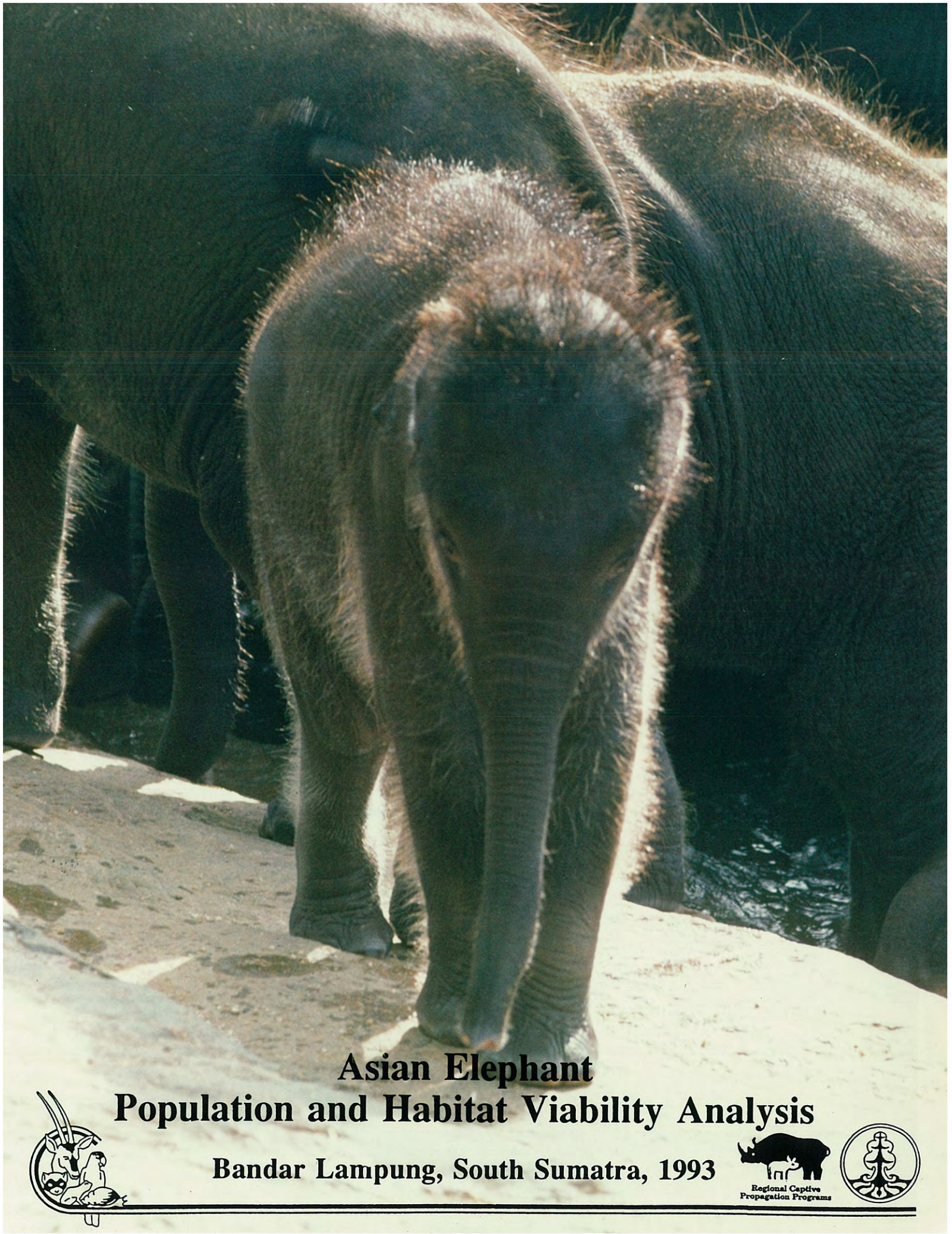


Asian Elephant
Population and Habitat Viability Analysis

Bandar Lampung, South Sumatra, 1993

Regional Captive Propagation Programs

Asian Elephant in Sumatra

Population and Habitat Viability Analysis Report

of the Captive Breeding Specialist Group Species Survival Commission of the IUCN

18 April 1994

Workshop Editors:

Ronald Tilson
Minnesota Zoo, Apple Valley, MN, USA

Komar Soemarna
Indonesian Forest Protection and Nature Conservation, Indonesia

Widodo Ramono
Indonesian Forest Protection and Nature Conservation, Indonesia

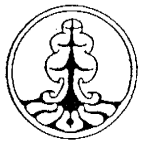
Raman Sukumar
Indian Institute of Science, Bangalore, India

Ulysses Seal
IUCN/SSC CBSG, Apple Valley, MN, USA

Kathy Traylor-Holzer
Minnesota Zoo, Apple Valley, MN, USA

Charles Santiapillai
University of Peradeniya, Sri Lanka

A Joint Endeavor of the Indonesian Forest Protection and Nature Conservation (PHPA), the IUCN/SSC Asian Elephant Specialist Group, and the IUCN/SSC Captive Breeding Specialist Group



Asian Elephant in Sumatra

Population and Habitat Viability Analysis Workshop

Bandar Lampung, Indonesia

8 - 10 November 1993

Supporting Organizations:

Indonesian Forest Protection & Nature Conservation (PHPA)

IUCN/SSC Captive Breeding Specialist Group (CBSG)

NYZS/International Wildlife Conservation Park

Australasian Species Management Programme (ASMP)

Minnesota Zoo

Asian Elephant in Sumatra
Population and Habitat Viability Analysis Report

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Population and Habitat Viability Analysis Report

Section 1:

PHVA Workshop Information

Executive Summary

Asian Elephant in Sumatra
Population and Habitat Viability Analysis

The Directorate General of Forest Protection and Nature Conservation (PHPA) of Indonesia and the IUCN/SSC Captive Breeding Specialist Group (CBSG) convened a workshop on the Population and Habitat Viability Analysis (PHVA) of the Asian Elephant in Sumatra in Bandar Lampung, Sumatra on 8-10 November 1993, which was attended by more than 40 participants from Indonesia, Malaysia, Thailand, New Zealand, Australia, United Kingdom, USA, Ireland, India and Sri Lanka. The success of this workshop was largely due to the efforts of Komar Soemarna (Director of Nature Conservation, PHPA), Widodo Sukohadi Ramono (Director, Species Conservation, PHPA), Ulysses Seal (Chair, IUCN/SSC CBSG), and Ronald Tilson (Director of Conservation, Minnesota Zoo). The international zoo community provided a generous grant that enabled many of the overseas participants to attend the workshop.

The workshop provided an opportunity to reassess the status of the Asian elephant in Sumatra in light of the recent changes in the human demography and forest cover. The last survey of the elephant in Sumatra was carried out almost a decade ago by Blouch and Haryanto (1984), Blouch and Sibolon (1985), and Santiapillai and Suprahman (1984). The total poulation size of the Asian elephant in Sumatra was estimated to be between 2,800 and 4,800. Much of the information on the number of elephants in Sumatra was gathered from local villagers and wildlife personnel. The information given by the wildlife chiefs from the provinces of Sumatra during the workshop indicates that there could be anywhere between 3,600 to 4,500 elephants in Sumatra today. This indicates an increased value for the minimum estimate given earlier but the maximum recorded is still less than what was projected earlier.

In the past, Santiapillai and Jackson (1990) identified 44 separate populations which by 1992 had been reduced to 41 as three populations of elephants became extinct locally. Subsequent work in the northern province of Aceh indicates the fragmentation of large populations so that at the workshop, the PHPA identified 47 populations in Sumatra, of which nine populations comprised less than 25 animals and were considered nonviable, while the remaining 38 populations with more than 25 animals each are distributed as follows: nine populations in national parks (963-1,173 animals), five in game reserves (710-860 animals), three in protection forests (130-180 animals), and 21 in production forests (1,895-2,320 animals).

The important finding is that the largest number of elephants (1,895-2,320) are found in the Production forests whose status varies. There are three kinds of Production forests: 1) limited production forests; 2) permanent production forests; and 3) conversion forests. The latter category can be converted to other land uses (such as agriculture, human settlement, mining, etc.). Therefore the long-term security of many of the elephants in such production forests appears bleak.

As a result of the decline in the forest cover and increase in the human population growth, the elephant-human conflicts in Sumatra have escalated. In extreme cases, the PHPA has been forced to capture chronic crop raiders and rogue elephants with the view to minimizing the human-elephant conflicts. This has led to the establishment of a number of Elephant Training Centers across Sumatra.

Some of the captured elephants have been trained and are being utilized by logging agencies, zoos and safari parks. However, unless there is substantial improvement in the veterinary care of the elephants, and sufficient financial and trained manpower resources are available, such increased capture of elephants cannot be justified. Furthermore, care must be taken to see that the annual off-take of elephants in the wild is sustainable.

The burden to resolve these issues fell primarily upon the Asian Elephant Populations, Threats and Management Working Group. They considered the current Asian elephant estimates--population by population, the Forestry land use category each of these populations was occupying, the probable future of these habitats, and whether these populations were viable or not based upon Vortex modelling. This information was then synthesized and from that, a comprehensive set of recommendations for each elephant population was generated and then reviewed and approved by all workshop participants.

The long-term viability of Asian elephants in Sumatra is unequivocally linked to the long-term protection of habitat capable of supporting major populations. The eight secure populations live in national parks and will need to be continually monitored. Smaller populations will need to be more intensively managed to ensure their viability. Some of the management strategies recommended for these populations included population strengthening, habitat improvement, and particularly the training of local people to handle and use elephants in patrolling. Unless elephants are integrated into village economy, it will be difficult to sustain their habitat and populations.

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Adapted from R. Sukumar and C. Santiapillai, Gajah (11), 1993 with comments by R. Tilson

DEPARTEMEN KEHUTANAN
DIREKTORAT JENDERAL PERLINDUNGAN HUTAN DAN PELESTARIAN ALAM
Alamat : Gedung Pusat Kehutanan Jl. Jend. Gatot Subroto Telp. 5730315, 5734818 JAKARTA
Jl. Ir. H. Juanda No. 15 Telp. 311615 BOGOR

Nomor : 1855/VI/PA-5/93
Lampiran : 1 berkas
Perihal : Permohonan bantuan

Bogor, 5 November 1993

Kepada Yth,
Kepala Kanwil
Departemen Kehutanan
Propinsi Lampung
di Bandar Lampung

Dengan hormat

Sehubungan dengan akan diselenggarakannya "Lokakarya Analisa Viabilitas Habitat Populasi Gajah Asia dan Badak Sumatera" di Hotel Marco Polo, Bandar Lampung, pada tanggal 8 - 13 November 1993, dengan ini kami mohon kesediaan Kantor wilayah Departemen Kehutanan Lampung untuk turut berpartisipasi dan menyiapkan personil untuk membantu kepanitiaan dalam penyelenggaraan Lokakarya tersebut. Bantuan tersebut kami harapkan dapat dimulai sejak awal hingga akhir acara.

Sebagai informasi (sesuai lampiran), Lokakarya ini diselenggarakan atas kerjasama Direktorat Jenderal PHPA Departemen Kehutanan dengan IUCN-SSC-CBSG.

Demikian permohonan kami, atas perhatian dan kerjasamanya kami ucapkan terima kasih.

Direktur Jenderal Perlindungan Hutan dan Pelestarian Alam
Mewakili

Ir. Ilyas Kasim, MS.
NIP: 080 023 428

Tembusan Yth.
1. Bp. Direktur Jenderal PHPA (sebagai laporan)
2. Dr. Ronald Tilson (IUCN-CBSG)
3. BKSDA II, Bandar Lampung.
4. Drs. Jansen Manansang (TSI)
5. Drs. Sukianto Lusli (WWF-IP)

DEPARTEMEN KEHUTANAN

DIREKTORAT JENDERAL PERLINDUNGAN HUTAN DAN PELESTARIAN ALAM

Gedung Pusat Kehutanan Jl. Jend. Gatot Subroto Telp. 583033 - 583037 JAKARTA
Alamat Kawat : Ditjen PHPA JAKARTA
Sekretariat Direktorat Jenderal PHPA, Gedung Pusat Kehutanan Jakarta,
Jl. Ir. H. Juanda No. 15 Telp. 324013 Bogor
Direktorat Perlindungan Hutan Jl. Ir. H. Juanda No. 100 Telp. 323972 Bogor.
Direktorat Pelestarian Alam Jl. Ir. H. Juanda No. 15 Telp. 323067 Bogor.
Direktorat Taman Nasional dan Hutan Wisata Jl. Ir. H. Juanda No. 100 Telp. 321014 Bogor.
Direktorat Penyuluhan Konservasi Sumber Daya Alam, Gedung Pusat Kehutanan Jakarta.

Nomor : 974/VI/PA-5/1993 JAKARTA/BOGOR 17 Juni 19 93

Lampiran :

Perihal :

Kepada Yth.

Ronald L. Tilson,Ph.D.
Director of Conservation
Minnesota Zoo.
13000 Zoo Beoulevard, Apple
Valley, MN 55124 612.431.9200
U S A

Thank you for your activity report in Indonesia we received your activity report along Indonesia dated 27 April - 2 May 1993.

Related to the Asian Elephant and Sumatran Rhino Workshop which is planed to schedule on November 1993 principally we suport that activity.

Furthermore could you please help us to inform this matter to the foreign participants.

Thank you very much for your coorporation.

The Director of Nature Conservation

Hadodo Sukohadi Ramono

Problem Statement

Asian Elephant in Sumatra
Population and Habitat Viability Analysis

The Asian elephant, estimated to be between 34,000 and 56,000, exists in a number of small, scattered and discontinuous populations from India in the west to Indo-China in the east. The population size ranges from a few animals, often fragmented with little prospects for long-term survival, to over 4,000 animals. In addition there may be up to 16,000 animals in captivity throughout Asia, especially in India, Thailand, Myanmar (Burma), and Sri Lanka. With few exceptions, the numbers of both elephants in the wild and in captivity are on the decline throughout Asia. The question is whether this trend could be reversed.

If we follow the enlightened policies adopted in some countries as far as wildlife conservation is concerned, then there is indeed some room for optimism. But what we see in many Asian countries leaves no cause for such euphoria. The good news is from South India where under sensible management using nothing more sophisticated than common sense, there has been a spectacular increase in the number of calves born to elephants in captivity by maintaining the captive elephants in semi-natural conditions in the vicinity of wild elephants. Wild bulls seek out and mate with oestrus females, thus siring the calves and improving the genetic stock of the elephants in captivity. Artificial insemination (AI) and other high-tech methods of assisted reproduction may work, but these are prohibitively expensive to carry out in many Asian countries, given the meager financial resources available for wildlife conservation.

Wild populations of Asian elephants are being threatened more by habitat loss and fragmentation as a result of escalating human population than by poaching for ivory. Only one third of the Asian elephant habitat is in protected areas. Poaching cannot be the terminal threat in the case of the Asian elephant as it is in the African elephant, where both sexes have tusks. In Asia only a proportion of the male elephants have tusks.

Many Asian countries with elephant populations face a dilemma: on the one hand, as custodians of biodiversity and charismatic megafauna they are forced to assume responsibility for their protection. Yet at the same time, most of these countries faced with expanding human populations, collapsing economies and crippling foreign debts are in desperate need of new resources to bolster their ailing economies and thereby keep the body and soul of their human populations in communication. Therefore conservation of elephant *per se* may rank rather low in their scheme of things.

The Species Survival Commission of the World Conservation Union (IUCN) has achieved enormous success and recognition through its production of the so called Action Plans. There is also an Action Plan for the Conservation of the Asian Elephant, but it remains just an achievement on paper. Sadly, it has not achieved its desired objectives. This may be due to the fact that it is already out-of-date and is therefore of little use now. This may be the case as far as the conservation of elephants in India is concerned. But in many other instances, the countries

concerned have neither the financial resources or the trained manpower needed to implement the recommendations the Action Plan identified. Without money and manpower, very little indeed can be achieved in Asia.

One of the surest ways of creating public awareness of the importance of conserving the Asian elephant and its habitat is to encourage and promote the study of elephants across their range in Asia. The emphasis of such studies should be on resolving human-elephant conflicts in order to create a climate of public opinion conducive to the long-term survival of the elephant as an integral part of the ecosystem. Conservation of elephants and their habitats, perceived by the local populace to be of direct economic importance, is far more likely to be successful in the long-term than by conservation for its own sake.

Adapted from L. de Alwis and C. Santiapillai, *Asian Elephant Specialist Group Newsletter*, No. 8, 1992.

LOKAKARYA ANALISA VIABILITAS HABITAT DAN POPULASI
GAJAH ASIA DAN BADAK SUMATERA
(Asian Elephant & Sumatran Rhino PHVA Workshops)

Hotel Marcopolo, Bandar Lampung, 8 - 13 November 1993

LAPORAN PENYELENGGARA

Assalamualaikaum Wr.Wb.,

Yang terhormat Bapak Menteri Kehutanan R.I. yang dalam hal ini diwakili oleh Bpk. Kepala Badan Penelitian dan Pengembangan Kehutanan,
Yang terhormat Bapak Gubernur KDH.Tingkat I Propinsi Lampung, yang dalam hal ini diwakili oleh Bpk. Asisten II Sekwilda Propinsi Lampung,
Yang kami hormati Bapak Kepala Kantor Wilayah Departemen Kehutanan Propinsi Lampung,
Para Pakar Internasional di bidang konservasi badak sumatera, gajah asia dan belibis pohon sayap putih, yang terdiri dari IUCN/CBSG, IUCN/SSC AsESG - AsRSG, International Rhino Foundation, Zoo Specialists,
Hadirin sekalian yang berbahagia.

Allow me to report on the preparation of this meeting in Bahasa Indonesia,

Perkenankan kami melaporkan bahwa pada saat ini telah berkumpul para pakar dibidang konservasi satwa badak sumatera, para pakar gajah asia dan para pakar belibis pohon sayap putih, para pelaksana teknis konservasi, pecinta margasatwa dan para pengamat yang berjumlah 60 orang.

Para peminat konservasi satwa tersebut yang berasal dari Amerika Serikat, Inggris, India, Sri Langka, Thailand, Malaysia, New Zealand, Australia dan Indonesia, berkumpul atas kerjasama antara:
Direktorat Jenderal Perlindungan Hutan dan Pelestarian Alam Departemen Kehutanan, dengan
Survival Service Commission (SSC) dari International Union for Conservation of Nature and Natural Resources (IUCN) yang diwakili oleh Captive Breeding Specialists Group (CBSG), dan
Taman Safari Indonesia sebagai anggota IUCN SSC/CBSG.

Dalam rangka memperingati Hari Cinta Puspa dan Satwa Nasional tahun 1993, dengan mengambil tempat di Hotel Marcopolo Bandarlampung di Propinsi yang terkenal gajahnya ini, para pakar dan teknisi tersebut bermaksud untuk membicarakan mengenai konservasi badak, gajah dan belibis pohon sayap putih dalam suatu lokakarya yang bertujuan untuk:
merumuskan saran strategi pengembangan manajemen kawasan konservasi di Sumatera dan dengan sasaran-sasaran:

- analis...

- analisis tentang status terakhir populasi dan distribusi gajah asia dan badak sumatera serta belibis pohon sayap putih,
- habitat dan pola pemanfaatan lahan,
- masalah perburuan liar,
- koordinasi antar instansi lokal terkait dan hal-hal penting lain, dalam perumusan strategi jangka panjang pengembangan manajemen populasi dan habitat satwa-satwa tersebut.
- masalah gangguan gajah

Demikian laporan kami dan akhirnya perkenankan kami memohon kepada Bapak Menteri Kehutanan untuk pada waktunya berkenan membuka Lokakarya ini.

Wassalamualaikum Wr.Wb.

tertanda,

Komar Soemarna MS.
Direktur Bina Kawasan Suaka Alam dan Konservasi Flora Fauna.

SAMBUTAN
GUBERNUR KEPALA DAERAH TINGKAT I LAMPUNG
PADA PEMBUKAAN LOKAKARYA ANALISA
VIABILITAS HABITAT POPULASI GAJAH DAN BADAK SUMATERA
TANGGAL 8 NOVEMBER 1993

Assalamu'alaikum Warakhmatullahi Wabarakatuh.

Yth. Dir. Jen. Perlindungan Hutan dan Pelestarian Alam (PHPA),
Yth. Para Direktur dilingkup Direktorat Jenderal PHPA,
Yth. Para Kepala Kantor Wilayah Kehutanan se Sumatera,
Yth. Para Utusan Pemda Tk. I se Sumatera,
Para Peserta Lokakarya Analisa Viabilitas Habitat Populasi Gajah dan Badak Sumatera, serta Hadirin yang kami hormati,

Pertama-tama marilah kita panjatkan puji syukur kehadirat Tuhan Yang Maha Esa atas segala limpahan rakhmat dan karunia-Nya yang telah kita terima, sehingga kita dapat berkumpul pada hari ini dalam rangka Lokakarya Analisa Viabilitas Habitat Populasi Gajah dan Badak Sumatera sebagai salah satu mata acara pada Hari Cinta Puspa dan Satwa yang telah ditetapkan oleh Pemerintah pada setiap tanggal 5 November.

Kami merasa memperoleh kehormatan yang besar atas penyelenggaraan Lokakarya ini di Bandar Lampung.

Dalam hubungan ini perkenankan kami mengucapkan selamat datang kepada para peserta Lokakarya di daerah "Sang Bumi Ruwa Jurai yang kita cintai ini.

Saudara-saudara sekalian,

Beberapa hari yang lalu kita juga baru saja menyelenggarakan acara Puncak Penghijauan dan Konservasi Nasional Tingkat Propinsi tahun 1993. Dalam era globalisasi yang dipenuhi dengan isu-isu tentang konservasi sumber daya alam, maka acara seperti Puncak Penghijauan Nasional (PPN), Pekan Konservasi Alam Nasional (PKAN) dan tak terkecuali hari Cinta Puspa dan Satwa ini kiranya amat relevan dan penting untuk dimasyarakatkan.

Keanekaragaman flora dan fauna Indonesia sangat tinggi, sehubungan dengan keadaan tanah, letak geografi dan keadaan iklimnya. Sebagai salah satu usaha untuk melindungi flora dan fauna dari ancaman bahaya punah, Pemerintah telah menetapkan jenis-jenis tumbuhan dan satwa tertentu sebagai tumbuhan dan satwa yang dilindungi berdasarkan Undang-Undang Nomor 5 tahun 1990 tentang Konservasi Sumber Daya Alam dan Ekosistemnya serta Peraturan Perundangan lain yang berlaku. Di Pulau Sumatera, terdapat beberapa jenis tumbuhan dan satwa

yang terancam punah antara lain Bunga Rafflesia, Gajah dan Badak Sumatera. Khusus untuk Propinsi Lampung, Bunga Asar dan Gajah telah ditetapkan oleh Pemerintah sebagai identitas flora dan fauna daerah.

Sejalan dengan itu habitat Gajah dan Badak Sumatera dari tahun ke tahun di Propinsi Lampung semakin menyempit seiring dengan menurunnya junlah kawasan sebagai konsekwensi dari pesatnya laju pertumbuhan penduduk dan laju pembangunan yang menuntut tersedianya lahan. Berdasarkan Tata Guna Hutan Kesepakatna (TGHK), luas kawasan hutan di Propinsi Lampung yaitu 1.257.208 ha atau 32,5% dari luas wilayah, yang terdiri dari hutan lindung 336.100 ha, hutan suaka dan hutan wisata 422.500 ha, hutan produksi terbatas 44.120 ha, hutan produksi tetap 281.029 ha dan hutan produksi yang dapat dikonservasi 153.459 ha. Populasi gajah di Propinsi Lampung dilaporkan antara 550-900 ekor. Sedangkan populasi badak belum dapat dipastikan junlahnya, meskipun bukti-bukti keberadaannya saat ini telah ditemukan. Baru-baru ini dilaporkan perjumpaan badak baik secara langsung maupun tidak langsung oleh petugas BKSDA II di Taman Nasional Way Kambas. Disamping itu, juga badak Sumatera dilaporkan keberadaannya di Taman Nasional Bukit Barisan Selatan.

Khusus mengenai gajah sebagai identitas fauna daerah Lampung, kini menghadapi permasalahan sehubungan dengan penyempitan habitatnya yang semakin hari semakin menuntut penanganan yang lebih intensif dan terencana. Meskipun telah banyak upaya yang dilakukan untuk memecahkan masalah tersebut; misalnya upaya-upaya yang telah dilakukan oleh BKSDA II, seperti Pendirian Pusat Latihan Gajah, penggiringan, penangkapan dan penjinakan gajah; kerjasama antara Kantor Wilayah Departemen Kehutanan dengan Kantor Wilayah Departemen Transmigrasi, Kantor Wilayah Departemen Sosial/Dinas Sosial. Namun demikian gangguan gajah di daerah ini masih sering terjadi.

Dalam rangka memecahkan masalah ini kami mengharapkan agar upaya pemanfaatan dan pemasyarakatan gajah di Propinsi Lampung pada khususnya dan di Pulau Sumatera pada umumnya, terus ditingkatkan untuk mewujudkan kondisi yang menunjukkan bahwa gajah dan masyarakat, khususnya petani, dapat hidup berdampingan secara harmonis dan saling menguntungkan. Sehingga pada gilirannya gajah Sumatera sebagai salah satu unsur pembentuk ekosistem hutan hujan tropis dapat terjamin kelestariannya.

Oleh karena itu kami mengharapkan melalui Lokakarya ini dapat dilahirkan konsep-konsep pemikiran mengenai upaya pemasyarakatan dan pelestarian gajah serta badak Sumatera yang realistis.

Akhirnya kepada para peserta Lokakarya kami ucapkan selamat berlokakarya, semoga Tuhan Yang Maha Esa memberikan kemudahan didalam menyusun konsep-konsep pemikiran tersebut.

Terima kasih atas perhatian Saudara-saudara. Wassala mu'alaikum Warakhmatullahi Wabarakaatuh.

GUBERNUR KEPALA DAERAH TK I LAMPUNG,
POEDJONO PRANYOTO

MENTERI KEHUTANAN
REPUBLIK INDONESIA

SAMBUTAN PENGARAHAN

MENTERI KEHUTANAN REPUBLIK INDONESIA

PADA LOKAKARYA MENGENAI KONSERVASI GAJAH ASIA, BADAK SUMATERA DAN BELIBIS SAYAP PUTIH.

PADA 8-13 NOVEMBER 1993

MARCO POLO, BANDAR LAMPUNG, SUMATERA SELATAN

ASSALAMUALAIKUM WR.WB.

SAUDARA-SAUDARA DIREKTUR JENDERAL, DIREKTUR DAN KEPALA KANTOR WILAYAH SERTA KEPALA DINAS LINGKUP DEPARTEMEN KEHUTANAN YANG SAYA HORMATI.

SAURARA-SAUDARA PARA PESERTA LOKAKARYA, PARA UNDANGAN DAN HADIRIN SEKALIAN YANG SAYA HORMATI.

PERTAMA-TAMA MARILAH KITA MEMANJATKAN PUJI DAN SYUKUR KEHADIRAT TUHAN YANG MAHA ESA, BAHWA KARENA KEHENDAKNYA PADA HARI INI KITA DAPAT BERKUMPUL BERSAMA DI TEMPAT INI DALAM KEADAAN SEHAT WAL`AFIAT DALAM RANGKA MENGHADIRI LOKAKARYA MENGENAI KONSERVASI GAJAH ASIA, BADAK SUMATERA DAN BELIBIS SAYAP PUTIH YANG DISELENGGARAKAN ATAS KERJASAMA DEPARTEMEN KEHUTANAN, DIREKTORAT JENDERAL PERLINDUNGAN HUTAN DAN PELESTARIAN ALAM, YAYASAN MITRA RHINO, IUCN, WWF, AWB, AAZPA DAN IRF YANG TELAH BANYAK MEMBANTU DEPARTEMEN KEHUTANAN, DIREKTORAT JENDERAL PERLINDUNGAN HUTAN DAN PELESTARIAN ALAM DALAM TUGAS KONSERVASI BAIK IN-SITU MAUPUN EKS-SITU DI INDONESIA.

SAUDARA-SAUDARA SERTA HADIRIN SEKALIAN YANG SAYA HORMATI,

PADA KESEMPATAN INI SAYA INGIN MENGEMUKAKAN RASA KEGEMBIRAAN SAYA, KARENA SAUDARA-SAUDARA DAPAT MENGHADIRI LOKAKARYA INI YANG MERUPAKAN RANGKAIAN DARI KEGIATAN KONSERVASI FLORA DAN FAUNA NASIONAL DALAM RANGKA MEMPERINGATI "HARI CINTA PUSPA DAN SATWA NASIONAL (HCPSN)" YANG TELAH DITETAPKAN JATUH PADA SETIAP TANGGAL 5 NOPEMBER. HCPSN INI TELAH DICANANGKAN OLEH PRESIDEN REPUBLIK INDONESIA, DALAM KATA SAMBUTANNYA PADA UPACARA PENCANANGAN TAHUN LINGKUNGAN HIDUP PADA TANGGAL 10 JANUARI 1993 DI TAMAN MONAS, JAKARTA.

SAYA JUGA BERSYUKUR KEPADA TUHAN YANG MAHA ESA, KARENA SAUDARA-SAUDARA DAPAT MENGHADIRI LOKAKARYA INI UNTUK MEMBERIKAN SUMBANGAN SARAN DALAM KONSERVASI GAJAH ASIA, BADAK SIMATERA DAN BELIBIS SAYAP PUTIH. TENTUNYA SUMBANGAN SARAN SAUDARA INI AKAN SANGAT BERARTI BAGI UPAYA MENINGKATKAN PEMBANGUNAN BERWAWASAN LINGKUNGAN YANG BERKELANJUTAN.

TIDAK LUPA SAYA SAMPAIKAN TERIMA KASIH KEPADA SEMUA PIHAK YANG TELAH BERUPAYA, SEHINGGA LOKAKARYA INI DAPAT DILAKSANAKAN, TERUTAMA REKAN-REKAN KAMI DARI IUCN/SSC-CBSG, WWF, AWB AAZPA DAN IRF

SAUDARA-SAUDARA PESERTA LOKAKARYA YANG SAYA HORMATI,

DALAM PENJELASAN UNDANG-UNDANG NO. 5 TAHUN 1990 TENTANG KONSERVASI SUMBER DAYA ALAM HAYATI DAN EKOSISTEMNYA TELAH DITEGASKAN BAHWA SATWA LIAR ADALAH SEMUA BINATANG YANG HIDUP DI DARAT, DAN DI AIR, DAN ATAU DI UDARA YANG MASIH MEMPUNYAI SIFAT-SIFAT LIAR, BAIK YANG HIDUP BEBAS MAUPUN YANG DIPELIHARA OLEH SEMUA MANUSIA. GAJAH ASIA, BADAK SUMATERA, DAN BELIBIS

SAYAP PUTIH ADALAH SATWA LIAR YANG TELAH MENGALAMI PENURUNAN POPULASI YANG CUKUP DRASTIS DI ALAM DI TEMPAT HIDUPNYA YANG BEBAS. KETIGA JENIS SATWA LIAR INI ADALAH MERUPAKAN SUMBER DAYA ALAM HAYATI YANG MENEMPATI EKOSISTIM TERTENTU YANG DAPAT DIUSAHAKAN KELESTARIAN DAN KESEIMBANGAN EKOSISTIMNYA SEHINGGA DAPAT LEBIH MENDUKUNG UPAYA PENINGKATAN KESEJAHTERAAN MASYARAKAT DAN MUTU KEHIDUPAN MANUSIA. KONSERVASI SUMBER DAYA ALAM HAYATI DAN ESKOSISTIMNYA INI ADALAH MERUPAKAN TANGGUNG JAWAB DAN KEWAJIBAN PEMERINTAH SERTA MASYARAKAT.

PARA HADIRIN SEKALIAN YANG SAYA HORMATI,

DALAM UNDANG-UNDANG NO. 5 TAHUN 1990 TENTANG KONSERVASI SUMBER DAYA ALAM HAYATI DAN EKOSISTEMNYA TELAH DITETAPKAN BAHWA KONSERVASI SUMBER DAYA ALAM HAYATI DAN EKOSISTEMNYA DILAKUKAN MELALUI KEGIATAN :

1. PERLINDUNGAN SISTEM PENYANGGA KEHIDUPAN
2. PENGAWETAN KEANEKARAGAMAN JENIS TUMBUHAN DAN SATWA BESERTA EKOSISTIMNYA;
3. PEMANFAATAN SECARA LESTARI SUMBER DAYA ALAM HAYATI DAN EKOSISTIMNYA.

SEDANGKAN PENGAWETAN KEANEKARAGAMAN TUMBUHAN DAN SATWA BESERTA EKOSISTEMNYA, DILAKSANAKAN MELALUI KEGIATAN :

A. PENGAWETAN KEANEKARAGAMAN TUMBUHAN DAN SATWA BESERTA EKOSISTEMNYA;
B. PENGAWETAN JENIS TUMBUHAN DAN SATWA

UPAYA-UPAYA PENGAWETAN JENIS TUMBUHAN INI BERPEDOMAN PADA TIGA HAL KEGIATAN SEBAGAI BERIKUT :

1. PENGAWETAN JENIS TUMBUHAN DAN SATWA DILAKSANAKAN DI DALAM DAN DI LUAR KAWASAN SUAKA ALAM
2. PENGAWETAN JENIS TUMBUHAN DAN SATWA DI DALAM KAWASAN SUAKA ALAM DILAKUKAN DENGAN MEMBIARKAN AGAR POPULASI SEMUA JENIS TUMBUHAN DAN SATWA TETAP SEIMBANG MENURUT PROSES ALAMI DI HABITATNYA

3. PENGAWETAN JENIS TUMBUHAN DAN SATWA DI LUAR KAWASAN SUAKA ALAM DILAKUKAN DENGAN MENJAGA DAN MENGEMBANGBIAKKAN JENIS TUMBUHAN DAN SATWA UNTUK MENGHINDARI BAHAYA KEPUNAHAN

TUMBUHAN DAN SATWA DIGOLONGKAN DALAM JENIS :

A. TUMBUHAN DAN SATWA YANG DILINDUNGI;
B. TUMBUHAN DAN SATWA YANG TIDAK DILINDUNGI.

SEDANGKAN JENIS TUMBUHAN DAN SATWA YANG DILINDUNGI DIGOLONGKAN DALAM :

A. TUMBUHAN DAN SATWA DALAM BAHAYA KEPUNAHAN;
B. TUMBUHAN DAN SATWA YANG POPULASINYA JARANG.

GAJAH ASIA, BADAK SUMATERA , DAN BELIBIS SAYAP PUTIH ADALAH TERMASUK DALAM KATAGORI SATWA DALAM BAHAYA KEPUNAHAN, DAN ATAU MERUPAKAN SATWA YANG POPULASI-NYA JARANG . TENTU SAJA KETIGA JENIS SATWA INI DI INDONE-SIA MERUPAKAN JENIS-JENIS SATWA YANG DILINDUNGI OLEH UNDANG-UNDANG NO. 5 TAHUN 1990 TENTANG KONSERVASI SUMBER DAYA ALAM HAYTATI DAN EKOSISTEMNYA. SEHINGGA SETIAP ORANG DILARANG UNTUK :

A. MENANGKAP, MELUKAI, MEMBUNUH, MENYIMPAN, MEMILIKI, MEMELIHARA, MENGANGKUT DAN MEMPERNIAGAKAN SATWA YANG DILINDUNGI DALAM KEADAAN HIDUP;

B. MENYIMPAN, MEMILIKI, MEMELIHARA, MENGANGKUT, DAN MEMPERNIAGAKAN SATWA YANG DILINDUNGI DALAM KEADAAN MATI;

C. MENGELUARKAN SATWA YANG DILINDUNGI DARI SUATU TEMPAT DI INDONESIA KE TEMPAT LAIN DI DALAM ATAU DI LUAR INDONESIA;

D. MEMPERNIAGAKAN, MENYIMPAN ATAU MEMILIKI KULIT, TUBUH, ATAU BAGIAN-BAGIAN LAIN SATWA YANG DILINDUNGI ATAU BARANG-BARANG YANG DIBUAT DARI BAGIAN-BAGIAN SATWA SATWA TERSEBUT ATAU MENGELUARKANNYA DARI SUATU TEMPAT DI INDONESIA KE TEMPAT LAIN DI DALAM ATAU DI LUAR INDONESIA;

E. MENGAMBIL, MERUSAK, MEMUSNAHKAN, MEMPERNIAGAKAN, MENYIMPAN ATAU MEMILIKI TELUR DAN/ATAU SARANG SATWA YANG DILINDUNGI.

PENGECUALIAN DARI LARANGAN TERSEBUT HANYA DAPAT DILAKUKAN UNTUK KEPERLUAN PENELITIAN, ILMU PENGETAHUAN, DAN/ATAU PENYELAMATAN JENIS SATWA YANG BERSANGKUTAN; TERMASUK PEMBERIAN ATAU PENUKARAN JENIS SATWA KEPADA PIHAK LAIN DI LUAR NEGERI DENGAN IZIN PEMERINTAH. PENGECUALIAN DARI LARANGAN MENANGKAP, MELUKAI, DAN MEMBUNUH SATWA YANG DILINDUNGI DAPAT PULA DILAKUKAN DALAM HAL OLEH KARENA SUATU SEBAB SATWA YANG DILINDUNGI MEMBAHAYAKAN KEHIDUPAN MANUSIA.

SAUDARA-SAUDARA SEKALIAN PESERTA LOKAKARYA YANG SAYA HORMATI,

JELASLAH SUDAH BAHWA UNDANG-UNDANG NO. 5 TAHUN 1990 TENTANG KONSERVASI SUMBER DAYA ALAM HAYATI DAN EKOSISTEMNYA SANGAT MENEKANKAN BAGI KEPENTINGAN PEMBANGUNAN BERKELANJUTAN DAN KESEJAHTERAAN MANUSIA. APABILA TERJADI PELANGGARAN TERHADAP LARANGAN SEBAGAIMANA DIMAKSUD DI ATAS, SATWA YANG DILINDUNGI TERSEBUT DIRAMPAS UNTUK NEGARA. JENIS SATWA YANG DILINDUNGI ATAU BAGIAN-BAGIANNYA YANG DIRAMPAS UNTUK NEGARA DIKEMBALIKAN KE HABITATNYA ATAU DISERAHKAN KEPADA LEMBAGA-LEMBAGA YANG BERGERAK DI BIDANG KONSERVASI SATWA, KECUALI APABILA KEADAANNYA SUDAH TIDAK MEMUNGKINKAN UNTUK DIMANFAATKAN SEHINGGA DINILAI LEBIH BAIK DIMUSNAHKAN. PENGAWETAN JENIS

TUMBUHAN DAN SATWA YANG DILINDUNGI HANYA DAPAT DILAKUKAN DALAM BENTUK PEMELIHARAAN ATAU PENGEMBANGAN OLEH LEMBAGA-LEMBAGA YANG DIBENTUK UNTUK ITU.

PEMANFAATAN SECARA LESTARI SUMBER DAYA ALAM HAYATI DAN EKOSISTEMNYA DILAKUKAN MELALUI KEGIATAN :

A. PEMANFAATAN KONDISI LINGKUNGAN KAWASAN PELESTARIAN ALAM;
B. PEMANFAATAN JENIS TUMBUHAN DAN SAWTA LIAR.

DIMANA PEMANFAATAN JENIS TUMBUHAN DAN SATWA LIAR DILAKUKAN DENGAN MEMPERHATIKAN KELANGSUNGAN POTENSI, DAYA DUKUNG, DAN KEANEKARAGAMAN JENIS TUMBUHAN DAN SATWA LIAR. SEDANGKAN PEMANFAATAN JENIS TUMBUHAN DAN SATWA LIAR DAPAT DILAKSANAKAN DALAM BENTUK :

A. PENGKAJIAN, PENELITIAN DAN PENGEMBANGAN;
B. PENANGKARAN;
C. PERBURUAN;
D. PERDAGANGAN
E. PERAGAAN;
F. PERTUKARAN;
G. BUDIDAYA TANAMAN OBAT-OBATAN;
H. PEMELIHARAAN UNTUK KESENANGAN.

HADIRIN SEKALIAN YANG SAYA HORMATI,

UNDANG-UNDANG NO. 5 TAHUN 1990 TENTANG KONSERVASI SUMBER DAYA ALAM HAYATI DAN EKOSISTEMNYA JUGA TIDAK MENGABAIKAN PERANSERTA MASYARAKAT, YAITU : PERAN SERTA MASYARAKAT DALAM KONSERVASI SUMBER DAYA ALAM HAYATI DAN EKOSISTEMNYA DIARAHKAN DAN DIGERAKKAN OLEH PEMERINTAH MELALUI BERBAGAI KEGIATAN YANG BERDAYA GUNA DAN BERHASIL GUNA; DALAM

MENGEMBANGKAN PERAN SERTA MASYARAKAT, PEMERINTAH MENUMBUHKAN DAN MENINGKATKAN SADAR KONSERVASI SUMBER DAYA ALAM HAYATI DAN EKOSISTEMNYA DIKALANGAN MASYARAKAT MELALUI PENDIDIKAN DAN PENYLUHAN. PERAN SERTA MASYARAKAT DALAM KONSERVASI SUMBER DAYA ALAM HAYATI DAN EKOSISTEMNYA INI SUDAH TUMBUH KEMBANG SEHINGGA SANGAT MEMBANTU DALAM MENINGKATKAN UPAYA KONSERVASI TUMBUHAN DAN JENIS SATWA YANG DILINDUNGI DI INDONESIA.

BERHASILNYA KONSERVASI SUMBER DAYA ALAM HAYATI DAN EKOSISTEMNYA BERKAITAN ERAT DENGAN TERCAPAINYA TIGA SASARAN KONSERVASI, YAITU :

1. MENJAMIN TERPELIHARANYA PROSES EKOLOGIS YANG MENUNJANG SISTEM PENYANGGA KEHIDUPAN BAGI KELANGSUNGAN PEMBANGUNAN DAN KESEJAHTERAAN MANUSIA (PERLINDUNGAN SISTEM PENYANGGA KEHIDUPAN)

2. MENJAMIN TERPELIHARANYA KEANEKARAGAMAN SUMBER GENETIK DAN TIPE-TIPE EKOSISTEMNYA SEHINGGA MAMPU MENUNJANG PEMBANGUNAN, ILMU PENGETAHUAN, DAN TEKNOLOGI YANG MEMUNGKINKAN PEMENUHAN KEBUTUHAN MANUSIA YANG MENGGUNAKAN SUMBER DAYA ALAM HAYATI BAGI KESEJAHTERAAN (PENGAWETAN SUMBER PLASMA NUTFAH)

3. MENGENDALIKAN CARA-CARA PEMANFAATAN SUMBER DAYA ALAM HAYATI SEHINGGA TERJAMIN KELESTARIANNYA. AKIBAT SAMPINGAN PENERAPAN ILMU PENGETAHUAN DAN TEKNOLOGI YANG KURANG BIJAKSANA, BELUM HARMONISNYA PENGGGUNAAN DAN PERUNTUKAN TANAH SERTA BELUM BERHASILNYA SASARAN KONSERVASI SECARA OPTIMAL, BAIK DI DARAT MAUPUN PERAIRAN DAPAT MENGAKIBATKAN TIMBULNYA GEJALA EROSI GENETIK, POLUSI, DAN PENURUNAN POTENSI SUMBER DAYA ALAM HAYATI (PEMANFAATAN SECARA LESTARI).

UPAYA PEMANFAATAN SECARA LESTARI SEBAGAI SALAH SATU ASPEK KONSERVASI SUMBER DAYA ALAM HAYATI DAN EKOSISTEMNYA, BELUM SEPENUHNYA DIKEMBANGKAN SESUAI DENGAN KEBUTUHAN, DEMIKIAN PULA PENGELOLAAN KAWASAN PELESTARIAN ALAM DALAM BENTUK TAMAN NASIONAL, TAMAN HUTAN RAYA, DAN TAMAN HUTAN WISATA ALAM, YANG MENYATUKAN FUNGSI PERLINDUNGAN SISTEM PENYANGGA KEHIDUPAN, PENGAWETAN KEANEKARAGAMAN JENIS TUMBUHAN DAN SATWA BESERTA EKOSISTEMNYA, DAN PEMANFAATAN SECARA LESTARI.

GAJAH ASIA, BADAK SUMATERA DAN BELIBIS SAYAP PUTIH YANG MERUPAKAN SUMBERDAYA ALAM HAYATI MERUPAKAN UNSUR EKOSISTEM YANG DAPAT DIMANFAATKAN UNTUK MENINGKATKAN KESEJAHTERAAN MASYARAKAT DAN MUTU KEHIDUPAN MANUSIA. NAMUN, KESEIMBANGAN EKOSISTEMNYA YANG HARUS TETAP TERJAMIN. OLEH KARENA ITU, MENGINGAT PENTINGNYA KONSERVASI SUMBER DAYA ALAM HAYATI DAN EKOSISTEMNYA BAGI PENINGKATAN KESEJAHTERAAN MASYARAKAT DAN MUTU KEHIDUPAN MANUSIA, MAKA MASYARAKAT JUGA MEMPUNYAI KEWAJIBAN DAN TANGGUNGJAWAB DALAM MELAKSANAKAN KEGIATAN KONSERVASI.

HADIRIN SEKALIAN PESERTA LOKAKARYA YANG SAYA HORMATI,

LOKAKARYA KONSERVASI GAJAH ASIA, BADAK SUMATERA, DAN BELIBIS SAYAP PUTIH YANG DIMULAI HARI INI, DIHARAPKAN DAPAT MEMBERI MASUKAN DAN MENYEMPURNAKAN HASIL-HASIL LOKAKARYA DAN SEMINAR YANG PERNAH DISELENGGARAKAN.

SEHUBUNGAN DENGAN HAL-HAL YANG TELAH SAYA SAMPAIKAN DIATAS, MENGENAI UNDANG-UNDANG NO. 5 TAHUN 1990 TENTANG KONSERVASI SUMBER DAYA ALAM HAYATI DAN EKOSISTEMNYA, DIMANA KETIGA JENIS DARI GAJAH ASIA, BADAK SUMATERA, DAN BELIBIS SAYAP PUTIH JUGA SEBAGAI SUMBER DAYA ALAM HAYATI DAN MERUPAKAN PULA SATWA LANGKA YANG TELAH DILINDUNGI;

MAKA BESAR HARAPAN SAYA AGAR DALAM LOKAKARYA INI SAUDARA-SAUDARA DAPAT MERUMUSKAN HAL-HAL YANG SANGAT MENDASAR UNTUK DAPAT MENGIMPLEMENTASIKAN KEGIATAN KONSERVASI DARI KETIGA JENIS SATWA LANGKA YANG TELAH DILINDUNGI TERSEBUT AGAR DAPAT BERMANFAAT BAGI KESEJAHTERAAN MASYARAKAT DAN KEHIDUPAN MANUSIA SECARA LESTARI. HAL INI DAPAT MENUNJANG PROGRAM PEMBANGUNAN JANGKA PANJANG TAHAP KE II DIMANA PROGRAM PEMBANGUNAN NASIONAL SAAT INI SUDAH MEMPRIORITASKAN KONSERVASI UNTUK DAPAT MENGENTASKAN KEMISKINAN. SEBAB SELAMA PROGRAM PEMBANGUNAN BELUM DAPAT MENGENTASKAN KEMISKINAN BERARTI PEMERINTAH BELUM BERHASIL MENINGKATKAN UPAYA KONSERVASI SUMBER DAYA ALAM HAYATI DAN EKOSISTEMNYA.

SAYA BERHARAP BAHWA RUMUSAN HASIL-HASIL LOKAKARYA INI DAN PETUNJUK-PETUNJUK PELAKSANAAN YANG AKAN DIHASIL-KAN OLEH PARA PAKAR GAJAH ASIA, BADAK SUMATERA, DAN BELIBIS SAYAP PUTIH, DAPAT SEGERA DIOPERASIONALKAN DILAPANGAN .

SAUDARA-SAUDARA HADIRIN YANG SAYA HORMATI,

SEKALI LAGI SAYA SAMPAIKAN TERIMA KASIH KEPADA PANITIA PENYELENGGARA DAN SAUDARA-SAUDARA PESERTA DALAM BERPERANSERTA DALAM LOKAKARYA INI. SEMOGA SUMBANGAN PEMIKIRAN SAUDARA-SAUDARA DAPAT BERMANFAAT BAGI PENGEMBANGAN KONSERVASI GAJAH ASIA, BADAK SUMATERA, DAN BELIBIS SAYAP PUTIH, DAN SATWA LIAR LAIN PADA UMUMNYA DI INDONESIA.

AKHIRNYA DENGAN MENGUCAPKAN BISMILLAHHIRROHMANIR-ROHIM, DENGAN INI SAYA BUKA LOKAKARYA KONSERVASI GAJAH ASIA, BADAK SUMATERA, DAN BELIBIS SAYAP PUTIH YANG MERUPAKAN RANGKAIAN PERINGATAN KEGIATAN HARI CINTA PUSPA DAN SATWA INDONESIA PADA 5 NOPEMBER 1993.

WASSALAMUALAIKUM. WR. WB.

BANDAR LAMPUNG, 8 NOPEMBER 1993

MENTERI KEHUTANAN

DJAMALUDIN

Asian Elephant in Sumatra
Population and Habitat Viability Analysis

Bandar Lampung, South Sumatra
8 - 10 November 1993

Workshop Agenda

Sunday, 7 November

Workshop participants and attendees arrive in Bandar Lampung.
Late afternoon registration.

18:00-19:00 Workshop Coordinators meeting (after dinner)

Monday, 8 November

09:00-12:00 **Asian Elephant PHVA Workshop convenes.**
Opening comments (Komar, Bandar Lampung officials, Seal, Tilson)
Overview of elephant distribution & threats (Widodo, Santiapillai, van Strien)

13:30-14:30 Presentation of map-linked database and land use patterns (Tilson)
PHVA overview/initial modelling of elephant populations and GIS (Seal, Sukumar, Santiapillai)

14:30-17:30 Working groups:
Protected areas, vortex models, *in situ* programs (Komar, Widodo, PHPA)
Discussion and data verification of working groups

20:00 Continue working groups

Tuesday, 9 November

08:30-12:00 Status reports of working groups (Komar, PHPA Chiefs)
Overview of wild Asian elephant management strategies (Komar, Sukumar, Seal)

13:30-16:30 Working groups: Evaluation of management strategies (PHPA staff, Sukumar)

19:30 Continue working groups

Wednesday, 10 November

08:30-12:00 Working group reports (PHPA staff)
Genetic management of metapopulations
Integration of management strategies (Seal, Komar, Sukumar)

13:30 Workshop draft recommendations: overall and site-specific
Workshop wrap-up

Workshop Participants

Asian Elephant in Sumatra
Population and Habitat Viability Analysis

Jasmi Bin Abdul
Dept. of Wildlife & National Parks
Km. 10, Jalan Cheras
50664 Kuala Lumpur
MALAYSIA
Tel: +60-3-9052873

Marcellus Adi C.T.R.
Yayasan Mitra Rhino
Gedung PHPA Kehutanan
Jl. Ir. H. Juanda 15
Bogor 16122
INDONESIA
Tel: +62-251-360737
Fax: +62-251-313985

Marizal Ahmad
Sumatran Rhino Survey
University of Lampung
Jl. Sumantri B.N. No. 1
Bandar Lampung
INDONESIA
Fax: +62-721-72767

Apriawan
c/o Taman Nasional Way Kambas
Way Jepar
Lam-Teng
Lampung 34196
INDONESIA

R. Bintoro
SBKSDA Aceh
Jl. T. Nyah Arief
Komplex Pertanian Jenlingki
P.O. Box 29
Banda Aceh
INDONESIA
Tel: +62-651-21115

Anwaruddin Chowdhury
Near Gate No. 1 of Nehru Stadium
Islampur Road
Guwahati 781 007 (Assam)
INDIA
Fax: +91-361-540376 (c/o E.W. Holiday)

Mual Daulay
Sub Balai KSDA Riau
Jl Sido Mulyo KM 8,5
P.O. Box 1048
Pekanbaru
INDONESIA
Ph: +62-761-21135

Desmonth Bangun
Protect Sumatran Rhino Programme
(Air Hitam Camp)
c/o Yayasan Mitra Rhino
Bogor
INDONESIA

Thomas Foose
International Rhino Foundation
c/o The Wilds
85 E. Gay St.,Suite 603
Columbus, OH 43215-3118
USA
Fax: +614-228-7210

Neil Franklin
Sumatran Rhino Survey Project
c/o Pt. Agro Muko
Muko Muko
Bengkulu Utara
Bengkulu 38365
INDONESIA
Fax: +62-751-28034 (off. hrs.)

Andy Green
Estacion Biologica de Donana
Pabellon del Peru
Avenida de Maria Luisa S/N
41013 Sevilla
SPAIN
Fax: +55-440033

Muniful Hamid
Sub-Balai KSDA Jambi
Jl. Arif Rahman Hakim No. 10B
Telanaipura
Jambi
INDONESIA

Amir Hamzah
BKSDA II
Jl. Hajimena 1/B
Bandar Lampung
INDONESIA
Tel: +62-721-73882

Sugeng Hariadys
Protect Sumatran Rhino Programme
(Air Hitam Camp)
c/o Yayasan Mitra Rhino
Bogor
INDONESIA

Siska Saskia Hendarin
WWF Indonesia Programme
Jl. Pela No. 3
Gandaria Utara
Jakarta Selatan
INDONESIA
Fax: +62-21-739-5907

Teguh Husodo (Himbio-Unpad)
c/o Department of Biology
Faculty of Mathematics & Nature Sci.
Padjadjaran State University
Jl. Raya Bandung-Sumedane Km.-21
Bandung
INDONESIA

Faustina Ida
Elephant Training Centre (PLG)
Way Kambas
Jl. Labuhan Ratu Lama
Way Jepara 34196
Lampung Tengah
INDONESIA

Waladi Isnan
Chief, National Park
Bukit Barisan Selatan
Kota Agung, Lampung
INDONESIA

Jim Jackson
Fossil Rim Wildlife Center
Rt. 1, Box 210
Glen Rose, TX 76043
USA
Fax: +817-897-3785

Richard Jakob-Hoff
Auckland Zoological Park
Motions Rd.
Western Springs, Auckland
NEW ZEALAND
Fax: +64-9-3780199

Ramon Janis
Sub Balai KSDA Sumatera Barat
Jl. Raden Saleh No. 4
P.O. Box 188
Padang 54136
INDONESIA
Tel: +62-751-54136

Pongpan Laothong
Wildlife Research Section
Forestry Technical Bureau
Royal Forest Department
Paholyothin Road, Chatuchuk
Bangkok 10900
THAILAND
Tel: +66-2-579-2776
Fax: +66-2-579-8611; 561-4809

Susilo Legowo
Sub Balai Konservasi
Sumber Daya Alam Bengkulu
Jl. Mahoni No. 11
Bengkulu
INDONESIA
Tel: +62-736-21697
Fax: +62-736-22856

Peter Litchfield
Howletts & Port Lympne Estates
Port Lympne, Lympne, NR Hythe
CT 21-4PD
UNITED KINGDOM
Fax: +44-303-264944

Sukianto Lusli
WWF-Kerinci Seblat Nat. Park
Jl. Re. Martadinata No. 31
Sungai Penuh 37101 Jambi
INDONESIA
Fax: +62-748-21968

Jansen Manansang
Taman Safari Indonesia
Jl. Sekolah Duta V/11
Pondok Indah
Jakarta Selatan 12310
INDONESIA
Fax: +62-21-769-5482
Fax: +62-251-328225

Colin McHenry
Way Kambas '93 Expedition
c/o Southampton University
Dept. of Biology
Southampton S09 3T0
UNITED KINGDOM
Fax: +44-703-594269

Djodi Mochtar
PHPA-Lampung Province
Jl. Hajimena I/B
Bandar Lampung
INDONESIA

Titus Muladi W.
SBKSDA Sumatera Utara
Jl. Pasar Baru No. 30
Medan
INDONESIA
Tel: +62-61-522108

Mike Ounsted
Asian Wetland Bureau--Indonesia
P.O. Box 254
Bogor 16002
INDONESIA
Fax: +62-251-325755

Rosie Ounsted
c/o Asian Wetland Bureau--Indonesia
P.O. Box 254
Bogor 16002
INDONESIA
Fax: +62-251-325755

Hasudungan Pakpahan
c/o Department of Biology
Faculty of Mathematics & Natural Sci.
Padjadjaran State University
Jalan Raya Bandung Sumedang Km-21
Bandung
INDONESIA

Michael Priyono
Balai Konservasi Sumber Daya Alam II
J. Haji Mena IB
Tanjungkarang
INDONESIA
Tel: +62-721-73882
Fax: +62-721-73434

Yayu Ramdhani
WWF Indonesia Programme
KSNP
Jl. Re Martadinata No. 31
Sungai Penuh, Jambi
INDONESIA

Widodo S. Ramono
Species Conservation, PHPA
Manggala Wanabakti 8th Fl.
Jl. Gatot Subroto
Jakarta
INDONESIA
Ph: +62-21-5730313
Ph/Fax: +62-21-5734818

Suherti Reddy Gt.
Taman Nasional Way Kambas
Way Jepara
Lampung Tengah 34196
INDONESIA

Joanne Reilly
Way Kambas '93 Expedition
School of Botany, Trinity College
Dublin 2
IRELAND
Tel: +16-353-1-772941
Fax: +16-353-1-7021147

Arief Rubianto
Team Sumatran Rhino Survey
c/o Pt. Agro Muko
Muko-Muko
Bengkulu Utara
INDONESIA

Rudyanto
Asian Wetland Bureau--Indonesia
P.O. Box 254
Bogor 16002
INDONESIA
Fax: +62-251-325755

Dudi Rufendi
WWF/Kerinci Seblat Nat. Park
Jl. R.E. Martadinata No. 31
P.O. Box 045/Spn
Sungai Penuh, Jambi 37114
INDONESIA
Ph: +62-748-21124
Fax: +62-748-21968

Haerudin R. Sadjudin
Yayasan Mitra Rhino
c/o Gedung PHPA
Jl. Ir. H. Juanda No. 15
Bogor
INDONESIA
Ph: +62-251-360737
Fax: +62-251-313985

Charles Santiapillai
Dept. of Zoology
University of Peradeniya
Peradeniya
SRI LANKA

Ulysses Seal
Captive Breeding Specialist Group
12101 Johnny Cake Ridge Road
Apple Valley, MN 55124
USA
Ph: +612-431-9325
Fax: +612-432-2757

Djoko Setijono
Natural Resources Division
Regional Forest Office
Lampung Province
Bandar Lampung
INDONESIA
Tel: +62-721-73177

Daniel Walter Sinaga
Directorate of Forest Protection, PHPA
Jl. Ir. H. Juanda No. 100
Bogor, West Java
INDONESIA
Ph/Fax: +62-251-323972

Guy Hills Spedding
Way Kambas '93 Expedition
c/o Southampton University
Dept. of Biology
Southampton S09 3T0
UNITED KINGDOM
Fax: +44-703-594269

Peter Stroud
Werribee Zoological Park
P.O. Box 274
Werribee 3030
AUSTRALIA
Fax: +61-3-7426339

Maria Sudjana
Kanwil Dep. Kehutanan Prop. Lampung
Jl. T. Umar. Rajabasa
Bandar Lampung
INDONESIA
Tel: +62-721-73177

Raman Sukumar
Centre for Ecological Sciences
Indian Institute of Science
Bangalore 560012
INDIA
Fax: +91-80-3341683

Komar Sumarna
Director of Nature Conservation, PHPA
Jl. Ir. H. Juanda No. 15
Bogor 16122
INDONESIA
Fax: +62-251-323067; +62-21-584818

Ucang Suparman
Sub Balai KSDA Sumatera Barat
Jl. Raden Saleh No. 4
P.O. Box 188
Padang
INDONESIA
Ph: +62-751-54136

Hayani Suprahman
Balai Konservasi Sumber Daya Alam II
Jl. Hajimena No. I/B
Bandar Lampung
INDONESIA
Tel: +62-721-73882

Prie Supriadi
Directorate General PHPA
Gedung Manggala Wana Galeti
Blok I Lantai 8
Jl. Gatot Subrota, Senayan
Jakarta Pusat
INDONESIA

Ronald Tilson
Minnesota Zoo
13000 Zoo Blvd.
Apple Valley, MN 55124
USA
Ph: +612-431-9267
Fax: +612-432-2757

Kathy Traylor-Holzer
Minnesota Zoo
13000 Zoo Blvd.
Apple Valley, MN 55124
USA
Ph: +612-431-9206
Fax: +612-432-2757

Philip Wells
Sumatran Rhino Survey Project
c/o Pt. Agro Muko
Muko Muko
Bengkulu Utara, Bengkulu 38365
INDONESIA
Fax: +62-751-28034 (office hrs.)

Kate Wilson
Dept. of Applied Entomology
University of Oxford
South Parks Road
Oxford
UNITED KINGDOM

Zainal Zahari Zainuddin
Zoo Melaka, Air Keroh
Melaka 75450
MALAYSIA
Tel: +60-6-324053
Fax: +60-6-325859

Asian Elephant in Sumatra

Population and Habitat Viability Analysis Report

Section 2:

Working Group Reports and Action Plan

Preliminary Working Group Report: Asian Elephant Distribution and Numbers in Sumatra

Working Group Members: Charles Santiapillai, Jim Jackson, Richard Jakob-Hoff, Jasmi Bin Abdul, Djoko Setijono, Kathy Traylor-Holzer, Marcellus Adi, Guy Hills Spedding, Colin McHenry, Joanne Reilly, Kate Wilson.

The preliminary working group on Asian elephant distribution and numbers considered previously published estimates of Asian elephant populations in Sumatra, specifically from the *IUCN/SSC The Asian Elephant: An Action Plan for its Conservation* by C. Santiapillai and P. Jackson, 199x. These population estimates were updated by the working group, which were then expanded and refined in a more thorough synthesis by the large contingent of PHPA staff in attendance at the workshop. These previous population estimates are presented below (see Tables 1 & 2):

Table 1. Summary estimates of Asian elephants in Sumatra by province (based on 1984-86 survey).

Province	Minimum Est.	Max. Est.
Aceh	600	850
North Sumatra	Few	
Riau	1,100	1,700
West Sumatra	Few	
Jambi	200	600
Bengkulu	100	200
South Sumatra	250	650
Lampung	550	900
Total	2,800	4,800

Another researcher estimated 300 total elephants in Sumatra in the early 80s, indicating that estimates in dense forest are difficult. Lowland forests (preferred habitat) are disappearing, so many of these populations may have gone extinct.

Based upon this working group report, it was recommended that a number of specific issues for each province be addressed. These are:

1) What is the current status of each elephant population?
2) What is the Indonesian Ministry of Forestry land use category for the habitat of each of these populations?
3) What is the quality of habitat for each of these populations?
4) What are the current PHPA recommendations for these populations, if any, and would these recommendations be revised based upon population management information reviewed at this workshop?

Table 2. Estimates and status of discrete Asian elephant populations in Sumatra (based on 1984-86 survey).

Lampung: 13 populations[a]
1) Gunung Sulah: Less than 50.*
2) Gunung Tanggang: Less than 50.*
3) Gunung Betung: Less than 50.*
* All 3 of the above populations are now extinct (animals removed).
4) Way Kambas NP: 250 after translocation into park.
5) Way Terusan: 50-100
6) North Barisan Selatan NP: 50-100
7) South Barisan Selatan NP: 100+
8) Gunung Raya: 50-100
9) Gunung Rindingan: 50-100
10) Block 42: Less than 50; now about 30
11) Block 46: 50-100; now about 20
12) Block 44: 50-100; now about 20
13) Block 45: 100+ (human conflict area, so numbers may have declined); now about 110
14) Block 47: Now about 40

South Sumatra--8 populations[b]
15) Tunggal Buta: Less than 50
16) Suban Jerji: Less than 50
17) Air Semangus: 50-100
18) Padang Sughihan: 232
19) Sungai Pasir: Less than 50
20) Bentayan: 50-100
21) Air Medak: 100+
22) Air Kapas: 100+

Jambi--5 populations
23) Intan Hepta: 50-100
24) Mendahara Ulu: 50-100
25) Suban: 50-100
26) Gunung Sumbing: 100+
27) Batang Tebo: 50-100

Bengkulu--2 populations
28) Sungai Ipuh: 100+
29) Bukit Hitam: Less than 50

Table 2. Continued.

Riau--11 populations
30) Torgamba: 100-200
31) Tanjung Medan: 50+
32) Nort Central Riau: 200-300
33) Koto Panjang: 50-100
34) Lipat Kain: 50-100
35) Langgam: 50+
36) South Central Riau: 100
37) Southern Riau: 300-400
38) Buantan: 50+
39) Siak Kecil: 100-200
40) Lower Rokkan: 50-100

West Sumatra-1 population
41) Sinkinjang: 50+

Aceh--4 populations
42) Singkil: Less than 50
43) Western Gunung Leuser: 50-100
44) Western Aceh: 200-300
45) Eastern Aceh: 300-400

[a]In 1984 Lampung with the area of 33,307 sq km had a natural forest cover of about 12,440 sq km (about 37%). By 1987 forest cover declined to 17% due to transmigration and conversion to agriculture. The largest increasing human population occurred in Lampung btn 1961 and 1980 when human # increased from 1.6 million to 4.6 million. Another source reports forest cover in 1990 was 1,257, 208 ha (about 32.5%).

[b]In 1984 the forest cover 41,790 sq km (about 40% of province). However, latest forest cover map indicates much less than 40%. This province contains the Padang Sughihan reserve with a total area of 750 sq km with 232 elephants which were driven into this, giving a density of 0.33 elephants per sq km (highest density in Sumatra, artificially high).

Working Group Report:
Asian Elephant Populations, Threats and Management in Sumatra

Working Group Members: Komar Soemarna (Facilitator), Widodo Sukohadi Ramono, Daniel Walter Sinaga, Dudi Rufendi, Titus Muladi, Suherti Reddy, Mual Daulay, Maria Sudjana, Amir Hamzah, Ucang Suparman, R. Bintoro, Prie Supriadi, Susilo Legowo, Siska Saskia Hendarin, Djoko Setiono, Djodi Mochtar, M. Priyono, Charles Santiapillai, Faustina Ida, Hayani Suprahman, Kathy Traylor-Holzer, Ronald Tilson.

INTRODUCTION

The Asian elephant in Sumatra is discontinuously distributed throughout the island. It occurs in descrete populations previously identified in surveys conducted ten years ago. Human population pressure and habitat loss have decimated local populations in North Sumatra and West Sumatra. Given the rapid pace of development in these two provinces, Asian elephant populations are unlikely to remain viable in the wild. These same factors are threatening populations in other provinces of Sumatra as well, particularly in Lampung, where forest cover has been halfed and human population has increased threefold in the last two decades.

Even though Asian elephants are large animals, they are difficult to census accurately in tropical rain forest habitat. Asian elephant population numbers at the turn of the century were estimated to be about 3,600, based upon the amount of ivory exported from Sumatra. More recently, interviews with local villagers, PHPA staff, and some field observations estimated Asian elephant numbers to be between 2,800 and 4,800. More than one-third of these elephants occurred in Riau province alone, nearly one-half occurred in the four southern provinces of Lampung, South Sumatra, Jambi, and Bengkulu, and the remainder occurred largely in the province of Aceh.

At the PHVA workshop the Distribution and Status Working Group reviewed a 10-year-old database of Asian elephant population estimates in Sumatra. These estimates were revised where more current information was available. The Population, Threats and Management Working Group took that information, updated it with data provided by PHPA staff attending the workshop (direct observations, indirect information, and habitat type). Each elephant population was then classified whether it was viable or non-viable based upon information provided by the Vortex modelling group (see #1 below). Viable populations were then classified according to Forestry Land Use Categories (see #2). Habitat development plans for each population were outlined (see #3), and management recommendations were made for each elephant population (see #4).

The goal of this working group was to recommend an Asian elephant population management plan that would conserve as many populations and habitats in Sumatra as possible.

Table 1. Past and present population estimates and threats for Asian elephants in Sumatra.

	1986	Status hutan	Threats (Habitat)	Threats (Population)	Remaining Population
I. Lampung Province					
1) Gn Sulah	<50	PF	16% encr	100% captured	0
2) Gn Tanggang	<50	PF	90% encr	14 captured	0
3) Gn Betung	<50	PF-Tahura	75% encr	3 captured	0
4) Way Kambas	100-200	NP	none	increases	200-250[1]
5) Way Terusan(47)	50-100	ProdF	converted	3 captured	40
6) BBS (Utara)	50-100	NP		1/yr poached	100
7) BBS (Selatan)	>100	NP	none	3 captured	>100
8) Gn Raya	50-100	GR	60% encr	15 captured	60
9) Gn Rindingan	50-100	PF	30% encr		50-100
10) Reg 42	<50	ProdF	converted		30
11) Reg 46	50-100	ProdF	converted		20
12) Reg 44	50-100	ProdF	converted	16 captured	20
13) Mesuji 45	>100	ProdF	converted	15 captured	110
II. South Sumatra Province					
14) Tunggal Buta	<50	ProdF	20% dist		60
15) Subanjeriji	<50	ProdF(core)	30% dist		20
16) Air Semangus	50-100	ProdF (core)	20% dist		75
17) Padang Sugihan	>100	GR	none		250
18) Sungai Pasir	<50	ProdF & GR	15% dist	1-2/yr poached	20
19) Bentayan	50-100	GR	10% dist	none	100
20) Air Medak	>100	ProdF	10% dist	none	>100
21) Air Kapas	>100	ProdF	10% dist	none	>100
III. Jambi Province					
22) Intan Hepta	50-100	ProdF	No info		50-100
23) Mendahara Hulu	50-100	ProdF	50% dist		50-100
24) Suban	50-100	ProdF	none		50-100
25) Gn Sumbing	>100	NP	2-3% encr	none	150
26) Batang Tebo	50-100	NP	none		100

IV. Bengkulu Province					
27) Sungai Ipuh	>100	NP/ltd ProdF	1% encr	13 captured	>100
28) Bukit Hitam	<50	PF	20% encr	none	50
V. Riau Province					
29) Torgamba	100-200	ProdF	75% conv[2]	1-2/yr poached	<50
30) Tanjung Medan	>50	ProdF	25% conv[3]	0.5/yr poached	<50
31) No Central Riau	200-300	ProdF	Disturb[4]	2/yr poached	200-250
32) Koto Panjang	50-100	ProdF	Dist(hydroele)	31 capt in 92	15-20
33) Lipat Kain	50-100	ProdF	Converted[3]	4 captured	30
34) Langgam	>50	ProdF	(321,000 ha)	none	50-100
35) So Central Riau	100	ProdF	Disturbed[3]	poaching	50-75
36) Southern Riau	300-400	GR	none	none	200-250
37) Buantan Riau	>50	ProdF	Disturbed[3]	2 capt in 91	<50
38) Siak Kecil	100-200	GR	none	31 added in 91	100-200(+31)
39) Lower Rokan	50-100	ProdF	5% disturbed	8 capt 88-90	50-100
VI. West Sumatra Province					
40) Sikinjang	>50	NP	10% encr		20-30
41) Tanjung pauh	---	PF	none	4 poach in 88	<30
VII. Aceh Province					
42) Singkil	<50	ProdF	20% conv[5]	none	50
43) Gn Leuser	50-100	NP	Hydroelectric (separate 2 populations)		
NE (Besitang)		NP	1% encr	none	94-169
South (Kluet)		NP	none	none	199-274
44) Western Aceh	200-300	PF&ProdF	20% convert.	1 poach, 6 capt 92	300-350
45) N. Eastern Aceh	300-400	ProdF	25% convert.	54 capt 87-93	350-400
46) Lesten-Lokop	---	PF&ProdF	none	none	15

Gn=Gunung; BBS=Barisan Selatan; PF=Protection Forest; NP=National Park; ProdF=Production Forest; GR=Game Reserve; encr=encroachment; dist=disturbed; No Central Riau=M Basung, Psr Pangarayan); So Central Riau=Siak sri Indra pura; So Riau=Kerumutan [1]152 translocated to Way Kambas btn '85-'93; [2]converted to plantation; [3]converted to timber estates; [4]plantation, oil mining; [5]converted for transmigration.

Table 2. Management of Asian elephant populations in Production forests.

Pop. in Prod. F	Location /Status	Activities to maintain	Activities to conserve	# captured 1994/95-98/99	Supportive ETC	Agencies
I. Lampung						
≥ 100 (110)	S. Buaya (45)/P	---	Capture	30;25;20;20;15	WK	Bappenas/MOF
≥ 25 (40)	Way Terusan (47)/P	---	Capture	25;10;5;-;-	WK	Indo Lampung G*
≥ 25 (30)	Rebang (42)/P	---	Capture	10;5;5;5;-	WK	Bappenas/MOF/Pt. inhutani V.
≤ 25 (20)	S. Muara Dua (44)/P	---	Capture	10;5;5;-;-	WK	Bappenas/MOF
≤ 25 (20)	Way Hanakau (46)/P	---	Capture	10;5;5;-;-	WK	Bappenas/MOF
II. South Sumatra						
≥ 100 (>100)	Air Medak/P	Monitoring, habitat protection, conservation area in Prod F	---	---	--	MOF
≥ 100 (>100)	Air Kapas/C	Same as above	---	---	--	MOF/LG
≥ 25 (60)	Tunggal Buta/L	Same as above	Capture	1;1;1;1;1	LH	Bappenas/MOF
≥ 25 (75)	Air Semangus/P	Same as above	Capture	2;2;2;2;2	LH	Bappenas/MOF/Barito Pacific Group/LG/MOT
≤ 25 (20)	Subanjeriji/P	---	Capture	4;4;4;4;4	LH	Bappenas/MOF/Caltex/Stanfac/Pertamina
≤ 25 (20)	Sungai Pasir/P	Monitoring, habitat protection	---	---	--	MOF/LG
III. Jambi						
≥ 100 (50-100)	Intan Hepta/C	Monitoring, habitat protection	Habitat mgmt	---	--	MOF/LG
≥ 100 (50-100)	Mendahara Hulu/C,L	Same as above	Capture	4;4;4;4;4	LN	Bappenas/MOF/LG/Sumatera Timber Utama Damai/WKS
≥ 100 (50-100)	Suban/C	Same as above	Capture, habitat mgmt	3;3;3;3;3	--	Bappenas/MOF/LG

V. Riau						
≥ 100 (200-250)	No Cent Riau/P,C	Monitoring, species prot.	Capture, driving	10;10;10;10;10	SB	Bappenas/MOF/Caltex/HTI
≥ 100 (50-100)	Langgam/P,C	Habitat prot., conservation area in forest production	---	---	LN	MOF/LG
≥ 100 (50-100)	Lower Rokan/P	Same as above	---	---	--	MOF/LG
≥ 25 (50-75)	So Cent Riau/P,C	---	Capture	15;15;15;15;15	DPB	Bappenas/MOF/LG/Caltex
≥ 25 (<50)	Torgamba/C	---	Capture	10;10;10;10;10	HR	Bappenas/MOF/LG/HTI
≥ 25 (<50)	Tanjung Medan/C	---	Capture	10;10;10;10;10	SB	Same as above
≥ 25 (<50)	Buatan Riau/P	Monitoring, habitat prot., conservation area in forest production	---	---	--	MOF/LG/HPH
≥ 25 (30)	Lipat Kain/C	---	Capture	6;6;6;6;6	LN	Same as above
≤ 25 (15-20)	Koto Panjang/L	Monitoring, habitat protection	---	---	--	MOF/LG
VII. Aceh						
≥ 100 (350-400)	No East Aceh/L,P	Monitoring, habitat prot., conservation area in forest production	Capture	20;20;20;20;20	LS	Bappenas/MOF/LG
≥ 100 (300-350)	Western Aceh & Seulawah Mt/P,L	Monitoring, conserv. area in ProdF	Capture, habitat improvement, population management	15;15;15;15;15	LS SL	Bappenas/MOF/ LG/HTI
≥ 25 (50)	Singkil/P,C	---	Capture	10;10;10;10;10	GL	Bappenas/MOF/LG
≤ 25 (15)	Lesten-Lokop/L	Maintain corridor w/GL	---	15;-;-;-;-	GL	Bappenas/MOF/LG
Total to be Captured:				210;160;150;135;125=780		

Status: P=permanent, L=limited, C=convertible; ETC=Elephant Training Center; WK=Way Kambas; LH=Lahat (Merati, Palempang); GL=Gunung Leuser National Park; LN=Langgam (Riau); SB=Sebanga; DPB=Danau Pulau Besar; DB=Danau Bawah Game Reserve; HR=Holiday Resort (North Sumatra); LS=Lhok Seumawe; SL=Seulawah (proposed); MOF=Ministry of Forestry; LG=local government; MOT=Ministry of Tourism; WKS=Wira Karya Sakti; HPH=Hak Pengusahaan Hutan; HTI=Hutan Tanaman Indusstri; North Central Riau=Ma. Barung, Pasir Pangarayan); South Central Riau=Siak Sri Indrapura; *Sugar cane estates

OVERVIEW OF THE WORKSHOP DATABASE

1) Identified populations: 47
   Viable populations (>25): 38
   Non-viable pop. (<25): 9
      Production Forests: 6
      Protection Forests: 3 (extinct)

2) Identified viable populations based on forest status
   Conservation Areas:
      National Parks: 9 (963-1,173)--} 1,673-2,033-\
      Game Reserves: 5 (710-860)---/ }1,803-2,213
      Protection Forests: 3 (130-180)----------/
      Production Forests: 21 (1,895-2,320)
         Permanent Production Forests
         Limited Production Forests
         Convertible Production Forests

3) Any development plans which will change natural landscapes?
      --hydroelectric dam?
      --natural forest --> timber estates? etc?
      --transmigrations?
      --how many elephants will lose "their" habitat?

4) How to save the remaining viable populations and habitats?
   How to save the elephants which will no longer have habitat (including the non-viable populations)?

From this database a set of conservation management recommendations for Asian elephants was developed (see *Indonesian Asian Elephant Action Plan*).

Working Group Report:
Asian Elephant Life History and Vortex Analysis

Working Group Members: Raman Sukumar, Ulysses Seal, Yayu Ramdhani, Charles Santiapillai, Zainal-Zahari Zainuddin.

LIFE HISTORY VARIABLES

Much of the demographic data on the Asian elephant comes from the studies of Sukumar (1989) in southern India, supplemented with some data on population structure of elephants in Way Kambas, Sumatra, in Santiapillai & Suprahman (1986). It is recognized that life-history variables are likely to be different for the southern Indian and the Sumatran elephant populations, as these inhabit tropical deciduous forest and equatorial rain forest respectively. In particular, it has been argued by Sukumar (1989) that elephants in the moister, more climatically "stable" rain forest habitats are likely to have evolved relatively more "k-selected" traits than would the elephants in the drier, more unpredictable habitats. Life-history variables for the Sumatran elephants thus reflect this expected difference.

Values for variables used in the VORTEX modelling were as follow:

Breeding System:
The elephant is a polygynous species. Although males are sexually mature when they are about 15 years old, they may not actually be able to mate until 20 or 25 years due to social reasons. Field studies in India show however that in the absence of older males the younger males can breed from the age of 15 years. Age at first reproduction was thus taken to be 15 years and 20 years under two scenarios modelled. Further, it was assumed that only 80% of the adult males are in the breeding pool in a given year.

Female Reproductive Rates:
Age at first reproduction in females was taken to be 15 years and 20 years. The latter figure may be more likely to be true of elephants in rain forest habitats (Sukumar 1989). Inter-calving interval has been found to be 4.5 to 5 years in southern India, but some data from Way Kambas indicates that females may reproduce only every 6 years on average. Thus, birth probability was taken to be 0.16/mature female/year; this was increased marginally to 0.18/mature female/year in later instances in order to achieve a higher deterministic intrinsic growth rate. Litter size is taken as 1; twinning is very rare in elephants (c. 1% of births) and inconsequential.

Maximum Longevity:
Elephants in captivity are known to have survived until 75 years or more in the case of females and about 60 years in males. However, female elephants cease reproduction by about 60 years. Thus the maximum longevity was taken to be 60 years. A precise figure is not very important because the proportion of old elephants in the population would be negligible and thus contribute little to reproduction.

Sex Ratio at Birth:
A large sample (>260) of births in captivity shows a slight bias towards male calves although this is not statistically significant. We used a 1:1 sex ratio at birth but also explored the effects of a male biased ratio (55:45).

Correlation between EV (reproduction) and EV (survival):
We assume that a correlation exists between these.

Mortality Rates:
Mortality rates were adjusted within small limits in order to vary the (deterministic) intrinsic growth rates. In general mortality of female elephants was taken to be 8-15% (age 0-1 year), 4% (age 1-5 years), 2% (age 5-15 or 20 years) and 1.5 - 2.5% (adult age) per year.

There is evidence that in elephants (as in other polygynous mammals) the mortality of males is higher than that of females under natural conditions. This is reflected in the female-biased sex ratios observed in all elephant populations. Male mortality rates were thus taken to be 15% (age 0-1 year), 5% (age 1-5 years) and 3% (ages above 5 years, including adult) per year.

In populations where selective poaching of males for ivory occurs the mortality rates in sub-adult and adult males should be even higher than the above figures. Simulations were also run with a 5% mortality probability in males above 5 years.

Environmental Stochasticity:
In VORTEX environmental stochasticity is modelled as variation in annual birth and death probabilities by sampling binomial distributions, with the standard deviation (SD) specifying the extent of variation. SD on both birth and death rates were taken to be 20% of the mean rates. This figure is based on the southern Indian study, assuming that environmental variation in rain forest habitat is lower than in drier habitats. In any case, environmental variation seems to make change to the final results (Sukumar 1992).

Carrying Capacity:
Carrying capacity (K) was generally set at about 20% higher than the initial population size except in case of a population size of 10 for which it was set at 30. Small variations in K may again not make any difference to the final outcome and was hence ignored. In one set of simulations a trend in K was taken as a loss of 0.5% of K per annum for 25 years.

Inbreeding Depression:
Although there are no data available on inbreeding depression in elephants, several studies on mammals in captivity have shown that it is important. We modelled scenarios without and with inbreeding depression. Inbreeding depression used a Heterosis model with a level of 3.14 lethal equivalents which represents the mean of over 40 mammalian species studied.

Catastrophes:
Potential catastrophes affecting elephant populations are drought and disease epidemics. Very low probabilities were assumed for both these factors; serious drought is not likely in rain forests and there is no historical evidence of an epidemic such as anthrax. A 4% probability of drought lowering fertility by 40% and killing 5% of individuals, and a 1% probability of disease killing 10% of individuals were assumed. The probability of drought was later reduced to 2% for populations to achieve a higher deterministic growth rate.

Harvest:
Elephants from the Sumatran populations are being captured if they are crop raiders. Some poaching of elephants also occurs. Two rates of harvest were considered. Under a low harvest rate four elephants (1 adult female, 1 juvenile female, 1 juvenile male and 1 adult male) were removed from the population every four years for 25 years, while under a high harvest rate the same number was removed for 50 years.

Population sizes were varied from 10 to 100 elephants as appropriate. All simulations began at stable age distribution and were run 500 times for 100 years.

RESULTS

Basic scenario I: Deterministic growth rate close to zero (r=0.002), no inbreeding depression, no harvest.
Under this scenario an initial population of 10 elephants had a 65% chance of surviving for 100 years and 37% for 200 years (Table 1 and Figure 1). Raising the population size to 25 elephants increased the probability of survival to 95% and to 50 elephants to >99% over 100 years. The population risk of extinction is 36% at 200 years. For the two larger populations for which the carrying capacity was set at levels close to initial population size, the stochastic growth rate was still negative and the surviving populations would continue to reduce in size on average over the 100 year period. Populations of these very long-lived animals can persist for a long time while in a steady decline.

Scenario II - r close to zero (0.002), inbreeding depression, no harvest.
The probability of extinction is increased for all 3 population sizes. The effect is more noticeable at 200 years or after about elephant 6-7 generations. The effects are most striking for the smallest populations which experience the effects more quickly. Probabilities of survival at 100 years for different initial sizes are 57% (pop. size 10), 96% (size 25) and >99% (size 50). The effects of inbreeding depression are require a long time to become evident in the elephant populations because of their longevity and long generation time and thus the effects are more evident at 200 years. Populations of 50 or more are resistant to these effects. The smaller populations could be protected by some form of genetic management such as the introduction of an animal (which would have to successfully reproduce) from another population every 25-30 years.

Scenario III - r close to zero (0.003), inbreeding depression, low harvest.
Probabilities of survival for 100 years are 1% (pop. size 25), 10% (size 50) and >99% (size 100). There is a dramatic difference between initial population sizes 50 and 100 in their chances of survival under conditions of a low harvest as defined earlier. Thus harvest of even one elephant per year on average for 25 years would almost certainly drive any population under 50 to extinction. With a starting population of 100 there is a high chance of survival, but even this population would reduce to about half its original size after 100 years.

Scenario IV - r close to zero (0.003), inbreeding depression, high harvest.
When the harvest of four elephants every four years is continued for 50 years, the probabilities of survival decrease. These are 2% (size 50) and 97% (size 100) at 100 years. The longer term survival of the population of 100 animals is further reduced to 85%.

Scenario V - r increased to about 1% (0.01), inbreeding depression, no harvest.
The probabilities of survival to 100 years increase as compared to Scenario II, these being 80% (size 10), 99% (size 25) and >99% (size 50).

Scenario VI - r about 1% (0.01), inbreeding depression, high harvest.
With harvest continuing for 50 years, the chances of survival for 100 years are 0% (size 25), 3% (size 50), 87% (size 75) and 98% (size 100). The surviving populations would however reduce in size during the 100 year period.

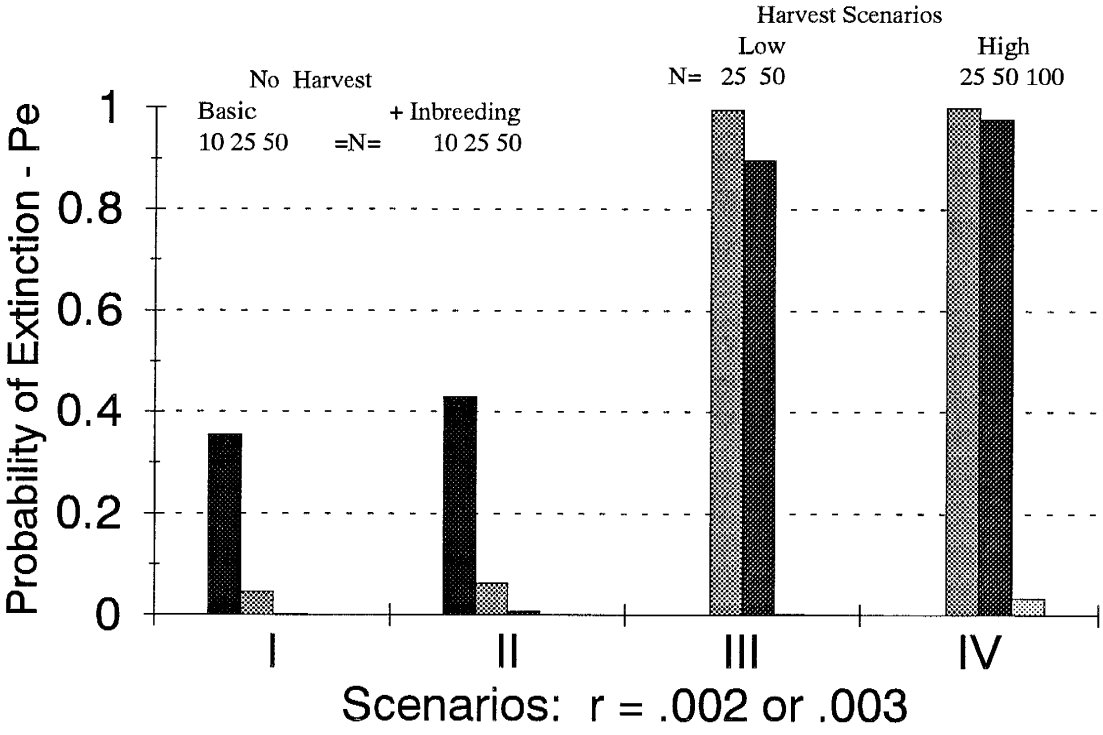
Scenario VII - r increased to about 2% (0.02), inbreeding depression, high harvest.
Even with a population that can potentially grow at r=0.02 (Table 1, Figure 2, scenario VII), the probabilities of survival are quite bleak (<5%) for population sizes less than 50 elephants. For higher sizes the chances of survival are 89% (size 75) and >99% (size 100).

SUMMARY OF RESULTS

Elephant populations smaller than about 25 animals are at a very high risk of extinction. These populations need to be supplemented with captured animals (if the carrying capacity of the habitat will allow) or managed as part of a metapopulation. If harvest of elephants (either through removals for control or poaching) does not occur, then a population of about 40-50 elephants, whose habitat is secure, would have a high chance of survival. If any harvest is envisaged, removals of about 1 animal per year would be absorbed only by populations of 100 or more elephants.

SUMATRAN ELEPHANT DEMOGRAPHY

Constant r & Population Size & Harvest



SUMATRAN ELEPHANT DEMOGRAPHY

High r & Population Size & Harvest

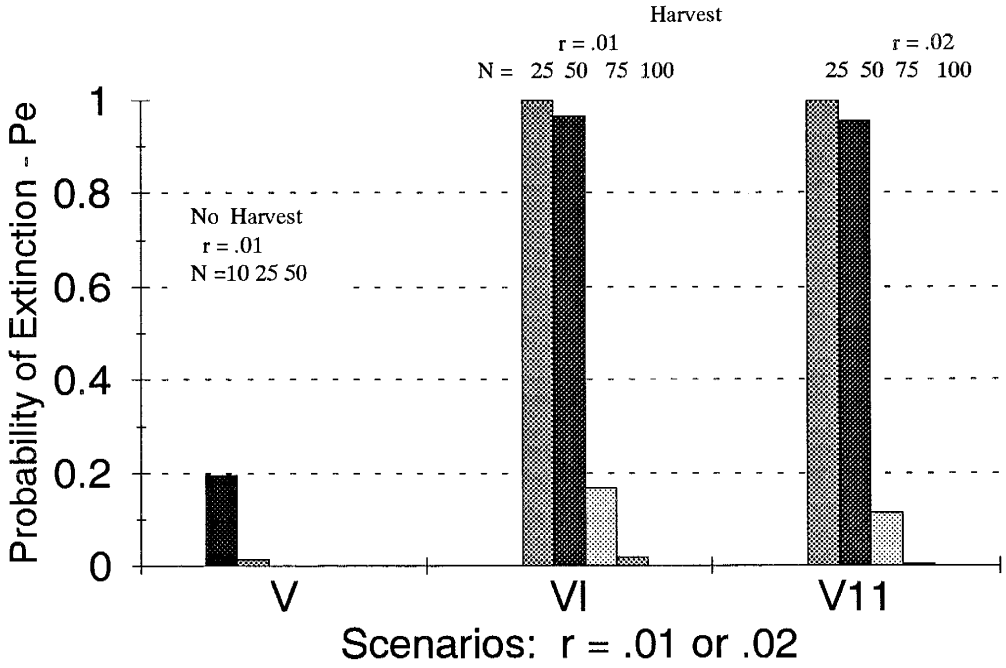


Table 1. Sumatran elephant population simulations under different growth rates, inbreeding, and harvest scenarios.

File #	Inbreed	Harv	Pop	r det	r sto	Pe-100	Pe-200	N-100 Y	Het-100	Te Yr
I. Basic Scenario - Low r, No Inbr, No Harv										
ER0C10	No	No	10	.002	-.005	.354	.630	12	.85	59
-C25			25	.002	-.0005	.046	.365	17	.93	77
-C50			50	.002	.0005	.002	.035	37	.96	84
II. Basic low r + Inbreeding										
ER0IC10	Yes	No	10	.002	-.0076	.430	.820	11	.88	63
-IC25			25	.002	-.0023	.062	.505	16	.94	75
-IC50			50	.002	-.0003	.006	.080	35	.97	91
III. Low r + Inbreed + Low Harvest										
E0ICLH25	Yes	Low	25	.003	-.0056	.996	1.00	10	.49	17
-LH50			50	.003	.0050	.898	1.00	10	.87	25
-LH99			100	.003	.001	.002	.058	52	.97	27
IV. Low r + Inbreed + High Harvest										
ER0ICH25	Yes	High	25	.003	-.0059	1.00	1.00	-	-	17
-H50			50	.003	-.0062	.978	1.00	6	.96	28
-H99			100	.003	.0003	.034	.150	44	.96	65
V. r = 0.01 + Inbreed + No Harvest										
ER1IC10	Yes	No	10	.01	.0011	.196	.390	15	.87	63
-C25			25	.01	.0063	.014	.140	20	.93	83
-C50			50	.01	.0075	0	0	62	.94	-
VI. r = 0.01 + Inbreed + High Harvest										
ER1ICH25	Yes	High	25	.011	-.0007	1.00	1.00	-	-	20
-H50			50	.011	.0004	.966	.995	8	.90	29
-H75			75	.011	.0078	.168	.280	31	.94	50
-H99			100	.011	.0097	.018	.018	64	.97	54
VII. r = 0.02 + Inbreed + High Harvest										
ER2ICH25	Yes	High	25	.02	.0078	.998	1.00	12		16
-H50			50	.02	.0076	.954	.985	14	.93	29
-H75			75	.02	.0168	.114	.225	40	.94	40
-H99			100	.02	.0189	.004	.004	79	.97	84

Table 1 Column Definitions

File #: Refers to the computer file with the output results from the VORTEX simulation.

Inbreed: Inclusion (Yes) or not (No) of inbreeding depression with 3.14 lethal equivalents in the simulation scenarios.

Harv: Inclusion or not of animal removals from population using harvest module of VORTEX.

Pop: The starting population size used to initialize the scenario.

r det: The deterministic rate of increase calculated with a Leslie matrix algorithm from the values provided for mortality and reproductive rates for the scenario. In models with catastrophes included the decrease in reproduction and increase in mortality is averaged in as a per year effect.

r sto: The stochastic intrinsic rate of increase. In scenarios with a harvest, this value is for the years without a harvest. In harvest years, the r value is always negative.

Pe-100: The mean probability of extinction at the end of a 100 year time period. This equivalent to about 3 elephant generations.

Pe-200: The mean probability of extinction at the end of a 200 year time period. This equivalent to about 3 elephant generations.

N-100 Y: The mean population size of surviving populations at 100 years. This number has an upper limit determined by the value assigned to K in the scenario.

Het-100 Y: The mean observed remaining heterozygosity remaining in the surviving populations after 100 years.

Te Yr: The median time of extinction of the populations going extinct during the 100 year time period the models were run.

Figure Legends

Figure 1. Probability of extinction at 100 years under the conditions of Scenarios I, II, III, and IV. Each of these scenarios varies the size of the starting populations and carrying capacity under the set of conditions described in the text. Conditions were set so that the deterministic r value was close to zero representing a stable population. Scenario I is the basic set of conditions Populations of 25 elephants are at high risk of extinction in all of the scenarios. Populations of 50 cannot sustain the on average loss or removal of 1 animal per year more than natural mortality.

Figure 2. Probability of extinction at 100 years under the conditions of Scenarios I, II, III, and IV. Each of these scenarios varies the size of the starting populations and carrying capacity under the set of conditions described in the text. Conditions were set so that the deterministic r value was approximately 0.01 or 0.02 representing a growing population. Growing populations of 50 cannot sustain the on average loss or removal of 1 animal per year more than natural mortality. A potentially growing population of 100 or more animals is needed to sustain removal of 1 animal per year.

Working Group Report: Elephant Training Centres

Working Group Members: Hayani Suprahman, R. Bintoro, Djodi Muchtar, Faustina Ida, M. Prijono, Jansen Manansang, Suherti Reddy, Ucang Suparman, Prie Supriadi, Susilo Legowo, Jasmi bin Abdul, Peter Stroud, Richard Jakob-Hoff.

BACKGROUND

Elephant Training Centres (ETC) have been established in the following provinces:

PROVINCE	YEAR ETC ESTABLISHED	NUMBER CAPTURED	NUMBER CURRENT
Lampung	1985	152	83
Aceh	1987	60	40
Riau	1989	45	41
Sum. Selatan	1990	40	40
Bengkulu	1992	13	13
TOTAL		**310**	**217**

Of the animals captured and brought to the ETC in Lampung, 69 have been distributed to zoos and other facilities.

Ratio of males to females captured = 2:3 with most animals being in the age class 10 - 20 years at time of capture.

Most captures utilize immobilization techniques (Telinject gun).

REASONS FOR CAPTURE

Human-elephant conflict (raiding of crops) resulting from changes in land use and associated with growing human population. Factors include: 1) forest exploitation, and 2) agriculture.

Transmigration is increasing the rate of population growth in Sumatra.

Most elephants are captured in the harvest seasons (March and July). The more serious the damage reported the more likely an elephant will be captured.

Some 20 immobilizations per year are taking place in the vicinity of Way Kambas alone as a result of crop raiding.

An average of 33 "problems" per year are dealt with.

Fully mature large elephants (e.g. rogue bulls) are considered to be a serious problem in that they are not suitable for capture and training - current captive stocks not yet suitable for use in the capture and training of such animals.

UTILIZATION OF ELEPHANTS CAPTURED

Elephants captured will be used for the following purposes:

1) Draft animals to be used in agriculture
   38 animals and handlers are in training (28 persons from transmigration projects and 10 young persons allocated by Social Department).

2) Timber extraction
   One company currently using 2 animals.

3) Zoos and other Tourism sites
   2 animals and 2 handlers in training.
   30 animals currently used in Way Kambas.
   Animals have been sent or will be sent to zoos and other tourist sites including: Bandung, Jakarta, Taman Safari Indonesia, Yogyakarta, Semarang, Borobodur, Surabaya, and others.

ETC ISSUES

1) Projected increase in elephant numbers in ETC's
   The number of elephants in existing ETC's will increase as doomed elephant populations are captured.

2) Veterinary care
   Could be improved by provision of equipment. Distance from laboratories a problem. Only on-site veterinarians are at Aceh and Lampung ETC's.

3) Breeding
   10 births conceived and delivered in Lampung ETC. (Other camps?) Captive husbandry methods need to be developed.

4) Deaths
   1 death at Lampung (August 1992) recorded. (Others?)
   Approximately Rp 6,583,000/elephant and mahout/year.

5) Costs
   Approximately Rp 2,800,000/mahout in training/year.
   (Source: "Terms of Reference, Project Proposal for Utilization of Elephants into Communities in Lampung Province, 1993")

Table 1. Maximum elephant holding capacity of existing and proposed Elephant Training Centres (ETC'S).

Province	Elephant Training Centre (proposed)	Size	Current Population	Recommended Maximum Population
Aceh	Lhokseumawe	200 ha	40	75
Sumatera Utara	(Holiday resort)	?	0	75
Riau	(Langgam)	?	0	75
Riau	Sebanga	5000 ha	41	40
Sumatera Barat	(Danua Bawa Game Reserve)	?	0	75
Bengkulu	Seblat	50 ha	13	30
Sumatera Selatan	Lahat	500 ha	40	75
Lampung	Way Kambas	500 ha	83	75
TOTAL			**217**	**520**

Maximum Current Holding Capacity in Sumatra, based on a recommended manageable maximum of 75 animals per ETC = 295 elephants.

The Maximum Holding Capacity with three additional elephant training centres = 520 elephants.

Table 2. Projected number of elephants proposed for capture and transfer to Elephant Training Centres in the period 1994-1998.

Province	Elephant Training Centre (proposed)	1994	1995	1996	1997	1998
Aceh	Lhokseumawe	35	35	35	35	35
Sumatera Utara	(holiday resort)	10	10	10	10	10
Riau	(Langgam)	13	13	13	13	13
Riau	Sebanga	20	20	20	20	20
Sumatera Barat	(Danau Bawa Game Reserve)	15	15	15	15	15
Bengkulu	Seblat	0	0	0	0	0
Sumatera Selatan	Lahat	7	7	7	7	7
Lampung	Way Kambas	85	50	40	25	15
TOTAL		**185**	**150**	**140**	**125**	**115**

Total Captures 1994 - 1998 = 715 Elephants

Table 3. Number of elephants which must be distributed from each Elephant Training Centre in order to remain within maximum recommended holding capacity.

Province	Elephant Training Centre (proposed)	1993	1994	1995	1996	1997	1998
Aceh	Lhokseumawe	0	0	35	35	35	35
Sumatera Utara	(Holiday resort)	0	0	0	0	0	0
Riau	(Langgam)	0	0	0	0	0	0
Riau	Sebanga	0	0	6	20	20	20
Sumatera Barat	(Danau Bawa Game Reserve)	0	0	0	0	0	0
Bengkulu	Seblat	0	0	0	0	0	0
Sumatera Selatan	Lahat	0	0	0	0	0	1
Lampung	Way Kambas	8	85	50	40	25	15
TOTAL		**8**	**85**	**91**	**95**	**80**	**71**

CONCLUSIONS

1) During the period 1994-1998 the number of elephants proposed for capture is 715.

2) The number of elephants which can be accomodated in existing and proposed ETC'S is 520.

3) Therefore the minimum number of elephants which must be dispersed to utilizaiton projects during the time period is 195.

4) Up to 235 elephants will need to be redistributed between ETC'S for best utilization of holding capacity.

RECOMMENDATIONS

1) The ETC project should be established as a formal government institution, perhaps as a Technical Operational Unit under the Directorate General of the PHPA. At present the ETC's long-term future is not secured and funding requires a full project proposal each year. More formal recognition of the role and status of the ETC's would allow more regular annual budgeting and the careers of employees would be assured.

2) A workshop should be convened as soon as possible with the aim of improving management of the captured elephants in existing and proposed ETC's. The workshop should involve staff and veterinarians from each ETC, from other captive centres in Asia and from the international zoo community. The workshop would consider all aspects of elephant management within the centres including:

   Elephant Training
   Issues to be addressed would include capture and training regimes, utilization of captured elephants.

   Husbandry
   Issues to be addressed would include captive breeding, record keeping and the establishment of a central data base, identification of all animals, establishment of a studbook to avoid inbreeding.

   Health Care
   Issues to be addressed would include the level of veterinary support for each ETC to ensure good health management, nutrition, discussion of elephant diseases and their prevention, quarantine protocols and facilities.

   Research
   Issues to be addressed would include investigation of opportunities for research on artificial reproduction, epidemiology of wildlife diseases, elephant behaviour and economic and ecological impact of the utilization of elephants.

3) Community support requires wide use and distribution of elephants. A pilot project to assess the practicality of using elephants in agriculture as draft animals, as guards against crop-raiding wild elephants and for other purposes should be urgently undertaken especially within transmigration areas close to elephant habitat.

4) As a large number of elephants requiring capture have been identified additional "capture elephants" will be urgently required. Four "capture elephants", (2.2.0) are required for each ETC. As 3 ETC's currently have no "capture elephants" 6 animals (3.3.0) should be imported immediately. Further potential "capture elephants" should be selected immediately for training. These animals should be at least 10 years old.

5) Additional transport is required to move elephants to and from ETC's. Two trucks equipped to carry elephants are required for each centre.

6) Additional medicines and laboratory equipment are urgently required at Way Kambas and Lhokseumawe ETC's.

7) A public relations officer is required to promote the ETC's and the utilization of the elephants. Such a position should be responsible for promoting the ETC programs within Indonesia and abroad, for production of information including regular newsletters and for establishing support from NGO's including relevant international organizations. (This position could eventually be self-supporting in terms of costs.)

8) Additional ETC's will be required to accomadate the number of elephants identified for capture. A maximum of 75 elephants per ETC is recommended for optimal management (this figure is already exceeded at the Way Kambas ETC). The locations for three additional ETC's should be Sumatera Utara, Sumatera Barat and Riau. These new ETC's should be located close to areas of high elephant-human conflict.

9) Communications between ETC's should be strengthened to allow optimal use of resources and rapid response to urgent situations eg. elephant problems within and outside ETC's. Each ETC should be equipped with suitable electronic communications systems. Information sharing between people working in ETC's should be improved.

10) The establishment of a non-government organization is strongly recommended to support the Elephant Training Centers, perhaps in the same way that the Sumatran rhino program is supported by Yayasan Mitra Rhino.

EXISTING ETC'S	LOCATION (ADDRESS)	SENIOR MANAGER
1. Aceh	Lhokseumawe c/o SBKSDA DI Aceh Jl T Nya Arif PO BOX 29 Banda Aceh	Drs Andi B
2. Riau	Sebanga c/o Kompl Kanwil Kehutanan Simpang Arengka Pakan Baru- Riau	Maulana
3. Bengkulu	Seblat c/o SBKSDA Bengkulu Jl. Mahoni no 11 Bengkulu	Yusuf
4. Sumatera Sel	Lahat c/o SBKSDA Kompl. Kanwil Kehutanan Punti Kayu-Palembang	Edi N
5. Lampung	Way Kambas N.P c/o SBKSDA Way Kambas Jl Labuhan Ratu Lama Way Jepara 34196 Lampung Tengah.	Ir. Rusman

Indonesian Asian Elephant Action Plan

PHVA Workshop Recommendations

RECOMMENDATIONS:

1) There are eight Asian elephant populations in National Parks that are large and secure. We recommend continued monitoring of these populations.

2) There is one population in Sikinjang of 20-30 elephants. Based on Vortex modelling there should be no removal, the population should be strengthened, protected and monitored, and there should be habitat improvement.

3) There are five elephant populations in Game Reserves, all with viable populations. Each is recommended to have continued protection, habitat improvement, and training of local people to handle and use elephants in patrolling.

4) There are three elephant populations in Protection Forests which are secure. Recommendations are continued protection, habitat improvement, and training of local people to handle and use elephants in patrolling.

5) There is one population in Protection Forest in Tanjung Pauh with less than 30. Habitat and species protection, population strengthening, guard training, and special attention to poaching and law enforcement are recommended for this population.

6) There is one population in Protection Forest in Lesten-Lokop with only 15 elephants. Based on Vortex modelling this population has a very low probability of survival unless the population is increased through strengthening, change of land use patterns, and creation of a corridor among the populations of Lesten, Kappi, and Sikundur. Adjacent plantations need to use electric fencing to minimize human/elephant conflicts and to contain elephants in their habitat.

   This population may be disturbed by a proposed hydroelectric dam. It is recommended that a field study of the population and an Environmental Impact Statement be initiated and analyzed within the next year so that an Action Plan can be developed to rescue this population.

7) There are 25 elephant populations within Production Forests, out of which five populations have less than 30 animals. Even though there are some changes of status planned, further assessment of the remaining 20 populations is thoroughly needed.

8) Of the 25 populations, the five with less than 30 elephants should be given priority for capture, translocation, and driving.

9) There are 17 elephant populations within Production Forests that are scheduled for capture. Before capture is undertaken, the precise status of each population needs to be established by field survey and other alternatives considered, such as driving the population to an adjacent habitat or translocating the population to another suitable habitat. Both of these options need to be evaluated as to the impact on where the animal is going. If none of these alternates are available, then careful protocol for safe capture and transfer of these elephants to an Elephant Training Center can proceed. The number of individual elephants removed each year should be based upon the schedule already presented but with a review at the time of capture.

10) To ensure long-term viability , secure one or two major populations of 300+ elephants in Sumatra.

DEPARTEMEN KEHUTANAN
KANTOR WILAYAH PROPINSI LAMPUNG
Jalan. Teuku Umar Raja Basa Telp. 73177.
BANDAR LAMPUNG

Closing remark

ASIAN ELEPHANT AND SUMATRAN RHINO
POPULATION AND HABITAT VIABILITY ANALYSIS WORKSHOPS

Distinguish Prof. Dr. Ulysses Seal-IUCN/SSC CBSG Chairman,
Distinguish Dr. Ronald Tilson - Minnesota Zoo and IUCN/SSC CBSG,
Distinguish Dr. R. Sukumar - IUCN/SSC Asian Elephant SG Chairman,
Distinguish Dr. Thomas Foose - International Rhino Foundation,
Distinguish Dr. James Doherty - AAZPA Sumatran Rhino SSP Co-coordinator,
Distinguish Representatives of WWF and AWB,
Distinguish Workshop Participants,
Ladies and Gentlemen,

The honourable Director General of Forest Protection and nature conservation of the ministry of forestry is unable to be with us today at the end of these valuable workshops. He requested me in my capacity as Kepala Kantor Wilayah Departemen Kehutanan Propinsi Lampung, to present some word as closing remarks to end these workshops,

Ladies and Gentlemen,

During these workshops we have discussed various aspects of the wild populations of Asian elephant, and Sumatrans rhinos as well as white wing wood ducks, in order to analyse their population and habitat.

These workshops are of strategic steps to conserve the mentioned three wild animal species ; this is mainly due to the followings:

- The species belong to protected animals and are being threatened more and more by habitat loss and fragmentation and a smal portion by poachings,

- Indonesia faces a dilemma: in one hand, as stated in the national policy, has a great intention and responsibility to protect them for the benefit of Indonesian people and the global community as well; whereas in the other hand has a great responsibility to extend our national development which is still strongly leaning against the natural resources.

We highly appreciate the IUCN/SSC CBSG , the Asian elephant specialist group , the International Rhino Foundation, the WWF and AWB, the corresponding zoos, as well as the whole participated experts and international donors, for their participation in these workshops. I do hope that the results of these workshops could be used as useful guidances in overcoming the mentioned dilemma and taking over the mentioned responsibility.

May I on behalf of honourable Director General of Forest Protection and Nature Conservation of the Indonesian Ministry of Forestry herewith to extend deep thankful to all of you for your participation in these workshops. We highly appreciate your efforts to help this country in developing appropriate planing and implementation of better wildlife management practices.

Thanks to local Goverment of Lampung Province and related authorities who has given permission and great attention to these workshops, and every body for their active participation.

To the local newspapers I extend my thank for good publicity concerning conservasition efforts of Asian elephant and Sumatran rhino, and white wing wood duck as well.

Last but not the least, my deep thanks are also addressed to the manager of Marcopolo Hotel for suitable accomodation and services, to Taman Safari Indonesia and the local forestry staff for good arrangement of these workshops.

Whit full of thank to god almighty, my I on behalf of the honourable Director General of Forest Pritection and Nature Conservation, officially close these workshop.

Thank you.

Bandar Lampung, Nopember 13 th, 1993.

Kakanwil Departemen Kehutanan
Propinsi Lampung,

DEPARTEMEN KEHUTANAN RI KANTOR WILAYAH PROPINSI LAMPUNG

Ir. [illegible] PANDJAITAN.

Asian Elephant in Sumatra

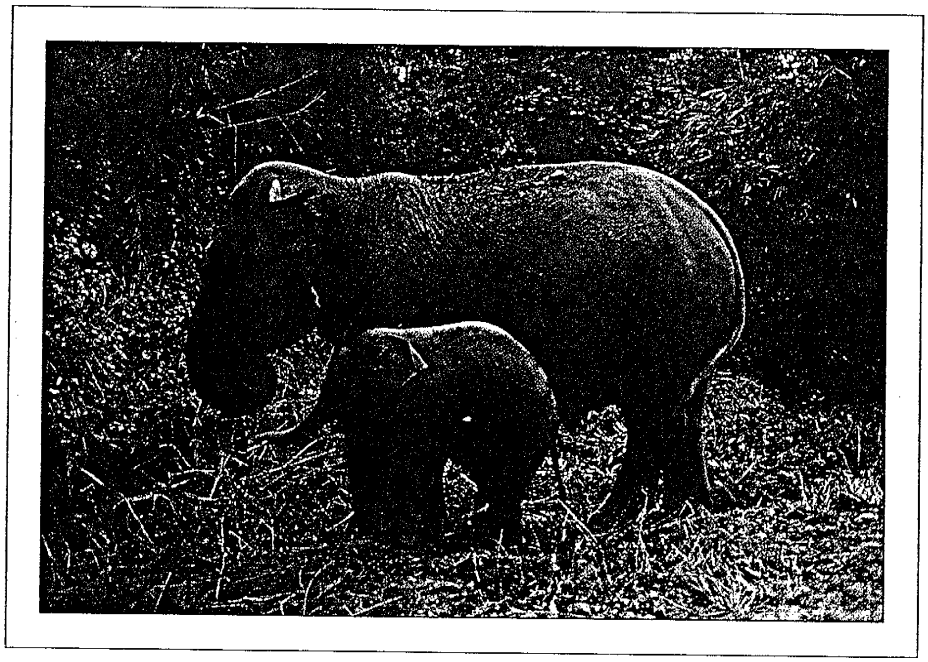
Population and Habitat Viability Analysis Report

Section 3:

Supporting Reports and Articles

The Asian Elephant

An Action Plan for its Conservation



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

DICKERSON PARK ZOO
UNEP
WWF
BRISTOL ZOO GARDENS
Zurich Zoo
Sultanate of Oman

Contents

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 attractive 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

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.

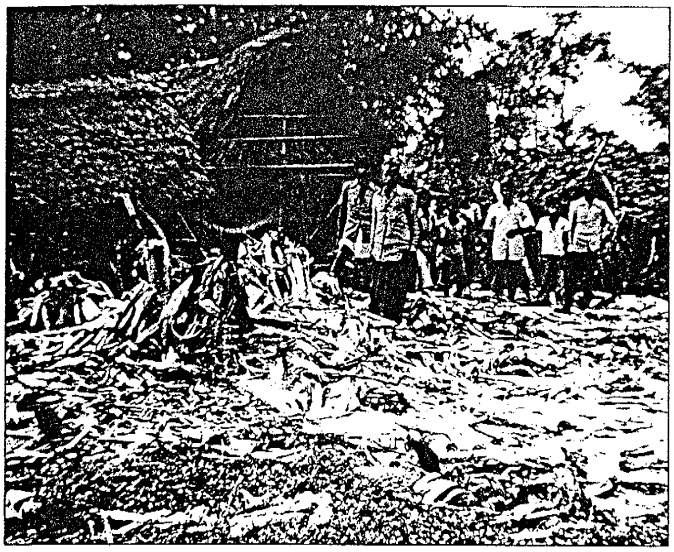
Compensation Schemes

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 Depradation 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).

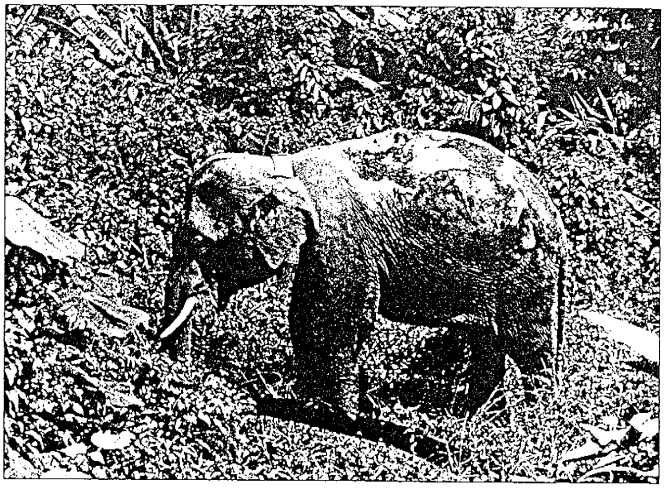
ries to CITES, should adhere as soon as possible in the long-term interest of their elephants.

- 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 replacement 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 km^2) and adjacent Karbi Anglong district should be consolidated by creation of a 200 km^2 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 connections 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.

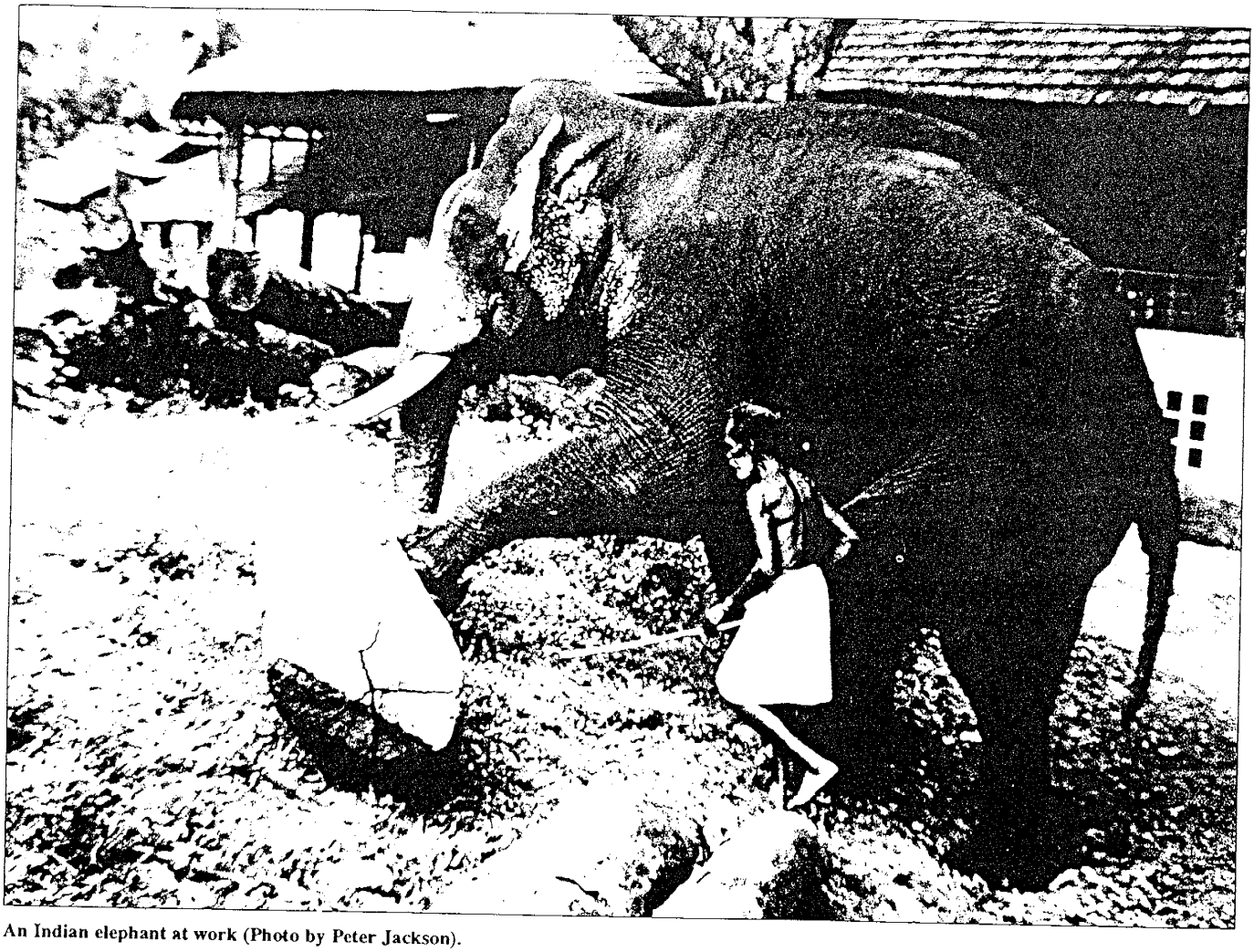
Populations of between 500 and 1,000 elephants

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 develop 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?

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 Heurn 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 Heurn 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 Heurn 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 Heurn (1929), based on the amount of ivory exported from Sumatra. Van Heurn 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

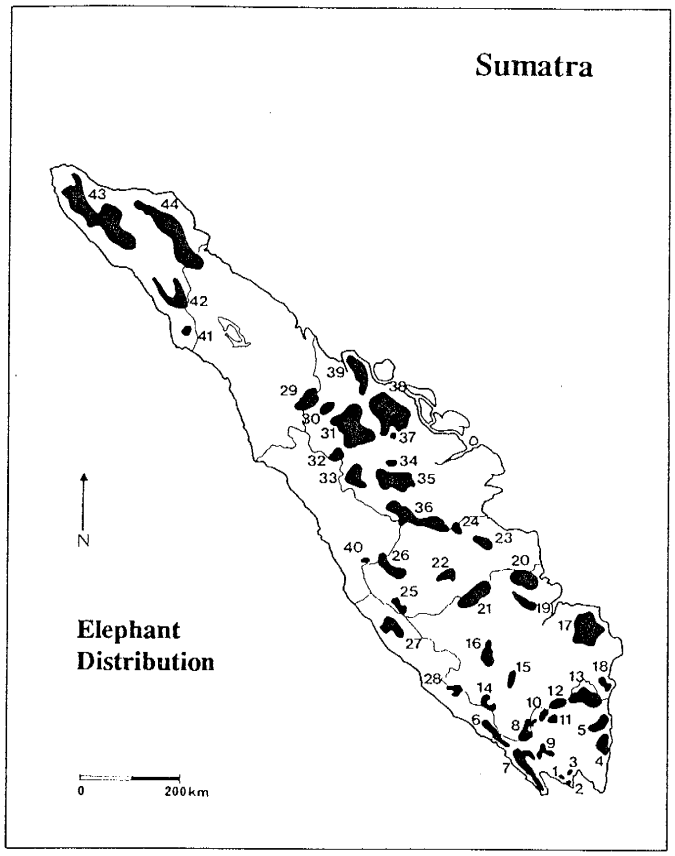


Figure 1. Elephant distribution in Sumatra. 1. Gunung Sulah. 2. Gunung Tanggang. 3. Gunung Betung. 4. Way Kambas. 5. Way Terusan. 6. North Barisan Selatan. 7. South Barisan Selatan. 8. Gunung Raya. 9. Gunung Rindingan. 10. Block 42. 11. Block 46. 12. Block 44. 13. Block 45 (Air Mesuji). 14. Tunggal Buta. 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. Buantan. 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.

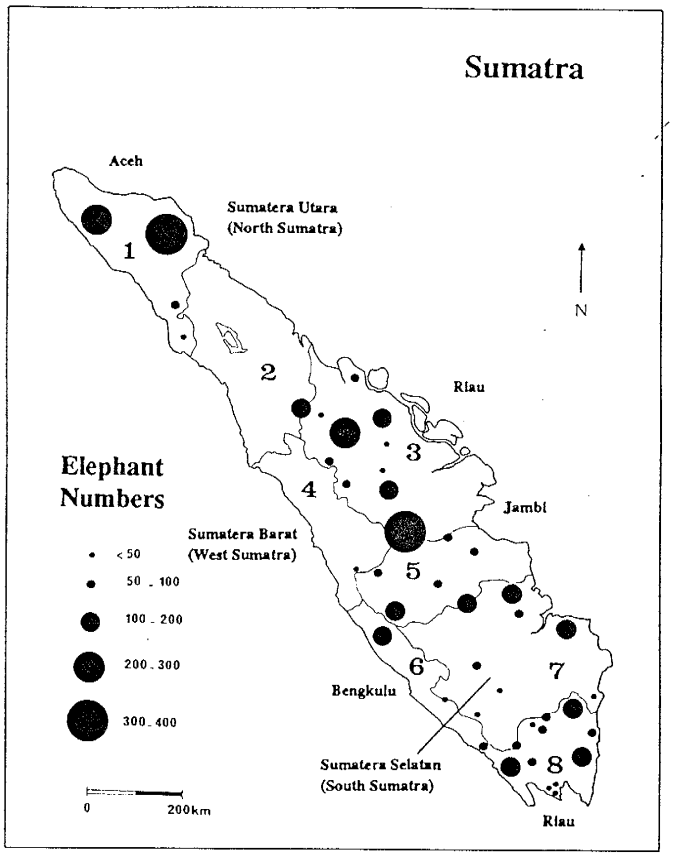


Figure 2. Relative size of elephant populations in Sumatra.

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 used in warfare and for ceremonial purposes. According to Van Heurn (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 Sebanga 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 35-40% 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 km^2 to 4,200 km^2 (Blouch and Simbolon 1985). One of the largest reserves, the Kerumutan Nature Reserve (1,200 km^2), 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 km^2 is under oil palm in Sumatra, while rubber plantations occupy 2,280 km^2 (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 km^2. 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 m^3/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,

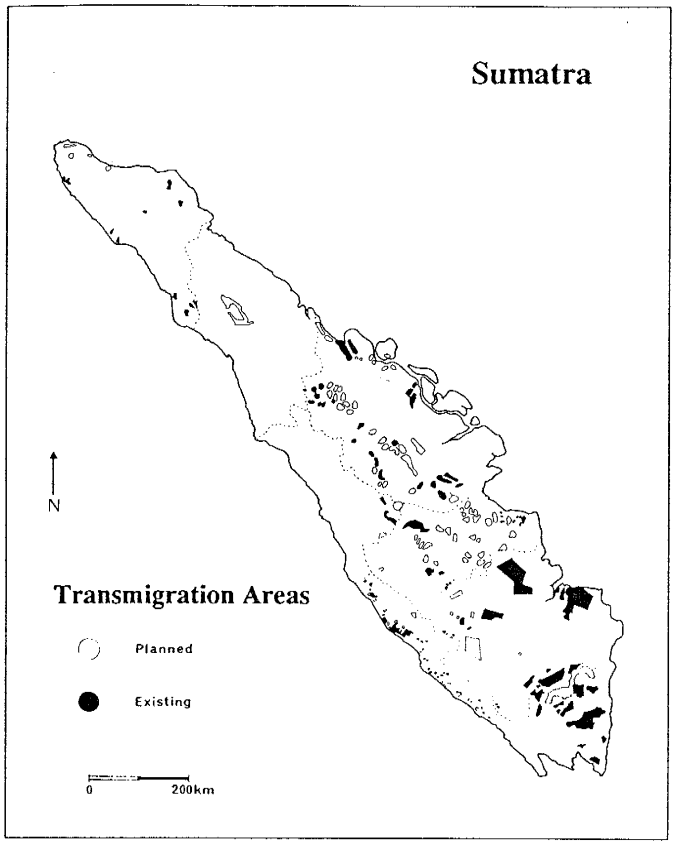


Figure 3. Location of existing and planned transmigration areas in Sumatra. Source: Blouch and Haryanto (1984); Blouch and Simbolon (1985).

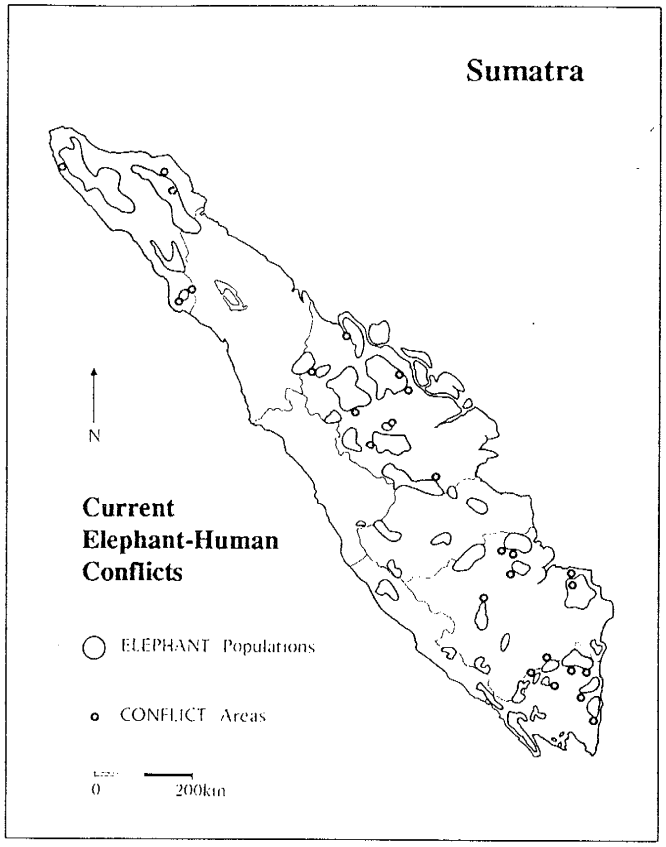


Figure 4. Areas of current conflict between elephants and people in Sumatra.

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 km^2 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/IIED 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 km^2) 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 km^2 (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/domesticate
42.	Gunung Leuser W.	-	-
43.	Western Aceh	lowland forest loss	establish reserve
44.	Eastern Aceh	rubber plantations	electric fencing

TM = Transmigration
MUF = Mutiple 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 km^2 (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 (km²)	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	200-1,090
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 focussed 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 population (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/km^2 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).

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

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/km^2 (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 km^2 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

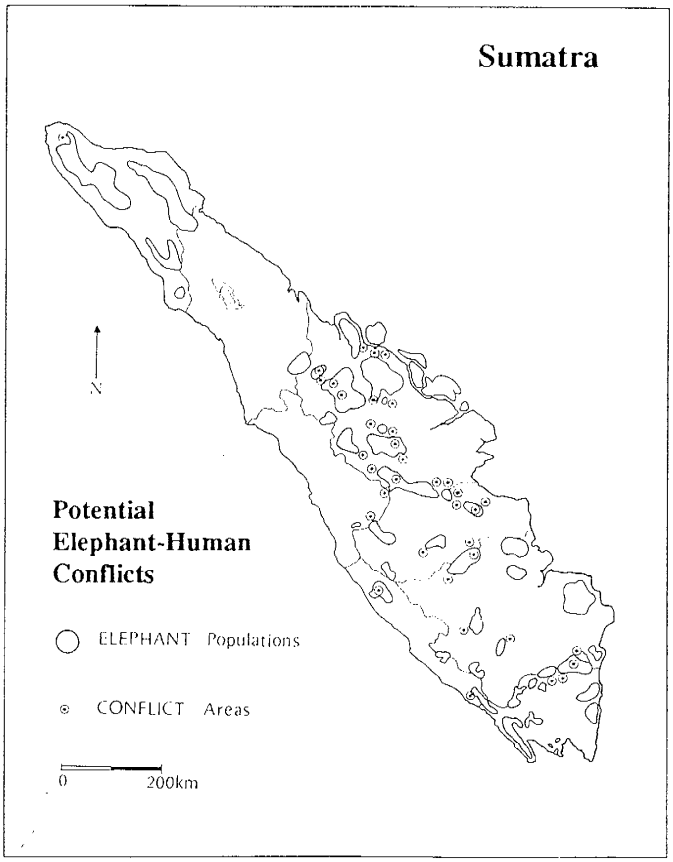


Figure 5. Areas of potential conflict between elephants and people in Sumatra.

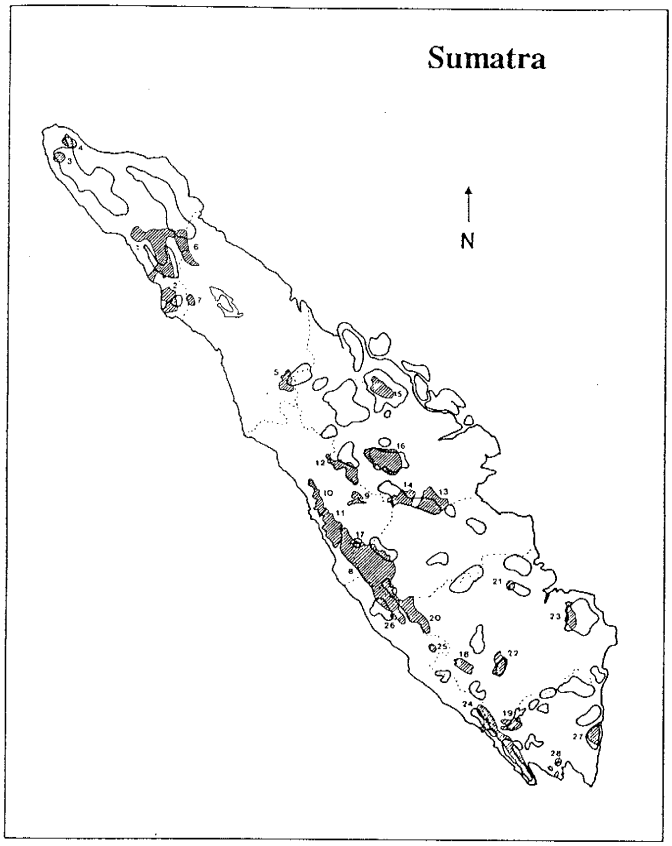


Figure 6. Protected areas (shaded) in Sumatra and the distribution of elephant populations. 1. Gunung Leuser. 2. Singkil Barat. 3. Jantho. 4. Gunung Selawah Agam. 5. Padang Lawas. 6. Sekundur and Langkat. 7. Dolok Sembelin. 8. Kerinci-Seblat. 9. Bukit Sebelah and Batang Pangan. 10. Banjang Air Tarusan. 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 Sugihan. 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 km^2 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 km^2) in Jambi and the Kerumutan Nature Reserve (1,200 km^2) 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.

		Biol.	Conservation	Economic	Totals			
No.	Locality	1 2 3	1 2 3 4 5 6	1 2 3	B	C	E	GT
1.	Mt. Sulah	4 1 2	1 0 3 2 1 5	5 3 1	7	12	9	28
2.	Mt. Tanggang	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.

		Biol.	Conservation	Economic	Totals			
No.	Locality	1 2 3	1 2 3 4 5 6	1 2 3	B	C	E	GT
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.

		Biol.	Conservation	Economic	Totals			
No.	Locality	1 2 3	1 2 3 4 5 6	1 2 3	B	C	E	GT
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.

		Biol.	Conservation	Economic	Totals			
No.	Locality	1 2 3	1 2 3 4 5 6	1 2 3	B	C	E	GT
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.	Dolok 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 km^2 of protection forest. This block is surrounded by production forests, 600 km^2 of which have not been given over to timber concessions. The new reserve (1,800 km^2) 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 km^2), and Peranap (1,200 km^2), 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 km^2) production forest known as IFA Forest. The second area concerns the planned Koto Panjang hydroelectric scheme, which would create a 124 km^2 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 km^2 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 background, 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.

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Reconciling Elephant Conservation with Economic Development in Sumatra

by

Charles Santiapillai
Dept. of Zoology, University of Peradeniya, Sri Lanka

and

Widodo Sukohadi Ramono
Directorate of Forest Protection & Nature Conservation (PHPA), Jakarta, Indonesia.

1.0 Introduction

The Sumatran elephant (Elephas maximus sumatranus) is the smallest of the three subspecies of the Asian elephant. Its numbers are estimated to be anything between 2,800 and 4,800 (Blouch & Haryanto 1984; Blouch & Simbolon 1985). Once widely distributed throughout the eight provinces of Sumatra, the animal has almost disappeared from two provinces and is under threat in the rest of the island from a host of development programmes such as logging, human re-settlement, establishment of large-scale plantation estates, oil exploration, mining, irrigation and agriculture. The conversion of primary forest into agricultural holdings has been one of the causes of conservation problems in Sumatra and the elephant has been among the large mammals most seriously affected by it. Development programmes have led to the annual elimination of tens of thousands of hectares of elephant habitat.

As their traditional migratory routes are blocked, habitats fragmented, the elephants are becoming increasingly confined to patches of forests that are surrounded by cultivated land. As Laws (1981) points out in the situation in East Africa, the situation in Sumatra too is reversing gradually "from one in which human islands existed in a sea of elephants, to a sea of people with elephant islands". These conditions have led to a dramatic increase in the scale of elephant depredations in Sumatra. In some cases the success of the development programmes has been threatened as a result of which, there has been a change in attitude by the planners in recognizing the need to take into consideration the ecological requirements of the elephant during the planning stage of any development programme. In return, the Directorate of Forest Protection and Nature Conservation (PHPA) which is primarily responsible for the conservation of elephant must match this recognition by the planners with realistic proposals to ensure the conservation of the species without leading to unacceptable conflicts. This paper is an attempt to reconcile elephant conservation with economic development in Sumatra.

2.0 Conservation of Elephant.

The human population of Indonesia currently estimated to be 170 million and concentrated in Java and Bali is growing at an annual rate of 2.1%, with no controlling mechanism in sight, and with a forecast which must be at best optimistic, of ultimately stabilizing at 400 million. In an effort to relieve the population pressure on the already over-crowded island of Java, the Government of Indonesia is currently resettling the surplus population on the so called "Outer Islands" of Sumatra, Sulawesi, Kalimantan and Irian Jaya. Such population over-spill into Sumatra would imply an even greater competition for land that is currently inhabited by the elephants. The population pressure is and will always be a real constraint on any attempt to find a rational solution to the long-term conservation of the elephant in Sumatra. Hence PHPA must adopt a realistic policy to ensure the long-term survival of the elephant in Sumatra by aiming to keep the elephant populations and human settlements as far apart as possible.

Given that our objectives is to ensure the long-term survival of the elephant in Sumatra, we must adopt a strategy that can achieve this objective. Parker (1984) recommended the protection of as many individuals as possible in as wide a range of habitats as is practical. This implies the fact that not all the elephants in Sumatra can be actively protected. Before such a strategy can be adopted, the PHPA must have clear information on the following:-

1. An approximate idea of the total number of elephants in Sumatra.
2. The number and size of discrete populations.
3. How such populations are distributed in space.
4. How many of these populations do in fact inhabit protected areas, and so can be actively protected.
5. What should be done with the populations that occur outside the protected areas?
6. What is the total extent of the protected areas in Sumatra.
7. How many of these areas are in fact large enough to hold viable elephant populations?

8. What can be done to enhance the survival prospects of the elephants inhabiting small areas?
9. What land-use practices can be accommodated along the periphery of the protected areas, without leading to unacceptable levels in elephant-human conflicts?
10. What is expected from other Government Departments, whose development programmes have been responsible in the past, for at least part of the current human-elephant problems in Sumatra?

2.1 Number of Elephants in Sumatra

On the basis of the surveys carried out by Blouch & Haryanto (1984) and Blouch & Simbolon (1985), between 2,800 and 4,800+ elephants are estimated to be present in Sumatra today, distributed mostly in six of the eight provinces (Table 1).

Table 1. The minimum and maximum number of elephants in Sumatra

Province	Minimum	Maximum
1. Aceh	600	850
2. North Sumatra	a few	a few
3. Riau	1,100	1,700
4. West Sumatra	a few	a few
5. Jambi	200	500
6. Bengkula	100	200
7. South Sumatra	250	650
8. Lampung	550	900
Total	2,800+	4,800+

Source: Blouch & Haryanto (1984); Blouch & Simbolon (1985).

2.2 Number and size of discrete populations

The surveys of Blouch & Haryanto (1984) and Blouch & Simbolon (1985) have identified at least 44 discrete elephant populations (Fig. 1) whose size ranges from less than 50 to 400 (Table 2). The largest populations with up to 400 elephants are found in Riau and Aceh provinces, which are important areas for economic development and so have been identified with chronic elephant depredations in the past. Some of the elephant populations in the heavily populated Lampung province are very small, consisting at times less than ten animals, and so have no long term viability.

Table 2: The number and size of the discrete elephant populations in Sumatra in 1985

	name	province	number
1.	Gunung Sulah*	Lampung	<50
2.	Gunung Tanggang*	Lampung	<50
3.	Gunung Betung*	Lampung	<50
4.	Way Kambas NP	Lampung	100-200
5.	Way terusan	Lampung	50-100
6.	North Barisan Selatan	Lampung/Bengkulu	50-100
7.	South Barisan Selatan	Lampung	>100
8.	Gunung Raya GR	Lampung	50-100
9.	Gunung Rindingan	Lampung	50-100
10.	Block 42	Lampung	<50
11.	Block 46	Lampung	50-100
12.	Block 44	Lampung	50-100
13.	Block 45 (Mesuji)	Lampung	>100
14.	Tunggal Buta	South Sumatra	<50
15.	Subanjeriji	South Sumatra	<50
16.	Air Semangus	South Sumatra	50-100
17.	Padang Sugihan GR	South Sumatra	≥100
18.	Sungai Pasir	South Sumatra	<50
19.	Bentayan	South Sumatra	50-100
20.	Air Medak	South Sumatra	>100
21.	Air Kepas	South Sumatra/Jambi	>100
22.	Intan Hepta	Jambi	50-100
23.	Mendahara Ulu	Jambi	50-100
24.	Suban NP	Jambi	50-100
25.	Gunung Sumbing NP	Jambi	>100
26.	Batang Tebo NP	Jambi	50-100
27.	Sungai Ipuh NP ?	Bengkulu	>100
28.	Bukit Hitam	Bengkulu	<50
29.	Torgamba	Riau/North Sumatra	100-200
30.	Tanjung Medan	Riau	>50
31.	North Central Riau	Riau	200-300
32.	Koto Panjang	Riau	50-100
33.	Lipat Kain	Riau	50-100
34.	Langgam	Riau	>50
35.	South Central Riau	Riau	100
36.	Southern Riau	Riau	300-400
37.	Buantan	Riau	>50
38.	Siak Kecil	Riau	100-200
39.	Lower Rokkan	Riau	50-100
40.	Sinkinjang	West Sumatra	>50
41.	Singkil	Aceh	<50
42.	Western Gunung Leuser	Aceh	50-100
43.	Western Aceh	Aceh	200-300
44.	Eastern Aceh	Aceh	300-400

(* extinct by 1990)

2.3 Distribution of elephant populations

The distribution of elephant populations in Sumatra is discontinuous (Fig. 1). The establishment of large scale oil palm and rubber estates have almost squeezed the elephant out of North Sumatra province. Heavy human pressure has also pushed the animal out of West Sumatra province. The elephant populations in Aceh still enjoy a wide distribution and good numbers. But in Riau, they are scattered and are under heavy pressure from development activities. Protected areas are woefully

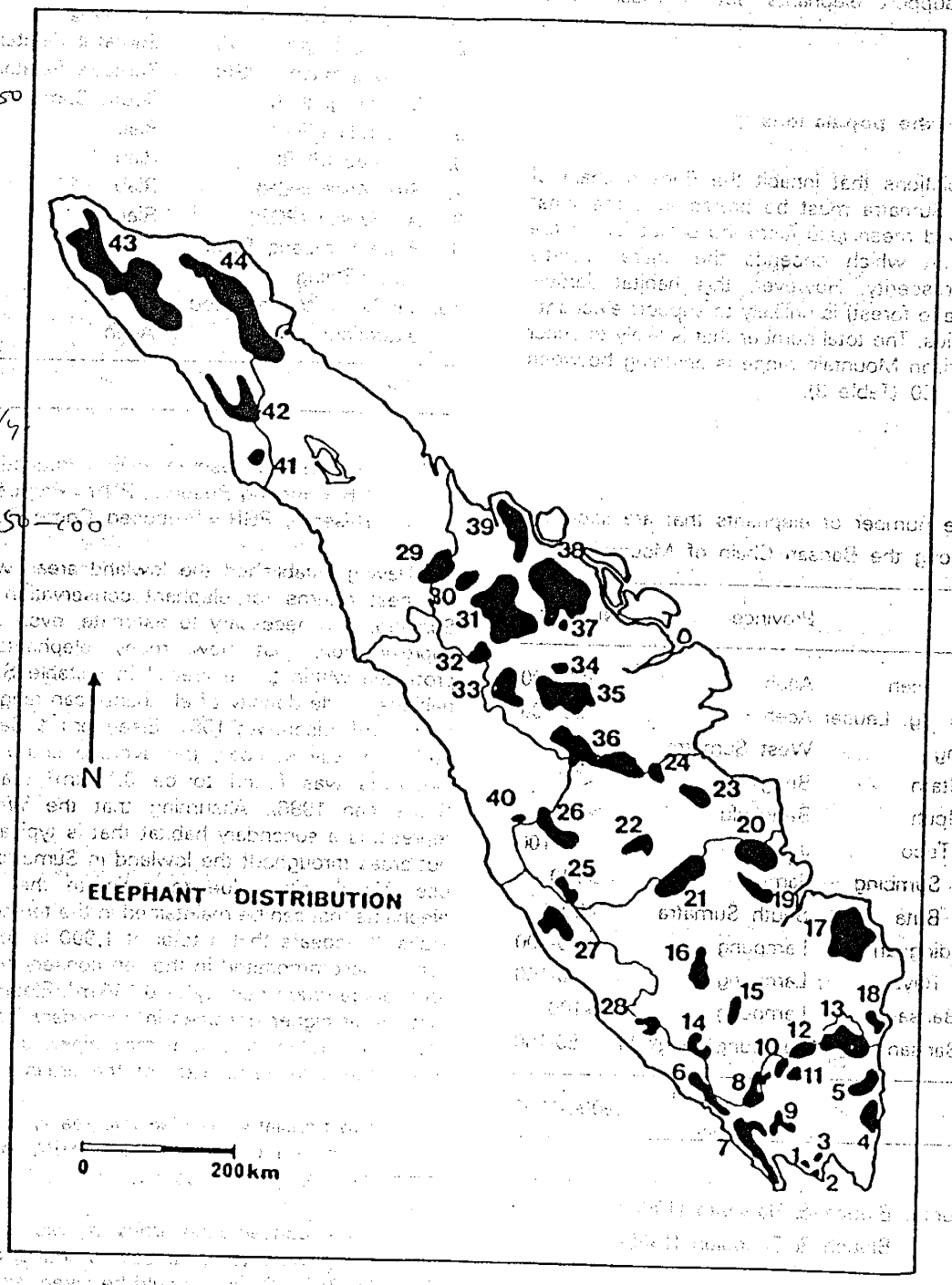

Fig. 1. Distribution of Elephant Populations in Sumatra, Indonesia

inadequate to accommodate all the populations in Riau. The situation in Lampung too is serious in that the animals are scattered in a man-dominated environment. The Barisan range of mountains that run along the spine of Sumatra support elephants but at much lower densities than the lowland forests.

2.4 Status of the populations

The populations that inhabit the Barisan chain of mountains in Sumatra must be protected come what may as it would mean *ipso facto* the protection of the watersheds, on which depends the entire island's agricultural prosperity. However, this habitat (largely primary montane forest) is unlikely to support elephants at high densities. The total number that is likely to occur along the Barisan Mountain range is anything between <900 and >1250 (Table 3).

Table 3. The number of elephants that are likely to occur along the Barisan Chain of Mountains

Name	Province	Number
43. Western Aceh	Aceh	200-300
42. Western Gg. Leuser	Aceh	50-100
40. Sinkinjang	West Sumatra	<50
28. Bukit Hitam	Bengkulu	<50
27. Sungai Ipuh	Bengkulu	>100
26. Batang Tebo	Jambi	50-100
25. Gunung Sumbing	Jambi	>100
14. Tunggal Buta	South Sumatra	<50
9. Gg. Rindinggan	Lampung	50-100
8. Gunung Raya	Lampung	50-100
7. South Barisan	Lampung	>100
6. North Barisan	Lampung/Bengkulu	50-100
Total		<900->1250

Source: Blouch & Haryanto (1984); Blouch & Simbolon (1985).

In contrast to the montane areas, the lowland forest habitates can maintain relatively higher elephant densities on account of the high productivity. Ten areas in the lowlands offer the best hopes for the long-term survival of elephants in Sumatra (Table 4).

Table 4. Lowland areas with the best potential for elephant conservation.

name	province	areas (km²)
1. Way Kambas (GR)	Lampung	1,235
2. Padang Sugihan (GR)	Sumatra Selatan	750
3. Lebong Hitam (PDF)	Sumatra Selatan	3,000
4. Subanjeriji (HR)	South Sumatra	650
5. Seberida (PNR)	Riau	1,200
6. Peranap (PHR)	Riau	1,200
7. Siak Kecil (PGR)	Riau	1,000
8. Air Sawan (PGR)	Riau	1,400
9. Bukit Kembang Bukit Baling-Baling	Riau	1,460
10. Jantho (with proposed extention)	Aceh	1,880
Total		13,775

Note: GR = Game Reserve; PDF = Production Forest; HR = Hunting Reserve; PNR = Proposed Nature Reserve; PGR = Proposed Geme Reserve

Having established the lowland areas which offer the best returns for elephant conservation efforts in Sumatra, it is necessary to estimate, even as a rough approximation, just how many elephants can be protected within these areas? In suitable South Asian habitats, crude density of elephants can range from 0.1 to 1.0/km² (Eisenberg 1981; Eisenberg & Seidensticker 1976). In way Kambas, the average crude density of elephants was found to be 0.14/km² (Santiapillai & Suprahman 1986). Assuming that the Way Kambas represents a secondary habitat that is typical of logged out areas throughout the lowland in Sumatra, we could use this density value to estimate the number of elephants that can be maintained in the ten conservation areas. It appears that a total of 1,900 is about all that can be accommodated in the ten conservation areas at an average crude density of 0.14/km². Elephants can in fact live at higher densities in secondary forests, but it would be prudent to aim at maintaining a number well below the carrying capacity of the areas.

But to translate this idea into reality would require strong action on the part of the PHPA to implement certain vital recommendations:-

a). The conservation areas in Riau (eg: Seberida, Peranap, Siak Kecil, Air Sawan and Bukit Kembang Bukit Baling-Baling) should be given legal status (At present they are designated simply as "prposed" and therefore amount to little more than "paper parks".)

b). These areas must be surveyed and properly demarcated and separated preferably from human settlements by suitable buffer zones.

c). The proposed nature reserve Jantho (80 km²) in Aceh is inadequate as an elephant reserve. However it could be much enlarged by incorporating the surrounding 1,200 km² block of protection forest and the 600 km² block of protection forest (Blouch & Simbolon 1985). The new reserve would then have a total areas of 1,880 km² and thus would be adequate to maintain a viable elephant population.

d). The Padang Sugihan Game Reserve is only 750 km² but it supports about 240 elephants, giving a crude density of 0.32/km² (Nash & Nash 1985; Nash 1987), which is one of the highest elephant densities known in South-East Asia. The Padang Sugihan elephants are about the maximum the reserve can support. Already there have been reports that some of the elephants have raided crops in the adjoining transmigration settlements. The problem is further compounded by the fact that forest fires within the reserve have also driven some animals out, leading to more conflicts with the human settlers nearby. The elephants are in turn threatened by harrassment and habitat degradation (Nash & Nash 1985; Nash 1987) within the reserve. Illegal logging takes place despite the fact it is a protected area. Loggers operate with impunity within the reserve, cutting trees well below the officially permitted diameter of 50 cm. In one sample study of 450 logs that were felled illicitly in the reserve, the average diameter was 33 cm, and some as small as 19 cm (Nash & Nash 1985; Nash 1987).

Given the high elephant density observed in Padang Sugihan reserve, it would be a fail safe measure if this reserve could be linked with the larger (3,000 km²) Lebong Hitam production forest to its east. Such a move would greatly increase the area for elephants from 750 km2 to 3,750 km² and will relieve the current pressures on the Padang Sugihan reserve as well.

But there are currently disturbing reports of forest fires even within the Lebong Hitam production forest that have destroyed up to 10,000 ha of peat swamp forest! Unless strong measures are taken now to prevent the recurrence of forest fires, even such an extensive area as Lebong Hitam would be useless as a refuge for the surplus elephants from the Padang Sugihan Game Reserve.

So, with the best of efforts and will, it might just be possible to protect between 2,800 and 3,000 elephants in Sumatra, one third of which inhabit the Barisan mountain range, while two thirds occur in the lowlands.

2.5 Elephants outside protected areas.

A decision must be made as to what should be done with the elephants that occur outside the protected areas. The home range of elephants do in fact overlap with the production forests in Sumatra. If such substantial areas do in fact accommodate the entire annual home range of a population, then the area is best managed as a multiple-use forest where elephants can co-exist with man and might even benefit from "limited human use of forested uplands, including selective logging for local consumption, traditional hunting, bamboo extraction and slash and burn agriculture" (McNeely 1978). The "Managed Elephant Range" concept was put forward by Olivier (1978) and offers a great potential to reconcile economic development and elephant conservation and so ought to be at least given a try.

If a population of elephants is causing unacceptable levels of depredations, then a decision must be made if the animals have to translocated to another reserve or captured for domestication and training. The PHPA have staff who are well experienced in both operations. They have successfully driven whole herds of elephants in 1982 and 1984 in Southern Sumatra and Lampung provinces, away from problem areas. If the number of elephants that are causing the problem is small (less than ten animals), then it would be more economical to capture them using chemical immobilization for either release into another reserve or for domestication and training.

In areas where elephants have become a problem as a direct result of economic development (eg: establishment of oil palm, rubber, sugar cane plantations), the onus of establishing elephant barriers (eg: electric fence, ditch etc.) must be on the development agency and not on the PHPA. At present all elephant problems, irrespective of their source of origin, are brought to the PHPA's "doorstep" to be resolved. Given the low budget on which the PHPA operates, it would be grossly unfair to expect the PHPA alone to solve all the elephant problems.

2.6 Protected areas in Sumatra

With a total area of 47.7 million ha, Sumatra is the second largest island in the Indonesian archipelago. 64.3% of the land area is officially designated as forest land (Anon 1984). The primary forest cover amounts to 42% (UNDP/FAO 1982). Protected areas (i. e: National Parks, Nature Reserves, Game Reserves, Recreation Parks, Hunting Reserves and Protection Forests) account for 17.2% of the total land area. As far as the elephant conservation is concerned, there are 28 areas in Sumatra whose total area is 48,448 km2 (Santiapillai 1987). But 50% of the areas are still in the "proposed" category and so do not have the full legal protection they deserve. However not all of them represent prime elephant habitat. About 65% of the areas is mountainous. The home ranges of at least 17 out of 44 elephant populations are within these protected areas, and they account for a maximum of 2,500 animals

2.7 Areas with potentially viable elephant populations

There are 13 areas in Sumatra (actual and proposed) which are over 1,000 km² in extent and so might be adequate to accommodate viable populations. However, size of a reserve alone is no guarantee for the viability of an elephant population. What is important is to determine the productivity of the area. Small areas can in fact support high densities of elephants in comparison to large areas. A good example is the Padang Sugihan Game Reserve which despite its small size (750 km²) supports a much higher elephant density than the largest conservation area in Sumatra, the Kerinci-Seblat National Park (14,846 km²).

2.8 Small areas

If resources are limiting, small areas are poor bets for long term conservation programmes. However, if it is indeed possible, every effort must be made to link small reserves with a nearby large reserve by forest corridors. For such corridors to be really effective, they should be broad (at least a minimum of 5 km wide), and established along the banks of the river.

2.9 Compatible land-use practices

Ideally, all protected areas where elephants occur, should be established as far away as possible from human settlements. If this is not possible, then a suitable buffer zone should be established in between the reserve and the human settlements. Elephants respond to edges, the transition zone between forest and grasslands in a positive way (Seidensticker 1984). Much of the elephant depredations in Sumatra is due to the establishament of crop lands by the side of the reserve, thereby creating a diversity of habitats for the elephant. The patch of land that lies between human settlements and elephant reserve should have "zero appeal" to the elephants to deter them from leaving the forest. This could be achieved by maintaining heavily grazed areas along the periphery of the reserve, establishing plantations that are not preferred by elephants (eg: Eucalyptus), or livestock husbandry instead of cash crop plantations.

2.10 Other Government Department assistance

The elephant problem must be looked upon as the collective responsibility of a number of Government Sectors that include Transmigration, Forestry (logging), plantations (oil palm, rubber, coconut, sugar cane etc.), Swidden agriculture, Mining, and power (hydro-electric and oil explorations) etc. Transmigration has been identified as an agent of forest desruction and much of the blame for the previous appalling failures of transmigration schemes is due to the scant attention the planners paid to site selection. A careful assessment of each forest block set aside for transmigration should be made before it is cut. Despitethe ambitious, well meaning efforts of the Government, the transmigration programme cannot possibly solve the demographic problems of Indonesia when human population growth in Java alone adds 2 million a year. The target for resettlement during 1984-1989 was 800,000 families (Ross 1984). The answer must lie in increased literacy, enhanced standard of living and the acceptance of the virtue of having small families. Transmigration is a fact of life in Indonesia, but it is a policy that cannot go on forever. As Ross (1984) points out, if the programme continues at the present rates of settlement untill all arable land is used, it would require an additional 5-10 million ha of land every five years, which must come from the forests.

The tropical rainforests of Sumatra contain a very high proportion of commercially valuable timber species. On an average, these forests contain as much as 200 m³/ha of commercial sizes trees (GOI/IIED 1985). In Sumatra, timber production means harvesting of old growth timber from natural forests. The commercially valuable dipterocarp species take about 70 years to attain the 60-70 cm dbh (diameter at breast height).

The Department of Forestry has laid down strict limits to the exploitation of commercial timber species. The regulations stipulate that a minimum diameter of 50 cm dbh and a cutting cycle of 35 years, leaving more than 25 trees per ha of commercial species of dbh 20 cm or greater (GOH/IIED 1985). As long as timber extraction is carried out selectively and within strict limits, it can enhance the carrying capacity for elephants (Santiapillai 1987). In practice, however, given the economics of timber extraction, 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 (Kartawinate et al., 1981). There is also profligate waste of timber at the point of extraction. Loggers often extract lower number but exploit larger areas. The rate of overall timber exploitation far exceeds any attempts of reforestation and rehabilitation. As far as the elephants are concerned, they do not have any escape routes to move from a disturbed area to another less distributed area. Shelton (1985) offers a practical solution to this problem which is to maintain unlogged buffer strips along the water courses to link a concession area with corridors of mature forest.

An ingenious way to maintaining areas of older forests as wildlife habitats within a logging concession is to cut it in a checkerboard pattren (Shelton 1985). It is worth quoting in full: "In a forest reserve managed on a 50-year rotation, which is fairly typical in Malaysia today, a block amounting to one fiftieth of the reserve would be logged each year. If alternate blocks were left unlogged until the second 25 yaers, 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.

The need to control the current rates of deforestation in Sumatra cannot be overstated. Logging operations *per se* are not responsible for large scale conservation of forests. These actions however expose the forest by providing access to many people along the logging roads, to the interior (Ross 1984). Roads in a normal logging operation in the high forests of Sarawak represent 4% of the total area logged (Hong 1987).

The department of Forestry must explore the possibility of using trained elephants in timber extraction within production forests, as is the case in Thailand and Burma. The Elephant Training Centres in Sumatra cannot hope to provide trained elephants to replace modern machinery but could assist in some way the extraction of timber from say, swampy areas where no machinery can function economically.

Soil erosion is perhaps the most serious environmental impact of logging (Hong 1987). The use of trained elephants in timber extraction within production forests can greatly reduce the negative impact of logging.

Plantation estates such as oil palm, rubber, sugar cane, coconut etc. have reaped enormous profits in the past but have not responded substantially to mitigating the current spate of elephant-human conflicts in areas where their activities have displaced the elephants. Proper environmental impact analysis must precede any new establishment of oil palm or other plantations. The oil palm is a much preferred food item of the elephant and so in the absence of effective elephant barriers, enormous elephant damage to oil palm trees will be inevitable. Appropriate electric fencing in Peninsular Malaysia could reduce elephant damage by more than 95% (Ratnam 1984). Electric fencing provides the most cost effective way of reducing elephant depredation under conditions prevailing in humid tropics (Blair & Noor 1981).

Shifting cultivation is often accused of causing much forest destruction. However, much of the damage to the forests is caused by the so called "Shifted cultivators" rather than by traditional slash and burn cultivators. As Ross (1984) points out, shifting cultivation in its classical form is the only self sustainable system of agriculture in the tropical rainforest. It becomes destructive only when their numbers exceed the carrying capacity of the forest. Compared to the amount of forest logged commercially, the primary forest opened by swidden farmers in Sarawak is only a small fraction (Hong 1987).

3.0 Conclusion

Elephant problems in Sumatra can never be completely eradicated. They can however be reduced substantially if much thought is given to the elephant in the planning stage of many of the island's development programmes. The PHPA alone cannot deal effectively with the elephant depredations. It would need the active support and generous financial assistance from both Governmental Departments and International Organizations. International philanthropy to date has paid more attention to helping with extraction of timber rather than reforestation and rehabilitation of degrarded areas.

The conservation of elephants in the face of growing economic development and increased human population growth calls for a provincial approach. Each province should establish a Task Force to deal with the elephant problems in that province on a respond-to-crisis basis. Each Elephant Task Force (ETF) should include a veterinarian trained in the use of cap-chur gun to tranquilize problem elephants if they need to be captured and translocated elsewhere.

The provincial ETFs should be under the control of a Director of Elephant Conservation whose Department would be responsible for the control, management and conservation of elephants in Sumatra.

The elephant Training Centres should provide trained elephants for use in forestry, wildlife and tourism. Trained elephants should be seen as an asset to economic development. Incentives must be given to individuals or companies that use trained elephants in hauling logs to using heavy machinery. Trained elephants performed a number of useful jobs during the Dutch colonial period; they ranged from hauling artillery during the war to hauling telegraph posts during peace. Capturing "problem elephants" and training them for useful service to man seems to be more humane and meaningful than shooting them as pests. The Elephant Training Centres in Sumatra should incorporate programmes to start breeding elephants in captivity. Elephants are slow breeders no doubt, but that should not prevent the PHPA in making a start in this direction. If elephants are to be trained for use in forestry operations, then they should be self-sustainable. Otherwise, there is a hidden danger that these training centres would simply become the raison d'etre for more captures from the wild.

The PHPA should base its policies on sound ecological research. This can only come about if increasing number of its staff are trained in wildlife management, and such trained personnel are in fact based in the field to address the problems and provide the appropriate solution. Unless and until this happens, wildlife conservation in Sumatra would be nothing more than an art of the possible.

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Asian elephant in Sumatra Population and Habitat Viability Analysis

Raman Sukumar & Charles Santiapillai

The Directorate General of Forest Protection and Nature Conservation (PHPA) of Indonesia and the IUCN/SSC Captive Breeding Specialist Group convened a workshop on the Population and Habitat Viability Analysis of the Asian Elephant in Sumatra (8-10 Nov. 1993), which was attended by more than 40 participants from Indonesia, Malaysia, Thailand, New Zealand, Australia, United Kingdom, USA, Ireland, India and Sri Lanka. The success of this workshop was largely due to the efforts of Ir Komar Sumarna (Director of Nature Conservation, PHPA), Mr. Widodo Sukohadi Ramono (Director: Species Conservation, PHPA), Dr. Ulysses S. Seal (Chairman: IUCN/SSC Captive Breeding Specialist Group) and Dr. Ronald. L. Tilson (Director of Conservation, Education & Research, Minnesota Zoo, USA). The international zoo community provided a generous grant that enabled many of the overseas participants to attend the workshop.

The workshop provided on opportunity to reassess the status of the Asian elephant in Sumatra in the light of the recent changes in the human demography and forest cover. The last survey of the elephant in Sumatra was carried out almost a decade ago by Blouch & Haryanto (1984), Blouch & Sibolon (1985) and Santiapillai & Suprahman (1984). The total population size of the Asian elephant in Sumatra was estimated tobe between 2,800 and 4,800. Much of the information on the number of elephants in Sumatra was gathered from local villagers and wildlife personnel. The information given by the wildlife chiefs from the provinces of Sumatra during the workshop indicates that there could be anything between 3,600 to 4,500 elephants in Sumatra today. This indicates an increased value for the minimum estimate given earlier but the maximumrecorded is still less than what was projected earlier.

In the past, Santiapillai & Jackson (1990) identified 44 separate populations which by 1992 had been reduced to 41 as three populations of elephants became extinct locally. Subsequent work in the northern province of Aceh indicates the fragmentation of large pupulations so that at the workshop, the PHPA identified 47 populations in Sumatra of which, 9 populations comprised less than 25 animals and were considered nonviable, while the remaining 38 populations with more than 25 animals each are distributed as follows:-

9 in national parks	(963-1,173)
5 in game reserves	(710- 860)
3 in protection forests	(130- 180)
21 in production forests	(1,895-2,320)

The important finding is that the largest number of elephants (1,895-2,320) are found in the Production forests whose status varies. There are 3 kinds of Production forests: (a) limited production forests, (b) permanent production forests, and (c) conversion forests. The latter category can be converted to other land uses (such as agriculture, human settlement, mining etc.). Therefore the long term security of many of the elephants in such production forests appears bleak.

As a result of the decline in the forest cover and increase in the human population growth, the elephant-human conflicts in Sumatra have escalated. In extreme cases, the PHPA had

been forced to capture chronic crop raiders and rogue elephants with the view to minimising the human-elephant conflicts. This has led to the establishment of a number of Elephant Training Centres across Sumatra. Table 1 provides data on the status of the elephants in these centres.

Table 1: Number of elephants in captivity in Sumatra

Province	year of establishment	number captured	number at present
Lampung	1985	152	83
Aceh	1987	60	40
Riau	1989	45	41
South Sumatra	1990	40	40
Bengkulu	1992	13	13
Total		310	217

Some of the captured elephants have been trained and are being utilized by logging agencies, zoos and safari park. However, unless there is substantial improvement in the veterinary care of the elephants, and sufficient financial and trained manpower resources are available, such increased capture of elephants cannot be justified. Furthermore, care must be taken to see that the annual off take of elephants in the wild is sustainable.

The population modelling group consisting of Raman Sukumar (India), Zainal-Zahari Zainuddin (Malaysia), Yayu Ramdhani (Indonesia), and Charles Santiapillai (Sri Lanka) used the VORTEX model produced by Robert Lacy (Brookfield Zoo, USA).

Life history variables:

Much of the demographic data on the Asian elephant comes from the studies of Sukumar (1989) in southern India, supplemented with some data on population structure of elephants in Way Kambas, Sumatra, in Santiapillai & Suprahman (1986). It is recognized that life-history variables are likely to be different for the southern Indian and the Sumatran elephant populations, as these inhabit tropical deciduous forest and equatorial rain forest respectively. In particular, it has been argued by Sukumar (1989) that elephants in the moister, more climatically "stable" rain forest habitats are likely to have evolved relatively more "k-selected" traits than would the elephants in the drier, more unpredictable habitats. Life-history variables for the Sumatran elephants thus reflect this expected difference.

The following variables were used in the VORTEX modelling:

Breeding system:

The elephant is a polygynous species. Although males are sexually mature when they are about 15 years old, they may not actually be able to mate until 20 or 25 years due to social reasons. Field studies in India show however that in the absence of older males the younger males can breed from the age of 15 years. Age at first reproduction was thus taken to be 15 years and 20 years under two scenarios modelled. Further, it was assumed that only 80% of the adult males are in the breeding pool in a given year.

Female reproductive rates:

Age at first reproduction in females was taken to be 15 years and 20 years. The latter figure may be more likely to be true of elephants in rain forest habitats (Sukumar 1989). Inter-calving interval has been found to be 4.5 to 5 years in southern India, but some data from Way Kambas indicates that females may reproduce only every 6 years on average (Santiapillai & Suprahman 1986). Thus, birth probability was taken to be 0.16/mature female /year; this was increased marginally to 0.18/ mature female/year in later instances in order to achieve a higher deterministic instrinsic growth rate. Litter size is taken as 1; twinning is very rare in elephants (c. 1% of births) and therefore, inconsequential.

Maximum longevity:

Elephants in captivity are known to have survived until 75 years or more in the case of females and about 60 years in males. How ever female elephants cease reproduction by about 60 years. Thus the maximum longevity was taken to be 60 years. A precise figure is not very important because the proportion of old elephants in the population would be negligible and thus contribute little to reproduction.

Sex - ratio at birth:

A large sample (>260) of births in captivity shows a slight bias towards male calves although this is not statistically significant. We used a 1:1 sex ratio at birth but also explored the effects of a male biased ratio (55:45).

Correlation between EV (reproduction) and EV (survival):

We assume that a correlation exists between these.

Mortality rates:

Mortality rates were adjusted within small limits in order to vary the (deterministic) intrinsic growth rates. In general mortality of female elephants was taken to be 8-15% (age 0-1 year), 4% (age 1-5 years), 2% (age 5-15 or 20 years) and 1.5-2.5% (adult age) per year.

There is evidence that in elephants (as in other polygynous mammals) the mortality of males is higher than that of females under natural conditions. This is reflected in the female-biased sex ratios observed in all elephant populations. Male mortality rates were thus taken to be 15% (age 0-1 year), 5% (age 1-5 years) and 3% (ages above 5 years, including adult) per year.

In populations where selective poaching of males for ivory occurs the mortality rates in sub-adult and adult males should be even higher than the above figures. Simulations were also run with a 5% mortality probability in males above 5 years.

Environmental stochasticity

In VORTEX environmental stochasticity is modelled as variation in annual birth and death probabilities by sampling binomial distributions, with the standard deviation (SD) specifying the extent of variation. SD on both birth and death rates were taken to be 20% of the mean rates. This figure is based on the southern Indian study, assuming that environmental variation in rain forest habitat is lower than in drier habitats. In any case, environmental variation seems to make some change to the final results.

Carrying capacity

Carrying capacity (K) was generally set at about 20% higher than the initial population size except in case of a population size of 10 for which it was set at 30. Small variations in

K may again not make any difference to the final outcome and was hence ignored. In one set of simulations a trend in K was taken as a loss of 0.5% of K per annum for 25 years.

Inbreeding depression

Although there are no data available on inbreeding depression in elephants, several studies on mammals in captivity have shown that it is important. We modelled scenarios without and with inbreeding depression. Inbreeding depression used a Heterosis model with a level of 3.14 lethal equivalents which represents the mean of over 40 mammalian species studied.

Catastrophes

Potential catastrophes affecting elephant populations are drought and disease epidemics. Very low probabilities were assumed for both these factors; serious drought is not likely in rain forests and there is no historical evidence of an epidemic such as anthrax. A 4% probability of drought lowering fertility by 40% and killing 5% of individuals, and a 1% probability of disease killing 10% of individuals were assumed. The probability of drought was later reduced to 2% for populations to achieve a higher deterministic growth rate.

Harvest

Elephants from the Sumatran populations are being captured if they are crop raiders. Some poaching of elephants also occurs. Two rates of harvest were considered. Under a low harvest rate four elephants (1 adult female, 1 juvenile female, 1 juvenile male and 1 adult male) were removed from the population every four years for 25 years, while under a high harvest rate the same number was removed for 50 years.

Population sizes were varied from 10 to 100 elephants as appropriate. All simulations began at stable age distribution and were run 500 times for 100 years.

Results

Basic scenario - Deterministic growth rate close to zero (r=0.002), no inbreeding depression, no harvest.

Under this scenario an initial population of 10 elephants had a 65% chance of surviving for 100 years. Raising this to 25 elephants increased the probability of survival to 95% and to 50 elephants to >99% over 100 years. For the two larger populations for which the carrying capacity was set at levels close to initial population size, the stochastic growth rate was still negative and the surviving populations would continue to reduce in size on average over the 100 year period.

Scenario II - r close to zero (0.002), inbreeding depression, no harvest

The outcomes are not particularly different except in the case of very small populations. Probabilities of survival for different initial sizes are 57% (pop. size 10), 96% (size 25) and >99% (size 50). This seems to indicate that inbreeding depression may not be a major factor in the survival except in very small elephant populations.

Scenario II - r close to zero (0.003), inbreeding depression, low harvest

Probabilities of survival for 100 years are 1% (pop. size 25), 10% (size 50) and >99% (size 100). There is a dramatic difference between initial population sizes 50 and 100 in their chances of survival under conditions of a low harvest as defined earlier. Thus harvest of even one elephant per year on average for 25 years would almost certainly drive any population under 50 to extinction. With a staring population of 100 there is a high chance of survival, but even this population would reduce to about half its original size after 100 years.

Scenario IV - r close to zero (0.003), inbreeding depression, high harvest

When the harvest of four elephants every four years is continued for 50 years, the probabilities of survival decrease to a certain extent. These are 2% (size 50) and 97% (size 100).

Scenario V - r increase to about 1% (0.01), inbreeding depression, no harvest

The probabilities of survival increase as compared to scenario II, these being 80% (size 10), 99% (size 25) and >99% (size 50).

Scenario VI - r about 1% (0.01), inbreeding depression, high harvest

With harvest continuing for 50 years, the chances of survival are 0% (size 25), 3% (size 50), 87% (size 75) and 98% (size 100). The surviving populations would however reduce in size during the 100 year period.

Scenario VII - r increased to about 2% (0.02), inbreeding depression, high harvest

Even with a population that can potentially grow at r=0.02, the probabilities of survival are quite bleak (<5%) for population sizes less than 50 elephants. For higher sizes the chances of survival are 89% (size 75) and >99% (size 100).

Summary of results

Elephant populations smaller than about 25 animals to begin with are at a very high risk of extinction. These populations should be supplemented with captured animals or managed as part of a metapopulation. If harvest of elephants (either through capture or poaching) is not envisaged, then a population of about 40-50 elephants whose habitat is secure would have a high chance of survival. If any harvest is envisaged this would be absorbed only by populations in the vicinity of 100 elephants.

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Address:

Raman Sukumar,
Centre for Ecological sciences
Indian Institute of Science
Bangalore 560 012 India.

Charles Santiapillai
Department of Zoology
University of Peradeniya,
Peradeniya, Sri Lanka.

Why do elephants raid crops in Sumatra

Charles Santiapillai &
Widodo Sukohadi Ramono

The Sumatran elephant (*Elephas maximus sumatranus*) has an image problem. Almost all the reports that are published in the media refer to its proclivity to raiding crops and thereby causing economic ruin to the farmers trying to eke out a precarious existence near areas inhabited by elephants. Elephant damage to oil palm and rubber plantations in South-east Asia can run into millions of dollars in economic loss to the country (Blair & Noor, 1981). Much of the crop depredations can be reduced if development planners and policy makers pause to understand why elephants raid crops.

The number of wild elephants in Sumatra is estimated to be between 2,500 and 4,500 animals (Blouch & Haryanto, 1984; Blouch & Simbolon, 1985). Prior to about 1900, when agricultural settlements in Sumatra first led to a substantial degree of deforestation, most of the island was covered with primary forest. Presumably, up to that time, the elephant was more or less continuously distributed throughout the entire island. Less than a century later, the elephant finds itself with its back against the wall. The conversion of primary forest into agricultural holdings, some of which have proved ephemeral and been abandoned, is a particularly serious cause of conservation problem in Sumatra, and the large mammals such as the elephant, rhinoceros and tiger are among the species most seriously affected by it. It is estimated that between 65 and 85% of the forests in the lowlands of Sumatra have already been lost (Whitten *et al.*, 1984). The mountain areas to date have been less seriously affected, but the disruption of continuous cover is already substantial in some cases (Santiapillai & Widodo, 1989), and perhaps 15% of their total area may tentatively be estimated as already removed.

The altitude range of the mountains in Sumatra is such that most of their area would have been rich habitat in the past in their undisturbed state. Although the elephants thrive in seral stages of vegetation, yet in the past when much of the land was under rainforest cover, the animals would have maintained large numbers by seasonally shifting their feeding grounds between the lowlands and the mountains. Many of the past elephant migratory paths extended from the hills to the lowlands and *vice versa* (Groeneveldt, 1938). All this had to change by the turn of the century, when increasing human population and increasing agricultural land use not only reduced substantially the land area once available to the elephants, but more importantly, blocked out certain channels of response such as emigration and dispersion. In extreme cases, the elephant herds have become "pocketed" into isolated, forest patches surrounded by a hostile landscape dominated by man (Olivier 1980). The situation has reversed from one in which man lived in small settlements in areas dominated by the elephants, to one in which the elephants find themselves surrounded by a man dominated environment. This has proved a sure recipe for escalation of elephant-human conflicts in Sumatra since then.

The elephants, like other wildlife have lost so much of their former habitat, that they are often forced to invade the communities that have displaced them (Caufield, 1984). Herein lies the crux of the elephant crop-raiding problem in Sumatra.

To understand why elephants resort to raiding crops, it is important to know something about their ecology. The elephant is a social animal. There are two social units comprising

the elephant populations (Laws, 1970): The first is the family unit or herd consisting of the oldest female (the so called matriarch), her daughters and their offspring. The members of the herd are related to one another and move about as a cohesive unit. In Sumatra, such units typically range in size between 4 and 8 animals. The second social unit is the bull group which is a loose temporary aggregation of often unrelated males (Eisenberg, 1981). Both males and females reach sexual maturity between the ages of 10 and 15 years. Once the male reaches sexual maturity it leaves the matriarchal herd and leads a solitary life. This is a way to prevent inbreeding in the herd. It will seek oestrous females in other herds and attempt to mate. Thus the adult, solitary bull is often more than a rogue elephant; it is a roving gene-pool. A number of adult bulls can meet and form the loose aggregations referred to as the bull groups. In Sumatra, much of the crop raiding is carried out either by solitary bulls or bull groups.

The male elephants also take more risks than do the matriarchal family units (Sukumar & Gadgil, 1988). In Way Kambas National Park, along the unprotected southern border which abuts on cultivated land, more males were responsible for crop raiding than family units. Male elephants also appear to respond to risks during the raids by forming larger groups. Why should this be so?

The elephants are unspecialised feeders: that means they are fairly catholic in their diets, feeding on a wide variety of plant species and not restricted to a few items. More than 90 species of plants are known to be eaten by elephants in Asia (McKay, 1973; Olivier, 1978; Santiapillai & Suprahman, 1986). A probable reason for the lack of selectivity is the need to consume between 6-8% of their body weight a day (Sukumar 1985; Vancuylenberg, 1974). This works out in the case of an adult male weighing 4,000 kg between 240 kg and 320 kg of wet weight per day (or 180-240 kg/day in the case of an adult female weighing 3,000 kg).

Given this background, it is easy to understand why elephants, with their large size and intemperate appetite raid cultivated areas and devour crops when their habitat is encroached by man. When extremely palatable and nutritious crops such as sugarcane, oil palm and paddy are cultivated by the side of elephant reserves, elephant raids are inevitable. Sugar cane and oil palm plantations function like elephant supermarkets, attracting the animals from far and wide (Ratnam, 1984). The proximity of such palatable items as sugarcane, oil palm, paddy etc. make available to elephants nutrient-rich food. It also eliminates searching time and thereby enables the elephants to optimise foraging efficiency. Increased nutrition would also lead to increased body size among the bulls and can ensure success in male-male competitions (Sukumar & Gadgil, 1988). Given the fact that the provision of parental care to the young is the prerogative of the females (mother, aunts and grandmother) and not of the adult males, it is easy to understand why the female herds do not take unnecessary risks by raiding crops frequently. Whenever female herds raid crops, they rarely stray out much farther from the forest boundary.

There are no easy solutions to stop elephants from raiding crops once agriculture becomes the principal land use in the vicinity of elephant reserves. The Directorate-General of Forest Protection and Nature Conservation (PHPA) of the Ministry of Forestry has attempted a number of measures in the past that range from translocation of entire herds of elephants from problem areas to the safety of game reserves, to the capture and domestication of chronic crop raiders for eventual use in Forestry, Agriculture and Tourism. The Elephant Training Centre near the Way Kambas National Park in Lampung province of Sumatra has been successful in training wild-caught elephants. Trained elephants have enormous economic potential and can be used in timber extraction in the Production Forest such as Teak, Eucalyptus and Pine. They also, unlike the heavy machinery, cause the least damage to

the environment. Domestic elephants form the backbone of timber extraction in Burma (Gale, 1974). There is no reason why they should not succeed in Sumatra as well.

However it would be naive to believe that capturing chronic crop raiders and training them in itself would solve the elephant-human conflicts in Sumatra. It is at best only a temporary measure and should not become institutionalized practice accepted as routine. Mitigating elephant-human conflicts would require more effective methods such as the use of electrified fences in combination with trenches in areas where elephants pose a serious threat to the plantations or crops (Piesse, 1992). But even these are unlikely to completely eliminate the conflicts as long as elephants are confined to a patch work of parks and reserves surrounded by hostile landscape dominated by man. Setting up of parks and reserves as viable self-sustaining ecosystems alone may prove poor bets for the long term if we fail to address the factors that have led to the conflicts.

On the one hand, people are tempted to have more and more consumer goods, and on the other, they are asked to preserve natural resources: these two are incompatible (Mishra, 1985). The problem concerning the elephant in Sumatra provides yet one more compelling argument for ending the indiscriminate felling and deforestation which have been sweeping across the island. While the need to retain large tracts of undisturbed forest is axiomatic, it is not essential *ipso facto* to stop commercial exploitation of timber in forest to be managed as habitat for the elephant. It is simply necessary to control it strictly.

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Address:

Charles Santiapillai
Department of Zoology,
University of Peradeniya,
Peradeniya, Sri Lanka.

Widodo Sukohadi Ramono
Directorate of Forest Protection & Nature Conservation (PHPA),
Mangala Wandabakti,
Jalan Gatot Subroto, Jakarta, Indonesia

TAMAN SAFARI INDONESIA'S CONTRIBUTION TO THE CONSERVATION OF ELEPHANT IN INDONESIA

The elephant is the largest terrestrial mammal in Asia. Prior to the larg 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 Indo-China and much of the southern China in the east. Today, the Asian elephant occurs in 13 Asian countries: Bangladesh, Bhutan, Burma, Cambodia, China, India, Indonesia (Kalimantan and Sumatra), Laos, Malaysia (Peninsular Malaysia and Sabah), Nepal, Sri Lanka, Thailand and Vietnam. At the turn of the century, it was estimated that there were more than 100,000 elephants in Asia. But today it is doubtful if the wild population in all the 13 countries could exceed 55,000 animals. Although the elephant's present range still extends from the Indian sub continent in the west to the rim of the Indo-chinese peninsula in the east, yet the total wild habitat available for it in Asia amounts to only about 500,000 km2 (or about the size of Thailand), which is declining at an average rate of 4,000 km2 per year. Therefore the Asian elephant is one of the most seriously endangered species of large mammals in the world. Indiscriminate forest clearance and poaching are the two main causes for the decline in number of elephants in Asia.

Prior to about 1900, when agricultural settlement in Sumatra first led to a substantial degree of deforestation, most of the island was covered in primary forest. Presumably up to that time, the elephant was more or less continuously distributed throughout the whole area. The island of Sumatra must have had a substantial population of elephants to enable the Acehnese kings to have them captured in large numbers and trained with the help of Indian mahouts. But this art of managing elephants in captivity disappeared with the decline in the influence of the kings and sultans in Sumatra and the arrival of the Dutch colonial powers.

Today, about 3000 elephants survive in Sumatra in a number of small, discontinuous populations from Aceh in the north to Lampung in the south, from sea level to over 1,750 m altitude. High human population and conversion of forests to oil palm and rubber plantations have almost eliminated the elephant from the province of North Sumatra. The importance of elephant in Sumatra stems from the animal's great size and its high longevity. These two factors enable the species to make relatively massive interventions in any ecosystem. It is therefore the most important species in the Sumatran ecosystems. In Sumatra today, a rapidly expanding human population is being maintained by an essentially subsistence economy. Changes in the land-use patterns are resulting in the continuous contraction of habitat available to the elephant. Range attrition can have an enormous consequence to the long-term survival of the elephants. It serves to cut off certain channels of response of the elephants such as emigration and dispersion. When elephants lose their range, they die. Elephants confined to small patches of forests that are surrounded by human settlement and agriculture are responsible for much of the crop depredations in Sumatra.

Against this background, elephant conservation is coming under increasing pressure from development agencies and planners to make it justifiable on economic grounds. The World Bank which provides huge loans to assist economic development is ambivalent about elephants and their inherent power to destroy their development projects. Elephant conservation requires habitat protection and this must be looked upon as a form of land-use where objectives other than short term benefits are emphasised. It involves a much larger time scale than in other forms of land-use. Ecological events have a time lag before they manifest themselves. But when they do, the consequences are often catastrophic.

Elephant conservation in Sumatra must be looked upon as a means to maintain large areas of forests vital to the welfare of the people. Many of the elephant populations today inhabit the chain of Barisan mountains that run along the western coast of the island. These mountains are the watersheds of almost all the major rivers in Sumatra and therefore their destruction would result in serious consequences to the people in Sumatra.

The long term survival of the elephant cannot be ensured simply by reservation of its habitat and enactment of laws for its protection. Such legislation failed to save the Bali and Javan tigers in Indonesia. What is more important is to have the active support of the people, especially those who live along the periphery of the elephant reserves. The goal of elephant management in Sumatra is therefore to minimise elephant-human conflicts on the one hand and to protect as many viable populations of elephants as possible. It requires some justification to contend that the elephant populations that live outside the protected areas should be conserved against the background of crop-depredations that have escalated over the years. Many farmers consider the most effective way to minimise their crop losses would be to eliminate the elephants. But there are compelling reasons why they should be saved.

The elephant is the four-wheel drive vehicle of the jungle whose potential use to man in Sumatra has been largely ignored until now. During the Dutch Colonial rule, the domesticated elephants were used in war and peace. The potential use of trained elephants in agriculture, forestry and tourism cannot be ignored. In India and China, trained elephants have been used successfully in agriculture to plough the land; In Burma trained elephants are the backbone of the timber industry, (about 3,000 to 5,000 trained elephants are used in timber extraction in Burma) while in Thailand, trained elephants are an important component in nature-oriented tourism.

Faced with the escalating problems of crop depredations by elephants throughout Sumatra, the Directorate General of Forest Protection and Nature Conservation (PHPA) tried many ways to minimise the human-elephant conflicts. These ranged from the translocation of entire herds of elephants from problem areas to the safety of protected areas, establishment of electric fences to prevent the movement of elephants into cultivated areas, and the capture of chronic crop raiders and rogue elephants using morphiomimetic drugs for domestication and use in forestry, agriculture and tourism.

But there was aproblem. How to domesticate the rouge elephants? The art of domesticating elephants disappeared in Sumatra about 300 years ago with the dissolution of the Kingdoms of the Sultans and the arrival of the Dutch. The whole technology had to be re-introduced from outside to Sumatra. It is at this stage that the Taman Safari Indonesia (TSI) extended its help to the PHPA.

Mr Jansen Manansang of TSI was among the eight people chosen by the PHPA to travel to Thailand in December 1985 to look at the possibility of training elephants for use in Agriculture, Forestry and Tourism. Then in 1986, Mr Frans Manansang went to India to study the management of elephants in the wild and in captivity. Subsequently, Mr Tony Sumampau from TSI also visitred India and Sri Lanka to study the local methods of capture and domestication of elephants. Then in 1987, Mr Manasang accomopanied an official PHPA team to Thailand to select and purchase two trained elephants and transport them with their mahouts from Chayaphum province in Thailand to Kuala Lumpur in Malaysia by truks and from Kuala Lumpur to Riau in Sumatra by boat and from Riau to Lampung by truks again. These two elephants and their mahouts formed the basis for the establishment of the First Elephant Training Centre (ETC) in Sumatra, with financial assistance from TSI.

Today, the PHPA have established ETCs the provinces of Aceh, Riau, Bengkulu and Sumatra Selatan in addition to Lampung to deal with the problem of elephant-human conflicts. The objective of the ETC is to minimise the human-elephant conflicts in Sumatra and also to provide a pool of trained elephants and mahouts for use in forestry, agriculture and nature-oriented tourism and thus re-establish the elephant as a part of Sumatra's myth, history and culture.

TSI is particularly careful to emphasise the use of trained elephants only in the production forests and not in the virgin forests in Indonesia. Teak is particularly suited to grow between altitudes of 2,000 and 3,000 m along steep hills. In such areas, there is no man-made machine that is superior to trained elephants in hauling timber. At first there was considerable reluctance on the part of the logging companies in Sumatra to embark on the use of trained elephants in timber extraction.

This is largely due to the economics of logging opertions which aim to maximise the extraction of timber within the minimum of time period. But at least, the PHPA have successfully demonstrated the potential benefit of using trained elephants in tinber extraction. Already one timber company, PT Great Andalas Timber, in Lampung province has incorporated trained elephants in its logging operations. This is indeed an remarkable achievement.

TSI is proud of its achievements in Indonesia. In addition to its contribution to the conservation of both in situ as well as ex situ conservation of the Sumatran elephant, TSI is also involved deeply in breeding other seriously endangered species of native fauna such as the Anoa (Bubalus quarlesi), Sumatran tiger (Panthera tigris sumatrae) and the rare Sumatran rhino (Dicerorhinus sumatrensis). Given the excellent conditions under which the tSI maintains its animals and the good veterinary care available, TSI has been chosen as the centre for breeding endangered species of wild fauna in Indonesia. It has established strong links with International Conservation Agencies such as the World Wide Fund for Nature (WWF), the Species Survival Commission (SSC) of the World Conservation Union (IUCN) and is an active partner with the American Association of Zoological Parks and Aquariums (AAZPA) in promoting credible ex-situ conservation programmes in Indonesia.

Jungle four-wheel drive

Like many other working animals, Asian elephants have lost ground to the machine in recent decades. But there is growing recognition of their merits, particularly in the forestry industry, since they can extract timber with much less incidental damage than machines. Encouraging their use in forestry and other industries, such as tourism, offers a way of reducing the conflict between people and elephants. Charles Santiapillai and Widodo Sukohadi Ramono consider the abilities of this gentle giant.

THE ACHINESE KINGS OF PRE-COLONIAL Sumatra held the Asian elephant in such high esteem that, when one of their domesticated animals died, its unfortunate "mahout" (keeper) was ordered killed and stuffed inside the dead pachyderm's stomach.

Today, nearly the opposite attitude prevails: *Elephas maximus* is threatened almost everywhere in its range—by indiscriminate hunting, habitat destruction and the retaliatory attacks of farmers whose expanding croplands are frequently devastated by the movements of increasingly hemmed-in elephant populations. Unlike the Achinese kings, development agencies and the national governments who are their clients are often ambivalent about the herds that remain, with their potential to destroy or damage ongoing rural projects. Pressed by farmers who see elimination of elephants as the best way to curtail crop losses, they tend to believe that, if elephant conservation cannot be justified on short-term economic grounds, it cannot be justified at all. Meanwhile, elephant numbers, estimated at more than 100,000 in Asia at the turn of the century, are less than half that total now—and shrinking. The creation of park reserves and the legal protection of animals is unlikely to reverse this situation, any more than it could have saved the tiger in Java or Bali.

Seen in a larger context, however, Asia's elephants are a long-term resource that should not be wasted. All over Southeast Asia, the elephant could be a key part of the equation in attempts to slow deforestation and prevent the disastrous flooding and land degradation that inevitably follow. It could also play a major role in what is unquestionably a future growth industry for the region: tourism.

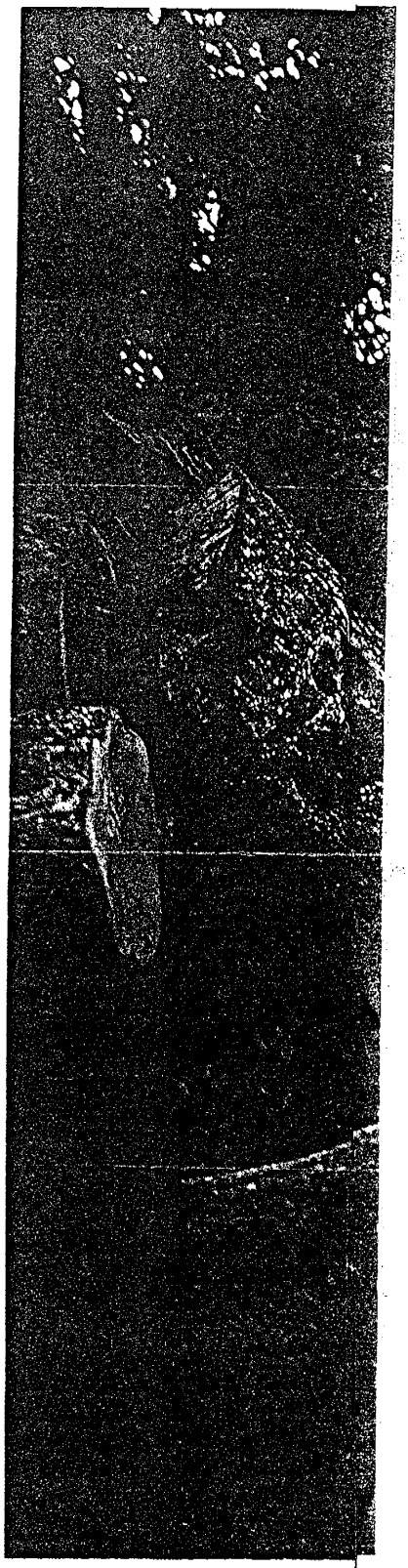
The original range of the Asian elephant, the largest terrestrial mammal in Asia, extended from the Tigris-Euphrates river systems in the west, across Asia south of the Himalayas, to Indochina and most of southern China in the east. Today, the species is still found in 13 countries: Bangladesh, Bhutan, Burma, Cambodia, China, India, Indonesia, Laos, Malaysia, Nepal, Sri Lanka, Thailand and Vietnam. Yet the wild habitat actually available to it within this range has shrunk to less than 500,000 sq km—about the size of Thailand alone—and continues to disappear at a rate of 4,000 sq km annually.

Elephas maximus' situation in Sumatra is typical. Before 1900, when agricultural expansion began in earnest, most of the island was covered by primary forest and elephants were more or less evenly distributed throughout. That elephant numbers were substantial is indicated by the fact that, in the late 19th century, Sumatra exported some 1,000 kg of ivory yearly.

NOW, ABOUT 3,000 ELEPHANTS SURVIVE ON THE island in small, scattered groups from Aceh in the north to Lampung in the south. The mushrooming human population and the conversion of large areas of forest to oil palm and rubber plantations have almost squeezed the elephant out of north Sumatra.

In other areas, subsistence farming—the support base of the majority of the fast-rising human population—has had the same effect. Between 65 and 80 per cent of the species-rich lowland forests of Sumatra have already been lost. Ironically, conversion of forest for agricultural purposes often proves ephemeral and is abandoned.

When elephants lose their range, they die—but they are not the only ones who do. The same indiscriminate logging and forest clearance that destroys elephant habitat were the cause of the floods that killed hundreds of people in Thailand a few years ago and led to that country's subsequent total ban on logging. In Sumatra, forest clearance in Bengkulu province was ▶



Sustainable haulage: working elephants run on little fuel and need no spare parts.

The Royal Geographical Society Magazine
GEOGRAPHICAL Vol. LXIV #12
Dec. 1992

◀ responsible for much of the human misery that accompanied the flash floods in 1988. The economic and social costs of such catastrophes are enormous, but they could be avoided if development planners heeded the warnings of ecologists and considered something more than short-term land use objectives. In the long term, elephant conservation in Sumatra could be of significant value in maintaining large areas of forest and thus protecting watersheds.

Many of the island's remaining elephant populations, for example, are found among the Barisan mountains, a chain running along Sumatra's western spine. The Barisan form the watershed of most of the area's important rivers, including the Musi and Batanghari and the destruction of the forests protecting these watersheds from erosion and floods would have incalculable consequences. Only scanty information is available, but it is estimated that the disruption of the forest cover in the region may already be substantial, with up to 15 per cent of the mountain area's trees removed.

The elephant, however, is the jungle's perfect cross-country vehicle. Domesticated elephants have been used, in war and peace, all over Asia. In Assam, in northeast India, elephants were put to work ploughing farmland and pounding rice. Everywhere in the region they were the backbone of the timber industry and today, in Burma, more than 5,000 trained elephants are still used in teak lumbering.

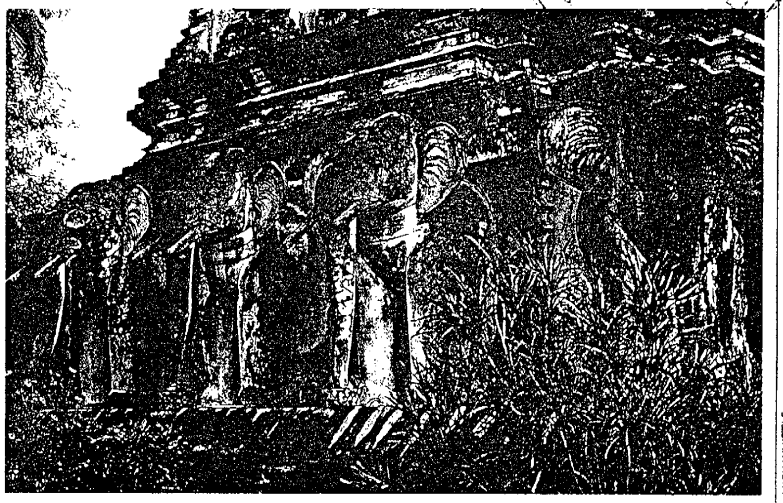
IT IS IN THIS LATTER ROLE THAT ELEPHANTS COULD be most useful today, when rapid but wasteful mechanical logging techniques result in so much incidental environmental damage. The elephant, used selectively for logging operations in sensitive areas, could be the basis for a comparatively benign, much less destructive mode of resource extraction. The elephant's advantages in forestry operations—both economic and environmental—are many and well proven.

A fully trained elephant is an investment for a lifetime. In Thailand, it costs US$6,000-10,000 to buy a 20-year-old timber elephant, whose working life after purchase may continue another 30 years. Compare this with the US$100,000-140,000 price of a crawler tractor, which has a working life of only six years and requires a continuous supply of diesel fuel.

Elephants remove the need for expensive access roads for heavy machinery. Of itself, the construction of such roads destroys a great deal of forest growth. But it also opens the interior to slash-and-burn farmers and poachers, who level whatever forest growth remains after the prime timber has been cut. Elephant-based logging eliminates this danger.

And unlike machinery, elephants do not rust, corrode or pollute the environment. They do not need expensive spare parts—which must be trucked in along more roads in vehicles using still more non-renewable petroleum fuels. Their dung acts as fertiliser as well as an agent of seed dispersal in the forest, automatically reforesting even as they remove trees. Their feeding thins the undergrowth in such a way as to enhance the germination and growth of many tree seeds, thus further fostering reforestation.

Elephants cause less damage to the land than heavy machines, whose wheel and tread ruts create erosion channels and whose weight causes soil compaction. Moreover, they can work throughout the year under any weather conditions, even in periods of rain and mud that stop machines. Though bull elephants have a period of "musth", during which they tend to be aggressive and are not worked, non-pregnant females work year-round. In some terrains, such as freshwater swamp forests or on very steep ▶

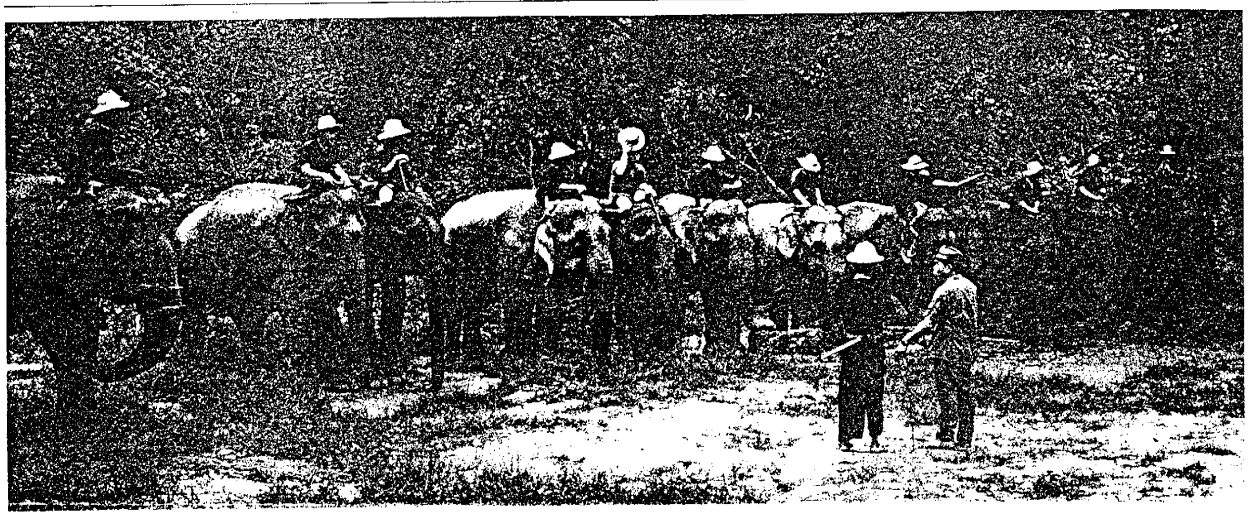


MICK WHITTLE

BEN EDWARDS/IMPACT

BRUNO BARBE/MAGNUM

Top: carved, elephant-shaped buttresses support ancient Siamese Buddhist temples in Thailand and symbolically defend the religious relics contained within. Bottom left: today, many elephants are employed to transport tourists, such as this one in the Amber Palace near Jaipur in India. Bottom right: an elephant demonstrates its weightlifting skills near Kandy in Sri Lanka.



MICK WHITTLE

All present and correct: Karen and Thai tribesmen supervise the morning assembly and veterinary inspection of student elephants, before the day's various training activities begin at Thailand's elephant university.

hills, elephants are the most cost-efficient, if not the only, means of timber extraction.

However, if they are used to take timber from places machines cannot reach—but where retention of forest cover is crucial to prevent erosion—elephants can present a danger to forest areas. This is why, in a recent project in Sumatra, the Directorate of Forest Protection and Nature Conservation (PHPA) was careful to ensure that elephants were only used in production forests which had been set aside specifically for monocultural cultivation of trees such as teak, pine and eucalyptus.

The project was launched in response to escalating problems of crop depredation by elephants throughout the island. The PHPA tried many ways to minimise the scale of human-elephant conflicts: the translocation of entire herds from problem spots to the safety of parks and protected areas; the establishment of barriers, such as electric fences, to prevent elephants from moving into cultivated regions; and the capture—with the use of potent morphiometric drugs—of chronic crop raiders, which could then be domesticated.

THE DOMESTICATION OF CAPTURED ROGUE elephants was a major learning exercise. The art of elephant training gradually died out in Sumatra with the dissolution of the kingdoms of the sultans and the demise of their hegemony over the island, following the arrival of the Dutch colonialists.

In 1987, the PHPA approached Thailand and brought two trained elephants, with their mahouts, from Chaiyaphum in central Thailand across the Straits of Malacca into Riau. From there they were transported by truck to the Way Kambas Game Reserve, where an Elephant Training Centre (ETC) was established. Its objective was to create a pool of trained elephants and mahouts for use in forestry and eventually, in nature-oriented tourism, simultaneously minimising elephant-human conflicts and re-establishing the elephant as part of Sumatra's history and cultural heritage.

As already noted, the project participants were mindful that elephants were not the best vehicle for every forestry operation. But teak, for example, is particularly suited for growing at altitudes of 2,000-3,000 m, along the same steep slopes that are most vulnerable to erosion—and hence in need of selective, rather than wholesale timber cutting. In such places, no machine can match the abilities of the elephant which, as noted by J H Williams in the book *Elephant Bill*, can haul a log "29 feet long and six or seven feet in girth—that is, over 100 cubic feet of timber, or four tons dead weight."

Despite considerable initial resistance on the part of Sumatran loggers, the PHPA seems to have successfully demonstrated the animals' potential. The turning point came when the P T Great Andalas Timber Company, in Lampung province, incorporated two trained elephants in its logging operations.

In the conservation of the earth's animal genetic resources, habitat protection is crucial, especially where large mammals like the elephant are involved. The key, in Sumatra at least, seems to lie in a multiple-use pattern of rangeland development. While the need to retain large tracts of undisturbed climax ecosystems is axiomatic, it is not essential *ipso facto* to stop commercial exploitation of timber to protect elephant habitat. It is necessary only to control and direct it. Trees, for example, should be taken selectively, with extraction limited to those exceeding 50 cm in diameter at breast height, leaving the remainder to provide the open canopy necessary for replacement saplings to grow.

Such policies are needed in any case, if sound long-term forest management is to replace the destructive exploitation so common in Asia. □

Charles Santiapillai is a senior scientific officer with the World Wide Fund for Nature (WWF), in Bogor, Indonesia. Widodo Sukohadi Ramono is chief of the Special Conservation Directorate of Forest Protection and Nature Conservation (PHPA) in Bogor.

TV LINK *Aliya the Asian elephant*, a drama documentary about the life of an Asian elephant in Sri Lanka will be broadcast on BBC2 on Sunday 20 December at 6.40pm.

Widodo SK

THE SIKUNDUR ELEPHANTS

TAMAN NATIONAL GUNUNG LEUSER

RINGKASAN PELAKSANA

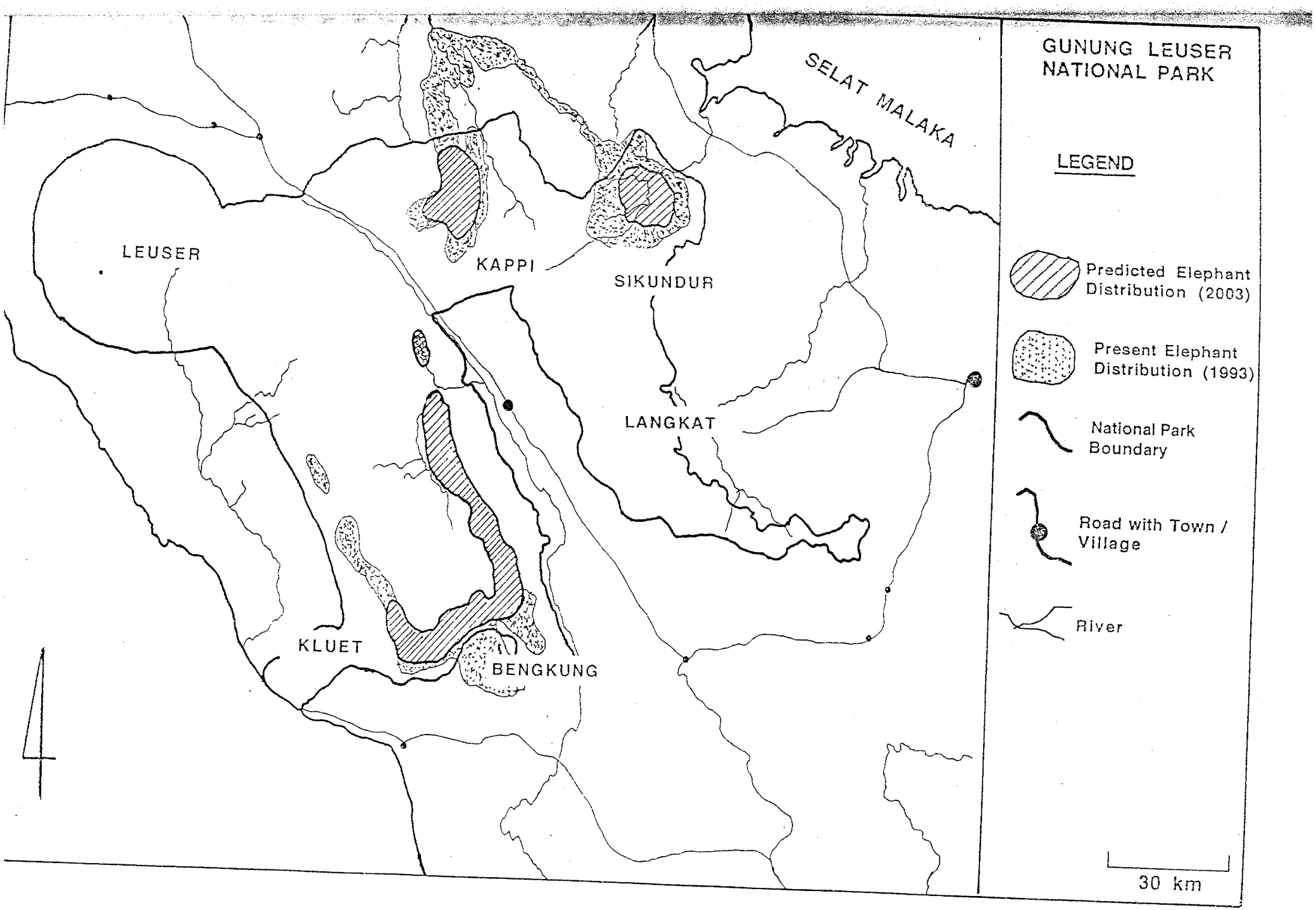
Oliver Nelson

Mai 1993

The World Wide Fund For Nature
Indonesia Programme

untuk

Direktorat Perlindungan Hutan
Dan Pelestarian Alam


GUNUNG LEUSER
NATIONAL PARK
SELAT MALAKA
LEGEND
LEUSER
KAPPI
SIKUNDUR
LANGKAT
KLUET
BENGKUNG
Predicted Elephant Distribution (2003)
Present Elephant Distribution (1993)
National Park Boundary
Road with Town / Village
River
30 km

SURVEI GAJAH YANG DILAKSANAKAN PHPA / WWF DI BAGIAN TIMUR LAUT TAMAN NASIONAL GUNUNG LEUSER

Dari bulan Juli 1992 sampai dengan April 1993 PHPA / WWF mengadakan penelitian populasi gajah di dan sekitar bagian timur Taman Nasional Gunung Leuser telah dilaksanakan.
Tujuannya adalah untuk menaksir keadaan species yang terancam dan menyelidiki cara-cara memelihara habitatnya yang mengandung keanekaragaman yang terkaya di luar ekosistem Leuser.

P e n e m u a n - P e n e m u a n

1. Gajah- Gajah dibagian timur laut Taman biasanya merupakan sub populasi dari suatu populasi yang lebih luas yang bergantung pada Ekosistem di Leuser bagi kelangsungan hidupnya. Populasi ini meluas dari lembah Alas dan akhirnya ke jaringan Sungai Bengkung dan Kluet.

2. Melalui pengikisan habitat gajah-gajah di Leuser telah menjadi sedikit baru-baru ini dan dalam keadaan bahaya yang akan habis sama sekali. Ini akan menjadi serius karena populasi gajah di Leuser mungkin suatu yang terakhir yang dapat hidup terus di seluruh Sumatera. Kematiannya berarti kepunahan dari gajah Sumatera.

3. Penyelidikan ini menggambarkan distribusi gajah - gajah sekarang ini di dan sekitar bagian timur laut Taman Nasional Gunung Leuser berdasarkan pada adanya kotoran hewan tersebut, tanda-tanda gosokan, jejak-jejak, tanda-tanda pemberian makanan dan lain-lainnya. Sebuah peta distribusi terlampir. Ini jelas bahwa selama jalannya penyelidikan gajah dan satwa sekitarnya secara kritis adalah terputus.

4. Suatu taksiran jumlah gajah di daerah Besitang adalah antara 94-169 ekor. Ini merupakan habitat gajah yang utama (terbaik). Berdasarkan dengan apa yang telah diketahui dari kawasan-kawasan gajah lain yang merupakan pemusatan suatu jumlah bagi semua gajah di suatu kawasan yang diperoleh dengan menjumlahkan perkiraan untuk setip wilayah sebagai berikut :
Kappi 80 ekor, Lesten 15 ekor, Tamian 10 ekor, Besitang 94 - 169 ekor. Populasi yang diberikan antara 199 - 274 ekor. Digabungkan dengan populasi perkiraan di bagian barat daya Leuser, diperkirakan 180 ekor yang memberikan suatu angka antara 379 - 454.

5. Menurut bukti-bukti yang terbaik (Jackson, Santiapillai tahun 1990) jumlah minimum dari satu populasi tidak kurang daripada 500 individu. Ini berarti bahwa walaupun perkiraan populasi gajah yang paling mempunyai harapan baik di bagian timur laut Taman Nasional Gunung Leuser tidaklah cukup bagi kelangsungan hidup jangka panjang, tanpa pengelolaan strategi yang efektif.

R e k o m e n d a s i

Agar dapat memelihara/melindungi gajah-gajah Sumatera, jumlah yang masih hidup di ekosistem Leuser harus dilestarikan. Untuk memperoleh suatu tujuan rekomendasi-rekomendasi dibuat sebagai berikut :

1. Semua populasi di Ekosistem Leuser harus dibatasi melalui ketentuan dari batas margasatwa.

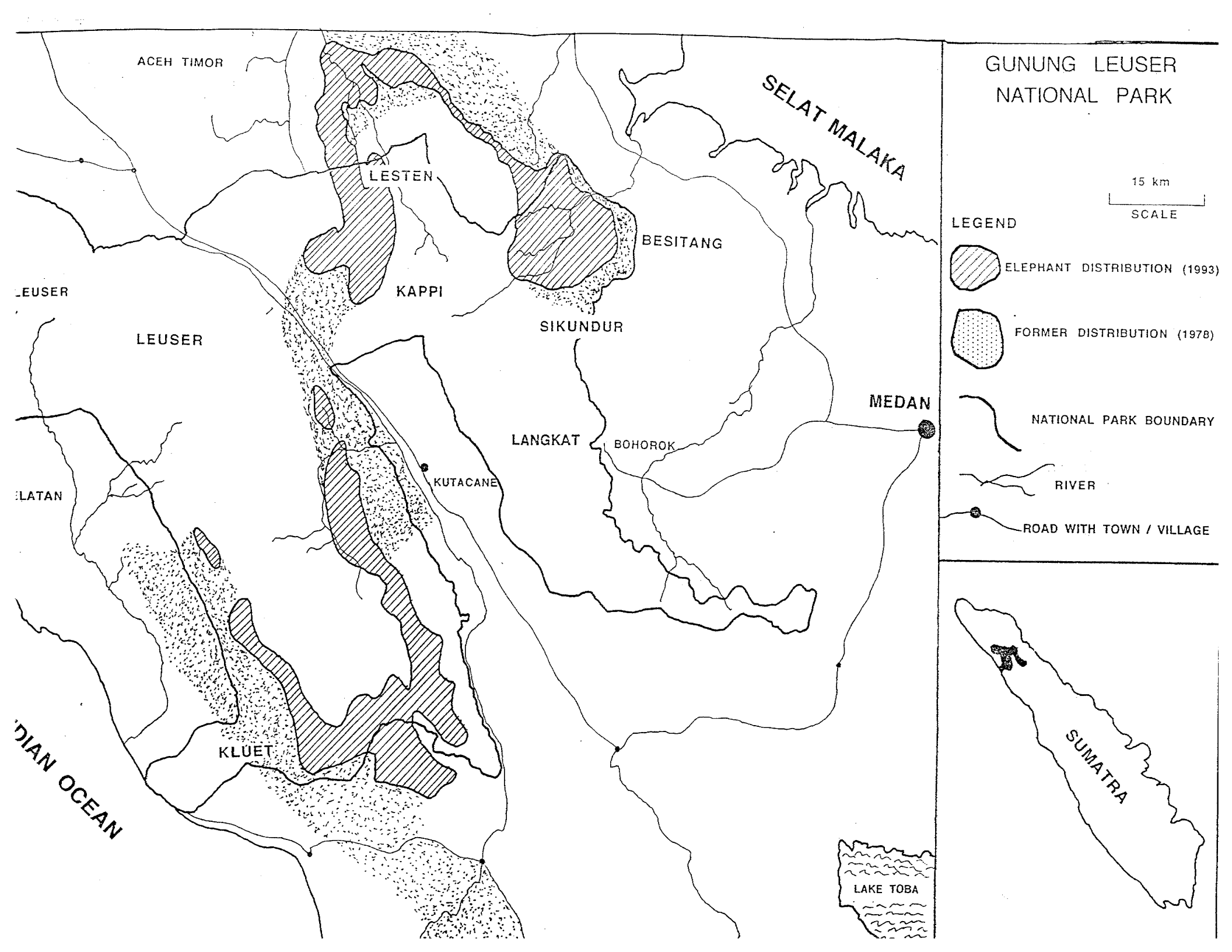
2. Ketentuan dari koridor ini harus dilakukan negosiasi dengan pemilik tanah, pemerintah setempat, Menteri kehutanan dan para penasihat konservasi.

3. Bagi populasi gajah di bagian timur laut Taman Nasional Gunung Leuser direkomendasikan bahwa mengelola tempat khusus gajah (tempat khusus bagi gajah Sikundur) ini didirikan agar dapat mengkordinir usaha-usaha untuk melindungi sub populasi penting secara kritis.

4. Diantara pengembangan-pengembangan projek diatas yang lain akan merupakan pembuatan sebuah pagar yang berhubungan listrik untuk menetapkan (koridor margasatwa Tamiang) dan mengurangi pertentangan antara gajah dan pemilik kebun. Sistem patroli yang efektif perbatasan ini juga akan menjadi prasyarat untuk menjamin keutuhan tempat gajah itu.

5. Lesten juga merupakan daerah penting bagi para gajah yang membentuk suatu batas antara gajah di dataran bagian timur dengan dataran tinggi Kappi. Ada beberapa rencana pengembangan yang dimaksud harus termasuk mengurangi tindakan untuk menjamin jalan lintas bebas gajah melalui daerah ini.

6. Penyelidikan harus secepatnya dimulai, menyusun cara-cara penggabungan kembali populasi di bagian timur laut dengan bagian barat daya taman. Ini merupakan tujuan penyelidikan utama yang lebih lanjut, sejak kegagalan utuk memperoleh hubungan ini akan mengakibatkan kematian gajah di bagian utara Sumatera dan kemungkinan akhirnya keseluruh pulau.


GUNUNG LEUSER
NATIONAL PARK
15 km
SCALE
LEGEND
ELEPHANT DISTRIBUTION (1993)
FORMER DISTRIBUTION (1978)
NATIONAL PARK BOUNDARY
RIVER
ROAD WITH TOWN / VILLAGE
ACEH TIMOR
LESTEN
SELAT MALAKA
BESITANG
KAPPI
SIKUNDUR
LEUSER
LEUSER
MEDAN
LANGKAT
BOHOROK
KUTACANE
KLUET
LAKE TOBA
SUMATRA