of the most important sites: Gunung Leuser, Way Kambas, Kerinci-Seblat, Barisan-Selatan, Sekundur, and Langkat. The proposed Kerinci-Seblat National Park should be gazetted as a matter of urgency.

- New reserves should be established in the following areas:

Aceh: There are an estimated 200-300 elephants in seven groups in western Aceh. A new reserve should be established around Jantho, which lies in a block of 1,200 km² of protection forest. This block is surrounded by production forests, 600 km² of which have not been given over to timber concessions. The new reserve (1,800 km²) would not only benefit the elephant, but also the highly-endangered Sumatran rhino.

Riau: Two areas are proposed as elephant reserves. The first is the Tigapulu hills, near the Riau/Jambi border; and the planned Koto Panjang hydroelectric dam on the Kampar Kanan river west of Pakenbaru (capital of the province). There are an estimated 300-400 elephants in Riau around the Riau/Jambi border. Two nature reserves, Seberida (1,200 km²), and Peranap (1,200 km²), have been proposed. The Tigapulu hills nearby, which are under 700 m and are floristically quite distinct from any other region of Sumatra, should be made a nature reserve and be connected by a corridor to the more extensive (2,000 km²) production forest known as IFA Forest. The second area concerns the planned Koto Panjang hydroelectric scheme, which would create a 124 km² reservoir. This would form the basis for an ideal reserve for the 50-100 elephants found there. The new reserve should be created along the Riau/west Sumatra border on the west, covering about 700 km² of good elephant habitat.

- Other important areas in need of appropriate conservation measures are Air Mesuji, Padang Sugihan, Air Medak, Bentayan, Gunung Sumding, north-central Riau, south-central Riau, Siak Kecil, and eastern Aceh. In Air Masuji, for instance, the multi-use approach should be continued with the aim of reducing conflict between elephants and transmigrant people.
- Electric fencing is urgently required along the southern boundary of the Way Kambas Game Reserve in Lampung Province to resolve elephant-human conflicts.
- A forest corridor should be maintained to link the eastern Aceh and Sikundur elephant populations. A similar forest corridor is recommended to link the Padang Sugihan Game Reserve and the Lebong Hitam production forest in south Sumatra.

Conclusion

In planning conservation of the elephant in Sumatra, the primary aim must be the maintenance of as much unfragmented habitat as is practicable on a long-term basis as both strictly-protected and multi-purpose forest. Provided good feeding conditions and cover are maintained over substantial areas,

elephants should be able to survive even outside protected areas. If the elephant populations become **too** fragmented and restricted to reserves, they will all be too small for long-term viability. There would **also** be a huge increase in conflict between people and elephants. The sound management of production forests in areas between the reserves so that elephants can survive there is, therefore, of fundamental importance in Sumatra.

Pocketed elephants have no long-term viability. They can be maintained by constructing barriers to keep them out of cultivated areas, but such measures are invariably expensive and in the long-term, unsatisfactory. The animals should be removed. However, there is limited scope for translocating them to forests elsewhere. The best answer is to capture such doomed animals for domestication and training. Trained elephants can be used in patrolling the reserves, in transporting visitors within the reserves, and in logging.

The PHPA has achieved considerable success in its efforts to capture and train marauding elephants in Sumatra. It has established an Elephant Training Centre in Lampung, where, with the assistance of the mahouts from Thailand, a number of Indonesians have been trained in the art of domesticating and training elephants in captivity. Trained elephants would be invaluable in extracting timber from the swamp forests in

Sumatra, where logs must be transported over long distances, often over soil conditions where no vehicle can operate. Large timber concessions currently haul logs from such swampy areas along narrow gauge railways. Among local loggers, operating individually, timber extraction is done entirely by manual **labour**. Elephants are strong, intelligent, and well-adapted to moving through difficult terrain, and they utilize the natural vegetation of swamp forests, rather than fossil fuels, for energy. These advantages give the animals great potential to increase the efficiency of logging in swamp forests. Furthermore, unlike heavy machinery, they do not cause serious damage to the environment and have no need for spare parts.

Elephants can be managed in Sumatra, but not entirely within the existing protected areas. A more realistic approach would be the establishment of buffer zones of suitable width along the periphery of the protected areas, and multiple use of forest reserves, where both non-disruptive resource **harvesting** and sustainable-yield timber **production** can be carried out in parallel with elephant conservation. Finally, given this **back-ground**, the overwhelming emphasis in conservation policy must be to maintain forest cover over large areas uninterrupted by human settlements and roads, where remoteness, difficulty of terrain, and density of cover provide natural protection for the elephant.

10. Laos

Area: 235,700 km²

Human population: 3900,000 (mid- 1989 est.)

Total forest: 136,360 km² (57.8%)

Status of the Elephant in Laos

Given its earlier reputation of being the “Land of a Million Elephants”, Laos must have had a substantial elephant population both in the wild and in captivity in former times. Just as in neighbouring Thailand and Burma, the elephant played a significant role in religion and other aspects of culture. It is still of great economic importance in the timber industry. Viable populations of elephant still occur throughout the country and so the animal is not in imminent danger of extinction (Sayer 1983a). The most serious current threat is poaching for ivory.

Elephant Distribution

There has never been a systematic survey to determine the distribution of the elephant in Laos. Limited information available from site visits and interviews with the local people and Forest Department personnel suggests a wide but fragmented distribution (Fig. 1.). Elephants are particularly widely distributed in the south where there is still substantial forest cover (Sayer 1983a). In the north, where human land-use (particularly shifting cultivation) has been most intensive, elephants now occur only around Hong Sa, where they are said to be numerous (Sayer 1983a). Significant populations of elephant still occur in Sayaboury Province (west of the Mekong River); in Vientiane Province (**Phou Khao, Khouly Massif**); and in Balikhamsay and Khammouane Provinces, primarily on the Nakai Plateau along the border with Vietnam (Sayer 1983a, b).

Number of Elephants in the Wild

The number of wild elephants in Laos is currently estimated to be in the order of **2,000-3,000** (Venevongphet 1988). The largest number-estimated to be more than half of the total population-occur in the south, below about 16°N latitude. Large numbers are also believed to occur in scattered locations across central Laos-perhaps 400-500 west of the Mekong River in Sayaboury Province; 200-300 in the Phou Khao Khouay area; and 150-300 on the Nakai Plateau. It is **empha-**

sized that these numbers are not based on survey data and should be taken as an indication only.

Number of Elephants in Captivity

Domestic elephants have long been a feature of life in Laos, and, until recent **mechanisation**, have been the backbone of the country's timber industry (Gullmark 1986, Devitt and Sayer 1987). A recent compilation by Venevongphet (1988) puts the number of domestic elephants at 1,332, of which the largest number (about 800) are in Sayaboury province. About 500 of these are employed in timber extraction and transport (Sayer 1983b). There are small numbers of trained elephants in Champassak and other provinces in the south, while a few are still used in Vientiane and Luang Prabang (Sayer 1983b).

Elephants are still captured from the wild, often in pit-traps, for the timber industry.

Conservation Problems

In Laos, as elsewhere in southeast Asia, the riverine grasslands considered to be favoured habitat of elephants have long since been converted to permanent (mainly wet rice) cultivation.

Extensive areas of forest were disturbed by bombing during the Indochina war of the 1960s and 1970s, but the net effect on elephant populations is unknown. At present an estimated 1,000-2,000 km² of closed forest are being converted to grasslands, bamboo forests, and savannahs as a result of shifting cultivation, logging, and uncontrolled fires (FAO/UNDP 1981; LaoPDR Government unpubl. data) but, again, there are no data on the effects of this habitat change on elephant populations.

Matters of most immediate concern are the widespread ownership of large calibre firearms (many remaining from the Indochina war) within the country; the lack of effective controls on hunting; and the ease with which ivory and other wildlife products can be moved across the Mekong River into Thailand, the major market. There are reports of elephants being poached for ivory.

To date, Laos has no protected areas, although this problem is currently being addressed.

Protection of wildlife habitat and enforcement of hunting and trade regulations will, for the foreseeable future, be constrained by poor infrastructure development and lack of trained

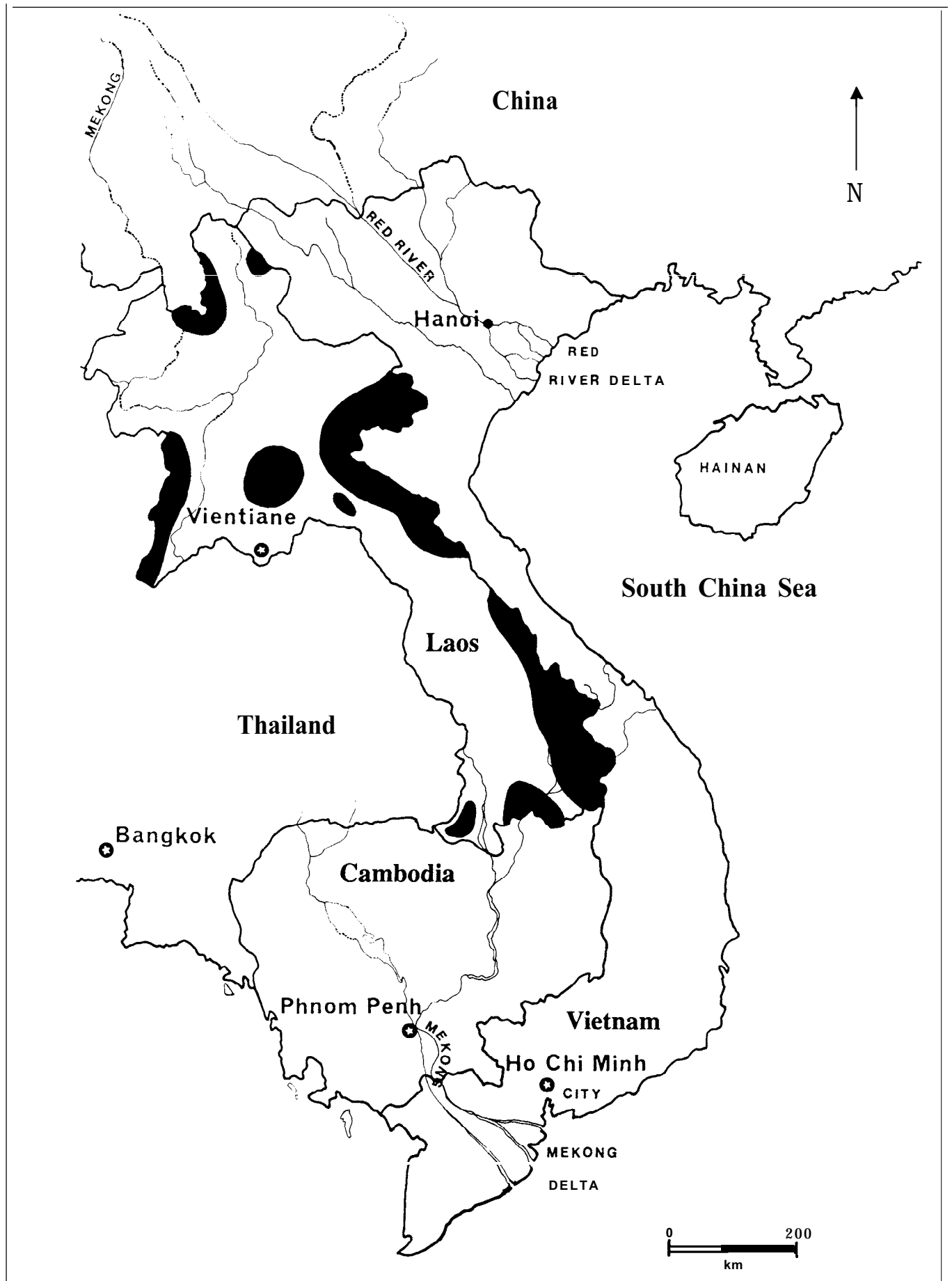


Figure 1. Distribution of elephants in Laos.

staff and equipment. Although several international donors are involved in the forestry sector, and the national and provincial governments are actively pursuing conservation objectives, it will take some time before these major problems are overcome.

Conservation Measures Taken

Under the French colonial administration, there were some efforts to control hunting. In 1939, for example, the whole of central and southern Laos was declared a hunting reserve (Sayer 1983a).

In 1983, the Lao PDR Government created the National Office for Protection of the **Environment**, which deals primarily with watershed management issues, and the Wildlife and Fishery Conservation Division (DWFC), which deals with wildlife and protected areas. Trade in wild elephants (alive or dead) was banned by decree of the central government in 1986 (Lao PDR 1986), and elephants are included on a list of species for which a hunting ban is now being considered (B. Phanthanvong pers. comm.).

A recent review of various proposals for establishment of protected areas identified 13 high priority and 16 moderate priority sites (Salter and Phanthanvong 1989), many of which may support wild elephants. Field surveys of these areas are now being conducted.

Recommended Actions

- Surveys should be carried out to determine the distribution and abundance of elephants throughout Laos and to identify viable elephant populations.
- Laos's conservation efforts are only just starting, and all measures will need to be coupled with extensive training programmes in wildlife and protected area management.
- A network of reserves should be established encompassing the diversity of ecosystems and wild species. Areas containing elephants could potentially be managed as national parks, wildlife sanctuaries, or Managed Elephant Reserves (**MER**).
- Captive breeding of elephants should be developed in order to reduce the need for capture from the wild for the timber industry. Training, handling, and veterinary care of captive elephants should be improved.
- The ban on trade in wild elephants, and proposed hunting restrictions should be enforced.
- Laos should become a Party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to curb trade in ivory.

11. Malaysia: Peninsular Malaysia

Mohd Khan bin Momin Khan

Area: 13 1,587 km²

Human population: 16,063,000 (mid-1989 est.)

Total forest: 75,780 km² (57.6%)

Status of the Elephant in Peninsular Malaysia

Large numbers of elephant were found in Peninsular Malaysia until the colonial era introduced firearms and large-scale conversion of forests to other land uses. The establishment of rubber and oil palm plantations brought the elephant into direct conflict with people. It was considered a pest by planters and was shot in large numbers, particularly during the first quarter of the 20th century (Olivier 1978). The elephant is now a protected species in Peninsular Malaysia.

Elephant Distribution

In the 19th century the elephant occurred throughout Peninsular Malaysia. According to Flower (1900), they were common everywhere except Penang and Singapore. At the turn of the century, it was the provinces of **Pahang** and **Negri Sembilan** that held the most elephants in the wild, and **Perak** and **Selangor** the fewest.

Today, wild elephants are found in small, scattered groups in nine provinces—**Johor**, **Kedah**, **Kelantan**, **Negri Sembilan**, **Pahang**, **Perak**, **Perlis**, **Selangor**, **Trengganu**. They are absent only from **Melaka** and **Penang** (Fig. 1). The retreat of elephants followed the opening up of forests for monoculture plantations, and by the first quarter of the 20th century, elephants had become rare or absent along the western coast. In **Perak**, indiscriminate killing of elephants to safeguard oil palm plantations caused a decline in numbers and the pocketing of the remaining herds in small patches of forests.

The future of wild elephants outside protected areas does not seem to be assured, given the country's rapid development and the desire to increase substantially its human population.

Number of Elephants in the Wild

There is considerable confusion about the number of elephants in Peninsular Malaysia. This is not surprising given the difficult terrain in which the animals are found, where dense and tangled vegetation makes observation difficult. The first attempt to

estimate the number of wild elephants was by Lord Medway (1966), who calculated the number in 1965 to be 681 on the basis of the records kept by the Game Department. The most recent estimate (Table 1) by Khan (1987) is 824 (range 800–1,000).

Conservation Problems

The crux of conservation problems in Peninsular Malaysia is the rapid exploitation of the land's rich but dwindling forest resources. Since independence in 1957, the pace of forest clearance for agriculture has been both rapid and sustained. Now that Indonesia and the Philippines have set quotas for the number of trees that can be cut down each year, Malaysia has become the biggest source of timber for Japan. It is feared that by the middle of the 1990s the production of logs will decline.

Forest clearance for agriculture and timber exploitation have led to some of the worst environmental problems in Malaysia, such as habitat destruction, soil erosion, siltation of rivers, and pollution.

The federal government has very little power over the states in agriculture, forestry, land, and water. For example, in early 1977, the **Pahang** state government granted logging concessions in its section of the core area of the proposed **Endau-Rompin** National Park (Aiken and Leigh 1984). It is therefore clear that any conservation area must have the support of the state in which it is located.

The presence of a large number of firearms is another conservation problem in that they lead invariably to an escalation in poaching. In Malaysia, illegal possession of firearms is a serious offence and it carries a death sentence, but the number of people having legally registered firearms is substantial.

Corruption among law enforcement officials is another problem (Khan et al. 1982).

As the area of forest land converted to oil palm and rubber plantations increased, so did the incidence of elephant-human confrontation and conflict. In Peninsular Malaysia, the area set aside for oil palm plantations increased from only 540 km² in 1960 to more than 16,000 km² in 1987.

Although a number of reserves have been proposed in Peninsular Malaysia, many are still to be approved.

Competition for the peninsular's dwindling natural resources is certain to intensify in the coming years, leading to even greater pressures on areas set aside for conservation.

Peninsular Malaysia

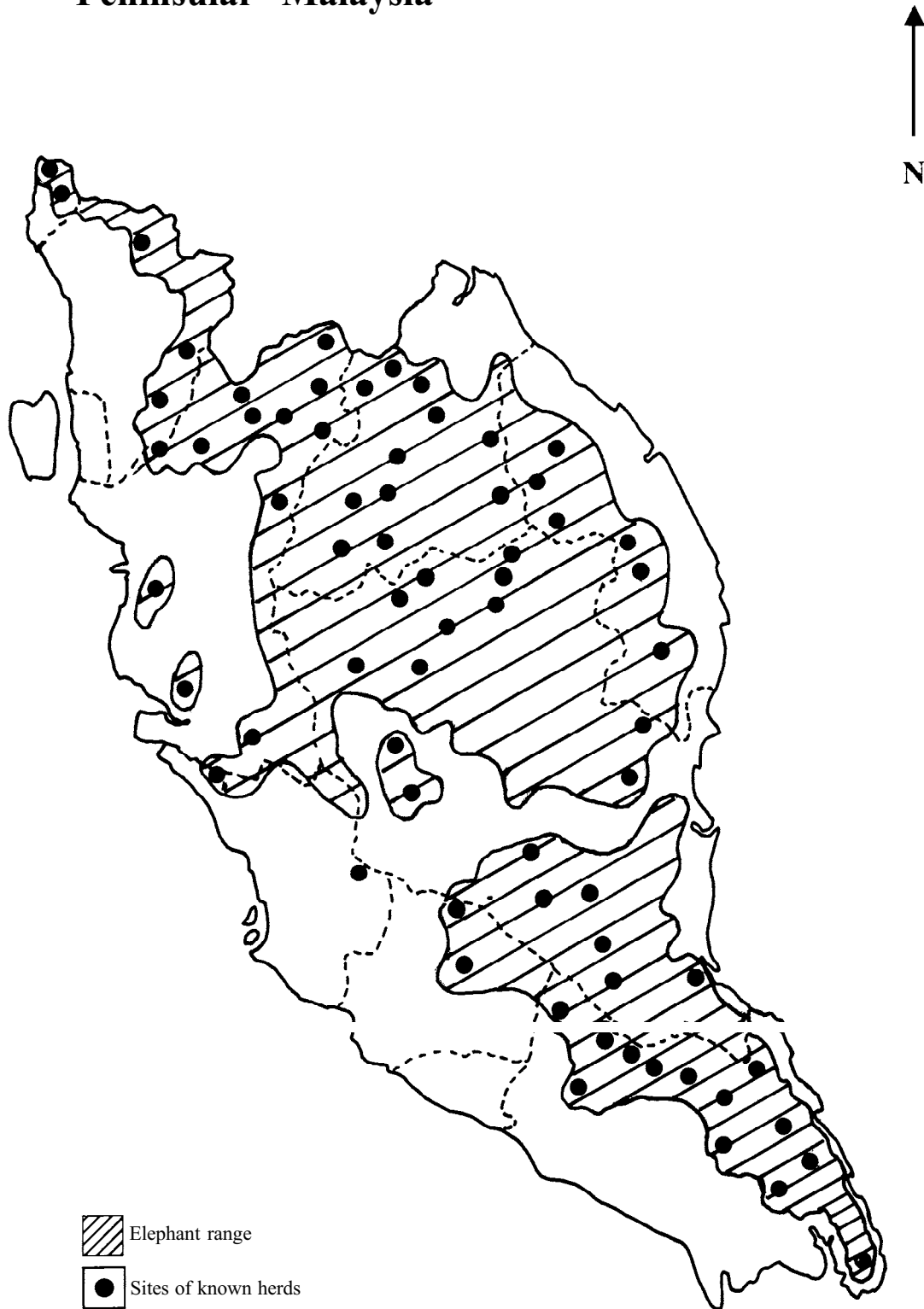


Figure 1. Distribution of elephants in Peninsular Malaysia.

Conservation Measures Taken

In the past, the traditional solution to elephant depredation was the elimination of the animal. This led to the deaths of large numbers of elephants. Between 1967 and 1977, the Game Department shot 120 elephants (Khan 1981). However, the Department of Wildlife and National Parks has since introduced new methods of translocating crop-raiding elephants to secure conservation areas, and has also employed other methods, such as the use of ditches, trenches, and electric fences, to reduce elephant depredation.

The Federal Government passed the Protection of Wildlife Act in 1972, which provides for the establishment of conservation areas, such as wildlife reserves and wildlife sanctuaries. The National Parks Act (1984) provides a legal framework for the creation and management of National Parks (Aiken and Leigh 1985).

The Fourth Malaysia Plan (FMP) for 1981-1985 allocated M \$13,000,000 (about U.S. \$5,000,000) for wildlife management and conservation programmes, but this was not adequate, given the complexity of the problems faced during the five years. In the Fifth Malaysia Plan M \$30,700,000 was approved for the development of conservation projects.

Concerted efforts by concerned citizens and organizations thwarted the proposal to log the core area of Endau-Rompin. A similar action by the people stopped the Government from building a dam in 1982 across the Tembeling river, thus preventing the flooding of a large area of the lowland forests in Taman Negara National Park (Aiken and Leigh 1983).

Malaysia became a party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1978.

Recommended Actions

Peninsular Malaysia retains an important elephant population despite intensive development of its forests. With considerable local expertise in conservation management and elephant handling available, the future of the herds can be assured, provided support is given at the highest levels of the Federal and State Governments.

- Land-use policies should ensure the conservation of viable areas of lowland forest, which are the principle wildlife

Table 1. The number of wild-elephants in Peninsular Malaysia.

State	Elephant numbers	Percentage
Perlis	6	0.7
Kedah	44	5.3
Perak	152	18.4
Selangor	6	0.7
Negri Sembilan	13	1.6
Pahang	203	24.6
Trengganu	37	4.5
Kelantan	269	32.6
Johor	94	11.4
Penang	0	0.0
Malacca	0	0.0
Total	824	100.0

source: Khan 1987

habitats. In particular, the **Taman Negara** National Park needs continued protection, and the proposed Endau Rompin National Park should be gazetted.

- Expansion of plantation industries should be consistent with maintaining the integrity of elephant habitats. Forest clearance for plantations should not be sanctioned without a study of the implications for Malaysia's wildlife resources.
- Malaysia's elephants should be managed as a single meta-population, with periodic translocations of bulls between populations to ensure genetic exchange.
- Effective measures should be taken to reduce elephant depredation on oil palm and rubber plantations and on human settlements and agriculture. The techniques employed already by the Department of Wildlife and National Parks should be utilised more widely.
- New reserves need to be established, especially in the states of Kelantan, **Pahang**, Perak, and Johor, where most elephants are found. Surveys should be carried out to identify the most important locations.

12. Malaysia: Sabah

Mahedi Andau and Junaidi Payne

Area: 80,520 km²

Human population: 1640,000 (mid- 1989 est.)

Total forest: 49,970 km² (62.1%)

Status of the Elephant in Sabah

Probably more than half of Sabah's elephants live outside protected areas. This is because Sabah has a small human population, and only part of the land suitable for permanent agriculture has been cleared. About 30% of Sabah's land area is considered suitable for permanent agriculture, such as oil palm and cocoa, yet less than 10% is actually in use. Forest clearance for agricultural plantations continues, however, and almost all clearance since 1980 has been, and in the future will be, habitat used by elephants. Killing of elephants, usually as a result of conflict with agriculture, continues both legally by wildlife staff and illegally by others, but on a small scale. Loss of habitat poses a much greater threat to the species than direct killing.

Elephant Distribution

Wild elephants occur in Borneo only in the extreme northeast (Fig. 1). Their origin is obscure. The very limited distribution has led to speculation that the species is not native to Borneo and that existing wild elephants are descendants of imported captive individuals imported some hundreds of years ago (Payne et al. 1985). They could have originated from tame elephants given to the Sultan of Sulu by the British East India Company in 1750, while there is a single report of captive individuals in Brunei in the 16th century (Medway 1965). On the other hand, Pleistocene fossils have been found, which suggest that today's elephants could be a relict population. The distribution appears to have been highly restricted for a very long time, and to cover barely 40,000 km², but the actual area inhabited by elephants must be considerably less. The range of elephants in Borneo has expanded only slightly during the past 100 years, despite free access to apparently suitable habitat elsewhere. Soils in Borneo tend to be young, leached, and infertile, and it has been speculated that elephant distribution in Sabah may be limited by distribution of natural mineral sources (Davies and Payne 1982). Unfortunately, no studies to investigate this hypothesis have been done, but the potential implications for conservation are important. Reserves for elephants may need to contain adequate natural mineral sources if they are to fulfill their function; reserve size alone may not be the critical factor. On



An elephant herd at night in Sabah (Photo by Junaidi Payne/WWF).

the other hand, reserves of adequate size could assume increased importance for elephant conservation if artificial salt licks are supplied and maintained at suitable localities.

Number of Elephants in the Wild

The total number of elephants in Sabah has been estimated to be at least 500, based on the location of known herds, and a maximum of 2,000, based on likely highest population density within known range (Davies and Payne 1982). Although the range of the species appears to have extended somewhat to the north during the 1980s, there has been a net loss of elephant habitat since that time, and numbers are expected to decrease in the foreseeable future.

Elephants in Captivity

There are no elephants from Borneo in captivity anywhere in the world.

Conservation Problems

There are two major elephant conservation problems in Sabah: first, saving those elephants displaced by habitat loss; and second, ensuring that the two conservation areas—Tabin Wildlife Reserve (about 1,220 km²) and a contiguous chain of commercial Forest Reserves (totalling about 16,670 km²)—continue to enjoy adequate protection.

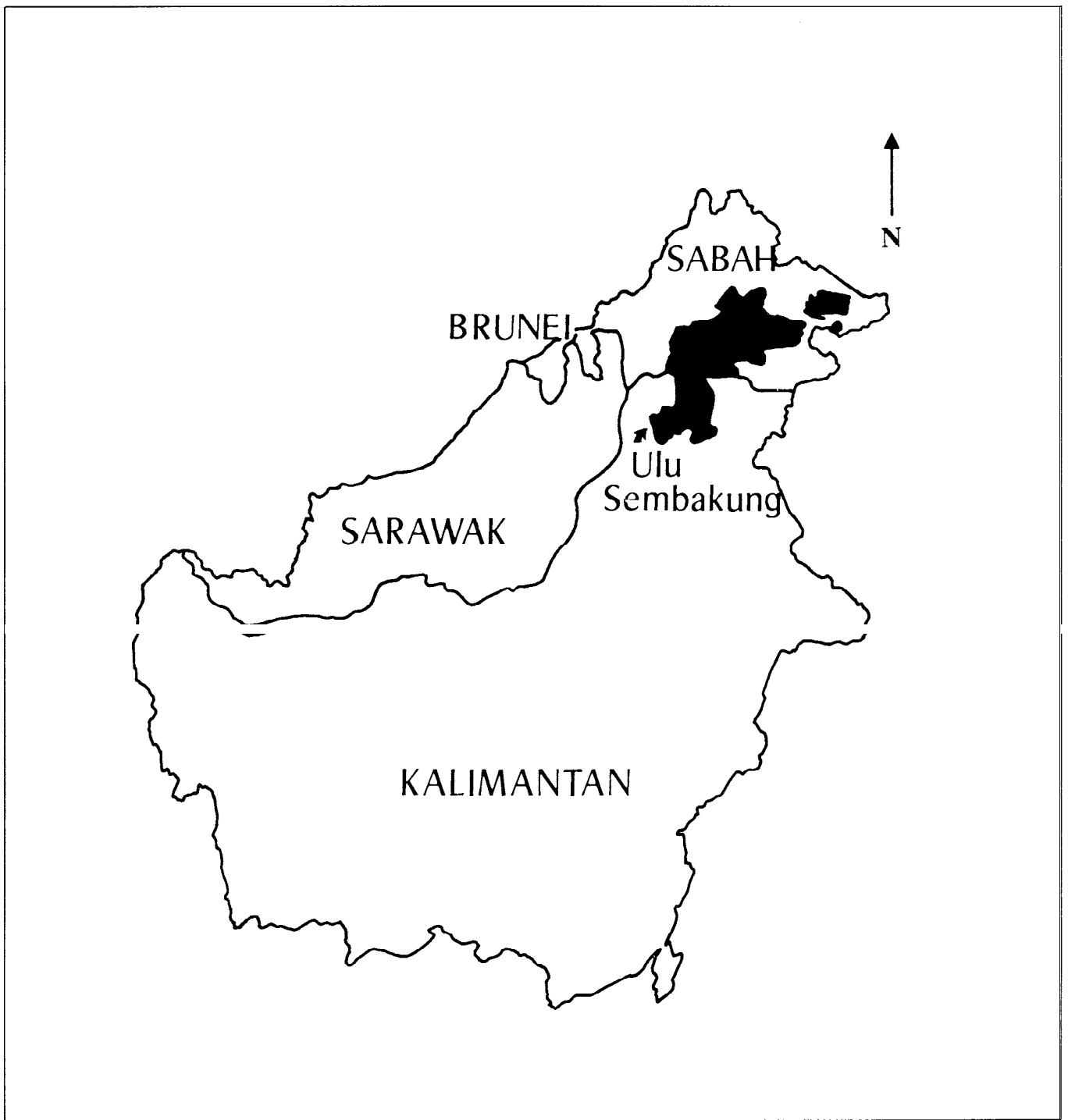


Figure 1. Distribution of elephants in Sabah (Malaysia) (and neighbouring Kalimantan).

In practice, there may be nothing that can realistically be done to save displaced elephants. Although the government has often been advised to “catch the elephants and put them in the National Park” (referring to Sabah’s mountainous Kinabalu Park, which could not support elephants), or “on an island”, it is suspected that the gaps in Sabah’s elephant distribution may reflect the inability of elephants to survive as breeding populations in some regions. In any case, with a field staff of less than

30 men and only two university graduates to cover all mammal, bird, and reptile conservation and management issues in Sabah, elephant translocation is too massive a project to contemplate. But it is encouraging to note that some elephants appear to be moving to the north of their previous range, away from plantations and into commercially logged forest. Electrified fencing is successfully keeping elephants out of many new plantations surrounded by logged forest (Andau and Payne 1986). Even

though the future elephant population will be smaller than it is now, it appears that some herds and individuals are able to shift their range after habitat loss.

The second conservation problem is ultimately far more critical to elephant survival. About 50% of **Tabin** Wildlife Reserve could support agricultural plantations, as could scattered parts of the commercial forest reserves. Prime elephant habitat is usually also good agricultural land. In the future, pressure may mount to excise the more fertile parts of both conservation areas for agriculture. Assuming that Sabah wishes to retain herds of wild elephants, such pressure can only be resisted by demonstrating that viable elephant populations must have certain minimum areas of habitat for their long-term survival.

It may be counter-productive in the long term to translocate problem elephants in all cases. This can only serve to support lobbies which wish to convert all lowland forests to plantations. It may be advisable to monitor any future translocation projects and point out weaknesses and real costs. This could help to strengthen the case for conserving large lowland reserves as a means of reducing elephant damage in adjacent plantations.

Conservation Measures Taken

Tabin Wildlife Reserve and the large area of commercial forest reserves containing elephants were gazetted in 1984. Remaining elephant habitat in Sabah has been allocated for agriculture and there is little chance of obtaining more large contiguous areas adequate for elephant conservation.

So as to minimise conflict between elephants and agriculture, the wildlife section of Sabah's Ministry of Tourism and Environmental Development (formerly the Wildlife Section of the State Forest Department) has been recommending that new

agricultural plantations in regions inhabited by elephants install electrified fencing. A questionnaire survey in 1986 distributed to plantations which had installed such fencing showed that, in most cases, the cost of installing and maintaining electrified fencing was less than the likely elephant damage that would be incurred in the absence of such fencing (Andau and Payne 1986).

Recommended Actions

- Sabah shares with Indonesian Kalimantan the only elephant population in Borneo. Cooperation between the authorities in both countries would enhance the future prospects of the elephants.
- All existing reserves and other protected areas containing elephants, especially **Tabin** Wildlife Reserve, should be maintained at their existing size and even extended, possibly by introducing special reserves for **licensed** hunting of deer and pigs. Habitat would be preserved for elephants, which would not be hunted.
- The costs and benefits of elephant translocation should be examined with a view to demonstrating to the public and to government decision-makers that there is no substitute for large reserves in certain parts of their natural distribution.
- The wildlife section in the Ministry of Tourism and Environmental Development should be greatly strengthened, with allocations of staff and funding sufficient to manage the state's reserves and wildlife resources. Training **pro-**grammes will also be needed for the organisation's staff.
- Research should be carried out on the effects of artificial saltlicks on elephant distribution and numbers.

13. Nepal

Area: 141,400 km²

Human population: 18,700,000

Total forest: 21,400 km² (15.1%)

Status of the Elephant in Nepal

About 30-40 years ago, much of the area known as the terai at the foot of the Himalayas in southern Nepal was covered by jungles unsuitable for human habitation because of malaria. These jungles were the home of such large animals as elephant, rhinoceros, tiger, crocodile, etc. However, malaria eradication in the 1950s resulted in a rapid influx of people from the hills and marked the beginning of large-scale agricultural development. The arrival of the settlers from the north meant the destruction of over 80% of the natural habitat of the elephant and other large mammals (Mishra 1980). Today, despite the fact that the elephant is fully protected under the National Park and Wildlife Conservation Act of 1973, the prospects for its long-term survival in Nepal are bleak because of the extremely small size of the population. However, even quite small populations are valuable and should be protected wherever practicable. These populations could be built up with translocations of elephants from countries with surplus elephant populations.

Table 1. Number and distribution of elephants in Nepal.

Locality	Number	Source
Sukhla Phanta WR	(5-10)	Mishra (1980)
Sukhla Phanta WR	20-30*	Questionnaire (1983)
Karnali-Bardia WR	7-12	Mishra (1980)
Thori-Sikaribas	10-12	Mishra (1980)
Koshi-Tappu-Sunsari	1	Mishra (1980)
Jhapa	2*	Questionnaire (1983)
Chitawan NP	12-15*	Questionnaire (1983)
Biratnagar	1	Questionnaire (1983)
Parsa (east of Chitwan)	8-12#	Smith et al. (1986)
Total	57-85	

Note: Total does not include the (5-10) from Sukhla Phanta

* mostly migratory herds from India

the only reproducing herd of wild elephants in Nepal



Elephant in Nepal (Photo by Mark Boulton/WWF).

Elephant Distribution and Numbers

It is likely that Nepal once had a population of elephants quite distinct from those in northern India (Olivier 1978). Elephants were particularly numerous in the area centred today on the Royal Chitawan National Park (Oldfield 1880).

The animal disappeared over much of the terai as forests gave way to agriculture and human settlement. Figure 1 shows the approximate distribution of the elephant in Nepal today. It is estimated that between 57 and 95 animals might be present (Table 1). However, this includes seasonal migrants from neighbouring India. Herds of 5-10 elephants move into the Royal Sukhla Phanta Wildlife Reserve from India. Furthermore, every year up to 30 elephants move into the Jhapa area in the extreme east to raid the rice crops. Three animals were shot there in 1978. A herd of about 15 animals from southeast of the Royal Chitawan National Park was reported to move in and out of the area a few years ago (Jackson 1983b).

Number of Elephants in Captivity

As of 1983, there were at least 64 elephants in captivity (Jackson 1983b). These were 10 in Sukhla Phanta, 39 in Chitawan, and 15 in Koshi. The number in Chitawan excludes privately-owned animals and refers only to those owned by tourist organisations, such as Tiger Tops. In October 1985, 16 elephants were obtained from India in exchange for four female rhinos, and so the total number of domestic elephants could be as high as 80.

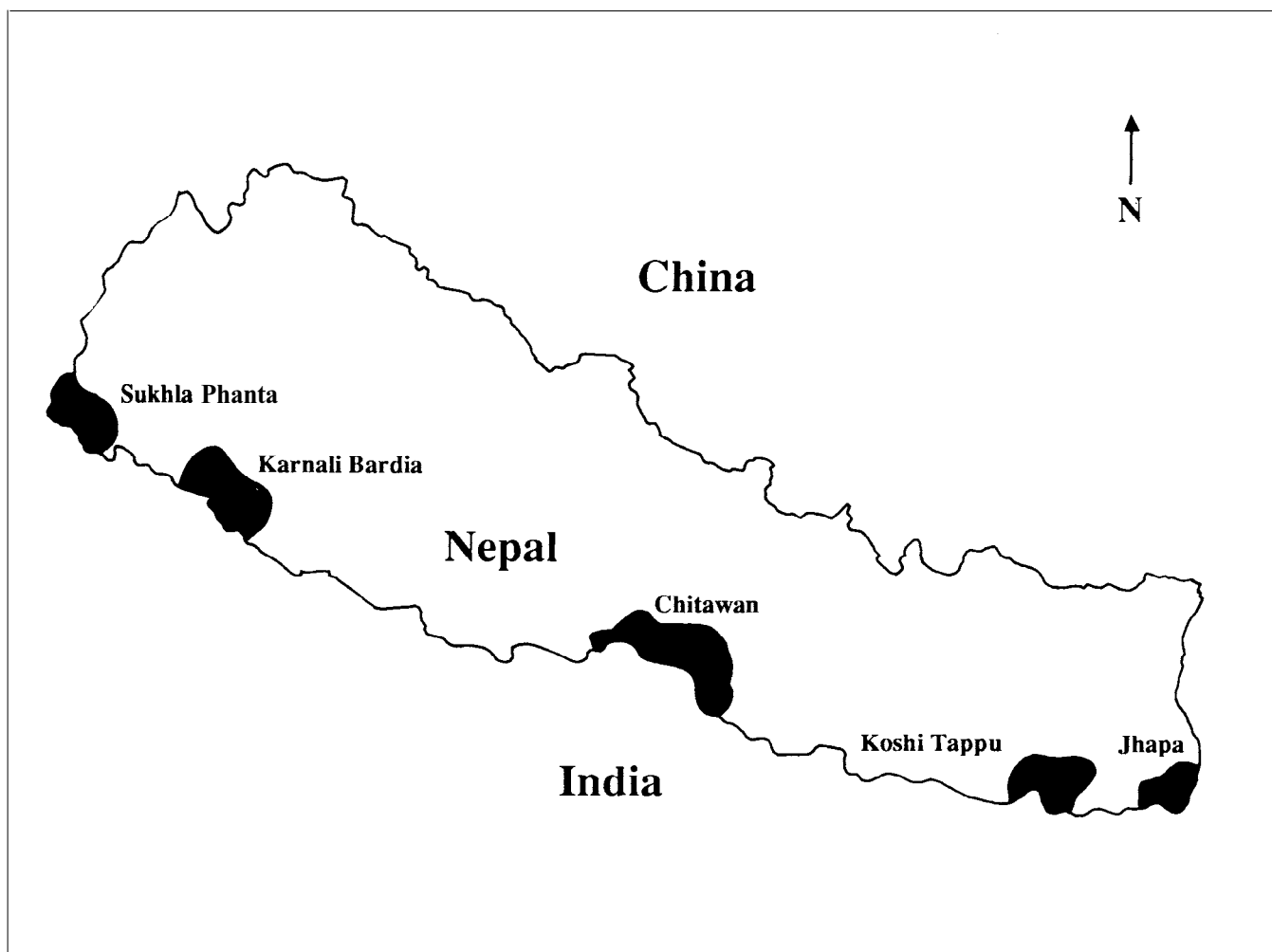


Figure 1. Distribution of elephants in Nepal.

Conservation Problems

In the terai, which is the last refuge of the elephant in Nepal, the forests and savannah grasslands are being cleared for timber and cultivation, leaving little habitat for elephants. High human population densities in many areas make the task of establishing new protected areas extremely difficult or almost impossible (Upreti 1985). The need for fuelwood, timber, and areas for grazing livestock has put enormous strains on the natural resources of some of the protected areas in Nepal (Upreti 1985). The limitations imposed by man are likely to increase further in the coming years if the rapid growth of the human population continues.

Conservation Measures Taken

Until 1950, Nepal was a closed country as far as most of the world was concerned. There was virtually no pressure on land nor excessive hunting, and thus little need for nature conserva-

tion measures. However, this changed in the 1950s with the conquest of malaria in the terai and improved medical services. The terai was rapidly settled and cleared for agriculture, destroying habitat for wildlife, which was also heavily hunted. As a critical situation developed, the late King Mahendra promoted the establishment of national parks and wildlife reserves to protect representative ecosystems (Upreti 1985). Today, the protected areas, consisting of six national parks, four wildlife reserves and one hunting reserve, make up 11,000 km² or 7.8% of the land area.

Conservation efforts became more effective with the enactment in 1973 of the National Parks and Wildlife Conservation Act by HM King Birendra Bir Bikram Shah Dev. It also established the National Parks and Wildlife Conservation Office, which is now responsible for the creation, protection, administration, planning and management of specific parks and reserves (Mishra 1974, Bista 1979). In June 1975, Nepal acceded to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Recommended Actions

- Detailed information concerning the distribution, number, home range, and movement patterns of the elephants should be obtained to identify the most important areas for **conservation** of the species.
 - The Royal Chitawan National Park should be expanded by incorporating the 1,085 **km²** of national forests to the east, thereby improving protection of the only reproducing herd of wild elephants in Nepal. This would result in a reserve of 2,125 **km²**, large enough to support a viable population.
- However, **to** achieve this situation would require a long-term programme and scientific management to ensure the genetic diversity of the population.
- India and Nepal should cooperate in protecting and **managing** elephants that move across their common frontier.
 - Isolated elephants, such as those found in **Koshi-Tappu-Sunsan**, Jhapa, and Biramagar, should be captured and translocated to the Royal Chitawan National Park.
 - Studies should be conducted to see if the Sukhla Phanta and Kamali-Bardia reserves could be extended to encompass more habitat for elephants.

14. Sri Lanka

Area: 65,610 km²

Human population: 16,900,000

Total forest: 17,710 km² (27%)

Status of the Elephant in Sri Lanka

The elephant *Elephas maximus maximus* in Sri Lanka is the type specimen of Linnaeus (Crusz 1986). Shotake et al. (1986) showed that it is genetically quite distinct from the Indian subspecies *E.m. ibengalensis*. In addition, the Mahaweli Flood Plains are known for some remarkably large elephants (N. Ishwaran, pers. comm.), which are thought by some to belong to a different subspecies (*E.m. vilaliya* Deraniyagala) and are referred to as either the marsh elephant or swamp elephant, but Ellerman and Morrison-Scott (1951) equate this with the nominate form.

To both Buddhists and Hindus in Sri Lanka, the elephant has an enormous cultural and religious significance. The Lord Buddha's relic casket is carried on an elephant (the Maligawa tusker) every year in Sri Lanka during the festival known as the Esala Perahera. In the past, the elephant has been put to a variety of uses in Sri Lanka, at times even as a Royal Executioner. (Knox 1681).

The elephant has been protected in Sri Lanka since the 12th century A.D. (Wikramasinghe 1928). Nevertheless, large numbers were captured to be used as war elephants or for export to other countries. The systematic slaughter of elephants in general and of tuskers in particular began with the arrival of the colonial powers and the introduction of firearms. The situation was exploited to such an extent that a government ordinance in 1891 banned the "wanton destruction" of elephants (Olivier 1978). The animal was given full legal protection in 1937. Today, only about six percent of the males have tusks in Sri Lanka, in contrast to southern India, where 90% of the bulls are tuskers (Sukumar 1986). Elephant numbers have declined in recent times, largely due to attrition of the animal's habitat. Thus, the long-term survival of the elephant in Sri Lanka is almost certain to be limited to protected areas (Santiapillai et al. 1984).

Elephant Distribution

Before the large-scale destruction of forests, elephants enjoyed wide distribution and good numbers in both lowlands and hills in Sri Lanka. They were reported from such present day urban



A Sri Lankan elephant (Photo by C.S. Wickramasinghe/WWF).

areas as Colombo, Kandy, and Ratnapura between 1669 and 1744 (McKay 1973). Even by the turn of the 19th century, elephants were distributed all over the island from sea level to the hills (Fernando 1973; Phillips 1935). Today, except for a small remnant population in the Sinharaja rain forest, elephants are restricted to the lowlands. Over the past 150 years, human land-use has forced the animals from the wet and fertile regions of the southwest of the island to much drier regions. Until recent times, the elephant was numerous in the southwest until human settlement spread. According to Olivier (1978) the elephant population in Sri Lanka may have declined by over 67% in the past 200 years. The limitations imposed by man will no doubt increase markedly in future.

Elephants occur in 6,121 km² or 9.3% of the total land area. The 15 areas with elephants are as follows:

1. Bundala Sanctuary (or Managed Nature Reserve) includes 62 km² of forest scrub on the southern coast between Kirindi Oya and Hambantota. Groups of up to 80 elephants frequent this area (IUCN 1986), but there is a problem of pocketed herds.
2. Flood Plains National Park covers 173 km² in the North Central Province and links Wasgomuwa National Park to the Somawathiya National Park under the Mahaweli Environment Programme. The importance for elephants of the rich grasslands around floodpans (known as *villus*) and the perennial supply of water in the area cannot be overstated. It is also the home of distinctively large elephants, to which some taxonomists have given subspecific status as the swamp elephant (*Elephas maximus vilaliya*).
3. Gal Oya National Park and sanctuaries cover a total area of 629 km² and are located in the southeastern part of the island. In the early 1970s, the total elephant population in the Gal Oya region was estimated to be between 260-300 individuals (McKay 1973).
4. Hurulu Biosphere Reserve in the North Central Province is only five km² in extent, but it is surrounded by about 255 km² of forest reserve, which acts as a buffer zone. Nevertheless, areas within the reserve have been logged and are subject to shifting cultivation.
5. Lahugala National Park covers an area of 16 km² and is situated in the basin of the Heda Oya in the Eastern Province. Despite its small size, it has always been renowned for its elephants. About 150 elephants are known from this area (McKay 1973; IUCN 1986). It lies within the proposed elephant corridor connecting Ruhuna National Park with Yala East National Park.
6. Maduru Oya National Park lies in the Mahaweli Development Area and is 515 km² in extent. Prior to the Park's establishment there were 150-250 elephants (IUCN 1986). It would protect only marginal portions of wet season habitat of the animal (Ishwaran 1984).
7. Minneriya-Giritala Nature Reserve covers an area of 420 km² in the Mahaweli Development Area. As Jansen (1986) points out, these reserves are interlinked by additional forest reserves and jungle corridors to accommodate as much as possible the dry and wet season feeding grounds of the elephant.
8. Ruhuna National Park originally covered an area of 137 km² but has been enlarged to 1,268 km². It is situated on the southeast coast of Sri Lanka, east of the Bundala reserve. About 400 elephants live in the Park, while in Block I alone up to 65 animals have been reported at any one time (Santiapillai et al. 1984).
9. Sinharaja Forest Reserve is 89 km² in extent and was declared a Biosphere Reserve in 1978. It lies in the lowland wet zone and is the last extensive patch of primary lowland rain forest in Sri Lanka (IUCN 1986). It contains only 7-9 elephants.
10. Somawathiya National Park, which has been established within the Mahaweli Environment Project, covers an area of 378 km². It lies in the deltaic plain of the Mahaweli Ganga, and is also the home of the swamp elephant. It is one of the richest elephant habitats in Sri Lanka.
11. Tirikonamadu Nature Reserve covers an area of 280 km² and is one of the reserves designated under the Mahaweli Environment Project. The *villus* grasslands provide excellent habitat for the elephants. Groups of 70-80 elephants were often seen feeding in the *villus* (N. Ishwaran pers. comm.).
12. Uda Walawe National Park was established around the Uda Walawe Reservoir in 1973. It covers an area of 308 km². In the past it suffered extensive abuse from encroachers and cultivators. Valuable timber was extracted within the area for about 20 years (Hoffmann 1973). About 150 elephants live in the Park (V. Nugegoda, pers. comm.).
13. Wasgomuwa National Park lies between the Amban Ganga on the west and Mahaweli Ganga in the east and has an area of 338 km². In the past, there were many squatters, who were later relocated in the Mahaweli settlement areas. The park holds about 150 elephants during the wet season (IUCN 1986). An aggregation of at least 88 animals was observed in 1981 (Ishwaran and Punchi Banda 1982).
14. Wilpattu National Park is 1,317 km² in extent and lies on the northwest coast. Although elephants are present here, their numbers have been relatively low in comparison to Ruhuna National Park. Eisenberg and Lockhart (1972) estimated the total number of resident elephants to be about 60. Wilpattu's elephant population has increased in recent years as herds have been moved there from areas being developed under the Mahaweli scheme. There are about 190 elephants in the south and about 200 in the north. Wilpattu is connected to the Madhu Road Sanctuary (326 km²) to the north.
15. Yala East National Park is 181 km² in area and is contiguous with the Ruhuna National Park. Poaching has become a problem inside the park during recent political unrest.

Table 2 indicates that, with the exception of Wilpattu and Ruhuna National Parks, all the other protected areas are less than 1,000 km² in extent. Ten areas are less than 500 km², and may not be adequate for elephants unless elephant ranges between such small reserves remain contiguous (Ishwaran 1984). This problem was overcome to a certain extent by in the Mahaweli Development Area by linking up national parks, such as Wasgomuwa-Flood Plains-Somawathiya, which provided a total of 1,311 km² of continuous habitat for the elephant.

Figure 1 shows the approximate distribution of the elephant in Sri Lanka today. Although elephants are found mainly in reserves, they also live elsewhere, in forests interspersed with agricultural areas, throughout the dry zone (N. Ishwaran, pers. comm.).

Table 1. Estimated number of wild elephants in Sri Lanka.

Location	Min.	Max.
Ruhuna National Park and Pelwatte	350	400
Hambantota district	150	160
Uda Walawe National Park and environs	150	200
Gal Oya National Park, Bibile and Ampara	300	325
Yala East National Park, Wil Oya,		
Heda Oya basins	150	175
Lahugala National Park	80	100
Deniyaya-Rakwana	8	10
Peak Wilderness	20	25
Randenigala catchment	20	25
Lower Mahaweli Basin Systems	650	700
ABCD and G		
Verugal, Kurunneamunnai, Kituluttuwa,	100	120
Anaolundewa, Ratmale, Yan oya &		
Kokkilai		
H2 Resvehera/H9 Kahalla	35	40
Wilpattu National Park, southern section	150	175
Wilpattu National Park, northern section	150	175
Anuradhapura district	100	125
Mannar district	150	175
Vavuniya, Kilinochchi, Mullaitheevu dist.	100	125
Pooneryan-Paranthan,		
Paranthan-Mankulam-Vavuniya	125	150
Total	2,788	3,205

Source: A.B. Fernando, pers. comm. (1989).

Number of Elephants in the Wild

The number of elephants in Sri Lanka today is but a fraction of that existing a few hundred years ago. How numerous elephants were at one time can be appreciated by a reference to the numbers captured or killed. Until 1830, elephants were so plentiful that their destruction was encouraged by the government (Storey 1907), and rewards were paid for any killed (Baker 1853). More than 5,000 elephants were eliminated systematically within a period of just ten years (Tennent 1867). A Major Rogers is credited with the slaughter of no less than 1,400 (Storey 1907), while a Captain Galway killed half that number and a Major Skinner almost as many, while “less deserving aspirants follow at humbler distances” (Tennent 1867). In addition to sport hunting, large numbers were also captured for use both locally and abroad. Between 1863 and 1899, 2,190 elephants were exported to zoos in the U.S.A. and Europe (Clark 1901), while large numbers went to princely courts in India (Marshall 1846).

During the period of British rule, the population of elephants in the wild dropped from an estimated 10,000 to 2,000 animals (Schultz 1984), due partly to excessive hunting, but probably even more because of the loss of habitat when vast areas of forests in the hill country were clear-felled to make way for coffee and, later, tea plantations. As a result, the elephant was pushed out of the hill country and became associated with the low country dry zones.

During the first half of this century, Sri Lanka had some of the best, and probably the most wildlife conservation areas in Asia (Hoffmann 1983). Most of them were located in the low country dry zone, where human pressure was not serious enough to prevent the recovery of elephant numbers. The recovery was slow at first. Under management by the Department of Wildlife Conservation, the number of elephants seems to have picked up somewhat in the sixties. McKay (1973) gave a minimum number of between 1,600 and 2,200. Hoffmann (1977) estimated the total to be at least 4,000.

Since then, conversion of wild lands may have resulted in a decline. Given the forest cover left in the island to be about 12,460 km², Santiapillai et al. (1984) estimated the *minimum* number of elephants to be about 1,800 on the basis of an average crude density of 0.15 per km². Schultz (1984) quotes Ishwaran's estimate of 2,500 as the likely number. This estimate has been corroborated by the Department of Wildlife Conservation, which has arrived at the same number (i.e. 2,500), 650-700 of which are thought to be in the Accelerated Mahaweli Development Area (Fernando, pers. comm.). However, a very recent estimate of the number of elephants (Table 1) by one of the leading field workers puts the figure as anything between 2,800 and 3,250 (Fernando, pers. comm.).

Number of Elephants in Captivity

The elephant has always played a significant role in Buddhist culture. During the annual religious festival known as the *Esala Perahera*, the casket containing the sacred tooth relic of the Buddha is carried on a large tusker which belongs to the Temple of the Tooth in Kandy. In the past, over 100 elephants used to take part in this festival, but today the numbers are low.

The ancient chronicle of Sri Lankan history, the *Mahawamsa*, refers to the presence of war elephants, all of them tuskers in Sri Lanka.

Elephants were reported to have been exported from Sri Lanka as far back as 600 B.C. (Kurt 1969). Sri Lanka was one

Table 2. Protected areas with elephants in Sri Lanka.

Name	Category	Area(km ²)
Bundala	Managed Nature Reserve	62
Flood Plains	National Park	173
Gal Oya	National Park	630
Hurulu	Biosphere Reserve	5
Lahugala-Kitulana	National Park	16
Maduru Oya	National Park	515
Minneriya-Giritala	Nature Reserve	420
Ruhuna	National Park	1,268
Sinharaja	Forest Reserve	89
Somawathiya	National Park	520
Tirikonamadu	Nature Reserve	280
Uda Walawe	National Park	308
Wasgomuwa	National Park	338
Wilpattu	National Park	1317
Yala East	National Park	181
Total		6,122

Sri Lanka

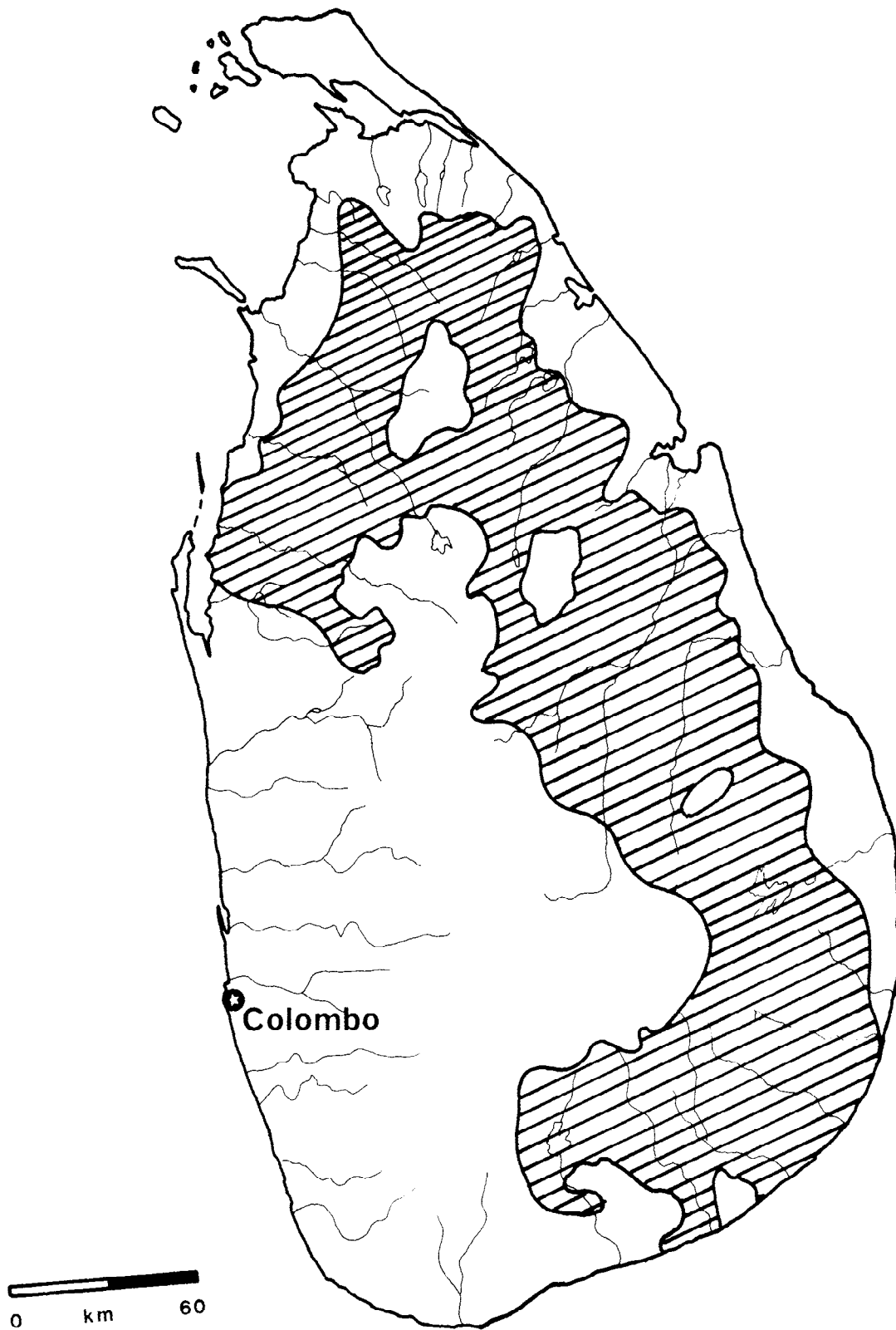


Figure 1. Distribution of elephants in Sri Lanka.

of the main suppliers of trained elephants to India. Digby (1971) refers to the dispatch of elephants from Sri Lanka to Bihar in the 3rd century B.C.

By 1955, there were at least 670 elephants in captivity (Deraniyagala 1955). Later, in a census carried out by Jainudeen and Jayasinghe (1970), the number was found to be 532. There have been no further censuses, but it is likely that the number has declined to less than 500. Most of the elephants in captivity are old and so, in the years to come, the captive population in Sri Lanka will see a rapid reduction in numbers (V. Nugegoda, pers. comm.).

The Department of Wildlife Conservation established an "Elephant Orphanage" to care for elephants captured or found abandoned in the forest, and, by 1982, there were about a dozen animals in captivity, which formed the nucleus for a captive breeding programme. Despite the poor reproductive performance of elephants in captivity in the past, the programme has achieved some measure of success. Three births have taken place in the orphanage in five years, and more are expected (Fernando, pers. comm.). The orphanage is now under the charge of the Department of National Zoological Gardens.

Conservation Problems

The core of the elephant conservation problem in Sri Lanka today stems from rapid loss of prime elephant habitat in riverine forest. The greatest threat to the elephant comes from an expanding human population and its demand for land. The elimination and fragmentation of vast areas of natural habitat in the Accelerated Mahaweli Development Programme is the single most serious setback to Sri Lanka's elephants in recent times.

According to Schultz (1984), 94% of Sri Lankans still depend on firewood and animal residues for cooking, each family requiring about two tonnes of firewood per year. There is also a substantial increase in the demand for industrial logs, which today is about 980,000 m³ and is expected to grow to 1.4 million m³ by the year 2000 (Anon. 1986). The Forest Department has been unable to curb widespread illegal felling outside the wildlife reserves and, based on current trends, it is only a matter of time before such activities spread into the reserves.

When the Accelerated Mahaweli Development Programme is completed, the Department of Wildlife Conservation expects a further escalation in already serious conflicts between elephants and people, since there are an estimated 650-700 elephants in the area. The result will be demands from farmers that marauding elephants be removed.

In the Wasgomuwa National Park-home of the so-called "swamp elephant"-disused pits dug to excavate gems have proved a hazard to elephants and other wildlife (Anon. 1985c).

In the Flood Plains National Park, official permits were granted for the establishment of 200 tobacco plots of 1.2 ha each. In all, 430 such plots have been established, of which 230 were illegal. The Somawathiya National Park is threatened by an increasing unauthorised tobacco cultivation along river banks, and the establishment of brick kilns, which are affecting elephant migration. The Department of Wildlife Conservation

allowed the manufacture of bricks inside the national park (Anon. 1985c), presumably using fuel from the forest. Furthermore, some elephants fell into disused pits.

As agricultural areas gradually expand, elephant populations face the danger of becoming pocketed. About 150 elephants are isolated in small pockets of forests between Walawe Ganga and the Kirindi Oya (Fernando 1987). Given the small size of the remaining forest blocks, these elephants inevitably disperse into the villages and raid crops. In desperation, some villagers shoot indiscriminately at the elephants, which often results in males becoming aggressive towards people.

In Moneragala district, large areas of forest near to Yala North, Gal Oya, and Uda Walawe National Parks were converted to sugarcane plantations, despite the known appetite of elephants for sugarcane. Predictably, the crops have been attacked by elephants. The problem has been particularly severe around the Pelwatte Sugar Company plantation. Electrified fencing has had to be installed, and in one area, 10 people have been killed by the elephants (Fernando 1987).

In Puttalam district, forest clearance has continued unabated during the past two decades. About 48.5 km² of forest on either side of the Puttalam-Anuradhapura highway have been replaced by teak and eucalyptus plantations. The elephant problem in this area has been further compounded by the fact that about 70-75 animals were added to the population in the 1982-1983 elephant drive from Resvehem (Fernando 1987). The increased elephant density has meant an escalation in elephant-human conflicts and the deaths of several people. The Wildlife Department has had to maintain a permanent Elephant Control Unit.

In Anuradhapura district, there are several isolated groups of elephants in scrub forest blocks surrounded by settlements and cultivation (Fernando 1987). The biggest concentration, according to Fernando, is in the catchment of Noachchiyaduwa tank (reservoir), where about 60-80 animals in 3-4 groups cause damage to both crops and property.

Prior to the damming of the Mahaweli Ganga, periodic flooding maintained extensive *villus* grasslands in the lower Mahaweli Basin, and these seasonal ponds supported high densities of elephants. When the Accelerated Mahaweli Development Programme is completed, the reduction in river flow will no doubt cause a great reduction in the extent of these grasslands, and, consequently, in the number of elephants which depend on them, despite the establishment of a number of conservation areas (Anon. 1981). One-third of the *villus* are drying up.

Conservation Measures Taken

Until the establishment of an autonomous Department of Wildlife Conservation in 1950, all matters relating to wildlife were the responsibility of the Forest Department. In 1964, the Department took a number of enlightened measures, including:

1. Abolition of shooting game on licence;
2. Acceptance of scientific research as a basis for improved management and conservation of wildlife;



Elephants grazing in Ruhuna National Park, Sri Lanka (Photo by Max Hemple/WWF).

3. Introduction of educational programmes in schools;
4. Establishment of a series of new protected areas;
5. Introduction of the concept of "jungle corridors" to link isolated reserves (de Alwis 1982);
6. Strict control of capture and export of elephants.

The Department of Wildlife Conservation is now under the Ministry of Lands, Irrigation, and Mahaweli Development. One of the most significant conservation measures Sri Lanka has taken was the implementation of a five-year conservation development programme, called the Mahaweli Environmental Programme, which started in 1982, and was funded by U.S. AID. This involves the development and management of a system of protected areas within the Mahaweli Development Programme area and adjacent river basins. The programme has been extended until 1991.

The Somawathiya National Park, established in 1986, is of great importance to elephant conservation as it contains part of the best elephant habitat in Sri Lanka, and contains a population of "swamp" elephants.

Wasgomuwa Strict Natural Reserve was declared a National Park in 1984 and provision was made for a strip of land on either side of the Mahaweli Ganga to link it with the Somawathiya National Park. This narrow strip of land became the Flood Plains National Park in 1984 and provides one of the best habitats for the "swamp" elephant.

Maduru Oya National Park was established in 1983. Although a large part of the park was heavily exploited in the past

by shifting cultivators, it was thought that the new park would provide at least some refuge for elephants. But detailed studies carried out by Ishwaran (1984) indicated that this park would protect only marginal portions of the wet season range of the elephant along the Maduru Oya. He recommended the establishment of suitable corridors to Gal Oya in the southeast and Wasgomuwa in the west in order to protect a larger part of the elephant range.

The creation of these four protected areas in the Mahaweli area represents the first attempt in Sri Lanka to incorporate the existing national parks and protected areas in an overall development plan (de Alwis 1984; Jansen 1986).

De Alwis (1984) refers to some of the most important recommendations the Department of Wildlife Conservation made to the government, such as:

1. That all catchments of reservoirs be made into nature reserves;
2. That wherever possible these catchments be inter-connected by jungle corridors, preferably along river banks;
3. That all nature reserves have a one mile wide buffer zone.
4. Conversion of all Intermediate Zones (former hunting areas) to National Parks.

The first translocation of elephants took place in 1979 when an entire herd of 10 elephants was immobilised and translocated to a national park. In north-central Sri Lanka, about 700 km² of land were set aside for agriculture and about 140 elephants were driven 50 km to the northern sector of Wilpattu National Park.

In 1982, another group of 76 elephants was moved to the southern sector of Wilpattu. These elephant **translocation** methods became models that were copied equally successfully in dealing with pocketed elephants in Sumatra and Malaysia.

The Department of Wildlife Conservation was able to acquire a total of 1,350 **km²** for national parks alone in the Mahaweli Development Area, a total exceeding that of the new and improved agricultural land to be developed (1,071 **km²**) under the Mahaweli **Development Programme** (de Alwis 1984).

Concerned at the decline in number of the elephants in captivity, the Department of Wildlife Conservation started the first Captive Breeding Unit in the Pinnawala Elephant **Orphanage** in 1982, which has proved a success.

Sri Lanka acceded to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1979.

Recommended Actions

- A long-term monitoring programme to assess numbers, population trends, ecological requirements, movements,

and people/elephant conflicts should be put into effect to provide a scientific basis for all management decisions.

- Surveys of target areas should be carried out before elephants are driven to them in order to determine that they are suitable, otherwise the elephants may return to their original habitat.
- Forest corridors linking elephant habitats should be at least one km wide to be effective. To ensure the viability of scattered elephant populations or groups, such corridors are essential. Corridors will, furthermore, reduce crop **depredation**.
- More Elephant Control Units, composed of competent personnel, should be established to function on a “fire brigade” basis to combat crop depredation by elephants.
- To solve elephant problems in the Puttalam and Anuradhapura districts, the Wildlife Department should improve the habitat in the Wilpattu National Park.
- The Lunugamvehara National Park should be established in the immediate catchment of the Lunugamvehera reservoir. It should be linked by a jungle corridor to Udawalawe National Park.

15. Thailand

Area: 514,000 km²

Human population: 55,600,000 (mid-1989 est.)

Total forest: 157,890 km² (30.7%)

Status of the Elephant in Thailand

Elephants have been protected in Thailand since the late 18th century when the present Chakri Dynasty came to power, but long before that time they were already an integral part of Thai culture and economy. All wild elephants in Thailand come under the jurisdiction of the Ministry of Interior, and, because of their importance, killing and wounding them is prohibited by law. The Wild Elephant Act of 1921 was specially enacted to ensure their availability for use in warfare as tanks, and as beasts of burden for hauling and moving logs in the timber industry (Lekagul and McNeely 1977a). Capture of wild elephants was subject to government regulations, which stipulated that one out of every five animals captured should be given to the government. The law was revised in 1961. Today, the trained elephants are used in forestry and tourism.

Elephant Distribution

Prior to World War II, when 80% of Thailand was forested, elephants were distributed throughout the country (Olivier 1978; Storer 1981). In the recent past, the excessive use of forest resources, including over-cutting and removal of tree cover, has extirpated the elephant in much of Thailand. Agricultural pressures in the lowlands have driven the animal to seek refuge in the hills. Its adaptability to higher altitudes has therefore been a great advantage now that it is confined to hilly areas that support the remaining forests (Fig. 1). Present day elephant populations are, for the most part, small, isolated and declining rapidly in an environment dominated by man. The current distribution of the elephant in Thailand is discontinuous, except perhaps along the Burmese border to the west. Lekagul and McNeely (1977b) recognised seven major areas with elephants: 1. Western and northern Thailand, 2. Petchabun range, 3. Khao Yai National Park, 4. West Dangrak range, 5. East Dangrak range, 6. Ranong/Chumphon, and 7. Trang/Pattalung (Fig. 2). More recent surveys carried out by Storer (1981) and Dobias (1987) have led to the identification of at least 16 national parks and 14 wildlife sanctuaries with elephants (Tables 1 and 2).

Table 1. National parks in Thailand with elephants.

National Park	Habitat	Area km ²	Elephants
Khao Yai	ME	2,168	250
Phu Kradung	MD	348	50-60
Thung Salaeng Luang	HE	1,262	5-20
Nam Nao	HEP	962	100
Phu Phan	DD	664	12-15
Erawan	MD	550	10-15
Khao Chamao	DE	83	5-15
Khao Kitchakut	ME	58	a few
Tham Than Lot	DE/MD	59	small
Srisatchanalai	MD	213	small
Kaeng Krachan	MD	2,478	100-150
Khao Sok	ME	645	5-10
Thaleban	ME	101	a few
Khlong Prao	ME	444	20-30
Lan sang*	DD	170	?
Khao Luang*	ME	567	?
Total		10,772	557-665+

Source: Dobias (1987); * Storer (1981)

Legend: ME=moist evergreen; MD=mixed deciduous; HE=hill evergreen; HEP=hill evergreen pine; DD=dry dipterocarp; DE=dry evergreen.

Dobias (1987) identified seven key areas in the largely mountainous regions of Thailand where there are viable populations of elephant in the short term. These areas, which total about 25,500 km², are estimated to hold between 500 and 1,500 elephants. These areas are as follows:

1. An area of 3,400 km² incorporating the Om Koi and Maetuen Wildlife Sanctuaries and the Mae Ping National Park in northwest Thailand.
2. About 2,870 km² on the Petchabun mountain range in north central Thailand, that includes the Phu Kradung and Nam Nao National Parks and the Phu Khieo Wildlife Sanctuary.
3. A small area (848 km²) on the Petchabun mountain range just north of the Phu Kradung/Nam Nao/Phu Khieo complex.

4. About 7,800 **km²** incorporating the two Wildlife Sanctuaries, Huai Kha Khaeng and Thung Yai Naresham plus the Sri Nakarin and **Erawan** National Parks in western Thailand.
5. The complex of National Parks (Khao Yai, Thap Lan, and Pang Sida) totalling 5,250 **km²** on the Dangrak Mountain range in southeastern Thailand.
6. **Maenam** Pha Chi Wildlife Sanctuary and Kaeng **Krachan** National Park (an area of 2,967 **km²**) on the Tenasserim range of mountains along the border with Burma.
7. The Khlong Naka and Khlong Saeng Wildlife Sanctuaries and the **Khao** Sok National Park, which total 2,281 **km²** on the western side of the peninsula in southern Thailand.

Number of Elephants in the Wild

There has never been a country-wide survey to assess the number of elephants in the wild. The forest environment makes it extremely difficult to arrive at even working estimates. Lekagul and McNeely (1977b), who were among the first to try, estimated the number at between 2,600 and 4,450, distributed in six areas (Table 3). Since their estimation, rapid forest conversion, sometimes 10% a year in certain areas (Jintanugool et al., 1982) has greatly reduced the habitats once available to elephants. It is inevitable that elephant numbers will have declined too. Today the number of wild elephants in protected areas is estimated to be between 1,300 and 1700+ (Dobias 1987), as seen in Tables 1 and 3, although elephants certainly survive outside the reserves.

Table 2. Wildlife sanctuaries where elephants occur in Thailand.

Sanctuary	Habitat	Area km ²	Elephants
Salak Phra	MD	859	20-35
Khlong Nakha	ME	480	20+
Phu Khieo	DE	1,560	100+
Khao Soi Dao	ME	745	30-40
Huai Kha Khaeng/			
Thung Yai	MD/DD/DE	5,775	250-300
Khlong Saeng	ME	1,156	25-75
Phu Luang	HE	848	125-175
Phu Wua	MD	187	10-15
Khao Banthat	ME	1,267	0-5
Maetuen/Om Koi	DD/MD	2,397	125-175
Ton Nga Chang	ME	182	5
Khao Ang Ru Nai	DE	108	15-25
Maenam Pha Chi	DE/ME	489	25-75
Phu Miang/Phu Thong*	HE/DE	545	?
Total		16,598	750-1,045+

Source: Dobias (1987); *Storer (1981)

Legend: ME=moist evergreen; MD=mixed deciduous; HE=hill evergreen; HEP=hill evergreen pine; DD=dry dipterocarp; DE=dry evergreen.

Table 3. Estimated number of wild elephants in Thailand during the mid-1970s.

Area	Minimum	Maximum
Petchabun range	200	500
Khao Yai National Park	100	150
Dangrak range	100	200
Peninsula	900	1,500
Northern Thailand	400	600*
Western Thailand	900	1,500*
Total	2,600	4,450

Source: Lekagul and McNeely (1977b)
* includes seasonal migrants from Burma.

Number of Elephants in Captivity

Thailand once had a substantial population of trained elephants in the timber industry. In 1884, there were more than 20,000 domestic elephants in northern Thailand alone (Seidenfaden 1967). Since then, the domestic elephant population has declined drastically. In 1950, a total of 13,397 domestic elephants were present in Thailand, which dropped to 11,022 in 1972 (Lekagul and McNeely 1977b). In 1980 and 1982, the Local Administration Department estimated the number of domestic elephants (98% of which are privately owned) to be 5,232 and 4,819 respectively (Dobias 1987). At present, the number of domestic elephants is estimated to be slightly over 5,000 (Lair 1988).

Two or three decades ago, domestic elephants were sold at an average value of U.S. \$1,000 each (Lekagul and McNeely 1977b). Even in 1981, work elephants could be bought locally for U.S. \$1,250 (Storer 1981). But with the decline in elephants in the wild, their capture has become increasingly difficult. Furthermore, natural reproduction among domestic elephants is low. As a consequence, the value of the domestic stock has increased greatly. In 1986, a full-grown, well-trained bull elephant cost 200,000 baht, or U.S. \$8,000 (Santiapillai et al. 1986).

Conservation Problems

Assuming an average elephant density of 0.057/km² in the wildlife sanctuaries and national parks, the existing protected areas (27,000 km²), even assuming that their stability remains assured, would protect no more than 1,500 elephants. This makes the elephant extremely **vulnerable** when populations are either fragmented or reduced in size. Because of the elephant's vulnerability to habitat changes, its prospects in Thailand are precarious if distribution becomes further fragmented.

The animal is under increasing pressure from a variety of causes. More than 300,000 people of the hill tribes and thousands of other ethnic Thais practice shifting cultivation (Jintanugool et al. 1982). Furthermore, habitat modification brought about by such activities as timber extraction, irrigation, road building, re-settlement of hill tribe people, mining, and

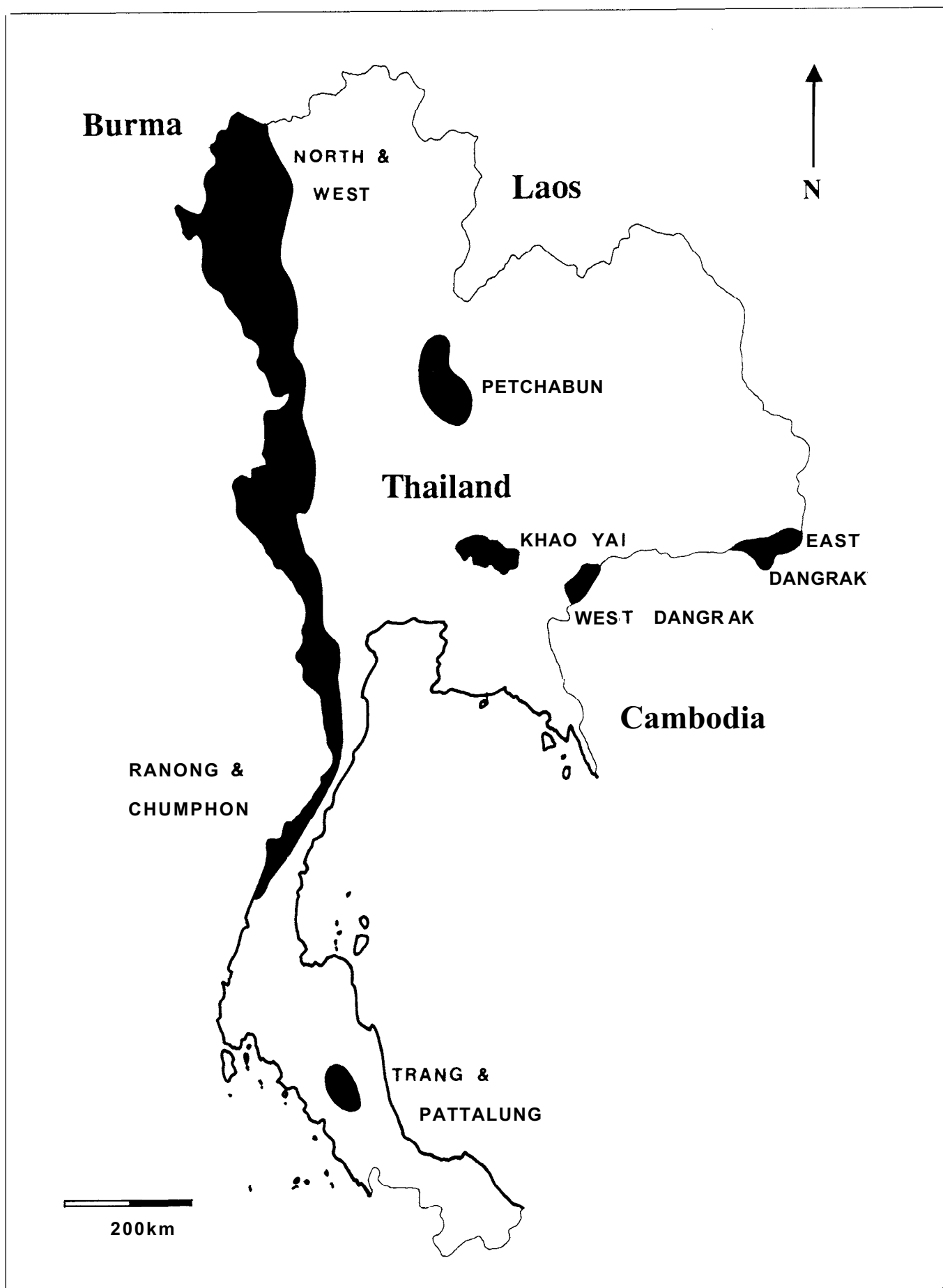
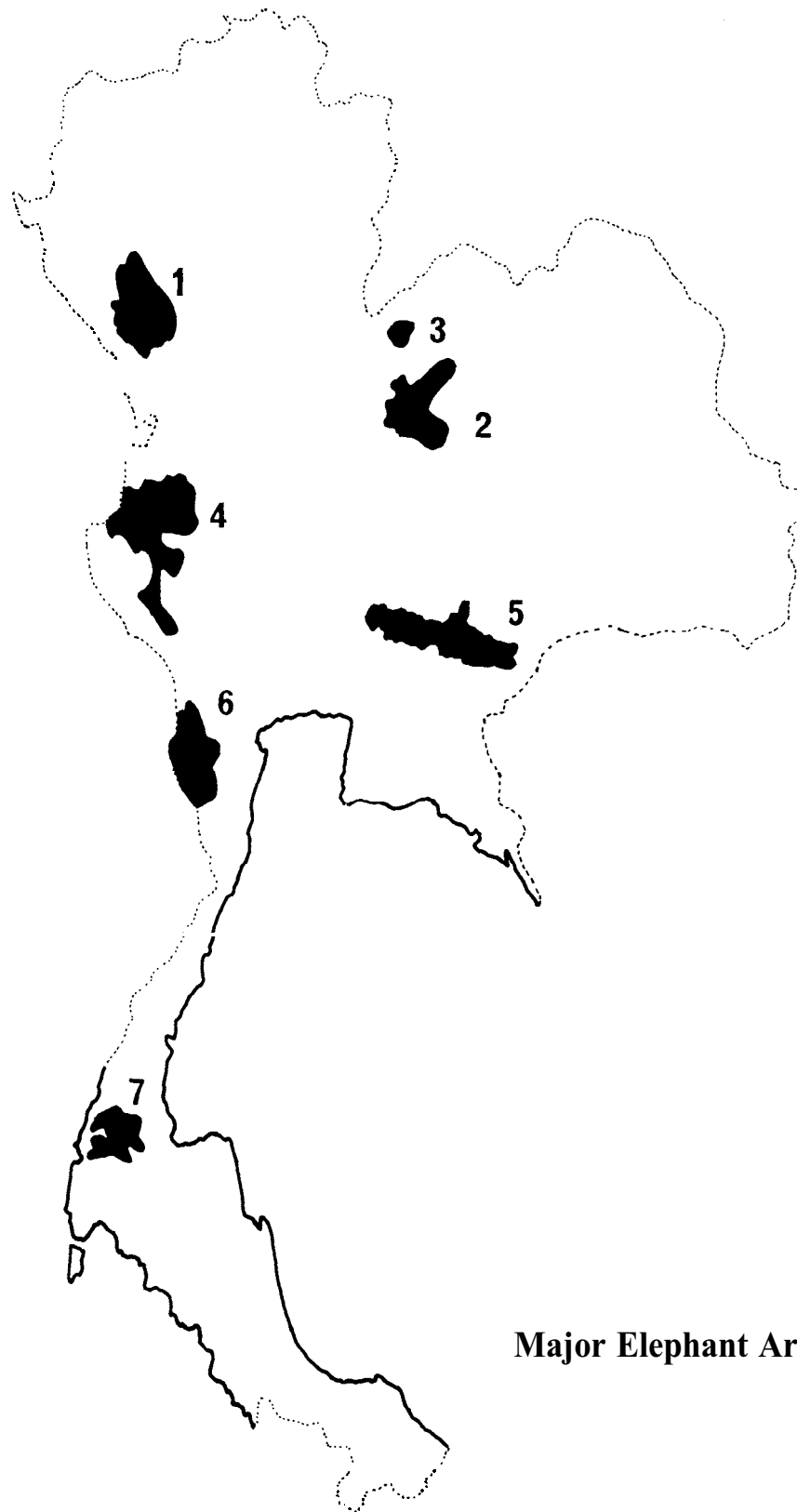


Figure 1. Distribution of elephants in Thailand. Source: Lekagul and McNeely (1977b).

Thailand



Major Elephant Areas

Figure 2. Seven major protected area complexes in Thailand with elephants. 1. Om Koi and Maetuen Wildlife Sanctuaries and Mae Ping National Park, northwest Thailand (3,400 km²). 2. Part of Petchabun mountain range in north central Thailand that includes Phu Kradung and Nam Nao National Parks and Phu Khieo Wildlife Sanctuary (2,870 km²). 3. A small area on the Petchabun mountain range just north of the Phu Kradung/Nam Nao/Phu Khieo complex (848 km²). 4. Huai Kha Khaeng and Thung Yai Naresuan Wildlife Sanctuaries, plus the Sri Nakarin and Erawan National Parks, in Western Thailand (7,800 km²). 5. Khao Yai, Thap Lan, and Pang Sida National Parks on the Dangrak Mountain range in southeastern Thailand (5,250 km²). 6. Maenam Pha Chi Wildlife Sanctuary and Kaeng Krachan National Park on the Tenasserim range bordering Burma (2,967 km²). 7. Khiong Naka and Khiong Saeng Wildlife Sanctuaries and Khao Sok National Park on the western side of the peninsula in southern Thailand (2,281 km²). Redrawn from Dobias (1987).

mineral exploitation must inevitably constrict the life support system of the elephant in Thailand today. As everywhere else in Asia, continued conversion of elephant habitat to agriculture and other incompatible land-use has led to the isolation of elephant populations (R. Dobias, pers. comm.).

Logging in itself is not harmful to elephants. In fact, logged forests make good elephant habitats as they regenerate, and enable elephants to exist at higher densities in logged habitats than in primary forests (Olivier 1978). However, indiscriminate logging can fragment and isolate elephant populations. Logging usually opens up the forest to illegal settlers, who then clear the forest permanently for agriculture. An expanding agricultural community is perhaps the most serious threat to the elephant in Thailand (Storer 1981).

The elephant is under threat from political as well as ecological factors. For centuries in the past, elephants have been moving in and out of Thailand from Burma, Cambodia, and Laos in response to changes in rainfall. But such movements are no longer possible in many areas in Thailand, mainly because of changes in land use. Mines and booby-traps have taken a heavy toll on the lives of men and elephants.

Poaching is an immediate threat to the elephant in Thailand. Between 1975 and 1979, according to Storer (1981), 91 elephants (representing almost 10% of his estimated study population of wild elephants) were poached in protected areas. It is doubtful that the situation has improved subsequently, as several parks and sanctuaries where good elephant habitats exist do not seem to have as many elephants as one would expect (R. Dobias, per. comm.).

Storer (1981) recognises two types of poaching: for meat and ivory, and for capture of live animals. He points out that elephant meat is commonly sold as dried water buffalo meat ("nuea khway"). Most Thai ivory comes from western and northern parts of Thailand (Storer 1981). Live capture of elephants is no longer easy, and there has probably been no significant capture for a decade or more. More serious is the new industry in elephant hide in northern Thailand, which manufactures belts, shoes, and bags. This industry is doubtless impacting Thai elephants (especially in the north) as well as animals from Burma.

Conservation Measures Taken

Early efforts in Thailand to protect wildlife concentrated on species. The Wild Animal Preservation and Protection Act B.E. 2503 (1960) that came into effect in 1961 recognised two categories of wild animals--reserved and protected--and the elephant was listed under Schedule 1 in the latter category (Jintanugool et al. 1982). Animals in Schedule 1 can be captured with a permit, but killing them is prohibited. In January 1983, Thailand ratified the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which bans international commerce in Asian elephant products.

With the enactment of the Wildlife Animal Preservation and Protection Act and the National Park Act of 1960, there was a fundamental shift of emphasis towards protection of habitats



Elephant feeding in Khao Yai National Park, Thailand (Photo by Robert J. Dobias/WWF).

and ecosystems. This led to the rapid development of the system of national parks and wildlife sanctuaries. Under the umbrella of the Royal Forest Department, wildlife sanctuaries come under the jurisdiction of the Wildlife Conservation Division, while national parks come under the aegis of the National Parks Division. Wildlife sanctuaries, national parks and non-hunting areas account for an area of over 50,000 km² (approximately 10% of the total land area), and the government plans to add not less than a further 5% of the land area to the protected area system (Dobias 1987).

On the face of it, the extensive network of protected areas must appear as a welcome conservation measure. However, opinion is divided among conservationists in Thailand as to the effectiveness of many of the established parks and sanctuaries in fulfilling their stated objectives. According to some critics, many of the newly-established national parks do not seem to meet international standards, and, in some instances, contain illegal settlers. It has therefore been suggested that the stated objectives of ecosystem conservation could be better realised by improving the protection of existing parks rather than establishing new parks of questionable viability (Sayer 1982). Some national parks, such as Khao Chamao (83 km²), Khao Kitchakut (58 km²) and Tham Than Lot (59 km²), are so small that they are unlikely to support viable populations of elephants or many other species.

Given the rapid attrition of forests throughout Thailand (Table 4) and the alienation of remaining forest areas outside

Table 4. Forest area (km²).

1961	1973	1976	1978	1982	1985
273,628	221,707	198,417	175,224	156,600	149,053

From: Arbhahirama, A., D. Phantumvanit, J. Elkington and P. Ingkasuwan (eds). 1987. Thailand Natural Resources Profile. Thailand Development Research Institute, Bangkok.

parks and sanctuaries for production forestry, advocates of the increase in national parks and wildlife sanctuaries argue that such a policy is justified since opportunities to set up new parks may no longer exist in the years to come (Sayer 1982).

This policy may be justified under the present circumstances, and undeniably has had beneficial secondary consequences in providing habitats to such endangered mammals as the serow (*Capricornis sumatrensis*), Eld's deer (*Cervus eldi*), and the goral (*Nemorhaedus goral*). But as Sayer (1982) points out, conservation must be measured, not in terms of the number of parks established, but in how successfully they are managed and how much they contribute to the wellbeing of local people as well as wildlife. Thailand has a great potential to develop and maintain a comprehensive and well-managed system of protected areas.

Recommended Actions

Thailand's elephant population has severely declined and been fragmented by extensive deforestation. Few existing and proposed national parks and wildlife sanctuaries containing elephants are of sufficient size to maintain viable elephant populations in the long-term. Even within such areas, poaching and continual human encroachment on elephant habitat are serious threats.

- The distribution of elephants in Thailand should be determined, using existing information, ground surveys, satellite imagery, and aerial photographs to determine which parts of the country contain sizable elephant populations, and to determine habitat suitability and quality, especially in areas which are not protected.
- Corridors should be established to link protected areas, such as between Nam Nao and Phu Kradung National Parks, and between Huai Kha Khaeng Wildlife Sanctuary and Sri Nakarin National Park; and possibly between Sri Nakarin and Erawan National Parks. Khao Yai/Thap Lan/Pang Sida

should be linked and protected as the area could ensure the long-term survival of the elephant.

- Provided the proposed dam at Thung Yai is not constructed, Huai Kha Khaeng/Thung Yai Naresuan is sufficiently large to support a viable population of elephants because the area borders Burmese forests. Given current conditions, this is perhaps the only area in Thailand capable of sustaining a viable elephant population in the long term. As such the area should be kept free of development activities that would disrupt conservation efforts, particularly development which would impede seasonal movements and/or promote increased access by poachers.
- The Khao Chamao National Park is small (83 km²) but has elephants. Some areas north of the park should be incorporated to enlarge the size and improve the survival prospects of the elephants.
- "Managed Elephant Ranges" (MERs) should be established in the Petchabum mountains in the northeast and Tenasserim mountains near the border with Burma, with a view to protecting the entire range of an elephant population. Human activities that do not conflict with elephant conservation, such as sustained yield forestry, slow rotation shifting cultivation, livestock grazing, and subsistence hunting etc., could be permitted within the MERs.
- National Parks and Wildlife Sanctuaries should be ranked in order of priority for development, given the government's limited financial and manpower resources. Protected areas, such as Khao Yai, Nam Nao, and Kaeng Krachan National Parks and Phu Khieo, Huai Kha Khaeng/Thung Yai, Phu Luang, and Maetuen/Om Koi Wildlife Sanctuaries, have some of the largest elephant populations in Thailand, and so must rank high in priority.
- Conservation education is both necessary and urgent to gain the widest possible acceptance by the general public of the need for conservation in general and of the elephant in particular.
- A demographic analysis of the elephants in captivity is needed urgently. Recommendations contained in an FAO report (Lair 1986) include the introduction of a licensing system for domestic elephants; preparation of an interdisciplinary, inter-institutional survey of Thailand's domestic elephants; and the development of computer models to analyse the population dynamics of the domestic elephants.
- The trade and industry in elephant hide should be closed down as a matter of urgency, and likewise the trade in live animals from Burma to Thailand should also be stopped in accordance with CITES obligations.

16. Vietnam

Area: 329,566 km²

Human population: 66,800,000 (mid- 1989 est.)

Total forest: 103,140 km² (31.3%)

Status of the Elephant in Vietnam

Vietnam once had a substantial population of elephants in the wild, and used to supply trained elephants in large numbers to Burma, Cambodia, Laos, and Thailand, and to zoos and circuses in Europe before the Second World War. However, a long history of poor law enforcement, together with the war, which was followed by the long conflict with France and the United States, must have drastically affected most wild animals, particularly elephants. In the past, elephants were given only partial protection, with a ban only on shooting females. But according to Constable (1982), elephants and rhinos were “traditionally not shot by Vietnamese.” The elephant is, however, now considered endangered in Vietnam. It is protected, and both the government and the Highland tribes are making efforts to increase the population (Hung 1982; Pfeiffer 1984). Hung (1982) refers to the presence of “white elephants,” which he describes as: “very rare in southeast Asia. Extremely intelligent, they can easily outwit even the best trappers.”

Elephant Distribution

In the past, elephants were quite numerous in the lowland areas of Vietnam. They maintained high densities in the fertile floodplains of rivers, such as the Mekong and La Nga (Olivier 1978). As the human population increased and agriculture expanded, elephants were forced to retreat into the mountains. Even as recently as 1976, elephants were reported as “numerous” in Buon Don on the Cambodian border (Olivier 1978).

Today the elephant’s stronghold appears to be the hills bordering Cambodia and Laos (Vu Khoi 1988) and in the Central Highlands (Fig. 1). The task of surveying potential elephant areas is made especially difficult because of unexploded mines. Several sites have wildlife potential, but whether they all have elephants is not known. The importance of thorough surveys is thus clear.

Number of Elephants in the Wild

Any assessment of elephant numbers in the wild is prone to underestimation as the lack of visibility in tropical forests

makes it extremely difficult to arrive at even working estimates. Vietnam is no exception. Olivier (1978) quotes McNeely’s estimate of 2,000-10,000 for the entire Mekong basin and suggests a total of 3,500-5,000 elephants in the wild in Cambodia, Laos, and Vietnam. The most recent estimate puts the number of wild elephants in Vietnam at between 1,500 and 2,000 (Vu Khoi 1988).

MacKinnon (1983) reported about 100 elephants living in the foothills and perhaps 200 more in the hill forests along the Laotian border. He states that their numbers are probably generally underestimated.

Number of Elephants in Captivity

The number of elephants in captivity in Vietnam is estimated to be about 600, of which 500 are in Ban Dong province (Vu Khoi 1988). There has been a long tradition, especially among the hill tribes in the Central Highlands, of capturing and taming wild elephants for local use and export. The Moi people eat elephant meat (Olivier 1978). Before the Indochina War, there existed in the Central Highlands “the biggest elephant market in the whole of southeast Asia, where domesticated elephants were sold to neighbouring countries and to zoos and circuses abroad” (Pfeiffer 1984). This market collapsed with the beginning of the war. Elephants were used during the war to haul supplies along the difficult mountain trails, and all elephants were treated as targets by the U.S. forces to deprive the Vietcong of transport. Elephants are still being captured.

Conservation Problems

The devastation of vast tracts of forest lands between 1961 and 1973 by bombs, napalm, herbicides, and defoliants during the war was the most serious man-made eco-catastrophe in Vietnam.

According to Lamb (1985), such practices destroyed 20,000 km² of forest in the south, which included about 1,400 km² of mangroves and 1,500 km² of closed tropical forest. In 1968, over 20% of the total forest in the south was deforested by chemical warfare. An estimated 10% of the inland forest, 3% of the cultivated land, 36% of the mangrove forest and 6% of other types of vegetation were affected by the programme.

Forests have continued to decline since the war as a result of uncontrolled logging, shifting cultivation, and fuelwood col-

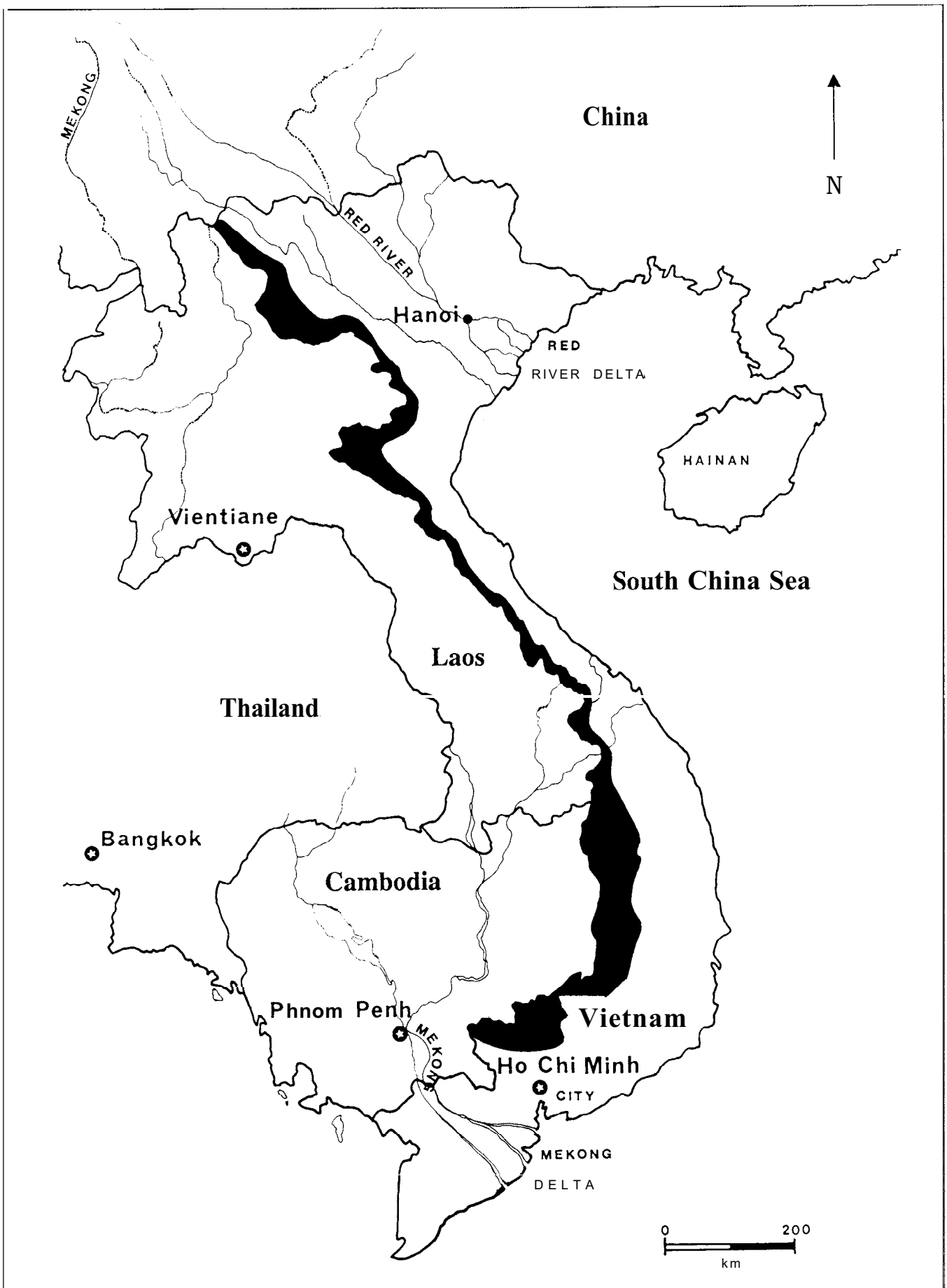


Figure 1. Distribution of elephants in Vietnam.

lection. These activities are responsible for an annual loss of 2,000 km² of forests (Kemf 1986). Shifting cultivation is practised by over a million mountain people, such as the Muong tribe. The number of people who practice such agriculture far exceeds the ability of the land to sustain them.

Wood from the forest is the main source of energy in Vietnam. The country has managed to meet its domestic requirements for food and fuel over the past three years at the cost of its forests. It is unlikely that such productivity can be sustained to meet growing demands in the coming decades. If billions of trees are not planted within the next few years, Vietnam will be devoid of natural forest cover by the year 2000 (Kemf 1986). In 1986, Vietnam planted a record 450 million trees, representing 1,600 km² of forest (Vo Quy 1987).

The tribal people, who make up about 5% of the Vietnamese population, pose a continuing conservation problem because of their reluctance to abide by the laws enacted to protect wildlife and natural habitats (Westing and Westing 1981). Some tribes, such as the Muong, poach extensively, often in protected areas, using primitive but powerful weapons, including bows and arrows tipped with poisons obtained from a local tree (Pfeiffer 1984). Modern firearms are also used to kill elephants.

A legacy of the war is the availability of firearms. This, in combination with weak legislation and law enforcement on hunting and forest protection, and the severe shortage of meat, has led to the decline in the number of game animals in many areas (IUCN 1985).

Conservation Measures Taken

During the past 40 years, through war and peace, the government of Vietnam proposed the establishment of a system of 87 protected areas (Trung 1985). The target is to protect at least 10,000 km², which amounts to about 3% of the country (MacKinnon and MacKinnon 1986). In 1981, the government set up a special committee to protect dwindling natural resources and the environment. As a result, the Ministry of Forestry set aside 40,000 km² of forest land and drew up plans to create a network of protected areas. Fourteen of these reserves, covering an area of 1,600 km², have already been approved by the government (IUCN 1985).

Before 1963, there were no regulations regarding hunting in Vietnam. This situation has now been redressed with the enactment of laws and regulations by the Department of Protection of the Ministry of Forestry, which regulates the hunting (Pfeiffer 1984).

Vietnam is planting about 1,300- 1,500 km² of forest annually (Vo Quy 1987). From 1955 to 1980, a total of 8,720 km² of forest was planted, but only about 3,160 km² still has a realistic tree cover, giving a survival rate of only 36% (IUCN 1985; Kemf 1986). Over the past few years, however, the tempo of afforestation seems to have increased. From 1981 to 1985, about 4,620 km² were afforested, and 1,640 million trees were

planted. In addition, some 3,700 km² of headwater forests were planted (Xuan 1986).

Forest destruction has been reduced by 50-70% (Xuan 1986), and the rate of soil erosion has dropped from 115.4 tonnes to 57.3 tonnes per year in areas where the techniques of agroforestry have been introduced (Kemf 1986).

A significant achievement was the launching in 1985 of the National Conservation Strategy (NCS), whose principal recommendations were officially endorsed by the Prime Minister. They are:

1. Reduction of population growth rate as soon as possible;
2. The launching of a massive reforestation programme to restore the hydrological balance, and;
3. Establishment of a Board of Environmental Coordination higher than ministerial level to help enforce the planned new legislation (Anon (1985b).

A new wildlife law was enacted in 1989, and a conservation education campaign has been started to promote its implementation.

Recommended Actions

- A large portion of elephant habitat in Vietnam overlaps with Cambodia and Laos, and so the animal should be looked upon as a shared resource in the border areas. A collaborative conservation programme by Vietnam, Laos, and Cambodia is needed to protect the elephant and other shared natural resources. This should include the establishment of a trans-frontier reserve between the three countries. In Vietnam, this would mean the expansion of the Mom Rai-Ngoc Vin Sathay National Park up to the Cambodian border.
- A survey is needed to determine more accurately the distribution and population of elephants in Vietnam. This should lead to clear conservation recommendations, including the establishment of reserves in key areas, and the management of as many elephants as possible in a multi-use elephant range, aimed at reducing habitat fragmentation and conflicts between elephants and people.
- Surveys should also be made to evaluate the nature and extent of habitat encroachment and poaching in protected areas. The results should be the basis for recommendations for improving the management of these reserves and the elephants in them.
- Vietnam should become a Party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The former Saigon regime signed the convention in 1973, but never ratified it. Adherence to CITES would help to reduce ivory poaching by controlling international trade.

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