GAJAH

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Journal of the Asian Elephant Specialist Group

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Editorial Note

Gajah will be published as both a hard copy and an on-line version accessible from the AsESG web site (www.asesg.org/gajah.htm). If you would like to be informed when a new issue comes out, please provide your e-mail address. If you would like to have a hardcopy, please send a request with your name and postal address by e-mail to <romalijj@eureka.lk> or to:

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Cover: Elephants in Yala National Park, Sri Lanka
Photo by Prithiviraj Fernando

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Instructions for Contributors

Gajah welcomes articles related to Asian elephants, including their conservation, management, and research, and those of general interest such as cultural or religious associations. Manuscripts may present research findings, opinions, commentaries, anecdotal accounts, reviews etc. but should not be mainly promotional.

All articles will be reviewed by the editorial board of *Gajah* and may also be sent to outside reviewers. Word limits for submitted articles are for the entire article (title, authors, abstract, text, tables, figure legends, acknowledgements and references).

Correspondence: Readers are encouraged to submit comments, opinions and criticisms of articles published in *Gajah*. Such correspondence should be a maximum of 400 words, and will be edited and published at the discretion of the editorial board.

Short papers: Manuscripts on anecdotal accounts and commentaries on any aspect of Asian elephants, and workshop and symposium reports with a maximum of 1500 words are accepted for the "short paper" section.

Full papers: Manuscripts reporting original research with a maximum of 5000 words are accepted for the "full paper" section. They should also include a short (100 words max.) abstract.

Tables and figures should be kept to a minimum. Legends should be typed separately (not incorporated into the figure). Figures and tables should be numbered consecutively and referred to in the text as (Fig. 2) and (Table 4). Include tables and line drawings in the MS WORD document you submit. In addition, all figures must be provided as separate files in JPEG or TIFF format. Photograph and maps should have a minimum resolution of 1 MB. The lettering on figures must be large enough to be legible after reduction to final print size.

References should be indicated in the text by the surnames(s) of the author(s) with the year of publication as in this example: (Baskaran & Desai 1996; Rajapaksha *et al*. 2004)
If the name forms part of the text: Sukumar (1989) demonstrated that...
Avoid if possible, citing references which are hard to access (e.g. reports, unpublished theses). Format citations in the 'References' section as in the following examples, writing out journal titles in full.

Baskaran N & Desai AA (1996) Ranging behavior of the Asian elephant (*Elephas maximus*) in the Nilgiri biosphere reserve, South India. *Gajah* **15:** 41-57.

Olivier RCD (1978) *On the Ecology of the Asian Elephant*. Ph.D. thesis, University of Cambridge, Cambridge, UK.

Rajapaksha RC, Mendis GUSP & Wijesinghe CG (2004) Management of Pinnawela elephants in musth period. In: *Endangered Elephants, Past Present and Future*. Jayewardene J (ed) Biodiversity & Elephant Conservation Trust, Colombo, Sri Lanka. pp 182-183.

Sukumar R (1989) *The Asian Elephant: Ecology and Management*. Cambridge University Press, Cambridge, UK.

Manuscripts should be submitted by e-mail to the editor <romalijj@eureka.lk>. Submission of an article to *Gajah* is taken to indicate that ethical standards of scientific publication have been followed, including obtaining concurrence of all co-authors. Authors are encouraged to read an article such as: Benos *et al*. (2005) Ethics and scientific publication. *Advances in Physiology Education* **29:** 59-74.

Deadline for submission of manuscripts for the next issue of Gajah is 30. April 2012.

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Editorial

Dhriti Kanta Lahiri Choudhury

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My connection with the Asian Elephant Specialist Group of IUCN/SSC goes back to 1997. The Group was first formed earlier in that year. In one sense I may be called one of its founder members, though I was not a part of the Group initially formed, but was invited to join it a few months later. The same year I participated in the first meeting of the Group held in Colombo that year or thereabouts. Thus I take it I am in a position to chronicle the Group's progress during its initial years.

The first task before the Group was to determine the number and home range of elephants in Asia. Very little of this was known those days, except vague hearsay evidence. This was true even a decade after the formation of the Group. To illustrate the point, in a meeting of Life Scientists held in the lecture hall of the Indian Museum in Calcutta, someone from the audience asked Mr. J. C. Daniel of Bombay Natural History Society, then the Chairman of the Group how many elephants were there in North East India? He answered that a study funded by WWF (International) was going on and he would be in a position to answer only when the study was complete.

India for the purpose of the study had been divided into four regions: North, Central, South and North East India. It was a time when the racio-political turbulence in North East India was at its height. Even now the situation in the hilly region of North East India is rather vague. Only the other day I read in a newspaper that the birth rates of elephants could vary depending on the habitat, and the soil. Taking a flat rate for all the regions would be extremely unreliable.

There was some confusion in the earlier stages: the first was the labelling of elephants as an "indicator" species. The top position had already been taken over by the Tiger as the "climax" species. Now it appeared that the "indicator" species (of the health of the habitat) was the only suitable label left for the elephant to indicate its importance in the scheme of land biota.

While working with elephants it became clear to us that the problem with elephants is not unidimensional; but had many layers not the least of it was the problem of man-elephant conflict. It was soon clear that with the rise of human population the demand for arable land became imperative leading to an inexorable encroachment on elephant territory. Even now in India the much debated question of "corridors" remains legally undefined, though elephants moving from one part of the habitat to another is often at the heart of the problem. The "corridor" problem came to the fore during our study of the "conflict" problem in 1975 in North Bengal. Even now the distinction between "passage" and "corridor" is not always clear. A passage may be developed into a habitat but a "corridor" must not become a passage. It must not encourage elephants to linger. A "corridor" allows movement but does not encourage elephants to linger when moving from one habitat pocket to another. The "corridor" problem is clearly stated in Government of India publication, *Project Elephant*.

Thus the next stage of our enquiry led to the problem of man-elephant conflict. An editorial is not the proper place for footnotes (nevertheless, I refer here to *Gajah* 25, 2006) as a valuable resource book on the topic. I remember sometime ago an editorial appeared in *Gajah* outlining the history of man-elephant conflict, each species claiming its share of the available natural resources; hence the elephant as an iconic species for conservation still remains an important topic since it continues to have many lacunae.

Finally, it is necessary to mention, therefore, that "number" can be a problem here. The more elephants the merrier is no solution to the

problem, but "proper use", that re introduction of the system of keeping "UDR" (undetected removal) register for every elephant forest and replacing the current practice in India, for example, of using elephants for patrolling forests on Jeeps, in short, "using" elephants for "work" and not merely to increase gate-takings of zoos of affluent countries.

It may be necessary at the present stage of our enquiry to review the progress of the project of elephant conservation, some stages of which have been outlined above and to ask for the status of different levels of field work in different regions. They have to be put in a format to make necessary investigations, remembering that it is not the "holy cow", which is a different kind of conservation, however pious the intention may be. Let us therefore, forget for the time being the present Theodicy of Conservation efforts and keep our eyes riveted on the new Holy Book – The Red Data Book and always keep in mind that we are interested in the survival of the species, rather than in the number of the species.

Elephants at Kala Wewa (Sri Lanka) Photo by Jennifer Pastorini

Note from the Editor

Jayantha Jayewardene

This is the 25th anniversary issue of Gajah, the Journal of the Asian Elephant Specialist Group. From its beginnings as a Newsletter, *Gajah* has now developed into a fully fledged, internationally accepted journal. We have to thank the late Lyn de Alwis and Charles Santiapillai for initiating the Newsletter. Special thanks are due to Charles Santiapillai who was the editor for a long period and made the metamorphosis from a Newsletter to *Gajah* happen. He worked indefatigably to bring this about.

Since this is the 25th anniversary issue, the editorial board thought it would be appropriate to have papers on the current status of elephants in the range states. The collection of papers, presented in this issue, provides an overview of the status of Asian elephants in 12 of the 13 Asian elephant range states, with separate papers for Peninsular Malaysia and Borneo (Sabah and Kalimantan). Unfortunately, a report on the status of elephants in Thailand is missing due to the paper not being submitted on time.

The assessments made and opinions expressed in each paper are those of the authors based on their experience and knowledge. Readers are encouraged to comment on any major omissions or additions necessary. This can lead to a fruitful discussion and greater clarity of the status of elephants in each of the individual range states.

Although it was intended to publish the list of AsESG members, as has been done in the past, unfortunately the many requests to the co-chairs to provide the current list failed to produce a result.

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Gleanings from the Asian Elephant Specialist Group's Newsletter, Hasthi and Gajah

Jayantha Jayewardene (Editor)

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In May 1986 the Inaugural Newsletter was sent out to the Asian Elephant Specialist Group (AsESG) members. However, the second newsletter published in July 1987 was called Hasthi. The third, sent out in Spring 1989, was back again as the Newsletter. The Newsletter was sent out regularly till August 1992, when the 9th issue was called *Gajah*, which name has been retained to date.

Newsletter Number 1 - May 1986

Mr. Lyn de Alwis is the editor of the very first issue. The size of the Newsletter is A4. Mr. Lyn de Alwis, the Chairman of the AsESG, in his message in the inaugural Newsletter states: "At the meeting held at the Bandipur Tiger Reserve, Karnetaka, India from 5th - 9th November 1985, the members regretted the lack of communication, for there was so much more scientific material and technical know-how available since the Colombo and Jaldpara meetings, that could have been utilized in the implementation of other Action Plans. The members present were unanimous that the AESG should immediately commence publication of a Newsletter on a regular basis."

This Newsletter contains a note on the meeting held at Bandipur in November 1985. It also discusses, briefly, the proposal to hold the next meeting of the AsESG. A short note by Katherine Latinen gives details of captive elephant breeding activities of some North American Zoos. This Newsletter lists the name and address of 35 members, divided by country.

The Functions of the Group. Lyn de Alwis has listed out for the benefit of the new members, the following Terms of Reference of the AsESG:

- The distribution and numbers of all remaining Asian elephant populations should be known as accurately as possible.
- The pressures on all known populations should be assessed and monitored as far as possible by regard to the following indicators:
  - Sufficiency of natural habitat. Is there enough? If so, at what rate, and in what way is it being reduced? How secure is this for elephants? Is there, and of what type, man-induced competition for elephant-important resources?
  - Poaching for ivory. The existence and seriousness of this is to be investigated. Efforts should be made to acquire annual records for legal / illegal imports / exports / confiscations / sales of ivory from the government agencies concerned.
  - Deaths and captures. Records should be acquired of exact numbers known to have been removed from the wild population annually through human agency and the reason given. Diseases and epidemics should be recorded.
  - Crop damage. This should be monitored and localities noted and its annual cost and seriousness assessed. Any deterrent activities (or lack of) by public or authorities should be recorded so that the Group can advise accordingly.

Hasthi Number 2 - July 1987

The editor Lyn de Alwis in his message says that "members may observe that our Newsletter now has a new name. 'Hasthi' in many Asian tongues means 'Elephant' or 'Tusker' and I thought it an appropriate title. I hope you will agree".

Lyn de Alwis continues: There is an increasing concern for Asian elephants by governments, scientists and conservationists, some of whom have only recently come to realize that elephants

(or, for that matter, wildlife) occur outside Africa. News reaching us tells of active protective measures being taken by Governments of Vietnam, Laos and Kampuchea, which may result in the creation of a unique national park, the boundaries of which will cross national frontiers. This apparently is the only answer to saving the Indo-Chinese sub species of elephant, which migrate from country to country.

This issue also contains a comprehensive report by Peter Jackson on the AsESG meeting held at Bandipur. The chairmanship of the AsESG was transferred from Mr. J. C. Daniel to Mr. Lyn de Alwis. This report also contains summaries of reports for India, Burma, Indonesia, Malaysia, Sri Lanka and Thailand. At this meeting the AESG made 22 recommendations on a variety of elephant conservation activities including fragmentation of habitat, ecological and management studies, Action Plans, census techniques, capture and removal of juveniles from the jungles, elephant tranquilization, maintenance of elephant corridors, trade in ivory and ivory poaching, translocation of pocketed herds, national parks, commercial capture from the wild and buffer zones. The recommendations also include the collection of information on elephants, nominees to represent Bhutan, China, Kampuchea, Laos and Vietnam on the AsESG, a regular Newsletter and the setting up of a Task Force in the different states to monitor elephant conservation and the implementation of the recommendations.

This issue also features two papers, one on the '*Episiotomy, a new obstetrical approach in elephants (sic)*' by H. Merkt *et al*. and the other on '*Translocation of elephants in Lampung, Sumatra*' by Charles Santiapillai.

Newsletter Number 3 - Spring 1989

The name has gone back to Newsletter. The two editors, Lyn de Alwis and Charles Santiapillai state: "This issue of the Asian Elephant Specialist Group Newsletter differs from earlier issues in format, style and content. It is intended to provide a forum to discuss the group's activities, facilitate the exchange of information among the members and publish news and articles concerning the Asian elephant and its habitat. The underlying theme of this newsletter is forest destruction and its consequences."

The AsESG held its third meeting in Chiang Mai, Thailand on 19-21 January 1988. The draft Action Plan for Elephant Conservation was reviewed. The current status of the elephant throughout its range in Asia was also assessed. It was agreed by those present that the main threat to the elephant in Asia is the rapid conversion of its habitat to other uses by man and called for more discretionary policies to replace the current indiscriminate exploitation of forests. The survival of the elephant in Asia would depend not only on the availability of viable reserves but also on how scientifically these reserves and their elephant populations are managed in order to ensure their long term survival and to minimize conflicts with human interests.

Workshops on the following themes were held at the Chiang Mai meeting: 1. Management of domestic and captive Asian elephants. Chairman: Dr. Mike Schmidt, 2. Human-elephant conflict policies for their resolution. Chairman: Dr. R. Sukumar, 3. Conservation and development: a new approach to habitat conservation. Chairman: Prof. D.K. Lahiri-Choudhury, 4. Appropriate conservation policies for Asian elephant populations. Chairman: Mr. J.C. Daniel, 5. Regulating the trade and use of ivory. Chairman: Mr. Peter F. Jackson.

The feature of this issue are the excerpts of a paper by D.K. Lahiri-Choudhury titled '*The Indian elephant in a changing world*'.

The regional news section contains news from Indonesia: '*Plan to kill rampaging elephants criticised*', '*Lampung Forests face extensive destruction*' and '*Nation warned of damage of forest destruction*'. The news from Thailand is on '*Elephants benefit from the governments ban on logging*'.

The research news section contains notes on, *'Male-female differences in foraging on crops by Asian elephants*' based on research carried out by Dr. R. Sukumar and published in Animal

Behaviour. It also has a note on '*Talking elephants*' based on the discovery by Katherine Payne on the means of elephant communicating.

This issue lists 37 AsESG members.

Newsletter Number 4 - Summer 1989

In the '*Editorial comment*' in this issue the two editors, Lyn de Alwis and Charles Santiapillai, discuss the recent total ban on logging in Thailand. This decision was taken by the Thai government in the light of the severe floods and landslides that took many lives and destroyed property. Though this ban was hailed at the initial stages, it now seems to have created different problems. There are demands by Thai entrepreneurs to be allowed to go to Burma and Laos and log the vast extents of forests there.

The principal activity of the AsESG has been to set up an Asian Elephant Conservation Centre in Bangalore, India. The first Asian Elephant Secretariat was established in Sri Lanka in the late 1970s under then Co-Chairman Dr. R.C.D. Olivier. Over time this secretariat fell in to abeyance. However now given the substantial research carried out in Sri Lanka, India, Malaysia and Indonesia much reliable data has been collected on elephant distribution and numbers. Furthermore, given the human population growth and the development programmes in many of the Asian countries where the elephant occurs, the conversion of forests to agricultural holdings and human settlements has led to a substantial escalation in human-elephant conflicts that need resolving. Hence it was felt that the Asian Elephant Secretariat should be revived.

The members expected the secretariat to focus on (1) the preparation of a brochure on the aims of the secretariat and basic information to be sent to all Director-Generals, Park Superintendents, Rangers etc who manage or work in parks that have elephants, (2) maintenance of a centralized data base on elephant distribution, abundance and conservation needs and the provision of up to date information, (3) encourage governments to census their elephant populations on a regular basis in order to draw up appropriate management policies, and (4) advising governments and conservation organisations of the conservation priorities of the Asian Elephant Action Plan.

The feature articles are '*Conservation of Asian elephants in Thailand*' by Choompol Ngampongsai and a very comprehensive paper on '*Management of elephants in camps*' by Dr. V. Krishnamurti.

The research section contains notes on (1) *'Growth in Asian elephants'* by R. Sukumar, (2) *'Sounds of silence revealed*' by Ian Redmond, (3) *'Characteristics of three populations of elephants of the Western Ghats*' by A. Vijayakumaran and (4) *'Protected areas and elephant conservation in India*' by A.J.T. Johnsingh.

This issue lists 43 AsESG members.

Newsletter Number 5 - 1990 (Special Issue)

The whole of this 'Special Issue' Newsletter is devoted to a paper on '*Sumatran elephant database*' by Charles Santiapillai of WWF and Widodo Sukohadi Ramono of the Directorate of Forest Protection and Nature Conservation in Indonesia. The paper is an attempt to establish a Sumatran elephant database. The editorial states that "It is hoped that this initial attempt to establish a database would provide the necessary stimulus to other elephant specialists in Asia to start compiling information that would ultimately result in the preparation of a Global Resource Information Database (GRID) for the Asian elephant."

The paper contains different sections on: an overview of Sumatra, climate and rainfall, elephant distribution, elephant density, protected areas, human population, transmigration, summary of the status of elephants in each province, and current elephant-human conflicts. Each of these sections has a map of Sumatra with the relevant details.

Interestingly the last paragraph of the *'Editorial comment*' states "The opinions expressed in this Newsletter do not necessarily reflect those of the Species Survival Commission (SSC) of

the International Union for the Conservation of Nature and Natural Resources (IUCN) or the World Wide Fund for Nature (WWF)."

This issue lists 42 AsESG members.

Newsletter Number 6 - Spring 1991

Mr. Lyn de Alwis and Dr. Charles Santiapillai are the editors. The '*Editorial*' by Lyn de Alwis is '*A plea to help save the Asian elephant*'. Mr. de Alwis traces the background to elephant conservation in Asia and Africa. He mentions that the push for the conservation of the African elephant by conservationists has been so successful that it has almost forgotten the Asian species. He says that "it is doubtful if, the wild population in all thirteen countries of the species range would add upto 50,000 animals". Though there seems to be a vast range for wild elephants in the ranges 'in actual fact there are only some 500,000 km^2 of wild habitat left and this is declining at an average rate of 4000 km^2 per annum'. 'In comparison, Africa still has 7,000,000 km^2 of forest for its estimated 600,000 elephants. In 1978 the Species Survival Commission (SSC) of IUCN responded to the repeated calls for a long-term plan to save the Asian elephant. It formed the Asian Elephant Specialist Group (AESG) to pool expert knowledge and experience available in the region and elsewhere to formulate and implement such a plan'. Mr. J.C. Daniel was the first Chairman of the AESG, which has grown into a strong hardworking body of 46 members.

Mr. de Alwis says that he feels that the setting up the AsESG Secretariat, governed by a steering committee, is a logical step in the progress of the AsESG. The Secretariat has the following aims and objectives:

- Identify the target elephant populations in Asia, which offer the best hopes for long-term survival and concentrate on safe-guarding these key populations through government and field actions.
- Carry out in-depth ecological studies in these selected populations and their habitats in order to obtain the best, most reliable and quantifiable data as a basis for sound management of elephant populations and their habitats.
- Design a mechanism for sharing practical knowledge especially in solving problems concerning herds migrating within or across national borders. This will also involve strengthening capabilities of staff through training programmes, workshops etc.
- Compilation of records of all the publications to date on the elephant and its habitat. This is particularly relevant today when research on elephants has become widespread and the publication of books has gathered momentum.

There is a report titled '*Singapore's brush with wild elephants*' based on the three young tuskers that swam across the sea from Malaysia to an island off Singapore. The report describes the efforts that were made to get these three back to mainland Malaysia. A special team from Malaysia, headed by expert Mohomed Shariff Daim came with two tame koonkie elephants and two large elephant transport trucks. The whole lot was transported to the island in the sea by the Singapore Army. The elephants were then tranquilized, captured and taken back to mainland Malaysia.

This issue contains a note on the progress of the Asian Elephant Conservation Centre (AESG Secretariat). Charles Santiapillai reports on a *'Preliminary workshop on censusing elephants in forests*'.

The regional section contains reports on: *'Elephants slaughtered in civil war (Sri Lanka)*', *'Saving elephants for posterity (India)*', *'India plans rescue of elephants*', *'Counterfeit ivory being sold as the real thing in Lampung Province (Indonesia)*', *'Illegal trade threat to timber-camp elephants (Burma)*', *'Resolving elephant-human conflicts in Xishuangbanna Nature Reserve (China)*' and *'Enhancing the survival of elephants (Sri Lanka)*'.

The book 'The Asian Elephant' written by R. Sukumar is reviewed separately by N. Leader Williams and Charles Santiapillai. This issue contains the revised list of the names and countries of 46 members.

Newsletter Number 7 - Autumn 1991

With 48 pages this is the largest issue of the Newsletter so far. The *'Comment'* by the two editors Mr. Lyn de Alwis and Dr. Charles Santiapillai states: "The lesson from these arguments is that wildlife conservation must be integrated in such a way as to confer direct benefit to the surrounding communities. Elephant conservation is no exception. In the final analysis, both economic and ecological considerations will determine the survival of much of the wildlife including the elephant. Although in theory, large conservation areas are better than smaller areas to enhance the long term survival of elephants and thus reduce the risks of early or untimely local extinctions, yet in practice, most countries in the world where elephants occur have neither the money nor the trained manpower needed to adequately protect such areas. If elephant conservation is to succeed in the coming decades, then the ball is in the international conservation organization's court. They have to adopt a long-term perspective and assist the Government organizations in the economically poor developing countries in Asia in tackling such broader issues as land-use planning and the reduction in human population growth rate. The factors adverse to elephant survival stem not only from the aspirations of a burgeoning human population in Asia but also from more demand by the industrialized countries in the west for goods of the kinds which lead to pressures on the elephants' life-support system.

An article titled '*The status of elephants in Vietnam'* by Do Tuoc and Charles Santiapillai gives details of the forest cover, protected areas, status of elephants, habitat utilization and conservation in that country. A map with the distribution of elephants in Vietnam is included.

Another interesting and detailed paper is titled '*An indirect method for counting Asian elephants in forests*' by A.J. Dekker, Shanthini Dawson and Ajay Desai. This is a synopsis of lectures and field exercises given at the Workshop on Censusing Elephants in Forests. The methodology is detailed in this paper. Another lengthy paper is by Jay Haight on the '*Captive management of breeding Asian elephants'*. This paper details the work done at the Washington Park Zoo. There is a fairly long and interesting paper titled '*Elephant catching*' by D.H. Wise, which recalls vividly elephant capture in the past. '*Immobilization of free ranging Asian elephant in Sri Lanka using etorphine hydrochloride and acepromazine maleate'* by leading Asian elephant capture specialist Mohomed Sharif-Daim, is another useful paper. The '*Importance of sex-ratio and age structure in the management of elephant populations*' by Widodo Ramono, is another paper. This issue contains the names and addresses of 43 members.

Newsletter Number 8 - Spring 1992

With this issue a contents page has been included. The '*Comment*' by the editors Mr. Lyn de Alwis and Dr. Charles Santiapillai states: "Many Asian countries with elephant populations face a dilemma: on the one hand, as custodians of biodiversity and charismatic mega fauna 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 debt are in desperate need of new resources to bolster their ailing economies and thereby keep the body and soul of their human population in communication. Therefore conservation of elephants per-se may rank rather low in their scheme of things. 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 its ecosystem. Conservation of elephants and their habitat, perceived by the local populace to be of direct economic importance, its far more likely to be successful in the long term than by conservation for its own sake."

One of the feature articles is '*Population structure, activity and density of elephants in the Ruhuna National Park, Sri Lanka'* by Sarath Dissanayake *et al*.. This study was carried out

from 1987-1989. A follow up survey was carried out in 1991. Three maps showing the distribution of elephants in the park, the park itself and the vegetation of the study area, are provided.

Another feature article is '*Managing elephant depredation in plantations in Sabah*' by Mahedi Andau and Junaid Payne. This paper, presented at the 9th Malaysian Forestry Conference in Sarawak in 1986, mostly discusses electric fencing as a means of elephant control. It concludes that 'In most situations, the cost on installation and maintenance of electrified fencing will be less than the cost incurred by elephant damage, if total costs are averaged over several years'.

The third major feature article is '*Conservation of elephants in Laos*' by Bouaphanh Phanthavong and Charles Santiapillai. This is a detailed paper that looks at Laos' forest cover, its protected areas, the status of elephants in that country and their numbers in the wild. The authors also discuss the conservation problems faced and make recommendations for future action.

'*Elephant Catching in Assam*' by A.J.W. Milroy, the author of the book 'Management of Elephants in Captivity', published in 1927, is a long article under the 'From the Archives' section. This paper deals comprehensively with the capture of wild elephants by the *Keddah* or *Kraal* method.

Seventeen abstracts of papers on the Asian elephant, taken from various journals, are published in this issue. This issue contains the name and addresses of 43 members.

Newsletter Number 9 - Autumn 1992

Quoted from the two editors Mr. Lyn de Alwis and Dr. Charles Santiapillai: "However, protection and maintenance of such crucial elephant habitats will need much more than a prayer and a proposal. What is needed is not only the political will and courage to set aside such areas for elephant conservation but also the necessary financial and trained manpower resources to implement sensible, viable and long-lasting conservation programmes. Already many poor countries are spending substantial sums of money on nature conservation in Asia. The proportion of government spending and national wealth devoted to conservation is indeed surprisingly high in some poorer countries like Sri Lanka. It is time therefore that the AsESG launches a massive global campaign to raise not only funds but more importantly the awareness of the ordinary man on the street to the plight of the elephants in Asia. Such a campaign needs the support of the international media such as the press, radio and TV to spread the message across the world. Here both the message and the media are important The AsESG Newsletter alone cannot do the job on a scale that would really make the world take notice of the serious situation of the Asian elephant. We need the Advertising Giants and the power of the press to highlight the plight of the elephant."

One of the feature articles is '*Recommendations for improving the management of captive elephants in Way Kambas National Park, Lampung, Sumatra, Indonesia*' by expert veterinarian Dr. V. Krishnamurty. This issue contains the name and addresses of 52 members.

Gajah Number 10 - Spring 1993

With this issue the name of the publication has been changed to Gajah. This issue is also in the A4 format.

Gajah Number 11 - 1993

The format of Gajah Number 11 has now been changed to an A5 format. The contents page, which in previous Gajahs was at the front, has been moved to the back cover. Interestingly there is a contents page at the front as well. Editorials have ceased from Number 11 onwards. A colour photograph is published on the front cover for the first time. The two editors remain Mr. Lyn de Alwis and Dr. Charles Santiapillai.

Gajah Numbers 12 - 34

Issue Numbers 18, 19, 20 and 21 are in a format slightly different to the A4 format. The format of Gajah returned to the A4 format with issue Number 22.

In issues Gajah Numbers 12, 13 and 14, Shantha Saravanamuttu and Charles Santiapillai have published '*A bibliography on elephants*'. This is in three Parts.

All the authors of Gajah Number 13 are Sri Lankan.

In Gajah Number 15 Lyn de Alwis, who hitherto was co-editor is now listed as Associate Editor. Dr. Charles Santiapillai remains editor.

Gajah Number 22 contains a '*Guest editorial*' by Chairman AsESG Raman Sukumar. For the first time '*Instructions to contributors*' is published in this issue. The names and addresses of the 70 members (2001-2003), listed by country, are published in this issue. This is the first time the list was published after the 10th issue (1993) and it was also the last time.

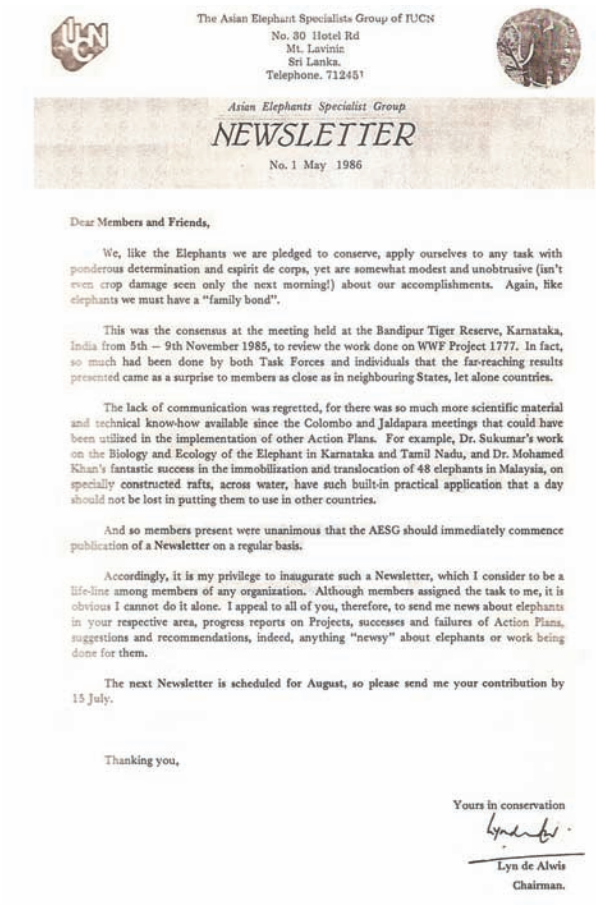
Gajah Number 23 is a Special Issue in which the only article is '*A glossary of elephant terms'* by Phillip Kahl and Charles Santiapillai.

In 2007 Jayantha Jayewardene took over as editor from Charles Santiapillai. The first Gajah with Jayantha Jayewardene as editor was Number 26. That issue includes, for the first time, colour pictures on the inside pages with the text.

Gajah on the Internet

In early 2008 Hank Hammat uploaded all issues of Gajah including the original issue and all Newsletters, and the lone issue of 'Hasthi' onto the Asian Elephant Specialist Group's website <http://www.asesg.org/gajah.htm>. Scanned copies of the past issues were given to him by Christy Williams and Jayantha Jayewardene. Technical assistance was given to Hank by Dr. Jennifer Pastorini and Mike Cordingley.

In November 2011, thanks to these efforts, Google Scholar for the first time also picked up papers listed in Gajah. Google Scholar is commonly used by scientists for literature searches and also sends out messages to its subscribers, when new papers are published.



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Asian Elephants Specialist Group

NEWSLETTER

No. 1 May 1986

Dear Members and Friends,

We, like the Elephants we are pledged to conserve, apply ourselves to any task with ponderous determination and espirit de corps, yet are somewhat modest and unobtrusive (isn't even crop damage seen only the next morning!) about our accomplishments. Again, like elephants we must have a "family bond".

This was the consensus at the meeting held at the Bandipur Tiger Reserve, Karnataka, India from 5th – 9th November 1985, to review the work done on WWF Project 1777. In fact, so much had been done by both Task Forces and individuals that the far-reaching results presented came as a surprise to members as close as in neighbouring States, let alone countries.

The lack of communication was regretted, for there was so much more scientific material and technical know-how available since the Colombo and Jaldapara meetings that could have been utilized in the implementation of other Action Plans. For example, Dr. Sukumar's work on the Biology and Ecology of the Elephant in Karnataka and Tamil Nadu, and Dr. Mohamed Khan's fantastic success in the immobilization and translocation of 48 elephants in Malaysia, on specially constructed rafts, across water, have such built-in practical application that a day should not be lost in putting them to use in other countries.

And so members present were unanimous that the AESG should immediately commence publication of a Newsletter on a regular basis.

Accordingly, it is my privilege to inaugurate such a Newsletter, which I consider to be a life-line among members of any organization. Although members assigned the task to me, it is obvious I cannot do it alone. I appeal to all of you, therefore, to send me news about elephants in your respective area, progress reports on Projects, successes and failures of Action Plans, suggestions and recommendations, indeed, anything "newsy" about elephants or work being done for them.

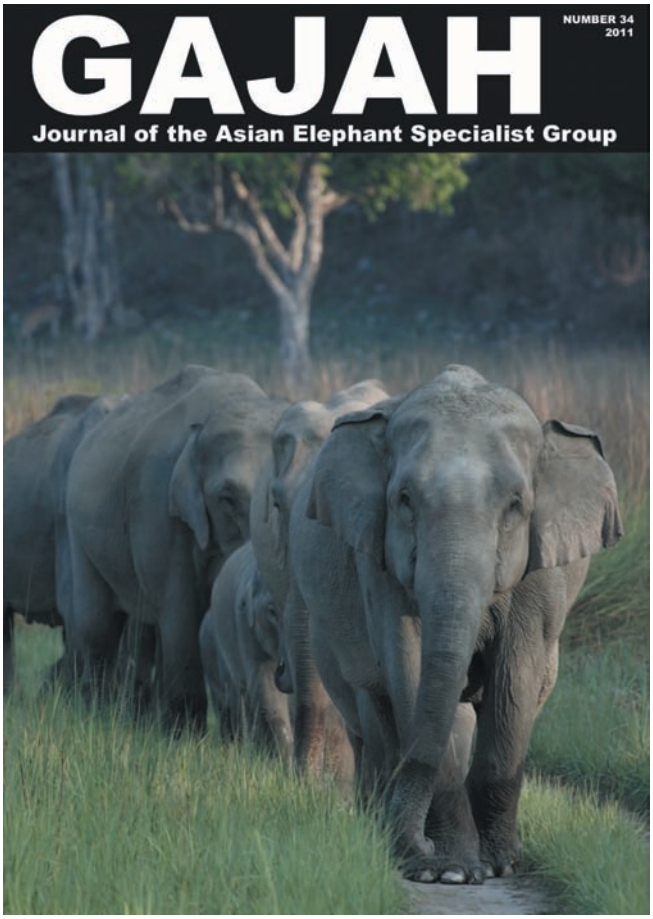
The next Newsletter is scheduled for August, so please send me your contribution by 15 July.

Thanking you,

Yours in conservation

Lyn de Alwis
Chairman.

Gajah has come a long way from this...



... to this .

Gajah 35 (2011) 10-14

Publications on Asian Elephants in 'Gajah' and Other Scientific Journals

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Introduction

The 'silver jubilee' of a journal based on a single species is a laudable and rare achievement. 'Gajah' began life as the 'Asian Elephant Specialist Group Newsletter' in 1986, became 'Gajah - Newsletter of the Asian Elephant Specialist Group' in 1992 and in 1993 morphed into 'Gajah - Journal of the Asian Elephant Specialist Group'. Since 1986 a total of 34 issues of *Gajah* have been published. In the 25 years since its first publication, there were 10 years with one issue and 10 years with 2 issues of *Gajah* being published. In 1994 three issues were published. *Gajah* was not published in the years 1988, 1999, 2000 and 2005.

Here we assess the evolution of *Gajah* as a medium for publication of matters pertaining to Asian elephants (*Elephas maximus*), and examine it in the context of wider scientific publications on Asian elephants.

Methods

The past 34 issues of *Gajah* were analyzed with regard to content, authors and the geographic origin of articles. To gain an overview of the types of publications in *Gajah* we divided them into two categories: 'papers' and 'other articles'. 'Papers' were defined as original publications addressing some aspect of Asian elephants and 'other articles' as those that were of a more informative nature. Both 'papers' and 'other articles' were subdivided into 9 sub-categories based on the subject addressed (Table 1), and we assigned each published article to one of them.

Based on the text we identified whether a given paper was on wild or captive elephants, and the country of the subject elephants.

To assess the origin of contributing authors, we screened the addresses of all authors and divided them into 'range country authors' and 'outside range country authors'. Where multiple addresses were given for a single author we used the first address provided. If a paper had several authors, authorship was apportioned proportionately (e.g. 4 authors: 3 from a range country = 0.75 and 1 from a non-range country = 0.25).

To compare the papers published in *Gajah* with those published in other journals, we analyzed 193 papers on Asian elephants published from 2008 to 2011. Several search engines on the internet were used to find every possible publication from January 2008 to July 2011. Only journal articles were included.

We applied the same criteria used for the *Gajah* papers to assign other journal papers to captive or wild, define the origin of authors and determine the subject addressed. An additional sub-category 'morphology' was added for the non-*Gajah* papers.

For the purpose of this analysis, we considered Borneo as a separate unit from Peninsular Malaysia and Indonesia although administratively

Table 1. Sub-categories of articles.

Papers	Other Articles
Conservation	News
Management	Meetings/Workshops
Veterinary	Appreciations
Methods	Literature (abstracts, references)
Behaviour	Book reviews
Demography	Correspondence
Ecology	Editorials
Genetics	Notes from co-chairs
History	AsESG member lists

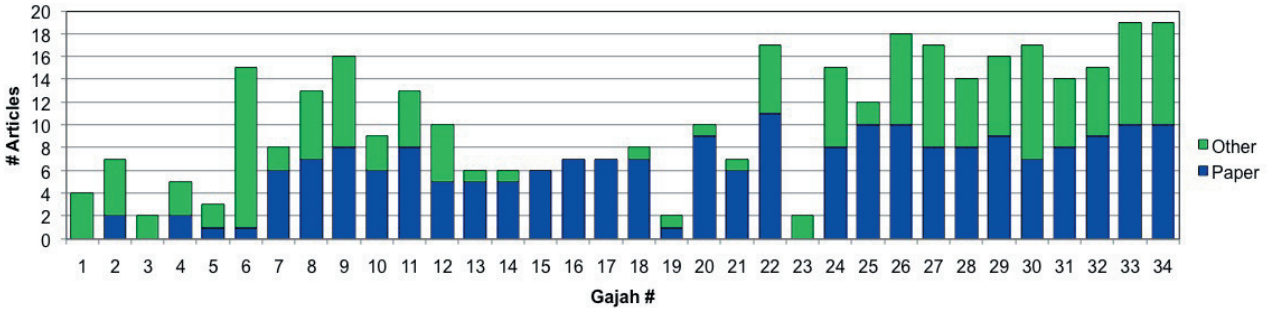

Figure 1. Number of papers and other articles published in *Gajah*.

elephant habitat in Borneo falls mostly under the Malaysian state of Sabah and a small segment lies in the Indonesian state of Kalimantan. Consequently there were 14 'range states'.

Results

A total of 359 articles were published in the first 34 issues of *Gajah*. Articles per issue ranged from 2 to 19 with an average of 10.6 articles per issue.

In the last 34 issues, 207 'papers' and 152 'other articles' were published (Fig. 1).

Other articles

In the last 25 years *Gajah* carried 50 news items, 23 editorials, 10 comments from co-chairs, 12 items of correspondence and 6 appreciations. The list of current members of the AsESG was published 6 times. *Gajah* also carried 21 reports on meetings and workshops. New publications were announced in 14 articles and 10 book reviews were published (Fig. 2).

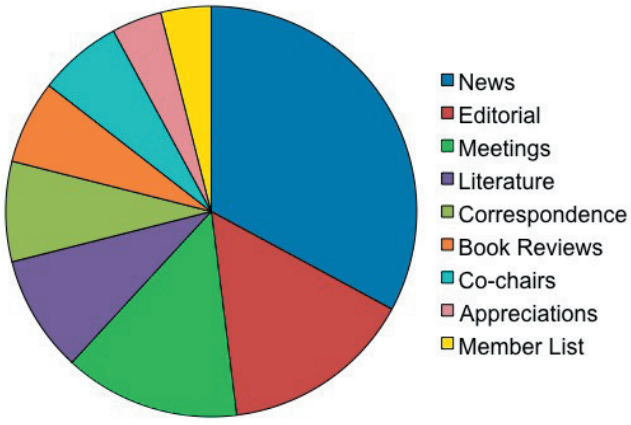

Figure 2. Proportion of types of 'other articles' published in *Gajah*.

Paper subjects

Of the 207 'papers' in *Gajah*, 29.0% were in the sub-category conservation and 27.1% in management. Veterinary aspects of Asian elephants were discussed by 11.1% of publications. There were also papers describing new methods (9.2%), on elephant behaviour (8.2%), and demography (7.7%). There were 8 (3.9%) papers on history, 6 on ecology and 2 on genetics (Fig. 3).

In 'other journals' 29.5% of the 193 papers were on veterinary aspects and 17.6% on management issues. The remaining 52.8% papers were on the other 8 subjects (Fig. 3).

Wild vs captive elephants

In *Gajah* 68.6% of the 207 papers were based on wild and 26.1% on captive elephants. Eleven papers (5.3%) included both wild and captive elephants. In 'other journals', 32.1% of the 193 publications were on wild and 66.3% on captive elephants, with 1.6% on both (Fig. 4).

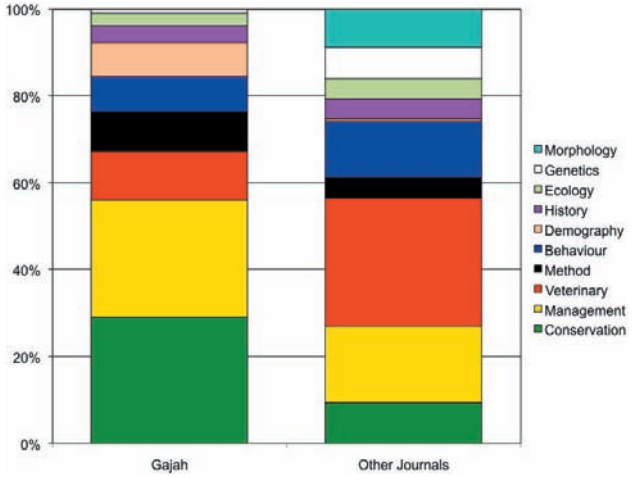

Figure 3. Proportion of papers published by subject in *Gajah* and other journals.

Geographic location of subject elephants

In respect of the geographic origin of the elephants, which were the subject of papers, in *Gajah*, 29.0% of papers were based on Indian elephants and 26.6% on Sri Lankan elephants. Sumatran elephants were the basis of 16 papers (7.7%). The number of papers published on other range country elephants was: Myanmar 8, Laos 5, Malaysia 5, Borneo 4, Nepal 4, Thailand 4, China 3, Cambodia 2, Vietnam 2, Bangladesh 1, and Bhutan none, which together comprised 18.4% (Fig. 5). Seven papers (3.4%) in *Gajah* were based on captive elephants kept in non-range countries.

In 'other journals', papers based on captive elephants held outside the range countries consisted 48.2% of publications. Indian and Thai elephants comprising of 17.6% and 11.9% respectively were the most common basis for papers on range country elephants. Publications on elephants from the other range countries totalled 16.6%, with 4 range countries (Borneo, Malaysia, Sumatra, Vietnam) having only one paper each (Fig. 5). There were no publications on elephants from Bhutan, Cambodia and Laos.

A total of 31 (15.0%) and 11 (5.7%) papers on elephants in *Gajah* and 'other journals respectively, were on Asian elephants in general, not pertaining to any geographic location.

Wild and captive elephant locations

Of 153 papers published in *Gajah* on wild

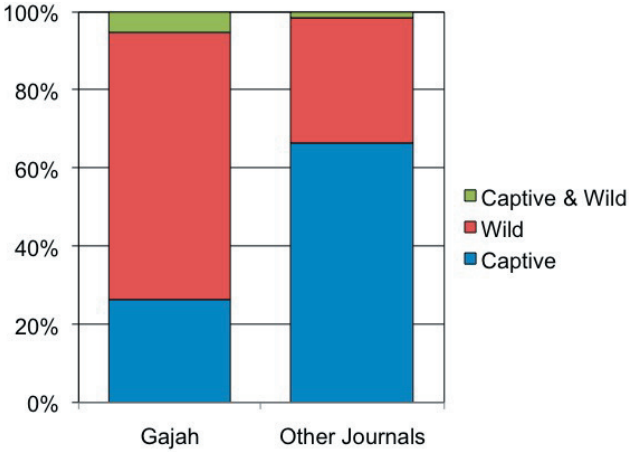

Figure 4. Proportion of papers published on wild and/or captive elephants.

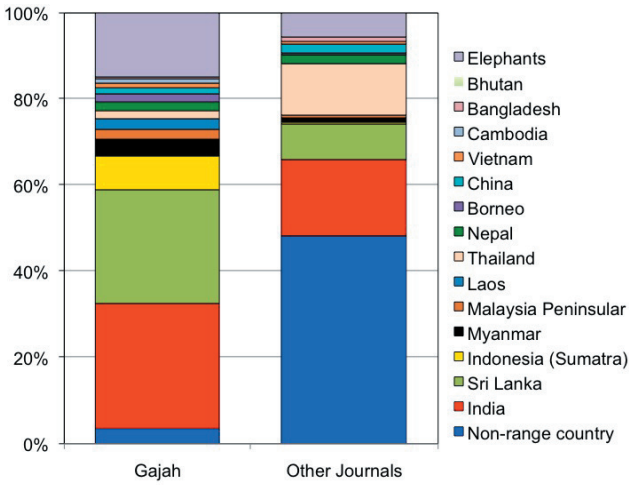

Figure 5. Geographic locations of elephants, papers were based on. 'Elephants' are papers discussing elephants in general, not from any particular location.

elephants, 31.4% were on Indian, 26.1% on Sri Lankan, and 26.8% on elephants from other range countries. Another 15.7% were on wild elephants in general. In 'other journals' 40.0% of 65 papers were on Indian, 21.5% on Sri Lankan and 21.5% on wild elephants from the other range countries, with 15.4% of papers written on wild elephants in general.

Of 65 papers on captive elephants published in *Gajah* 73.8% and 10.8% were based on elephants in range countries and outside range countries respectively. In 'other journals' 26.7% of the papers were based on elephants held in range countries and 71.0% outside range countries (Fig. 6). In *Gajah* 15.4% and in 'other journals' 2.3% of the papers were written on captive elephants in general.

Author origins

Of the papers in *Gajah* 84.0% were from range country authors and 16.0% from non-range country authors while in 'other journals' 31.1% of the authors were from range and 68.9% from non-range countries (Fig. 7). When looking at first authors only, the results were nearly the same (*Gajah*: 84.1% range-country and 15.9% outside; 'other journals': 31.1% range country and 68.9%). In *Gajah* 7.7% of papers had authors from both range and non-range countries. In 'other journals' 22.3% of papers had mixed authorship.

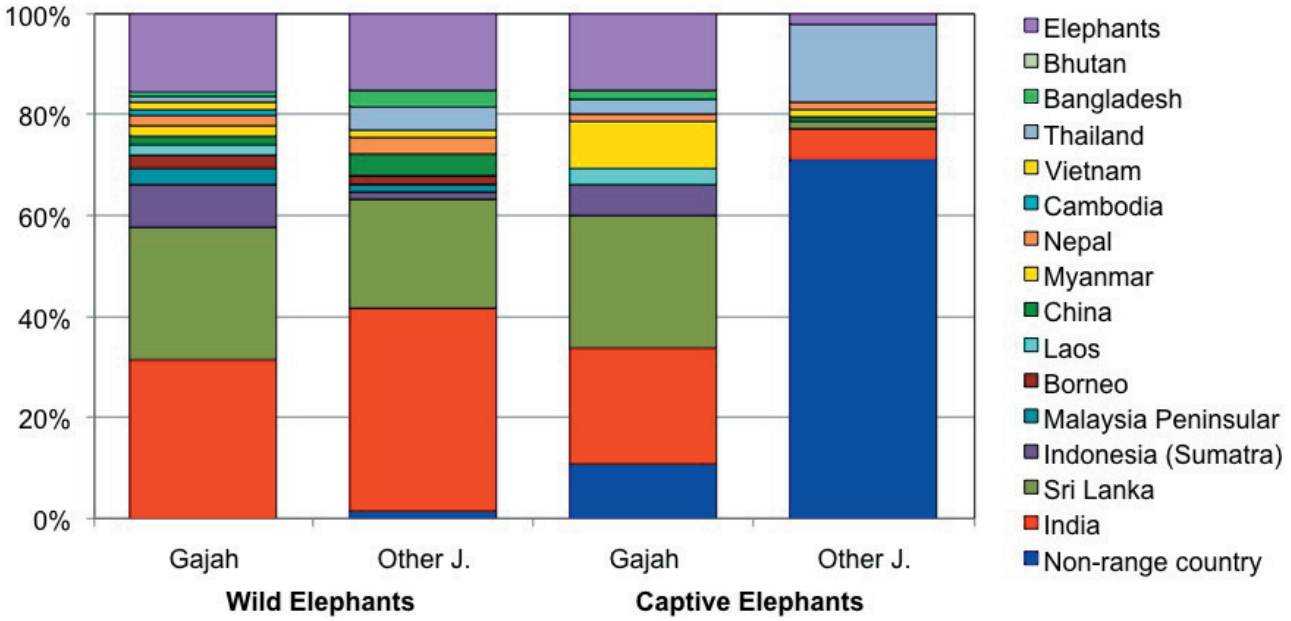

Figure 6. Locations of wild and captive study elephants used in *Gajah* and other journals.

Discussion

Gajah is intended to reach a readership united by their interest in Asian elephants. The readers are anticipated to have a broad range of backgrounds - scientific and non-scientific, and a wide spectrum of interests from the conservation, management and study of Asian elephants to those who only view elephants as 'interesting' or 'lovable' animals. In the early life of *Gajah* issues tended to oscillate between having largely 'papers' or 'other articles'. More recently a stable ratio between 'papers' and 'other articles' has been achieved (Fig. 1). Similarly the number of articles per issue tended to vary widely in *Gajah*'s early life but have gained more stability with maturity. The current balance between papers and articles in *Gajah* could be considered fitting, in view of the target readership.

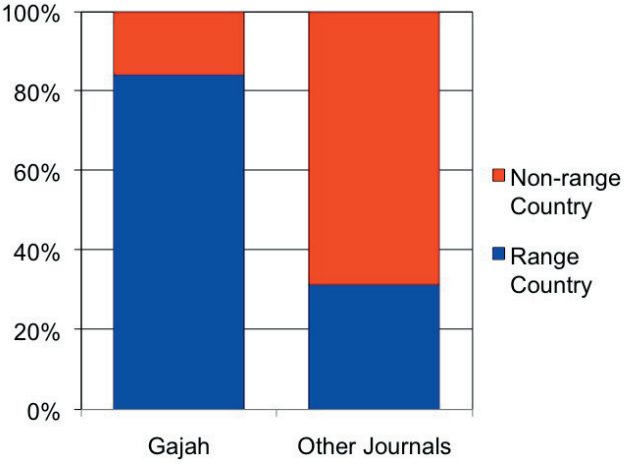

Figure 7. Proportion of authors from range and non-range countries in *Gajah* and other journals.

Gajah publications reflected a wide spectrum of subjects within both 'papers' and 'other articles'. The range of subjects covered in *Gajah* 'papers' was comparable to that published in other scientific literature. The only sub-category that was missing in *Gajah* was morphology, which comprised a small percentage of publications in 'other journals'. The relative proportions of subjects covered in *Gajah* and 'other journals' differed considerably with *Gajah* publications being dominated by conservation and management which together comprised over half of the papers, compared to 'other journals' where the largest representation (30%) was on 'veterinary aspects'. The difference between *Gajah* and 'other journals' likely reflects differences in interests and work conducted, in relation to different sub-categories between range countries and non-range countries, with *Gajah* more representative of the range country context.

Elephant origins

Gajah papers were heavily biased towards wild elephants with around two thirds of papers. In contrast, 'other journal' papers were equally biased towards captive elephants (Fig. 4). The difference again is likely to be explained by the greater range country affiliation of *Gajah*.

The focus of *Gajah* on wild Asian elephant conservation and management is a welcome finding, given the primary importance of conserving the Asian elephant *in-situ* within its range, which is the most desirable and important for the species' conservation. Conserving Asian elephants within the native range in the wild state also greatly benefits wider conservation, given the Asian elephant's role as a flagship species and an umbrella species.

In respect of the geographic origin of elephants, which provided the subject, *Gajah* papers were dominated by studies on Indian and Sri Lankan elephants which together represented more than half the publications. 'Other journal' publications were dominated by papers on (captive) elephants in non-range states. While few in number, *Gajah* publications had a wider representation of range states than 'other journals' (Fig. 5). Notably, publications of studies on Thai elephants were comparatively less in *Gajah* and publications on Bhutan elephants were absent in both.

When only wild elephant studies were considered more than half of the papers in *Gajah* as well as in the 'other journals' were on Indian and Sri Lankan elephants. All other range country studies together comprised one fourth of studies on wild elephants (Fig. 6). Both *Gajah* and 'other journals' reveal a paucity of studies in range countries other than India and Sri Lanka, which points to the need for greater efforts at encouraging and developing scientific research in most range countries.

In consideration of studies of captive elephants, almost three fourths of studies in *Gajah* were on elephants in range countries while a similar proportion of studies in 'other journals' was on elephants in non-range countries (Fig. 6). Again this dichotomy is likely due to the respective affiliations of those who publish in *Gajah* and 'other journals'.

Author origins

When considering the geographic origin of authors, the far greater majority of those who published in *Gajah* were from range countries while the majority publishing in 'other journals' were from non-range states (Fig. 7). As one of the most important purposes of *Gajah* is to promote and advance scientific study, publication and knowledge of Asian elephants, in range countries, this is a welcome finding. Considerable representation of range country authors amounting to one third was also observed in the 'other journals'. Surprisingly, the proportion of first authors from the categories range and non-range, was numerically the same as when considering all authors in both *Gajah* and 'other journal' publications. This suggests that there was no great bias towards either category in first authorship. The number of papers with mixed authorship was greater in 'other journals', perhaps indicating a greater propensity for collaborative work between range country and non-range country scientists to be published in 'other journals'.

The greater representation of non-range country authors in other journals and range country authors in *Gajah* is also probably due to the lower ranking of *Gajah* as a scientific journal. More established scientists, of whom there are greater numbers outside the range countries, are likelier to publish in journals that are perceived to be of a higher standard. Continued improvement of *Gajah* will probably attract more non-range country authors in the future.

Conclusion

The geographic origin of studies and the number of papers published reveals that a large amount of data from range countries has been published in *Gajah*. Therefore, *Gajah* represents an important repository of information on Asian elephants for managers, students, researchers and other interested parties in range countries as well as outside. In this regard, the greater accessibility and higher profile of *Gajah*, enabled through the internet, increases its value and utility. Further development of ease of access and easier reference of *Gajah* material is something we should keep focusing on.

Gajah 35 (2011) 15-20

Range-wide Status of Asian Elephants

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Introduction

As the second decade of the 21st century ticks by, Asian elephants remain endangered across their range. Although not yet extinct in any of the 13 range states, in five countries - Bangladesh, Bhutan, China, Nepal and Vietnam, the number of wild elephants in the entire country is less than 200 (Cao Thi Ly 2011; Islam *et al*. 2011; Jigme & Williams 2011; Pradhan *et al*. 2011; Zhang 2011), and in another three countries -, Cambodia, Laos and Thailand, it is less than 1000 (Khounboline 2011; Maltby & Bourchier 2011; Lohanan 2001) (Table 1). In two countries, Indonesia (Sumatra) and Vietnam, elephants have recently crossed a threshold to become 'critically endangered' (Azmi & Gunaryadi 2011; Cao Thi Ly 2011). The situation in Sumatra is of the greatest concern as the Sumatran elephant is one of four unique sub-species. Local extinctions of elephant populations have probably occurred in all range states within the last decade. However, in India, Sri Lanka and Bhutan, concurrently elephant range seems to be expanding in some areas, with elephants re-colonizing locations from which they have been absent for decades (Baskaran *et al*. 2011; Fernando *et al*. 2011; Jigme & Williams 2011). In many Southeast Asian range states exemplified by Myanmar and Cambodia, elephants are thought to be present in large areas, but no definitive data exists (Leimgruber *et al*. 2011; Maltby & Bourchier 2011).

It is a matter of great worry that there is still not a single Asian elephant distribution map based on actual on-the-ground-data such as a systematic grid survey for any country or location. The range-wide map (Fig. 1) developed by the AsESG workshop in Cambodia (Hedges *et al*. 2008) and all the range state maps presented in this *Gajah* issue are based on 'expert opinion'. While these maps are the best put together so far, none of the distribution 'data' available in any of the range states or even locations allows

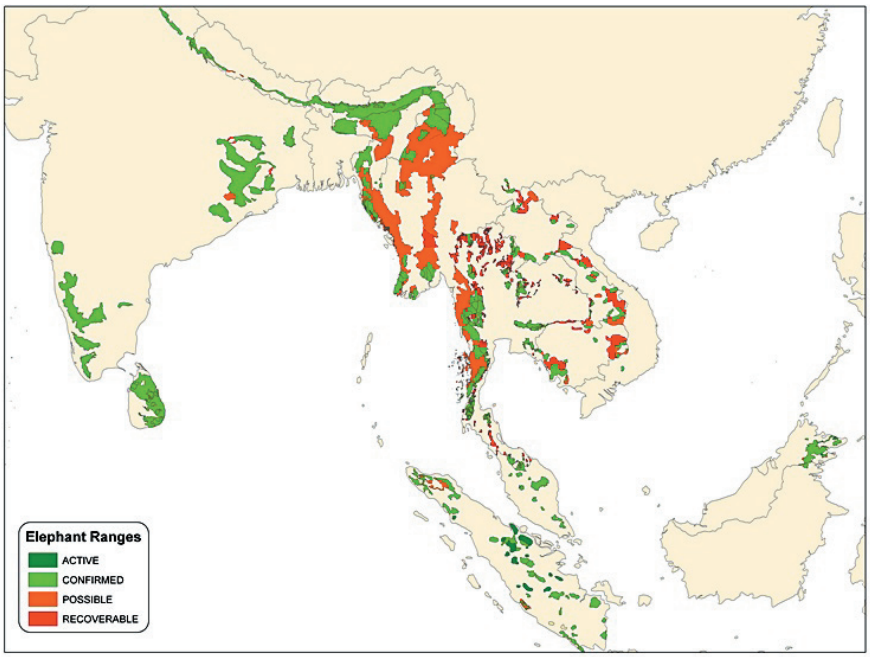

Figure 1. Range-wide elephant map (Hedges *et al*. 2008).

Table 1. Human and elephant population parameters of Asian elephant range countries.*

Country	Area [km^2]	# Humans	# Elephants			Source
			Min.	Max.	Mean	
Bangladesh	147,570	142,319,000	300	350	325	Islam *et al*. (2011)
Bhutan	38,394	695,800	60	150	105	Jigme & Williams (2011)
Borneo	747,996	19,871,913	1200	3670	2435	Alfred *et al*. (2011)
Cambodia	181,035	13,395,682	250	600	425	Maltby & Bourchier (2011)
China	9,572,900	1,339,724,852	178	193	186	Zhang (2011)
India	3,166,391	1,210,193,422	26,000	28,000	27,000	Baskaran *et al*. (2011)
Indonesia (Sumatra)	456,167	47,728,472	2400	2800	2600	Azmi & Gunaryadi (2011)
Laos	236,800	6,128,000	600	800	700	Khounboline K (2011)
Malaysia (Peninsular)	132,723	22,656,253	1223	1677	1450	Saaban *et al*. (2011)
Myanmar	676,577	52,171,000	1181	2056	1619	Leimgruber *et al*. (2011)
Nepal	147,181	26,620,809	109	142	126	Pradhan *et al*. (2011)
Sri Lanka	65,610	20,653,000	5879	5879	5879	Fernando *et al*. (2011)
Thailand	513,120	65,479,453	NA	1000	1000	Lohanan (2002)
Vietnam	331,212	85,846,997	83	110	97	Cao Thi Ly (2011)
Total	16,413,676	3,053,484,653	39,463	47,427	43,445	

*Source for area and human population figures: Brinkhoff T (2011).

accurate monitoring of distributional changes over time, other than the complete disappearance of an entire population. It is high time that a concerted effort is made to assess Asian elephant distribution across the range on systematic grid based surveys, to provide a solid baseline.

Approximately three fourths of all wild Asian elephants are in India and Sri Lanka (Table 1, Fig. 2). Overall the status and conservation prospects of elephants in South Asia especially Sri Lanka and India appear to be better than in Southeast Asia. This is surprising, as South Asia is more densely populated than Southeast Asia (Fig. 3). It becomes even more surprising when country-wise elephant densities are considered, where the elephant density in Sri Lanka is many times greater than in any other country (Fig. 4).

Southeast Asian states such as Myanmar, Laos and Cambodia in particular may have large extents of natural habitat which are thinly populated by people but also with few elephants. In Myanmar, Cambodia, Laos and Borneo, the numbers of elephants appear to be less than the available habitat could support (Alfred *et al*. 2011; Khounboline 2011; Leimgruber *et al*. 2011; Maltby & Bourchier 2011). However, comparison of elephant densities between countries and habitats other than at a very coarse scale may not be valid given the poor quality of the data available.

Human attitudes

Across the range Asian elephants live in countries with large human populations (Table 1, Fig. 5) with approximately 70,000 people per elephant across the range. Therefore, their future will be determined by the attitudes of the people towards elephants and their conservation.

Governments

All range state governments have recognized Asian elephants as being endangered and in need of protection, which is commendable and gives hope for the species' conservation. With the exception of Sri Lanka and Sumatra, almost all the other range countries have trans-boundary

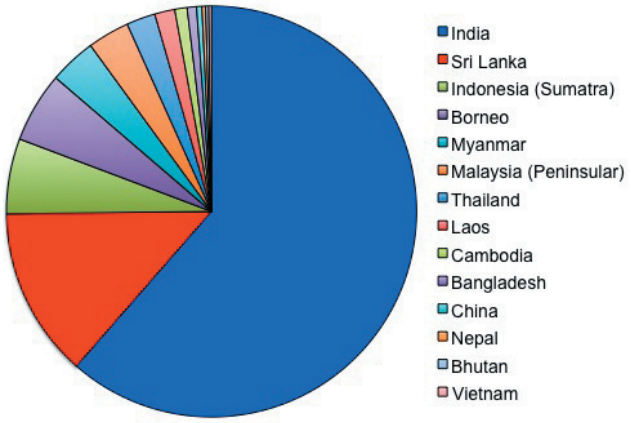

Figure 2. Portion of elephants in each range country.

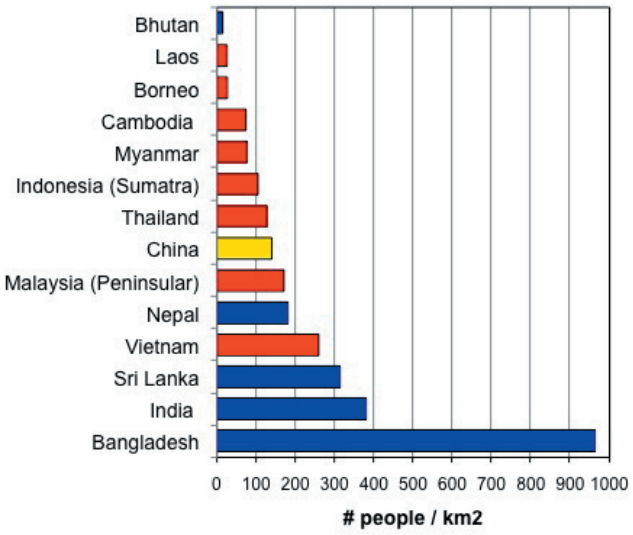

Figure 3. Human density in South (blue), Southeast (red) and East (yellow) Asian range countries.

elephant populations. While they constitute a small fragment of the country population in countries like India and Myanmar (Baskaran *et al*. 2011; Leimgruber *et al*. 2011), they are a significant fragment of the total population in Nepal, Bhutan, Bangladesh and Indonesian Kalimanthan (Alfred *et al*. 2011; Islam *et al*. 2011; Jigme & Williams 2011; Pradhan *et al*. 2011). The majority of country populations are below the minimum viable population threshold. Therefore inter-governmental collaborative management is critical for the conservation and management of Asian elephants in general and trans-boundary populations in particular.

Public

The attitude of people towards elephant conservation appears to vary significantly among range states. In countries such as Sri Lanka and India even with a high level of human-elephant conflict (HEC), people still seem to love and revere elephants and want to conserve them (Baskaran *et al*. 2011; Fernando *et al*. 2011). In contrast, in countries such as Bangladesh, Indonesia, Malaysia and Vietnam the overall attitude towards elephants appears to be less benevolent with HEC justifying the elimination of elephants (Azmi & Gunaryadi 2011; Cao Thi Ly 2011; Islam *et al*. 2011; Saaban *et al*. 2011). Countries with low HEC levels such as Bhutan, Nepal and Cambodia, appear to occupy the middle ground where HEC escalation may tip the balance towards intolerance (Jigme & Williams 2011; Maltby & Bourchier 2011; Pradhan *et al*. 2011). In most range states some communities or groups appear to have much greater affiliation towards elephants. Such differences in attitudes within and among different countries may occur due to cultural, religious and historical factors. However, it suggests that greater appreciation of elephants and greater awareness of their imperilled status can be a powerful tool for their conservation. Therefore awareness programs targeting all stakeholders and tailored to specific groups would be an important conservation measure.

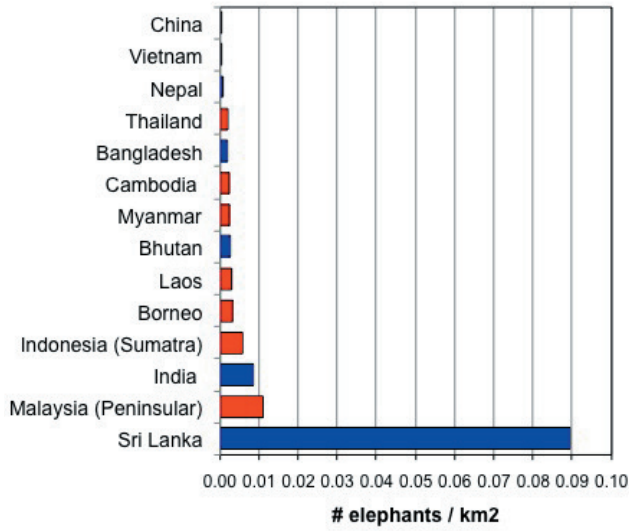

Figure 4. Elephant density in South (blue), Southeast (red) and East (China) Asian range countries.

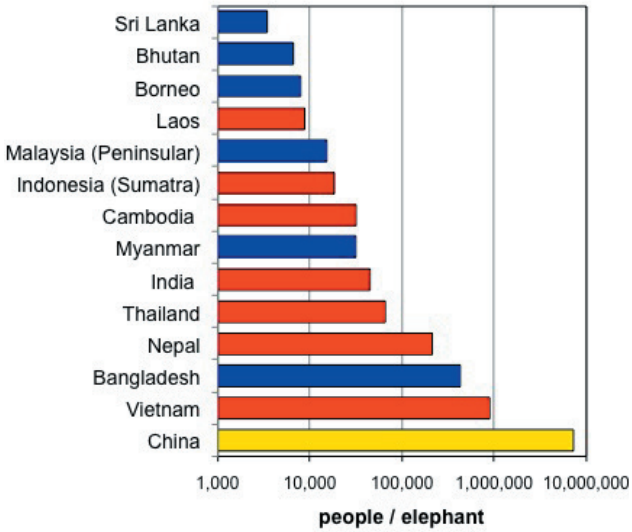

Figure 5. Number of people per elephant in South (blue), Southeast (red) and East (yellow) Asian range countries. Note: logarithmic X-axis.

The role of captive elephants

Across the range, captive elephant numbers appear to be decreasing with their role as work animals being increasingly supplanted by machines. However, their use in tourism is on the increase and may sustain the demand for captive elephants. Unfortunately captive breeding of Asian elephants appears to lag behind with the notable exception of the Pinnawela Elephant Orphanage in Sri Lanka. As a result, captive populations are still largely maintained by wild captures, both legal and illegal, which is of great detriment to the conservation of the species

The role of captive elephants in temples, zoos, circuses and work animals as ambassadors fostering the love and appreciation of elephants among people is an interesting if controversial aspect we need to examine closely. Through direct personal contact and interaction with people, such elephants could play an important role in the larger picture of elephant conservation. Standing next to an elephant in real life, touching it and perhaps feeding it a banana, will leave an indelible impression on a child, no amount of TV documentaries or observing wild elephants on safari can compare with. In that context, annual 'elephant festivals' such as in Laos and Vietnam (Cao Thi Ly 2011; Khounboline 2011) where captive elephants gather annually and people interact with them on a personal level may be something every range country should adopt. However, there is no argument that most captive elephants in range countries can and should be managed much better than is the current case, with more attention to their care, physical and psychological well being, and social needs.

Habitat loss and fragmentation

Large-scale loss

Across the range, habitat loss due to conversion of natural habitat to permanent settlements and cultivation represents a major threat to Asian elephants. Such habitat loss appears to be extreme in parts of Southeast Asia, especially in terms of conversion of natural habitat to large-scale commercial agriculture (e.g. palm oil). There is an ever increasing threat of such changes across the range also including South Asia. In general, conversion of natural habitat to large-scale agriculture primarily results in habitat loss.

When extensive habitat changes that exclude elephants occur in a short time span, what happens to the elephants that used to occupy such habitats is unknown. The general attitude of developers, conservationists and governments appears to be that those elephants will move to 'other areas' and adapt. In some instances management and conservation agencies even attempt to move entire populations to other areas by elephant drives and capture-translocation as a 'conservation measure'. However, as demonstrated by research in Sri Lanka (Fernando unpublished data) there is a very strong possibility that such habitat loss and forced eviction of elephants from their home ranges results in their death. If we are to address habitat loss, we need to determine the impact of such large-scale development and management on elephants, based on pre and post monitoring of elephants subject to them. Such information can guide development to minimize detrimental impacts on elephants, help minimize resultant increase in HEC and compel those causing HEC to take responsibility for its mitigation.

Small-scale loss

Conversion of habitat occupied by elephants to small-scale agriculture and settlements, often by illegal encroachment of state land occurs across the range and is especially evident in states such as Sri Lanka and Indonesia (Fernando *et al*. 2011; Azmi & Gunaryadi 2011). Although the amount of habitat loss by an individual encroachment is small, what it lacks in extent it makes up in numbers, with hundreds to thousands of such encroachments occurring annually in areas with elephants in most range states. Such habitat conversion while adding up to a significant loss of habitat has an even greater impact through habitat fragmentation. In most instances such small-scale 'development' occurs insidiously and is widespread, leading to fine scale habitat heterogeneity with an intricate jumble of natural (elephant) and human (settlements and cultivations) habitat.

Usually elephants continue to remain in such fragmented areas, leading to frequent encounters and conflict between elephants and people. This results in much suffering for both for decades and the ultimate elimination of elephants. Assessment and monitoring of such habitat changes, the impact on elephants and their response, and changes in HEC is difficult given the temporal and spatial scale, and insidiousness of such change. However, if we are to address elephant conservation and HEC mitigation effectively, such information is essential. It will allow stronger lobbying of authorities to prevent encroachment and unplanned development, and make encroachers aware of their role in causing HEC.

Human-elephant conflict

HEC is perceived widely as the main threat to Asian elephants. Across the range, activities to mitigate HEC are undertaken by people, and governmental and non-governmental agencies. Although a large number of 'mitigation techniques' have been developed and tried, few if any have been adequately assessed (Fernando *et al*. 2008). In range states with high levels of HEC such as Sri Lanka and India, governments spend significant funds on mitigation efforts (Baskaran *et al*. 2011; Fernando *et al*. 2011).

Across the range HEC is observed to be on the increase and is becoming a major concern of people, governments and conservationists. Obviously lessons could be learnt from countries, which have grappled with this issue, if information on the successes and failures is gathered and made available. Therefore monitoring and documentation of the effectiveness of HEC mitigation methods across the range is of great importance.

A very important aspect of assessing the effectiveness of HEC mitigation is that it is almost entirely from the human point of view. Actions such as elimination or capture as HEC mitigation measures are undoubtedly successful but at the cost of the elephants. While elimination is no longer practiced, live captures were sanctioned as mitigation measure in Indonesia till recently (Azmi & Gunaryadi 2011), which clearly made a significant contribution to the current 'critically endangered' status of Sumatran elephants. HEC mitigation activities such as capture-translocation, elephant drives, chasing elephants and range restriction by electric fences are widely practiced across the range. The impacts of such activities on elephants are not so obvious and the responses of elephants to them remain largely unknown. Research in Sri Lanka through GPS monitoring of elephants suggests that HEC mitigation activities may have severe detrimental impacts on elephants, and increase and cause wider spread of HEC (Fernando unpublished data). Recently initiated GPS monitoring of capture-translocation of elephants in India (pers. comm. A. Desai) and Malaysia (pers. comm. A. Campos-Arceiz) appear to suggest that the patterns observed in Sri Lanka are not unique. Monitoring the impact of HEC mitigation activities on elephants and their response should be a primary objective and responsibility of conservation authorities and conservationists, if we are to mitigate HEC without killing off all the elephants.

Elephant habitat and protected areas

Across the range the main approach to elephant conservation and HEC mitigation is the 'restriction of elephants to protected areas'. However in most countries the number of elephants and extent of elephant range outside protected areas greatly exceeds that within them. The extensive spatial occurrence of HEC in range countries bears testimony to this, as HEC occurs outside protected areas. One of the main reasons why limiting elephants to protected areas has failed is that the optimal habitat for elephants is not undisturbed forest but habitat with an intermediate disturbance regime (Fernando & Leimgruber 2011). Such habitat is mostly found outside protected areas. Research on elephant ecology based on GPS tracking of elephants and assessment of habitat and resource use is essential if we are to better understand their needs. Such efforts are a priority across the range if we are to conserve the Asian elephant.

Conclusion

In conclusion, the overall conservation status of Asian elephants across the range has remained static over the past decade or so over a larger part and lost ground in some states. Awareness of the endangered status of elephants appears to be increasing, especially among authorities. Across the range, HEC is gaining momentum and poses a serious threat to the survival of the species. HEC mitigation is entrapped in a web of archaic beliefs and traditions and is ill equipped to face the mounting challenge. The key to successful conservation of Asian elephants is robust scientific data that can guide development and conservation. It is high time we made obtaining that information a priority.

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Current Status of Asian Elephants in Bangladesh

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Introduction

Having been extirpated from most of the country, elephants are critically endangered in Bangladesh (IUCN Bangladesh 2000). Bangladesh is one of the most densely populated countries in the world and having a still growing human population, elephant conservation faces many obstacles. Lack of awareness has been identified as one of the most important challenges for natural resource conservation in Bangladesh (Chowdhury *et al*. 2011), which also effects elephant conservation. A survey of people in the Chunati Wildlife Sanctuary found 49% willing to conserve elephants, l6% undecided, and 35% against their conservation (Islam 2006). In a survey of 388 people in four protected areas (Teknaf Game Reserve, Chunati Wildlife Sanctuary, and two Reserve Forests in the south-east and the northeast) almost two-thirds stated that a protected area with wild elephant conservation would provide people with no value, while the remaining one-third agreed with the recreational value and the importance of elephant conservation for biodiversity and ecology (Sarker & Røskaft 2010). The distance people lived from a park (closer more negative) and the financial status (poorer more negative), were found to be the main predictors for attitudes of forest villagers towards elephant conservation (Sarker & Røskaft 2010).

In the past, wild elephants were captured by *Kheda* (stockade) operations, which were first practiced in Bangladesh in 1868. The Forest Department started kheda operations in 1915. *Kheda* operations were stopped in Bangladesh in 1965 (Islam 2006). All wild elephants are now protected under the Bangladesh Wildlife Conservation (Amendment) Act of 1974 and cannot be hunted, killed or captured. The act has provision for the Chief Wildlife Warden to declare an elephant as a 'rogue elephant' and issue a special permit for destroying it. According to the Wildlife (Conservation) Act (Draft) 2011, the penalty for killing an elephant will be imprisonment for 2 - 7 years or a fine of Tk 100,000- 1,000,000 (US$ 1,420-14,200) or both, and for a repetition, imprisonment and a fine of Tk 1,200,000 (US$ 17,140) or both (MoEF 2011). The Act has been tabled at the parliament and sent to the Parliamentary Standing Committee responsible for MoEF for review.

Wild elephants

Past distribution

Only about a hundred years ago, elephants were abundant in most forests of Bangladesh, including places such as Madhupur near Dhaka. In early 1990s the number of wild elephants was estimated to be 195-234, with 83-100 of them being trans-boundary elephants (Chakraborty 1996; Islam 2006).

Current distribution

Resident wild elephants are present only in the south-east. They occupy forests in Chittagong, Chittagong Hill Tracts and Cox's Bazar areas (Fig. 1) (Islam 2006). Trans-boundary elephants occur in the north-east and south-east, with ranges

overlapping neighbouring India and Myanmar. In the north-east, elephants in Kurigram, Sherpur, Netrokona and Maulvi Bazar districts, have trans-boundary ranges overlapping the Indian states of Meghalaya and Assam (IUCN 2004; Islam 2006). In the south-east, some herds in the Chitagong Hill Tracts move to and from Mizoram state of India and some in the Teknaf area in Cox's Bazar move to and from Arakan of Myanmar. The presence of non-resident elephants in Bangladesh coincides with paddy harvesting seasons, i.e. February-May and September-December.

Numbers

There maybe around 300-350 wild elephants (Fig. 2) in Bangladesh of which around 200 are resident and 100-150 have trans-boundary ranges. In 2003 the elephant number was estimated as 178 based on dung counts, and as 196-227 residents and 83-100 non-residents based on interviews and sightings (IUCN 2004). Non-resident elephants consisted of 8-10 in Rajibpur of Kurigram district, 40-45 in Nalitabari of Sherpur district, 20-25 in Durgapur of Netrokona district, and around 10 in the Sylhet forest division of the Maulvi Bazar district, (IUCN 2004; Islam 2006). In 2008-2009, Wildlife Trust of Bangladesh (WTB) and Zoo Outreach Organization (ZOO) India, reported 100-120 elephants in Nalitabari of Sherpur and 50-70 in Durgapur of Netrokona, and 30-35 in Rangunia of Chittagong, based on a participatory rural appraisal and questionnaire survey.

Threats

Habitat loss and fragmentation have had a severe impact on the wild elephant population in Bangladesh (Islam 2006). It is estimated that the national forest cover has been reduced by more than 50% since the 1920s. Forests have undergone drastic reduction due to fuel wood and timber extraction and conversion to cropland (Gain 1998; Geisen 2001; Islam 2006). An estimate in 1990 revealed that Bangladesh had less than 0.02 ha per capita forest land, one of the lowest forests-to-population ratios in the world. Throughout the 1980s, introduction of advanced

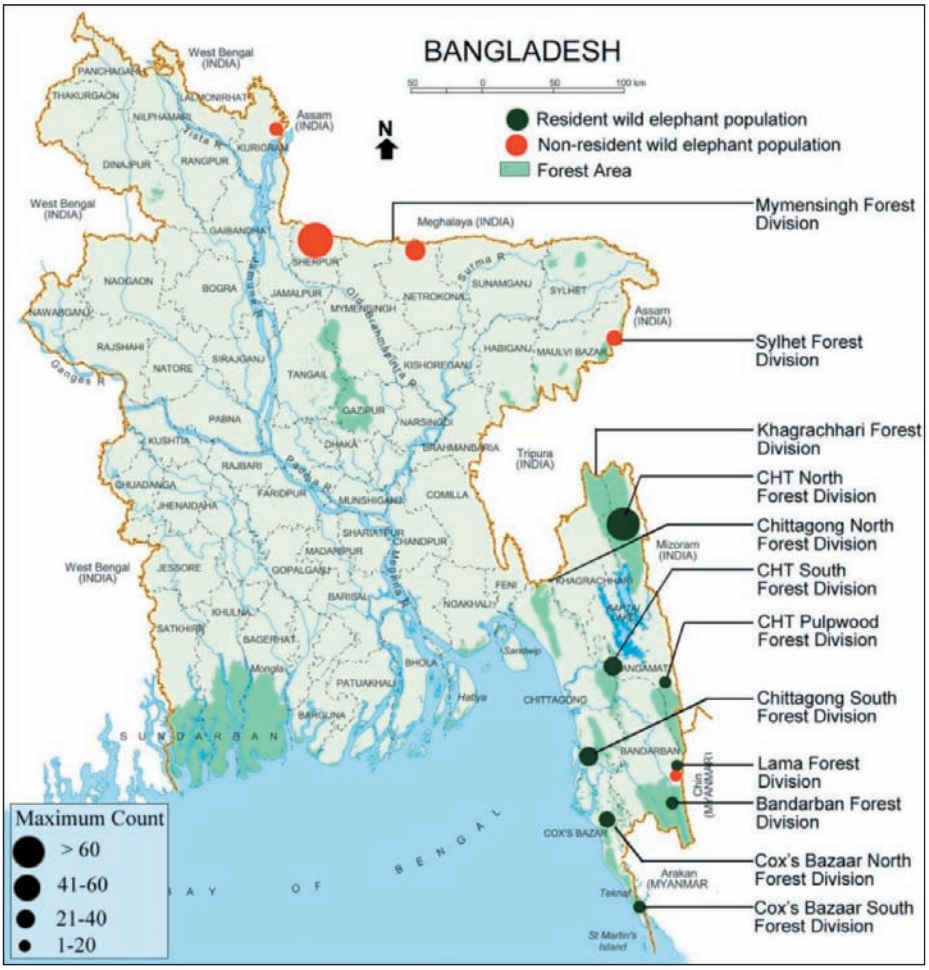

Figure 1. Current distribution of elephants in Bangladesh.

Figure 2. Wild elephant feeding at Fasiakhali Wildlife Sanctuary. Photo by Samiul Mohsanin.

technologies, such as high yield varieties of rice, made it possible to expand crop yields without utilizing more land. This vertical expansion (more crop yield on the same area of land) has almost reached its limit. Consequently horizontal expansion into forests and wetlands is on the increase (Islam 2006).

Crop depredations by elephants are on the increase in Bangladesh, during which people also get injured and killed. In 1997, 21 human and 2 elephant deaths were recorded and the economic loss caused by elephants through feeding and trampling of crops amounted to about US $ 102,000 in 30 incidents (Islam *et al*. 1999). In 2000, 17 people were killed and 15 injured by elephants. Three elephants were killed by local people in September and November 2001. Newspapers recorded the death of 7 elephants and 47 people from 2006 to 2011 and the Bangladesh Forest Department recorded the death of 37 elephants from 2003-2011 and 73 people from 2008 to 2010.

The main threat to elephants in the northeast is disruption of their migration routes due to development (IUCN 2004). A new threat to trans-boundary elephants is permanent fencing along international borders. Such fences built by India and Myanmar will seriously disrupt the regular movement of elephants between them and Bangladesh. Another threat is monoculture (rubber and acacia) plantations in and around elephant habitats in the Bandarban district by the Forest Department and others. 'Rohinga' (refugees from Myanmar) encroachment of elephant habitats is another long lasting threat in the south-east. Demand for elephant meat and tusks in the south-east also pose a serious threat to elephants.

Management and HEC mitigation

About 2% of the country's total area has been brought under protection through government initiatives. Teknaf Game Reserve and Chunati Wildlife Sanctuary in the southeast were set up specifically to protect elephants. However, human-elephant conflict (HEC) still occurs within and around protected areas. Protected area management is inadequate due to lack of funds and capacity.

IUCN-Bangladesh has been working in elephant conservation since 2001, establishing baselines, conducting pilot interventions, mapping elephant distribution, HEC areas, elephant corridors and paths, and improving understanding on HEC issues at community and decision-maker levels. WTB in collaboration with ZOO, worked on human-elephant conflict resolution by conducting research and awareness programmes from 2008 to 2009 at Sherpur, Netrokona and Chittagong, and provided training and awareness workshops on human-elephant coexistence (HECx) and translated HECx manual to the local language (Bangla). In May 2004, WTB along with the Bangladesh Forest Department helped Indian foresters to successfully translocate three elephants from Gopalganj district of Bangladesh to India. These elephants came all the way from Jharkhand of India.

In 2010, the Government of Bangladesh approved a compensation scheme for loses caused by elephants with US$ 1400 for loss of life, US$ 700 for physical injury and US$ 350 for loss of livestock, property, plants, trees, crops etc. (MoEF 2010). However, no one has yet got this money due to official formalities.

Captive elephants

The number of captive elephants (Fig. 3) in Bangladesh in 2002-2006 was 94 (Islam 2002, 2006; IUCN 2004). They were mostly used in the

timber industry and circuses. Most were found in Maulvi Bazar district. Of the 94 elephants, 74 were log haulers (of 17 government owned elephants, 13 were log haulers), 17 circus elephants, 3 zoo elephants, and one was owned by Betbunia Police Station, Rangamati. There were 56 females and 38 males, with 57 (27 males and 30 females) under 30 years and 22 (15 males and 7 females) less than 10 years old.

All circus parties are registered with the district commissioner's office. The mahouts and the owners are largely ignorant of the legal status of their elephants and even the necessary diet for a captive elephant. Proper veterinary care is also absent with only the government-owned elephants receiving veterinary care. Some elephants are registered with the local administration although the registration of captive elephants is the jurisdiction of the Bangladesh Forest Department (Islam 2006).

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Figure 3. Elephant in captivity at Dulahazara Safari Park. Photo by Samiul Mohsanin.

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Current Status of Asian Elephants in Bhutan

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Introduction

In Bhutan, the elephant has always been revered as a godly figure known by various names such as Meme Sanjay (Grandpa Buddha) by the Sharchopas and Lord Ganesh by the Hindu Lhotsampas. The religious significance of the elephant is depicted through paintings of elephants on the walls of monasteries and temples across Bhutan. One of the most prominent elephant paintings is "four harmonious friends" that collaborate together to get fruits or jewels of wisdom.

The legal status of elephants in Bhutan guarantees complete protection with inclusion in Schedule I of the Forests & Nature Conservation Act of Bhutan (MoA 1995) equivalent to Appendix I of CITES.

Unlike many of the other elephant range countries, Bhutan has substantial areas of undisturbed natural environments. Forests cover 80.80% of the land area (MoAF 2010) and 51.44 % of the land area is under the protected area network. This has contributed to successful conservation of elephants in Bhutan.

Wild elephants

Elephant numbers

There is no established baseline for elephant populations in Bhutan as a nationwide survey has not been conducted. Estimates of the number of elephants in Bhutan range from 60-150 (Santiapillai & Jackson 1990). Increase in crop raiding incidences, may indicate a stable or increasing elephant population due to uncultivated agricultural land becoming forested, and strict law enforcement resulting in decrease of poaching and death of elephants in the last ten years.

The first nationwide elephant survey was attempted in 2005 based on direct sightings of elephants and block counts. The survey did not provide results because of very limited sightings. In 2010, a dung transect survey was conducted in Samtse, Sarpang and Phipsoo Wildlife Sanctuaries based on 5x5 grids located in and around areas known to have elephants, with a random sample of 30% of the grids being surveyed by 4 km line transects. Elephant density was estimated at 0.641 elephants/km^2 with a 95% CL of 0.038-2.246 elephants/km^2. This gives a total of 513 elephants with a 95% CL of 30-1797 for the 800 km^2 area in Samtse, Sarpang and Phipsoo Wildlife Sanctuaries. In May 2011, the survey was scaled up across the southern belt of Bhutan and simultaneously dung was collected for DNA analysis, the results of which are not yet available.

Current elephant distribution

Elephants are now seen at altitudes as high as 1400 m whereas in the past the sightings were reportedly below 300 m. Therefore, although found in the same Dzongkhags (districts) their range has possibly increased. The elephant distribution covers foothills along the Southern border in the districts of Samdrupjongkhar, Sarpang, Tsirang, Samtse and Gedu. During the 1990's the elephant population in Samdrupjongkhar is reported to have been lower than now (G. Kuenley, pers. comm.). A likely reason could be the increase in habitat due to relocation of villages. Security threats have forced huge migrations along other stretches of southern Bhutan also, thereby

gradually transforming agricultural lands into forests (W. Ugyen, pers. comm.).

Most elephants migrate seasonally to neighbouring India and are mostly observed in Bhutan during the growing seasons of the major crops. During the non growing seasons, elephant sightings are rare. The movement patterns of elephants in Bhutan are not known and understanding such patterns could help human elephant conflict (HEC) mitigation.

Elephants are present in protected areas including Royal Manas National Park (RMNP), Phipsoo Wildlife Sanctuary (PWS) and Khaling Wildlife Sanctuary (KWS) (Fig. 1). The relative numbers of elephants residing within and outside protected areas is unknown. Field reports suggest that elephants are resident at Phipsoo Wildlife Sanctuary (Gyem Tshering, pers. comm.). This maybe due to the low human pressure at Phipsoo compared to other protected areas, and the availability of saltlicks within the sanctuary - where elephants are commonly sighted.

Threats

Much of the elephant habitats in Bhutan run across high hills and steep slopes that are prone to soil erosion. The rugged terrain has caused the highest proportion of elephant casualties in the past (Table 1).

The inadequate number of forestry personal with scientific expertise on elephants has restricted information collection and maintenance of databases on elephants and conflicts. The shortage of field staff has also effected the implementation of conservation activities such as anti-poaching, research and monitoring. Inadequate financial support and the security threat along the Bhutan-India border have restricted long term research on elephants.

The conflicts mostly occur outside protected areas or in buffer zones, since there are few settlements inside the protected areas. Crop depredations and damage to property occur regularly and death and injury of humans occasionally, across southern Bhutan. Over the years, threats to life and property, and damage to crops by elephants has contributed to economic loss and social pressure on farmers in southern Bhutan. The constant state of fear and regular economic losses without compensation has invited criticism and amplified the communities' negative perception of conservation. This has led to a change in communities' perception of elephants, although the change was not alarming at this point of time (Nagdrel 2008). Thus HEC may become

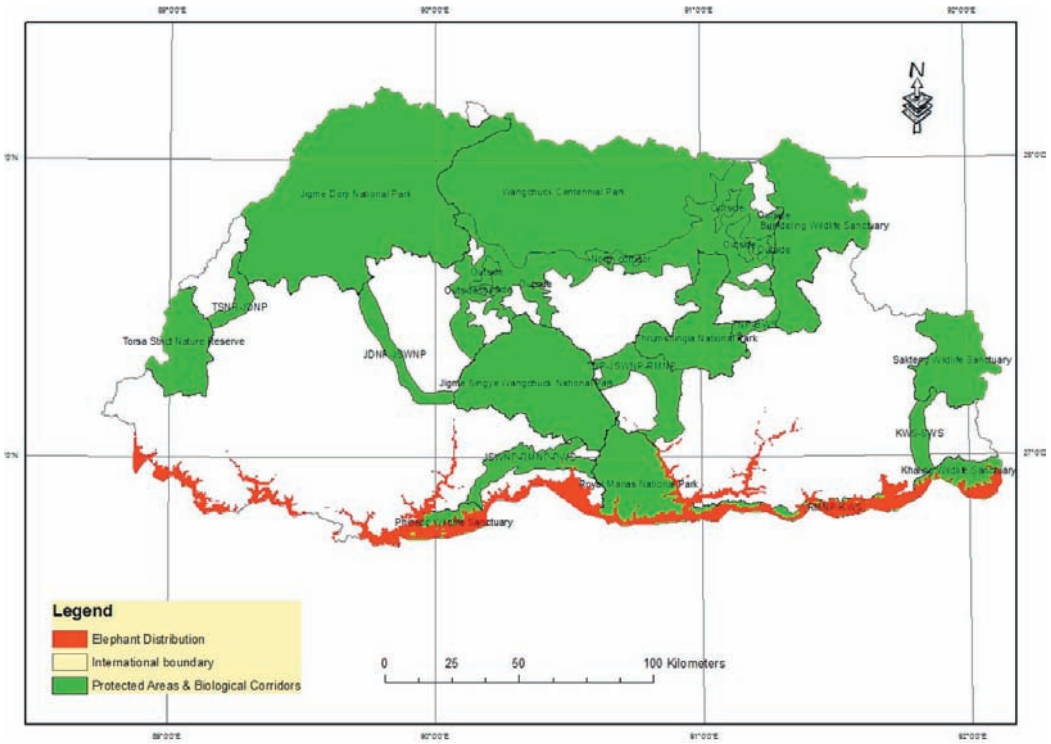

Figure 1. Elephant distribution map.

Table 1. Wild elephant casualty reports 2005 to 2011.

Sex	Age	Causes	Date	Location	Remarks
Male	30 years	Retaliation	Nov. 2005	Sarpang	Tusk intact
Female		Electrocuted	10.2.2008	S/jongkhar	4" tusks intact
Juvenile	2 years	Fall off cliff	28.2.2008	S/jongkhar	
Juvenile		Fall off cliff	25.7.2008	S/jongkhar	Decayed
Male	4 years	Electrocuted	Nov. 2008	Sarpang	Tusks intact
Male		Unknown	7.7.2009	Samtse	Tusks intact
Female		Fall off cliff	5.10.2009	S/jongkhar	Decayed
Male	11 years	Fall off cliff	15.4.2010	RMNP	Tusks intact
Juvenile	4 months	Unknown	8.3.2011	RMNP	
Male		Unknown	8.7.2011	Samtse	Tusks intact

the greatest threat to the survival of elephants in Bhutan.

The damage caused varies from one place to the other with some areas being frequently and extensively damaged. The annual crop loss to elephants was estimated to range from 0.3 to 18 % of total household income (DFPS 2008). On average farmers spend about two months per year guarding their maize and paddy from wild animals. Guarding is mostly done at night and has cost farmers untold hardships, additional expenses, and possible injury (DFPS 2008). The economic impact on humans has become a challenge faced by the Department of Forests & Park Services (DFPS) in conserving elephants. Damage caused by elephants plays a significant role in creating animosity among communities. This is becoming a key issue concerning elephant conservation.

A significant number of elephants in Bhutan have trans-boundary ranges, and they are prone to environmental disturbance outside Bhutan. Illegal harvesting of timber especially along the southern border with India could contribute to considerable habitat destruction in the near future, with resultant negative impacts on elephants.

Elephant management and HEC mitigation

HEC is of increasing concern to the Department of Forests & Park Services and communities in southern Bhutan (Nagdrel 2010).

In 2009 a solar electric fence was erected at Senge Gewog in Sarpang Dzongkhag with financial support from UNDP and WWF. It was of a high standard with iron posts and 3 strands of wire, instead of 1 strand and wooden posts as earlier. The 4.5 km solar electric fence covered an area of 271 acres. Since the construction of the fence, the people of Senge Gewog have started growing crops on fallow land. Subsequent field reports cited success in keeping elephants away from the fields, with 50 households consisting of 340 people having benefited from this mitigation measure.

At Umling geog, a low cost solar electric fence of 2.57 km was constructed in 2007 to benefit more than 420 households in five villages. In 2010, with additional financial support from WWF the wooden posts were replaced with iron posts. An additional 2.3 km fence was erected covering the main elephant entry points. In 2010 the UNDP extended its support to construct a 6.7 km solar electric fence in Samtse. Understanding the gravity of the conflict situation, the Royal Government of Bhutan (RGoB) in 2010 further supported construction of solar electric fences at Dina, Samtse. The construction of a 10 km solar electric fence (low cost with use of sal posts) in Lhamoizingkha was recently completed with support from WWF. The Wildlife Conservation Division (WCD) has sought UNDP support to construct solar electric fences at Diafarm in Samdrupjongkhar.

Supplying equipment such as sound alarm fences and heavy duty torches to farmers and forestry personals has been done as a HEC mitigation measure. An ultra-sonic sound device was piloted at Senge village in 2010. Besides

these, communities still practice the following indigenous elephant driving techniques:

- Lighting of bonfire and shouting by the assemblage of villagers
- Use of fire crackers
- Beating of empty vessels to produce loud sound
- Performing rituals
- Chasing away with support from forestry personals

With human-wildlife conflict becoming a national concern, the DoFPS has initiated crop and livestock insurance schemes. A crop insurance scheme was piloted in Lhamoizingkha with seed money of Nu 300,000 (ca. US$ 5650) from WWF. In order to make the scheme sustainable the 'Endowment Fund for Human Wildlife Conflict Management' was established in 2010. The funds raised will be invested in the 'Bhutan Trust Fund for Environmental Conservation' (BTFEC) and interest generated will be made available as seed money to the Gewog Conservation Committee (GCC). The community will be responsible to partially cover the annual insurance premium, which will provide an inherent check and balance for the utilization of funds in a prudent and transparent manner. The GCC can also initiate fund raising for their respective endowment fund. As their first program they will oversee the livestock and crop insurance compensation scheme – an initiative, which is targeted at offering monetary compensation in the form of insurance coverage. The formation of GCCs will facilitate the gradual transfer of custodianship of responsibility for nature conservation to the people. In the future the GCC will be mainly responsible for taking up all conservation related activities in Gewog.

Captive elephants

Bhutan has 10 captive elephants (2 males, 6 females and 2 juveniles) with the Department of Forests & Park Services. All of the captive elephants were rescued as young orphans and were trained by a process of grooming. They were never subjected to physical abuse. Each elephant is looked after by two caretakers from the beginning of their captive life. As Bhutan did not have a history of employing elephants and the Department of Forests & Park Services does not favour the idea of captivity, but the need to have captive elephants has become an imperative. Captive elephants are important for forestry personal living in far flung outposts of parks. They are the only means of transport to carry supplies when accessibility is completely cut off during most part of the rainy season. Captive elephants can also be used for anti poaching patrolling within protected areas. Since all the protected areas in southern Bhutan are closed for tourists, elephants are not used in ecotourism. Elephants are mostly left free under the care of the DoFPS till the onset of next monsoon season.

Records show the birth of two calves to two females in captivity. A male was born in 1997 and a female in 2003. Both were fathered by the same male who later died of old age. Breeding still occurs among captive elephants. Probability of breeding captive elephants with the wild population is limited, as the captive elephants do not venture unescorted into forests. So far three captive elephants have died of natural causes (old age) and one was killed by a lightning strike.

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Current Status of Asian Elephants in Borneo

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Introduction

The origin of the Bornean elephant is still very controversial, despite the publication of a genetic study by Fernando *et al*. (2003) indicating the distinctiveness of the Bornean elephant and its derivation from Sundaic stock. The authors suggested independent evolution of the Bornean elephant for some 300,000 years since a postulated Pleistocene colonization and recognized it as native to Borneo and as a separate Evolutionary Significant Unit. Based on the lack of genetic variability and fossil evidence in Borneo the theory that elephants sent to Sulu at the end of the 14th century as a gift between royal personages, proliferated on the island and subsequently provided the founder members of the existing population of northeast Borneo has been revisited (Cranbrook *et al*. 2008). While the conclusion by Fernando *et al*. (2003) was based on the absence of a source population on the mainland, Cranbrook *et al*. (2008) suggest that the source could have been the now extinct Javan elephant. Nevertheless, the debate on the origin of the Bornean elephant should not lead us astray from the fact that it is unique and that it deserves conservation efforts. Bornean elephants have many distinctive characters such as smaller size, larger ears, straight tusks, long tail that reaches to the ground and may also show some behavioural differences.

In Sabah, elephants are protected under the Wildlife Conservation Enactment (WCE) 1997. Under the listing, they can only be killed with a license issued by the Director of the Sabah Wildlife Department in specified instances such as to avoid human deaths due to serious Human and Elephant Conflict incidents (Section 26(1) WCE 1997). For killing an elephant illegally the penalty is a fine of 50,000 Ringgit (US$15,625) or imprisonment for five years or both. However, during the recent Sabah Wildlife Colloquium Conference in January 2012, the status of Sabah's Bornean pygmy elephant will be upgraded to Part 1 of Schedule 1 of the Totally Protected Animals under the Wildlife Conservation Enactment 1997 of the State.

Wild elephants

Past and current distribution

Wild elephants only occur in the north-eastern part of Borneo, mainly in Sabah extending over to a small area across the international boundary between Malaysian Sabah and Indonesian Kalimantan. In Sabah itself, they occur in forested areas in the south, centre and east of the State. They prefer low-lying areas where movement is relatively easy, and generally avoid steep slopes. Forests near rivers, with open areas for feeding as well as secluded areas where they can retreat during the day, are generally preferred.

The range of wild elephants in Sabah and Kalimantan seems to have expanded very little in the past 100 years despite access to suitable habitat elsewhere on Borneo. Borneo's soil tends to be young, leached and infertile, and there is speculation that the distribution of wild elephants on the island may be limited by the occurrence of natural mineral resources (Davies & Payne 1982). Figure 1 shows the past and current distribution of elephants in Borneo. The latest elephant distribution (2011) is shown in the confirmed range in the map.

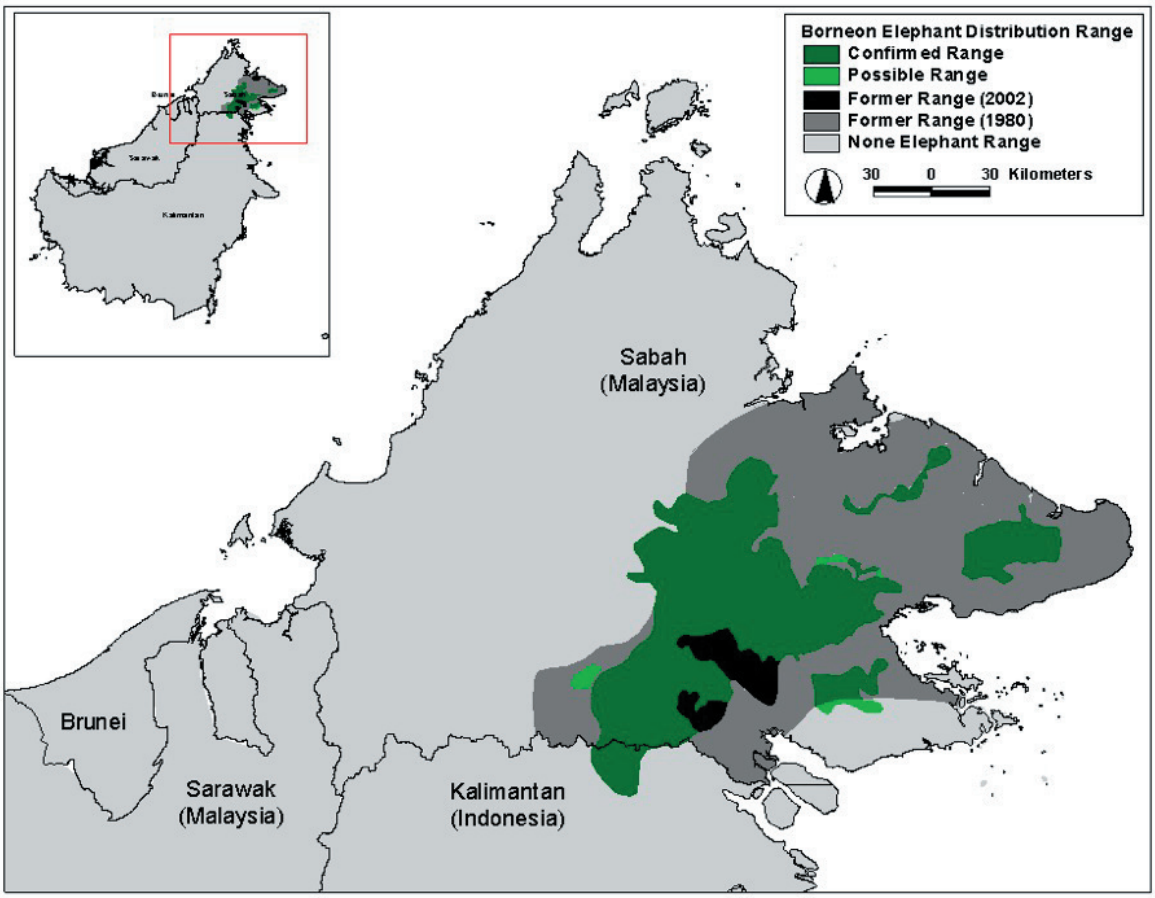

Figure 1. Past and current distribution of Bornean elephant in Sabah (Alfred *et al*. 2010).

In the early 1980's Davies & Payne (1982) suggested that Sabah's wild elephant population numbered between 500 – 2000 animals. In 2002, Ambu *et al*. provided estimates based on habitat availability between 1127 and 1623 individuals distributed in five major Managed Elephant Ranges and a couple of isolated populations. Alfred *et al*. (2010) based on line transect surveys conducted in all the major elephant ranges and monitoring dung decay rates, estimated the total number of elephants in Sabah to be around 2040 individuals with a range of 1184 to 3652. The number of individuals in Kalimantan is estimated to be less than 20, with approximately 0.1 elephants/km^2 (Alfred *et al*. 2009). Table 1 and Figure 2 show the estimated elephant density and population in each survey range.

Elephant density in each forest reserve

The upper catchment of Ulu Segama Forest Reserve (Fitch) has the highest density of elephants (3.69 elephants/km^2), followed by the Danum Valley Conservation Area (DVCA) with 2.35 elephants/km^2. As habitat has been converted to agriculture (oil palm and industrial

Table 1. Elephant density and population in the Managed Elephant Ranges (Alfred *et al*. 2010).

No	Survey Site	Density [elephants/km^2]	Number of elephants	95% CI Lower	95% CI Upper
1	Tabin Range	0.60	342	152	774
2	Lower Kinabatangan Range	2.15	298	152	581
3	Central Forest of Sabah (Ulu Segama, Danum Valley, Gunung Rara and Kalabakan)	1.18	1132	748	1713
4	North Kinabatangan Range (Deramakot, Tangkulap, Segaliud Lokan)	0.56	258	131	511
5	Ulu Kalumpang Range	0.12	10	1	73

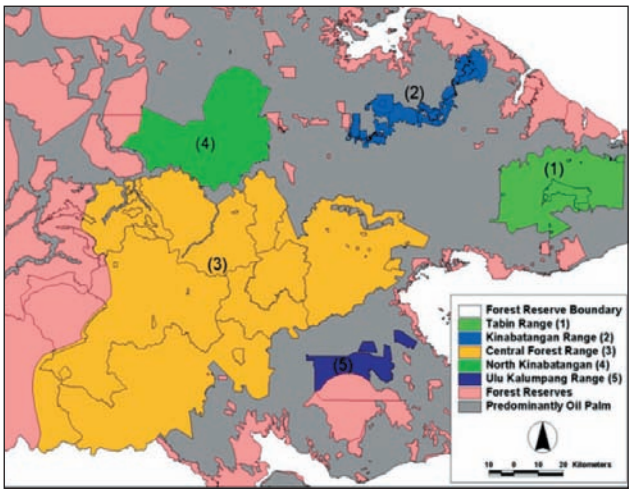

Figure 2. Location of key managed elephant ranges in Sabah (Alfred *et al*. 2010).

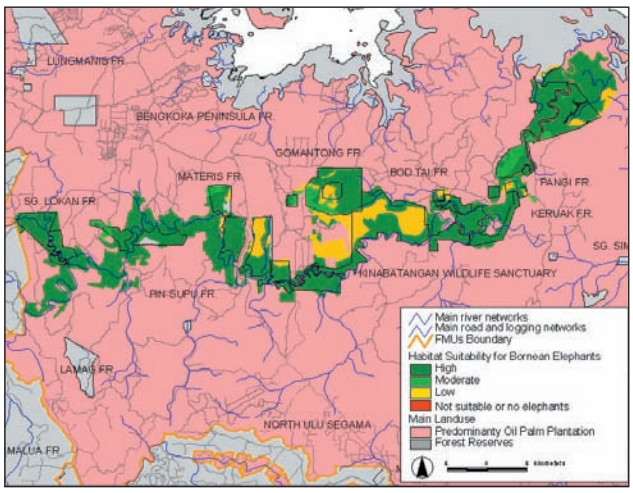

Figure 4. Key habitat for elephants in Lower Kinabatangan (Alfred *et al*. 2010).

tree plantations), it appears that there has been an increase in elephant habitat utilisation including elephant density, in the remaining habitat in the northern part of DVCA and upper catchment of Ulu Segama Forest Reserve (Fig. 3).

Lower Kinabatangan Wildlife Reserve, 2.15 elephants/km^2 (Fig. 4). Sukumar (2003) suggested that the viability of the habitat is still good if an equilibrium density of the elephant is ranged between 0.5-1.5 elephants/km^2. Based on this suggestion, Lower Kinabatangan range may not be a viable habitat for the elephants since the density in this area is 2.15 elephants/km^2.

In North Kinabatangan Range, Tangkulap Forest Reserve has a density at 1.26 elephants/km^2), Deramakot Forest Reserve has a density at 0.86 elephants/km^2, while Segaliud Lokan Forest Reserve has a density at 1.41 elephants/km^2. The key habitat for the elephant in North Kinabatangan Range is shown in Figure 5.

Malua Forest Reserve, which is contiguous to Kuamut Forest Reserve and Malubuk Virgin Jungle Reserve has a density of 1.41 elephants/km^2. In 1997, the elephant density in Malua Forest Reserve was calculated at 0.79 elephants/km^2 (Boonratana 1997). The increase of the density of elephants in Malua may be due to logging activities in the adjacent forest reserves (namely Kuamut Forest Reserve and within Malua Forest Reserve itself). This argument is supported by the evidence that elephant groups moved outside Malua range into the oil palm plantations during the survey period (Fig. 6).

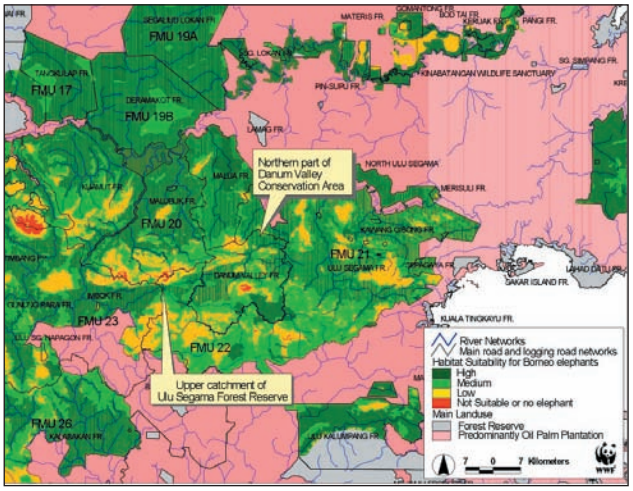

Figure 3. Key habitat for elephants in Upper Ulu Segama Malua and Danum Valley Conservation Area (Alfred *et al*. 2010).

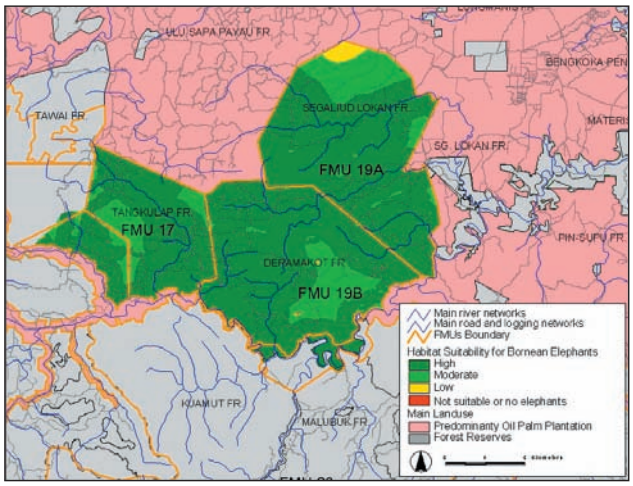

Figure 5. Key habitat for Bornean elephants in North Kinabatangan (Alfred *et al*. 2010).

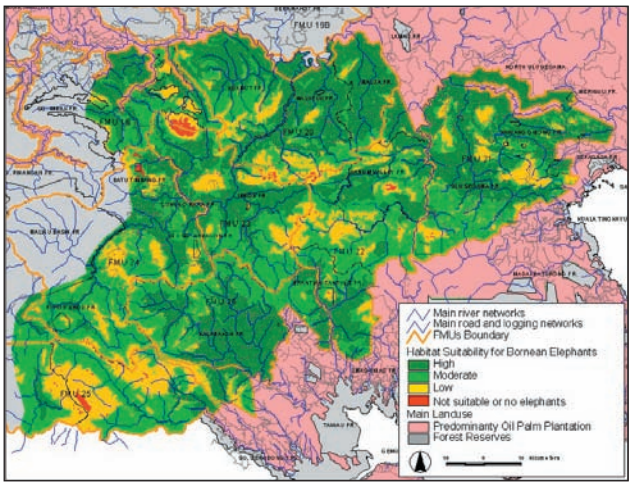

Figure 6. Elephant habitat in the central forests of Sabah (Kuamut-Malubuk and Kalabakan-Sapulut-Maliau Ranges) (Alfred *et al*. 2010).

Ulu Kalumpang Forest Reserve and Kalabakan-Sapulut-Maliau Range have the lowest density of elephants, at 0.12 and 0.28 elephants/km^2 respectively. Boonratana (1997) estimated at least 0.01 elephants/km^2 in Kalabakan Forest Reserve. This indicates that the elephant density has increased with loss of key habitat due to conversion to large-scale plantation. Elephants are now absent from the main Kalabakan Forest Reserve, especially in the Benta Wawasan oil palm area as from 2002-2005 key habitat has been destroyed.

Given the abundance of the elephants in each forest range, the issue of habitat viability for the elephants needs to be addressed. There are three major habitat attributes, namely size, integrity and quality that have to be considered for the conservation of the elephant population. Elephants could be seen regularly in the Lower Kinabatangan River due to the limited extent of suitable habitat in the Lower Kinabatangan range. Linking suitable habitat patches with forest corridors will improve the habitat viability. The other forest habitat ranges (i) Tabin range, (ii) North Kinabatangan range, (iii) Central forest range and (iv) Ulu Kalumpang range are considered viable as they are. Figure 8 shows the location of the key forest corridors that need to be maintained or re-established.

Four of the five main elephant populations in Borneo have less than 1000 individuals. Only the central forest range supports an elephant population of more than 1000 individuals. For elephant conservation in Sabah it is necessary to protect all five key populations and to address where possible, limitations to the growth of these populations particularly where habitat is the limiting factor.

Key threats

1. Habitat loss and fragmentation

In Sabah, the primary threat to the Bornean elephant is the loss and degradation of continuous forests. Over the last 40 years, Sabah has lost about 40% of its forest cover, which has been converted to plantations and human settlements. In the 1980-90s, large tracts of these forests were divided into 'Forest Management Units' (FMUs) of around 1000 km^2 each, which were

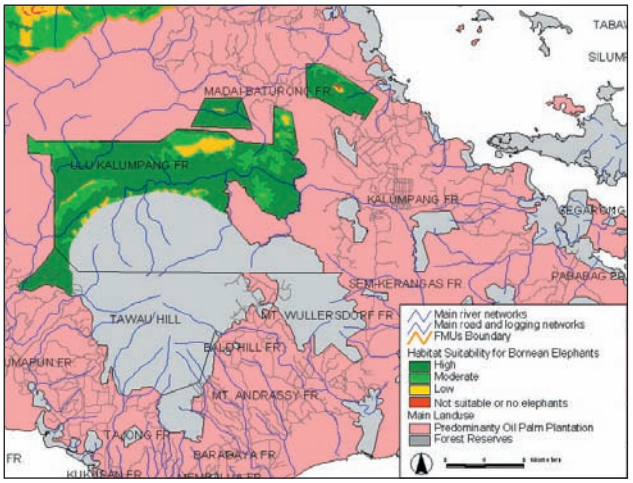

Figure 7. Key habitat for Bornean elephants in Ulu Kalumpang Range (Alfred *et al*. 2010).

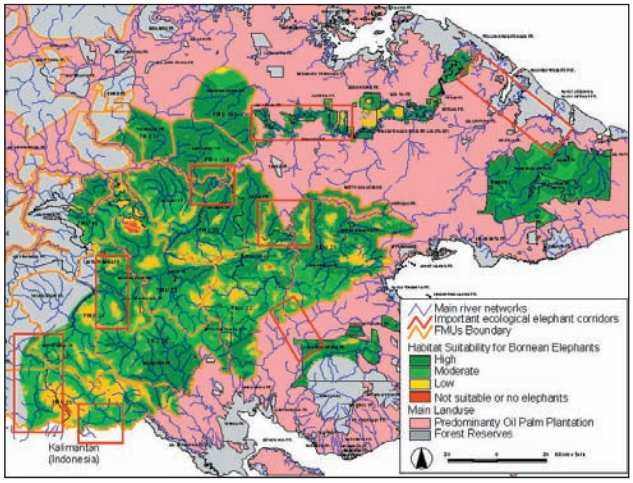

Figure 8. Key forest corridors needed within the managed elephant range (Alfred *et al*. 2010).

leased for up to 100 years, to be managed for sustainable wood production. However, years of unsustainable logging before the 1990s had taken their toll, making many of these big concessions commercially unviable in the short to medium term. Therefore, some of the FMU concessionaires have been converting part of their holdings into wood or oil palm plantations. The conversion of forests to plantations remains the biggest threat to elephants with the current rate at 4000 to 8000 ha per year, because plantations cannot provide the types and amounts of food necessary to sustain breeding populations of elephants.

Apart from habitat loss due to conversion of natural forests to plantations (Fig. 9), other threats include habitat fragmentation and increase in human presence close to forest blocks when oil palm plantations come into operation. This rapid increase in human population causes greater small-scale encroachments and increased elephant-human conflict.

2. Low genetic diversity

A recent genetic study found extremely low genetic diversity in the Bornean elephant population and significant genetic differentiation between currently demographically isolated populations (Goossens, pers. comm.). These results suggest the desirability of re-establishing gene flow between some populations if an increase of inbreeding and a loss of fitness are to be avoided.

3. HEC, illegal killing and illegal trade

Current annual loss of elephants in Borneo from HEC is around 10-16 annually with an increasing trend (Fig. 10). Approximately 1-2 human deaths are reported annually. The extent of oil palm destroyed by elephants is around 300-500 ha per month. Although poaching was not a serious problem in the past (see Tuuga 1992), recent reduction of elephant populations in Ulu Kalumpang area might indicate the contrary.

Figure 9. Habitat loss due to plantation.

Figure 10. Elephant caught by snares.

Occasional incidents of illegal killing (shooting, poisoning) do occur but these are usually related to the intrusion of elephants into oil palm plantations where they can cause extensive damage. Moreover, snare traps set catch wild mammals for meat pose a risk to elephants, especially in the forest patches bordering oil palm plantations, such as in the Kinabatangan floodplain. It is estimated that 20% of resident elephants have sustained injuries from snares set illegally in the forest by oil palm workers for wild boar and deer. Public awareness, but most importantly, awareness campaigns in oil palm estates are needed to stop such illegal activities.

In terms of illegal trade, there is not much data available in Sabah. However, on April 30, 2009, one pair of elephant tusks was seized in Nunukan (Indonesia) from a Malaysian citizen from Tawau.

4. Poor public awareness

Lack of knowledge and appreciation is an indirect threat to the Borneo elephant's long-term conservation. Therefore, the Sabah State Government and its relevant departments as well

as local and international NGOs and scientists need to tackle public ignorance, increase their awareness and change their attitudes towards conservation.

In situ conservation efforts

In situ conservation efforts cover all areas designated as "Managed Elephant Range" (MER). Areas with at least 50 breeding elephants (translating into a total population of 125-150 elephants) are declared as MERs. Currently declared MERs include Lower Kinabatangan Range, North Kinabatangan Range, Tabin Range and Central Forest Range. Further investigation will be needed in Ulu Kalumpang in terms of whether the elephant population is connected to the one in Ulu Segama of Kalabakan Forest Reserve.

The responsible agency for implementing the elephant conservation efforts is Sabah Wildlife Department, with support from other government agencies (Sabah Forestry Dept., Sabah Foundation and Sabah Park), and relevant NGOs.

In order to reduce human and elephant conflicts, several management measures were implemented through the establishment of electric fencing, driving away problem elephants and establishing a translocation programme. Culling is only practiced by the Sabah Wildlife Department when human life is threatened in accordance with the 1997 Wildlife Enactment.

The recent Elephant Action Plan (2012-2016) developed by Sabah Wildlife Department with support from relevant NGOs, aims to:

- Investigate and ensure all key and necessary measures to maintain or re-establish connectivity within and between the key MERs and initiate specific protection for critical corridor habitats.
- Increase the value of the forest (through forest restoration and REDD program) in the MER. This is to ensure the key habitat for elephants will not be converted into other landuse.
- Ensure that every management plan designed for any natural forest or plantation with elephants should be in line with the recommendations developed in the State Elephant Action Plan. This is to ensure that key corridor and habitat for the elephant is the forest management unit will be excided from any other forest conversion activities.
- Upgrade the status of the Bornean elephant to Schedule 1 of Totally Protected Species in Sabah. This is to ensure that no license shall be given to kill this species, and higher penalty could be imposed to those who are involved in killing this species.
- Support the creation of the "Bornean Elephant Conservation Alliance" (BECA) as a venue encouraging collaboration and communication between all partners involved in elephant management in the State.
- Promote responsible production of palm oil and oil palm products.
- Carry out, before 2013, a Population Habitat and Viability Analysis (PHVA) for the whole Sabah elephant population in order to estimate its extinction risk.
- Carry out regular monitoring and surveys in all four managed elephant ranges and build up a comprehensive database on elephant population trends in Sabah.
- Increase and promote communication and public awareness, and publicize the conservation needs of elephants in local, national and international media. Awareness campaigns targeted toward the general public, with a focus on schools and rural areas, are also crucial throughout the State, with an emphasis in the east coast.
- Promote zero poaching/killing through strict law enforcement and synchronized awareness programs.
- Engage with the oil palms estates surrounding the Managed Elephant Ranges to mitigate conflicts and to address illegal activities such as logging and poaching within and around the MERs.

Captive elephants

Ex-Situ conservation of the Bornean elephant would play an important role in the management of small fragmented groups of elephants outside the managed elephant ranges, when translocation is not an option.

Currently, 14 elephants are kept in Lok Kawi Wildlife Park, for conservation education and public awareness purposes. These elephants do not interact with other wild populations. However, they are managed as a group, which allows them to interact with each other in captivity. Most of these elephants were rescued from the oil palm plantations. So far, 3 elephant calves were born in the Lok Kawi Zoo, since the zoo was established 6-7 years ago. The Sabah Wildlife Department is also looking at the possibility of providing some elephants to zoos outside Sabah for global awareness of the plight of the Bornean elephant, as tourism ambassadors of Sabah and for captive breeding purposes.

In the near future, the Sabah Wildlife Department plans to set up an Elephant Rescue Center where injured elephants can be treated and then translocated back into the wild and orphaned baby elephants can be housed and taken care of.

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Current Status of Asian Elephants in Cambodia

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Introduction

Elephants hold particular cultural significance in Cambodia, most famously for the critical role their harnessed power provided in the building of the 12th Century temple of Angkor Wat – the largest religious building in the world. Elephants are also depicted in numerous bas reliefs of ancient battles throughout the vaulted galleries of Ankgor Wat (Fig. 1), as well as at the Terrace of the Elephants (Fig. 3), located in the walled city of Angkor Thom. At 350 m in length and 3 m in height, the Terrace was once used by the King of Angkor to view his armies returning from battle.

Numerous ethnic minority groups use domestic elephants for transport and work. The Bunong tribe of Mondulkiri province (members of this group can also be found in significant numbers across the border in Dak Lak province, Vietnam) has a particularly close relationship with elephants and traditionally used to capture elephants from the wild for domestication. Capture of wild elephants has been illegal since the mid-1990's and only a handful of elders who know how to capture a wild elephant are still alive. The remaining Bunong elephants are rapidly approaching the end of their working lives and with cultural taboos prohibiting the breeding of domestic elephants combined with a preference for riding motorbikes instead of elephants, this shared culture of people and elephants is slowly dying out.

Cambodia has been signatory to CITES since 1997. The Asian elephant is protected under Cambodian law, with illegal killings and attempts to trade in elephant parts punishable by a lengthy jail sentence. However, the resources and capacity of law enforcement officials to combat wildlife crime, both at the provincial and national level is limited and combined with a weak penal system, successful prosecutions of offenders are seldom seen.

Wild elephants

Estimates of elephant numbers

Local people report a mass migration of wildlife, including elephants, between the Cardamom Mountains and Samlaut Hills across the agricultural plains of Battambang and Pursat provinces to the Tonle Sap Great Lake – the largest freshwater lake in southeast Asia, as recently as 50 years ago. Similar movements were reported on the north side of the Great Lake between Beng Per Wildlife Sanctuary and Boeung Tonle Chhmar (Kol Touch, Ministry of Agriculture, Forestry and Fisheries, pers. comm.). However, these seasonal rhythms have been steadily eroded over the past decades, as lowland forest habitat has been lost to development, the expansion of agricultural lands and the building of major roads and infrastructure. These factors were compounded by the civil war of 1975-79 where people suffering under the Pol Pot regime were forced to hunt elephants and other wildlife for food, as well as Khmer Rouge soldiers who commonly hunted elephants to sell ivory for cash. The following twenty or so years of political instability coupled with widespread firearm ownership resulted in what is now largely considered to have been a massive decimation of wildlife, especially large mammals, nationwide.

In 1993 the existing 2.2 M ha protected areas system was revised, with the proclamation by King Norodom Sihanouk of twenty-three new protected areas in an effort to safeguard what remained of Cambodia's natural heritage.

Figure 1. Bas relief at AngkorWat.

Indeed, elephants were referred to as a "national indicator of hope" (Ashwell, pers. comm.) when King Norodom Sihanouk returned to Cambodia after the civil war in 1993. Further protected areas have been designated since and it is tentatively estimated that approximately 70-80% of Cambodia's elephants are today found within the boundaries of the protected area system, with the remainder largely in adjacent areas of state forest. However, anecdotal reports prior to 1993 suggest that elephants were still widespread and locally abundant until this time, with a Uruguayan contingent of the UN Transitional Authority of Cambodia reporting a herd of two hundred elephants on the border of Mondulkiri and Ratanakiri provinces (Ashwell, pers. comm.); and local farmers along National Highway 4 between Phnom Penh and Sihanoukville reporting delays of several hours while waiting for elephants to cross the road at the Pich Nil mountain pass during the 1980's.

Previous estimates of the elephant population of Cambodia range from 2000 (Kemf & Jackson 1995), to 500 to 1000 (Osborn & Vinton 1999), to 250-600 (Murdoch 2008), of which the authors consider the latter to be the most accurate. However it must be noted that large areas of habitat remain recoverable (particularly in the Cardamom Mountains). Although threatened by a range of factors comparable to those in other range states, the available habitat is still large enough to support an elephant population much larger than exists today, assuming adequate levels of support to law enforcement and protected area management are in place.

Current elephant distribution

The two largest elephant populations are located in the eastern plains of Mondulkiri province and the Cardamom and Elephant Mountains in the countries' southwest (Fig. 2). Both landscapes are mosaics of National Parks, Wildlife Sanctuaries, Protected Forests and state forests (the latter are not classified as protected areas) and at a size of approximately 1.5 million ha each, they are the two largest PA complexes in Cambodia.

There are smaller trans-boundary populations inside and outside protected areas along the northern border with Lao PDR in Preah Vihear and Ratanakiri provinces, and also a small (rumoured to be around 30 individuals) population in Samlaut district, western Battambang province which form part of a trans-boundary population shared with Thailand. There is also a small population (number unknown by generally thought to be less than 20) in Prey Long forest, which straddles the boundaries of Kompong Thom, Kratie and Stung Treng provinces and is not a protected area.

The Greater Cardamoms Landscape (GCL, often generally referred to as just "the Cardamoms") is a forested mountain complex consisting of the Cardamom (Kravanh) Range, the Elephant Mountains, and Phnom Aural, spanning portions of the provinces of Battambang, Pursat, Koh Kong, Kampong Speu, and Kampot. The area is vast – with almost unbroken forest cover remaining between Phnom Samkos in the northwest of the range to the coastal lowlands of Botum Sakor National Park – a distance of over 170 km. Appoximately 1.5 M ha or roughly 75% of the GCL is designated as some form of protected area, with the remainder classified as state forest, much of which was commercially logged until a national moratorium on logging was passed in 2002.

The vegetation of the GCL can be characterized as largely lowland moist evergreen forest below 600 masl with sub-montane moist evergreen forests associated with elevations higher than 600 masl. Other vegetation formations include coniferous forests associated with ridgetops and sub-montane shrublands, as well as grasslands

associated with ridgetops and shallow soils at higher elevations in the Cardamom Range. There are also bamboo forests with areas that were commercially logged during the 1980s-1990s.

Fauna & Flora International, Conservation International and Wildlife Alliance are the major conservation NGO's currently working in the Cardamoms, supporting a range of activities on strengthening PA management, law enforcement, improving local livelihoods inter alia. However there are numerous areas of significance for elephants currently receiving little by way of direct protection. The area between the Areng valley in the southeast of the Central Cardamoms Protected Forest (CCPF) and Chi Phat village in the Southern Cardamoms Protected Forest appears to hold a greater elephant population than anywhere else in the GCL and encounters between locals and elephants along with low-level HEC are common.

The Eastern Plains (EP) of Mondulkiri province are largely characterized by a mosaic of semi-evergreen and deciduous forests below 600 masl. There is some remaining sub-montane forest above 600 masl but this has largely been converted to grasslands up to an elevation of approximately 900 masl. A number of large protected areas cover the majority of the province, which in 2005 was estimated to have a staggering 94% forest cover. There are currently a range of international conservation NGOs working in the landscape including WWF, WCS and PRCF. The Seima Protection Forest in particular is confirmed to hold a large (ca. 120 individuals) genetically diverse and relatively well protected population (Pollard 2007). It should be noted that the EP are also being proposed as the primary Tiger Conservation Landscape (TCL) in Cambodia which should naturally afford greater protection to elephants and other wildlife as the proposed National Tiger Recovery Program (NTRP) comes into effect over the next decade or so.

Heffernan *et al*. (2001) noted the difficulties of surveying elephants at relatively low densities in forest, using dung encounter rates. However, more recently this issue has been redressed by the advent of molecular techniques and accurate studies based on faecal DNA have been conducted successfully. Faecal DNA based studies undertaken by WCS in the Seima Protection Forest (PF), Mondulkiri province and by FFI in the Cardamom Mountains have indicated a minimum number of individuals of 81 and 135 respectively. Capture mark-recapture (CMR) analysis indicates a maximum number of individuals of 116 in Seima PF, however CMR analysis was not possible for the Cardamom Mountains population due to a paucity of data from the DNA analysis. However, CR analysis yielded an absolute population estimate of 116 (±10) in Seima PF. A second survey in Seima PF was completed in 2011 and analysis of samples is currently underway. Results of this second survey will allow a preliminary trend analysis for this population, the first of its kind for Asian

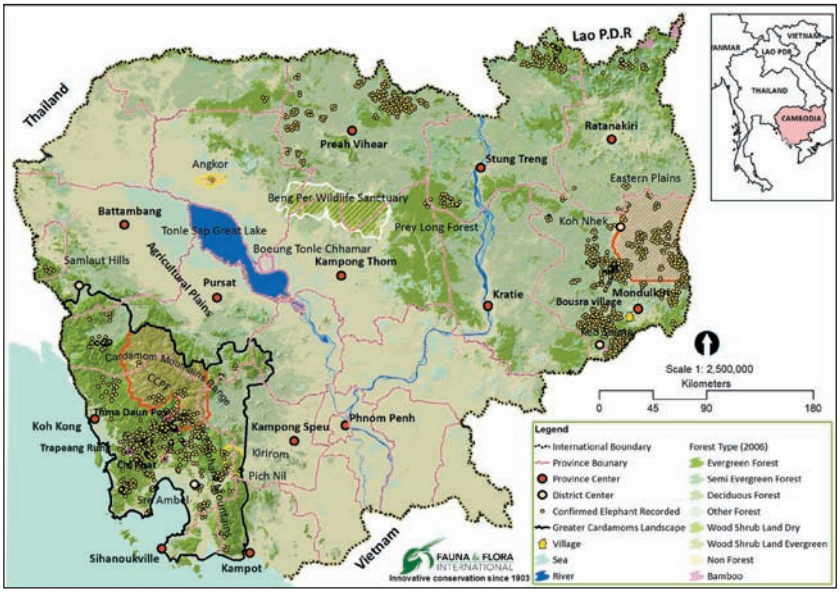

Figure 2. Elephant distribution (yellow) in Cambodia.

elephants in Cambodia. Analogous fecal DNA surveys have also been carried out by WCS in Preah Vihear Protected Forest in the Northern Plains and by WWF in Mondulkiri Protected Forest and Phnom Prich Wildlife Sanctuary, in the Eastern Plans. Both surveys are expected to yield absolute population estimates and the results of the genetic analysis are pending.

Illegal killing of elephants has occurred on an extremely low scale over the past five years, with 2010 being the first year since 2005 that a wild elephant was reported killed due to HEC. Coupling this with numerous field reports from FFI of new elephant calves during the same period, it has been speculated that each of the country's two major elephant landscapes could be tentatively estimated to hold a population of at least approximately two hundred animals (Tuy Sereivathana, pers. comm.). Indeed, new data from ranger patrols indicates that elephants are using huge areas of lowland forest in western Koh Kong province that were previously not thought to hold elephants and have not yet been comprehensively surveyed.

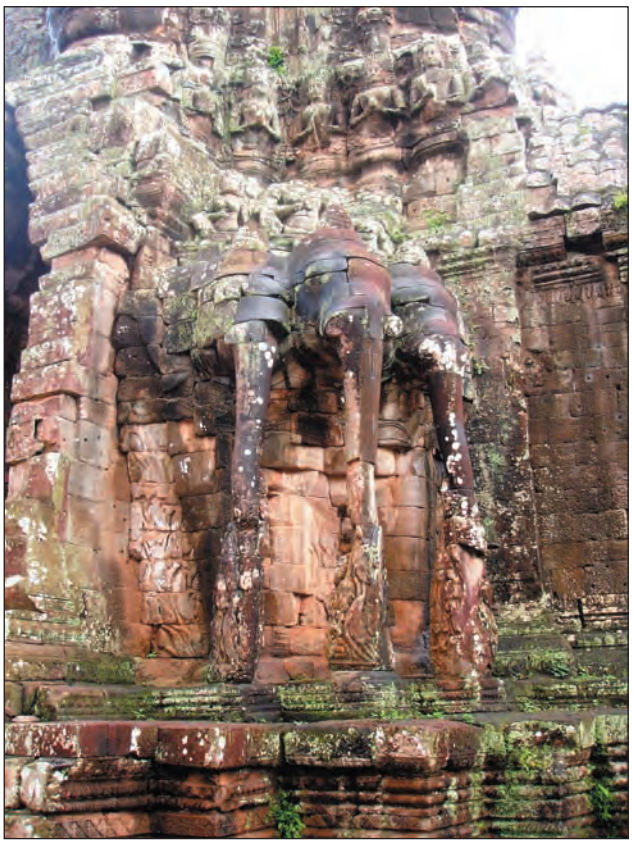

Figure 3. Terrace of the Elephants at Angkor Wat..

Observing elephants in Cambodia remains a huge challenge. Indeed, it is rare for field workers to catch more than an occasional fleeting glimpse of elephants disappearing into the forest. This is probably due to the historically high levels of elephant hunting and a heightened sense of wariness of elephants towards humans. Thus there is currently nowhere one can safely visit and have a high chance of observing wild elephants.

Threats

Four wild elephant deaths were reported in 2010. In Seima Protection Forest, Mondulkiri province, one pregnant female was poached, presumably for body parts and in a separate incident the remains of one juvenile elephant were found, although the cause of death was unknown (KOK Bunly, CHEA Virak, pers. comm. Forestry Administration). One male tusker was killed for ivory inside the Mondulkiri Protected Forest and one female died from suspected starvation in Prey Long forest, Kratie province after losing the end of her trunk to a snare (CHEA Virak, pers. comm.).

The 1999 sub-decree issued by the Royal Government of Cambodia "Management and Control of All Types of Firearms and Explosives" prohibited ownership of all firearms and has been largely successful in removing a lot of guns from the hands of hunters, however an extensive range of firearms still remain reasonably accessible on the black market. An FFI study tour of Indochina in 2010 indicated that Cambodia probably has the lowest level of illegal killings from both direct poaching and due to repercussions from HEC in the region.

25% of Cambodia's land cover is designated as a protected area, compared to a regional average of approximately 11%. Despite this fact, habitat loss and degradation remain the largest threat to Asian elephants in Cambodia.

With economic growth averaging 5.5% over the last decade, protected areas and forests at large are struggling to compete with competing land uses, such as mining operations, hydropower schemes, agribusiness and other forms of economic development. The Cambodia Daily newspaper

recently reported on the current "bonanza of concessions inside conservation areas", and calculated that 1100 km^2 of protected area land was privatized between February and April 2011. This equates to an average loss of 1997 ha per day during the same period. (*Cambodia Daily, 29th April 2011*). By comparison, small-scale land clearing by subsistence farmers remains a problem but is relatively manageable inside protected areas with management plans and assistance from external agencies. Moreover, protected areas receiving little or no technical and/or financial assistance from external agencies generally experience much higher incidence of illegal land clearance, hunting and trapping.

At the turn of the millennium, human elephant conflict in Cambodia was relatively localized but nevertheless acute, and resulted in a small number of injuries and deaths to both people and elephants, (HEC database, FFI, MoE, FA). Key HEC "flashpoints" are along the northern side of National Road No. 4 between Kirirom National Park and Sre Ambel town, Kompong Speu and Koh Kong Province; outer-lying villages around Chi Phat, Thma Daun Pov and Trapeang Rung communes, Koh Kong province; and to a lesser extent various communities around Keo Seima, Bousra and up into Koh Nhek district, Mondulkiri province. It should be noted that the majority of cases reported in recent years occur in areas where people have illegally encroached creating settlements or farmland inside protected areas.

Small-scale crop and property damage is a regular but localized occurrence in a number of forest-edge communities in Koh Kong and Mondulkiri provinces, with individual farms commonly experiencing significant damage to crops overnight. Serious property damage is less common, however one example from Khmer New Year 2009 (Fig. 4) demonstrates the need for constant vigilance on guarding crops when the village-led elephant guarding group left their stations to celebrate in a nearby town. When they returned two days later they found numerous farm buildings and houses destroyed and access to a plantation blocked by trees dragged by elephants.

Elephant management and HEC mitigation

The remit of managing wild elephants is shared between two government ministries: the Forestry Administration (FA), responsible for the management of Protected Forests and the broader forest estate outside of protected areas; and the Ministry of Environment, responsible for the management of Cambodia's twenty three protected areas including National Parks, Wildlife Sanctuaries and Multiple Use Areas. All domestic elephants are required to be registered with the FA.

The initial mapping and design of protected areas in 1993 was largely informed by data on the diversity of vegetation, in an attempt to conserve all areas of floristic significance. Wildlife, including large mammals and elephant were generally abundant and roamed over larger areas in addition to the proposed protected areas. (Ashwell, pers. comm.).

Fortunately these areas (Protected Forests, National Parks and Wildlife Sanctuaries) now overlap with what are now considered to be of major importance for elephant, but this also explains why some areas were not designated as PA's and why "gaps" in the protection of wild fauna remain to date, particularly within the Greater Cardamoms Landscape.

There are no proactive attempts by government or other agencies to restrict the elephant population

Figure 4. Major damage by elephants at Khmer New Year.

to protected areas. This is partly because land use pressures are relatively low on state forests (although they are likely to increase as the country develops) and the likelihood that the majority of crop raiding is done by relatively few individual elephants, plus the fact that the two main PA complexes are so large. Thus, there has never been a need for elephant drives or similar measures to be conducted.

In close collaboration with the Royal Government of Cambodia's Forestry Administration and Ministry of Environment, FFI began work to assist villagers to mitigate HEC in 2003. A range of measures have been employed to date, including support to land use planning initiatives at a village level in an effort to relocate crops vulnerable to elephant depredation away from the forest edge to areas where they can be more easily guarded; a local language "*HEC Toolbox – A Guide for Farmers Living with Elephants*" have been distributed in communities experiencing HEC; and complementary technical support on the deployment of mitigation measures such as fireworks, other noisemakers, watchtowers, planting of bio-fences and solar-powered electric fences is ongoing.

All mitigation measures are very much focused on building community capacity to locally manage HEC without the need for long-term financial or technical support, thus reducing the pressure on under-resourced government departments to deal with the problem. Compensation is never paid to farmers experiencing crop loss or property damage and is deemed to be unsustainable in the Cambodian context, though an insurance scheme could be of use and warrants further investigation.

Data collected by the Cambodian Elephant Conservation Group (FA, MoE, FFI) in 2009/10 shows an average of 2-3 HEC events reported to government every week. Webber *et al*. (2011) reports that damage to crops recorded between 2003-2008 varied significantly by crop, with rice, banana, cassava, sugar cane and papaya most frequently raided, and a peak-raiding season recorded between October-December. Most crop raiding occurs in Koh Kong province, followed by Mondulkiri however there were no significant differences between years. Levels of crop damage were reported to decrease after mitigation strategies such as observation towers, deterrents and fences were implemented (Webber *et al*. 2011).

FFI has been piloting the use of low-cost solar-powered electric fences for four years now. Fence units are lent to community members on a long-term loan basis and after training are responsible for their maintenance. Practitioners in the field report multiple incidents of successful repels and not a single breach of fences to date.

One "rogue" elephant was captured in 2004 and re-housed in the Phnom Tamao Wildlife Rescue Centre after causing high levels of crop and property damage and posing a direct threat to the safety of villagers. The animal was found in a palm-oil plantation in Sihanoukville province and was thought to have originated from Bokor National Park nearby. Upon closer inspection it was discovered that a huge metal spike in the animals foot was the cause of the rampage, and after its removal the elephant made a full recovery in captivity. Translocation of wild elephants is currently not a practice used for elephant management in Cambodia.

Captive elephants

The owners of captive elephants in Cambodia are required by law to register their animals with the Forestry Administration, and this has largely been done. There are perhaps a small number of animals that are not yet registered. The majority of captive elephants are privately owned by individuals, often members of ethnic minority groups in the northeast provinces of Mondulkiri and Ratanakiri. A handful of elephants are privately owned in Siem Reap province and used for tourism purposes around the temples of Angkor; and there are currently five elephants cared for at the government-run Phnom Tamao Wildlife Rescue Centre and Zoological Gardens, as well as three elephants at a poorly run private zoo in Kampot province.

Table 1. Breakdown of elephant numbers by province.

Province	Males	Females	Total
Mondulkiri	26	37	63
Ratanakiri	2	9	11
Takeo	1	4	5
Kampot	2	1	3
Siem Reap	3	15	18
Phnom Penh	0	1	1
Total	34	67	101

In the 1997 FAO report "Gone Astray", captive elephant numbers were estimated to be between 300-600, while Chheang *et al*. (2001) calculated the number to be approximately 162 based on field studies.

A 2009 study by FFI identified 101 captive elephants nationwide (Table 1). However, reports from 2010 suggest that six elephants have since died of old age in Siem Reap province and one male was donated along with one female from Ratanakiri to a zoo in South Korea in an act of "elephant diplomacy". This gives a tentative total of 93 known captive elephants in Cambodia today.

Privately owned captive elephants are largely managed in isolation from other captive elephants, with the exception of seven elephants working with the Elephant Valley Project in Mondulkiri province. However, where possible, captive elephants are often released by their owners to browse for food in surrounding forests. Breeding between captive elephants owned by indigenous groups is actively discouraged and is a cultural taboo. It is thought that past pregnancies were the result of interaction with wild bulls.

There is currently no effort to breed existing captive elephants with a view to maintaining the domestic population in Cambodia. Indeed, many of the animals are too old, with only a handful of candidates scattered across the country that might have breeding potential. Even if political will could be garnered for a breeding program, the cost would be prohibitive. Preserving Cambodia's heritage of elephant domestication is more a question of cultural conservation than it is a wildlife conservation priority and barring the import of animals from overseas or capture from the wild, it is likely that the current captive elephant population will continue to decline and eventually die out in the next 10-20 years.

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Gajah 35 (2011) 43-46

Current Status of Asian Elephants in China

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Introduction

Asian elephants are only found in a very small area of southern China with a total number of individuals less than 200. They occur in bamboo-broadleaf mixed forests along gullies and rivers, at altitudes under 1000 m. Current elephant habitat is highly fragmented and consists of isolated patches situated among extensive stretches of tea and rubber plantations, and croplands. Habitat loss and poaching were once major threats to elephants in China, but since the 1980s, effective conservation measures have been adopted by the Chinese government to protect elephants by establishing nature reserves and banning illegal hunting (Zhang *et al*. 2006). Asian elephants are listed as a class I protected wildlife species under the Wildlife Protection Law (Zhang 2007).

In the current distribution area in Yunnan, local indigenous groups including Aini, Dai, Jingpo and Wa believe that elephants can bring luck. Elephant figurines made of wood or stone and depiction of elephants on paintings can be found in many local temples. Elephants are also used as a symbol of good fortune in local religious events. Elephants are an important tourist attraction in the Wild Elephant Valley in Xishuangbanna. However, with the rapid increase in human activities in elephant range areas in the past decade, human–elephant conflict has become a problem, challenging the survival of this endangered species in China (Zhang & Wang 2003).

Wild elephants

Past elephant distribution

In 1976, elephant bones and teeth were found in the Sangganhe area near Datong of Shanxi Province in North-west China. This is believed to be the most northern distribution record of Asian elephants in China, which historically dates back to the Xia dynasty about 4000 years ago (Jia & Wei 1980; Sun *et al*. 1998). More than 3000 years ago, large populations of Asian elephants still roamed the forests along the Yellow River. As farming clans spread through south China, elephant distribution receded south at a speed of 0.5° of latitude per century (approximately 0.5 km per year), and now hold their position only in a small area of the country's mountainous and frontier areas (Sun *et al*. 1998).

Current elephant distribution

The remnants of China's once abundant population of Asian elephants are living in the lush rainforests that cover the southern- most part of China's Yunnan Province, bordering Myanmar and Laos (Zhang *et al*. 2006). Elephants can be found in Xishuangbanna, Pu'er and Lincang, prefectures (Fig. 1), with a total number of 178-193 (Yang 2010).

There are 18-23 elephants living in the Nanguanhe national nature reserve in Lincang, where about 8% of forest was lost in the past 30 years (Feng *et al*. 2010). In Pu'er, there are about 34 elephants consisting of 3 small family groups and 2 bulls. All of them migrated from Xishuangbanna to the area since 1996. More than 90% of wild Asian elephants in China occur in Xishuangbanna, which is located in the extreme southern part of Yunnan, including 3 sub-populations in Mengyang, Mengla and Shangyong. In Mengyang, there are 63 individuals identified with morphological characters from 697 images taken in the protected area from 2003 to 2010, including 10 bulls and 10 family groups (Liu, unpublished data). With the dung DNA capture-

recapture methods, 76-108 elephants were estimated to be present in Mengyang area (Cai 2007), but two family groups, 28 individuals and 2 bulls, dispersed north to Pu'er in mid 2000s. There are 60-68 elephants distributed in Shangyong Protected Area and 25-32 elephants in Menglang Protected Area bordering Laos (Lin *et al*. 2011; Chen 2005).

Threats

Competition over land resources seems to fuel human-elephant conflict. Over the past five decades, the demand for economic development has pushed farmers to convert forested areas to farmland. The area covered by natural forest in Xishuangbanna decreased from 1.05 million ha in 1952 to 0.3 million ha in 1994, whereas the area of land represented by farmland increased from 36,242 ha in 1949 to 114,774 ha in 1998 (Guo *et al*. 2002). In response to this, efforts have been made to maintain and enlarge the protected areas; for example, in Xishuangbanna, the local government relocated 1120 people comprising 195 households in eight villages out of the core protected area, and in Nangunhe National Nature Reserve, more than 120 households were moved. However, such measures had the effect of removing the buffer zones or other forms of separation between human habitats and reserves.

Local governments have to cope with the pressures of limited arable land and small budgets, and hence can ill afford any resettlement plan. Conversion of wild habitats into cultivated lands or areas of intensive forestry production has declined greatly in recent years due to rigorous management by local forestry bureaus. However, efforts to restore wild habitat are offset from time to time by people who appropriate state-owned land, which is often forested and remote from other communities.

In Xishuangbanna, the average annual human population growth rate in 2003 was 2.16%, which was much higher than the national average of 1.07% (National Bureau of Statistics of China 2003). In an agriculture-based economy, an increase in the human population inevitably places pressure on natural resources, especially land resources (Zhang *et al*. 2006).

Although the Asian elephant is a class I protected species in China, the reappearance of wild elephants was not welcomed by local farmers. Humans have dominated this land for generations, and their lives are closely tied to it. Competition between humans and elephants over this limited resource affects both. Conflicts first become acute in communities bordering the protected area, and farmers suffer the most. Bamboo, pineapple and sugar cane, which are major income sources for local farmers, are the crops most frequently raided by elephants (Zhang *et al*. 2006). Rubber plantations are also affected, as elephants often trample plantations of young trees, breaking them.

Wild elephants cause heavy property loss almost everywhere they make an appearance in Xishuangbanna Prefecture (Bureau of Statistics, Xishuangbanna 2002). In some remote areas, elephants even enter houses to locate food. In the affected areas, people are so frightened that some do not visit friends after dusk or send their children to school in the early morning. These conflicts between humans and elephants also detract from the limited resources that governments can invest in conservation projects. According to the provincial wildlife-caused-damages compensation legislation of Yunnan, local county and prefecture governments are

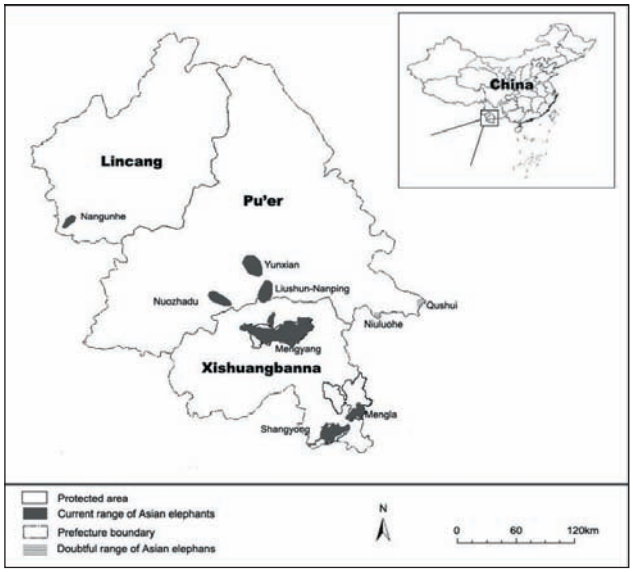

Figure 1. Current distribution of Asian elephants in China.

responsible for half of the compensation paid for life and property loss caused by protected terrestrial wild animals (Government of Yunnan Province 1998). Although local governments attempt to raise funds for compensating farmers for crops damaged by elephants and other wildlife, the compensation is not sufficient. The gap between the value of crops damaged by elephants and compensation awarded to farmers becomes wider each year, and would overshadow current conservation achievements if no further measures were taken to prevent crop damage. Since 2009, Xishuangbanna National Nature Reserve started cooperating with commercial insurance companies to purchase social insurance to compensate crop damages caused by wild elephants in the prefecture. Elephant crop raiding insurance was also introduced in Pu'er by the local forestry department in 2010.

From 1985 to 2003, elephants in the three prefectures of Linchang, Pu'er and Xishuangbanna accidentally killed 13 people (Bureau of Statistics, Xishuangbanna 2002; Zhang & Wang 2003).

Elephant in China
Photo by Aidong Luo

With the ever-increasing resident population around protected areas, contact between humans and elephants may become more frequent and lead to more tragic accidents. Such tragedies will undermine the authority of local wildlife conservation departments and fuel the resentment that humans have towards elephants. Since the State Forestry Administration and local governments are not permitted to deal with problem elephants, locals sometime risk the penalties and take action themselves. In the autumn of 2002, wild elephants in Xishuangbanna killed three people, and in retaliation farmers then killed a 7-year-old male elephant. From 1992 to 2007, there were 32 elephant deaths in Shangyong protected area in Xishuangbanna including 7 tuskers poached for ivory (Lin *et al*. 2011).

Captive elephants

There were few elephants in zoos in China in the past 50 years. They mostly comprised of captive elephants from India, Sri Lanka and Thailand given to the Chinese government as official gifts and kept in zoos since 1950s. A few zoos have successfully bred Asian elephants in captivity in Beijing, Fuzhou and Shandong. Since late 1990s, over 20 safari zoos have been established in China, and demand for captive elephants has increased sharply. Captive elephants have been imported from Thailand and Myanmar legally or illegally into China since then.

Currently there are about 50 elephants in captivity in China. Most of them belong to state owned or private owned zoos and safari parks for tourism. There are also three rescued wild elephants kept in the breeding center in Xishuangbanna for a national captive breeding program. However, there has not been any success in breeding at this center since 2004. Another 20 captive elephants were imported from Thailand to the Wild Elephant Valley in Xishuangbanna for tourism and circus performance in 2007. They are rented from the Thai private sector and are allowed free range for foraging after performances everyday, and have interactions with local wild groups sometimes. Three calves were born to this group in recent years.

All captive elephants are registered under the State Forestry Administration, which is the key governmental agency responsible for wildlife conservation and management. Elephants in zoos are under the management of the Ministry of Housing and Urban-Rural Development.

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Elephants in China
Photo by Aidong Luo

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Current Status of Asian Elephants in India

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Introduction

India holds by far the largest number of wild Asian elephants, estimated at about 26,000 to 28,000 or nearly 60% of the population of the species (Bist 2002; data from Project Elephant Directorate in 2011). *Elephas maximus* is placed in Schedule I and Part I of Indian Wildlife Protection Act (1972) conferring it the highest level of protection. Historically, the significance of the elephant in Indian culture and mythology, as well as its economic and military role in subcontinental armies, has also contributed to a remarkable level of tolerance and support of people towards its survival and conservation (Sukumar 2011). However, the resource needs of a growing human population (over 1.2 billion people: Census 2011) of a country experiencing strong economic growth, growing and dispersing elephant populations at regional scales, shrinkage and fragmentation of elephant habitat, and increasing human-elephant conflicts emphasize the urgent need for appropriate long-term policies to manage and conserve the species.

Given its long history of about 4500 years in taming the elephant (Sukumar 2011), India also presently manages 3400-3600 elephants in captivity (Bist 2002). Captive elephants have been used for a variety of purposes in India including warfare, logging, cultural and religious ceremonies, recreation in zoos, and circuses and more recently for wildlife tourism and protection of Sanctuaries and National Parks. However, with declining work due to the ban on timber logging in the country and the use of modern machinery, the traditional interest among private owners and state forest departments in managing captive elephants is diminishing. In contrast, demand for elephants in temples, which once received its animals from the state forest departments, continues to increase with their stock getting depleted due to old-age deaths and absence of recruitment from breeding.

Wild elephants

Past distribution

The present-day distribution of elephants in India is a fraction (about 3.5%) of its former range that extended from south of Himalayas to cover the entire subcontinent with the exception of the most arid tracts about six thousand years ago (Nair *et al*. 1980; Sukumar & Santipillai 1996; Sukumar 2011).

The Kautilya *Arthasastra* (c. 300 BCE – 300 CE) records the presence of elephants in eight *gajavanas* or elephant forests north of Krishna river, including places such as Saurashtra from where it has completely disappeared (Trautmann 1982). Information on the distribution of elephants in central India is available from memoirs and writings of the Mughal emperors of the 16th and 17th centuries (Ali 1927; Sukumar 2011); these indicate that elephants were once widespread from southern Uttar Pradesh through Madhya Pradesh and Chhattisgarh from where they disappeared (though elephants have recolonized Chhattisgarh in recent times). By the late 19th century, expansion of agriculture and settlement had shrunk their distribution to the forests at the foothills of the Himalaya, east-central India, and southern India. Although, the number of wild elephants in historical times is not known, a record of the French navigator Pyrard de Laval from the period of the emperor Jahangir (early 17th century) indicates a total of about 40,000 elephants (possibly captive plus wild) within the territories of the Mughal empire and Bengal (Sukumar 2011).

Present distribution

Wild elephants are presently confined to the forested hilly tracts of four different regions: (i) the foothills of Himalayas in the north (ii) the north-eastern states (iii) the forests of east-central India, and (iv) the forested hilly tracts of Western and Eastern Ghats in southern India (Fig. 1). A small population of feral elephants exists in the Andaman Islands. A brief account of the status and distribution of elephants for the four major regions in India is given below. Population estimates for several major and smaller populations are available from independent research studies as well as from population estimation carried out every 4-5 years by the concerned government agencies; we have provided only the latter figures in this write-up in order to make valid comparisons over time and across regions.

Northeastern India: Elephant distribution in this region extends along the Himalayan foothills from northern West Bengal eastward into the states of Assam, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura and Meghalaya. Some of these ranges are contiguous to Bhutan, Bangladesh and possibly Myanmar. The region is estimated to hold approximately 9000-9500 elephants, but figures from 1997, 2002 and 2007 show a decrease compared to 1978-83 and 1993 (Table 1), a likely consequence of significant loss of habitat in states such as Assam and Meghalaya. The elephants of this region are spread across 32,600 km^2 (Table 1, Fig. 1), but divided into perhaps as many as 14 sub-populations, with only four of them [North Bank of the Brahmaputra in Assam and Arunachal Pradesh (3250 elephants), South Bank—Eastern Areas in Assam and Arunachal (1200 elephants), South Bank—Central Areas of Kaziranga-Karbi Anglong-Nagaland (2950 elephants) and South Bank—Western Areas of Assam extending into Meghalaya (3000 elephants)] remain fairly large, over larger areas (for more details see Choudhury 1999). The elephant habitats in this region have experienced tremendous pressure from legal and

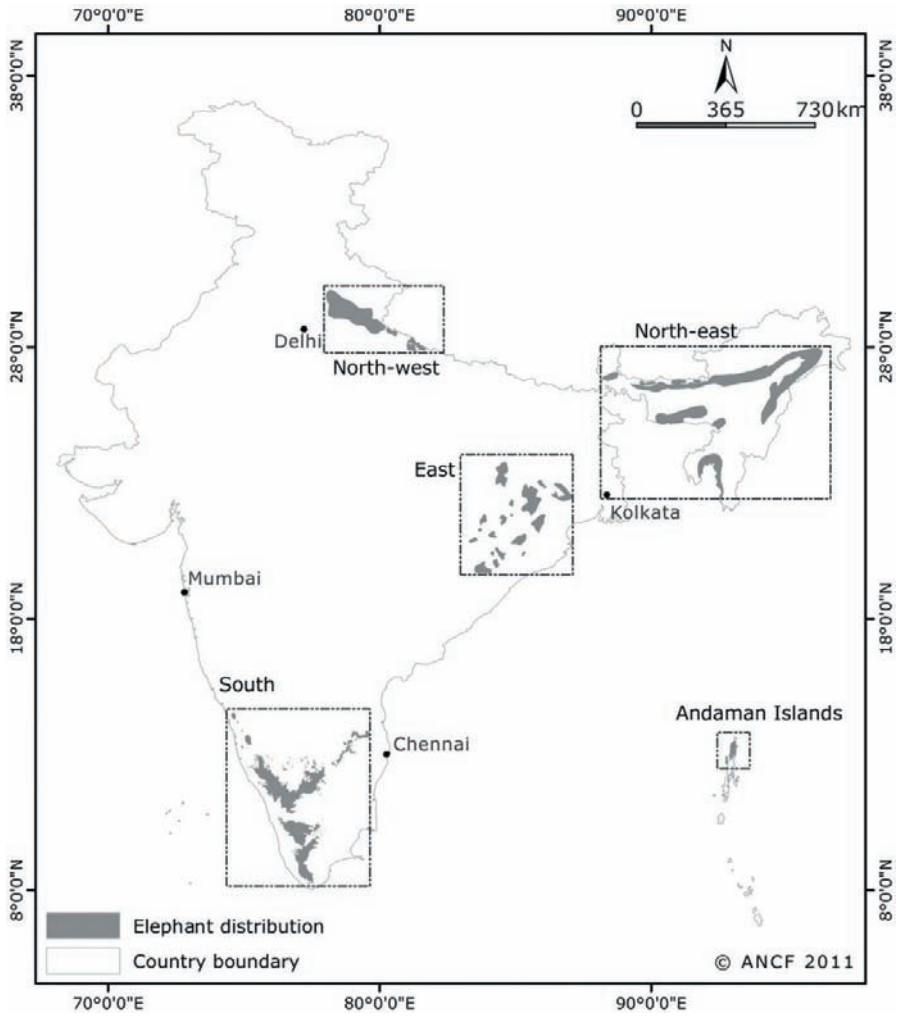

Figure 1. Map showing the regional distribution of Asian elephant in India.

Table 1. Estimates of regional wild elephant numbers in India.

Region	Habitat [km^2]	# corridors[a]	1978-83[b]	1993[c]	1997[c]	2002[c]	2007[c]
Northeastern	41,000	36	10,273	11,027	9482	9243	9330
Northern	5,500	12	525	875	1200	1667	1726
East-central	23,500	20	2310	2314	2444	2649	2633
South	39,500	20	6450	11,353	12,716	12,814	14,005
Andaman Islands	500	-	?	35	35	40	?
Grand total	110,000	88	19,558	25,604	25,877	26,413	27,694

[a]Corridors based on the list provided in Menon *et al*. 2005.

[b]Total count method, North-east: Lahiri-Choudhury 1980, IUCN North-east India Task Force 1981; North-west: Singh 1978; East: Shahi 1980, South: Nair *et al*. 1980.

[c]Synchronized elephant census (sample block count method), Project Elephant website, Bist 2002.

illegal logging, shifting cultivation, monoculture plantations and encroachments. Within a span of 10 years (between 1991 and 1999) elephant habitat to the tune of over 3000 km^2 was lost from Arunachal Pradesh, Assam, Manipur, Mehalaya, Mizoram and Nagaland (Bist 2002) due to encroachment and deforestation. The prospects for the conservation of elephant in the northeastern India are seriously affected by habitat loss, fragmentation and increasing human–elephant conflict.

Northern India: The elephant range is spread in a west-east direction along the foothill forests and floodplains of the Himalaya in the states of Uttarakhand and Uttar Pradesh, partly adjoining Nepal. The region is presently believed to support about 1700 elephants and the numbers have shown an increasing trend over the years (Table 1). Rajaji and Corbett National Parks and Lansdowne Forest Division are the important elephant habitats of this region (Singh 1978). Prior to independence, the range of the elephant was probably contiguous along the *terai-bhabbar* tract from the river Yamuna in the west to the river Sharda in the east. Post-independent large scale developmental projects in the form of irrigation and power generation projects, expansion of human settlement and cultivation along the major rivers, and introduction of monoculture forest and commercial plantations have fragmented the habitat apart from creating bottlenecks to elephant movement at about a dozen locations (Johnsingh *et al*. 1990; Singh 1995).

East-central India: The elephants of eastern India are distributed over 23,500 km^2 mostly in the Chota Nagpur plateau across the states of Orissa and parts of Jharkhand (Shahi & Chowdhury 1986; Sar & Varma 2004). Since 1986 some of these elephants have also been moving into neighbouring states, in particular to southern West Bengal, Chhattisgarh and, more recently, to northeastern Andhra Pradesh, where they are in serious conflict with people. Recent estimates (Synchronized Elephant Census 2002 and 2007) place the figure at around 2650 elephants (Table 1), with elephants of Orissa constituting over 70% of them (1860 elephants) followed by Jharkhand (624 elephants), Chhattisgarh (122 elephants) and southern West Bengal (25 elephants resident). The elephant habitats of this region are a diffused mosaic of natural forest, often degraded or fragmented, village forest, as well as cultivation and mining. Large-scale mining for minerals such as iron, manganese and chromate is the single largest threat to the conservation of elephants in northern Orissa and southern Jharkhand. The most viable habitat and population of this region is undoubtedly the Mayurbhanj Elephant Reserve (that includes the Simplipal Tiger Reserve) in Orissa, while other sizeable populations are also found in the Mahanadi and Sambalpur Elephant Reserves of the same state, as well as the isolated Palamau Tiger Reserve in Jharkhand where elephants were introduced by the rajah of Sarguja during the early 20th century.

Southern India: The elephants in southern India range over forested hilly tracts of the Western Ghats and its adjacent Eastern Ghats in the states of Karnataka, Kerala and Tamil Nadu, and more recently in a small area of Andhra Pradesh, Maharashtra and Goa. Their distribution has shrunk to within the Ghats owing to increase in human population and its resultant opening of new land for the expansion of agriculture,

commercial plantations, and hydroelectric and irrigation dams (Sukumar 1989). At present, elephants are found in five major landscapes in southern India as follows:

- Uttara Kannada and crestline of the ghats, mainly in the forests of Dandeli as the important elephant habitat with approximately 40-50 elephants that includes a few elephants that move into Maharashtra and Goa.
- The Malnad plateau, in particular the Bhadra Wildlife Sanctuary, to the east of the ghats holds an isolated population of about 250 elephants.
- The Brahmagiri–Nilgiri–Wyanad–Mysore landscape with the Nagarahole, Bandipur, Wyanad and Mudumalai complex of reserves harbours one of the highest elephant densities (about 2 individuals/km^2) in Asia, followed by significant numbers in the Biligirirangans and the hilly tract along the Cauvery river of the Eastern Ghats. This landscape is estimated to support over 8800 elephants. A small population of elephants that dispersed from here in the 1980s now ranges as scattered groups over isolated hills to the east in Andhra Pradesh and Tamil Nadu.
- Anamalai–Nelliyampathy–High Ranges landscape with Anamalai, Parambikulam, Malayattur and Vazahchal Forest Divisions being the most important elephant habitats supporting over 3000 elephants, includes ca. 225 isolated elephants in Idukki Sanctuary and Kothamangalam Forest Division.
- Periyar–Agasthyamalai landscape with Periyar, Ranni, and Srivilliputhur as the most important elephant habitats harbouring nearly 2000 elephants including ca. 250 elephants isolated to the south of Shenkota pass in the Agasthyamalai hills.

Wild elephants in Corbett National Park
Photo by A. Christy Williams

In total about 14,000 elephants (Synchronized Elephant Census 2007, Table 1) are found in southern India, with over one-fourth of the habitat being Protected Areas and signs of growing numbers in some populations (Baskaran *et al*. 2007). This population has great conservation significance for the species.

Island Population: There are 40 feral elephants in Andaman and Nicobar Islands (Synchronized Elephant Census 2002) confined to Diglipur Forest Division in North Andaman and the Interview Island Sanctuary (Sivaganesan & Kumar 1995). These elephants were taken from mainland for timber extraction and abandoned by the company in 1962 (Sivaganesan & Kumar 1994).

Threats in country to elephant conservation

Habitat loss and threat of further fragmentation are perhaps the most important threats to the conservation of elephants in the country. Many of the existing corridors are threatened by infrastructure development in a rapidly growing economy, being susceptible to activities such as construction of new roads and railway lines or expansion of existing ones (as in the northeast), tourism infrastructure (as to the east of Corbett National Park in the north), mining (as in Keonjhar and Saranda districts in the east-central region) and demand for large dams (as in the south). To give an example from one such threat, about 44 elephants have died in direct collision with trains across the country over a period of five years (2006-2011).

Fragmentation, loss and degradation of habitat, combined with increasing elephant populations at places (and cessation of elephant captures), has escalated elephant-human conflicts in the country with resulting manslaughter, damage to cultivated crops and property. Added to the chronic conflict prevalent at places is the phenomenon of dispersing elephant clans since the early 1980s in practically every region that

sharply increases conflict between elephants and people who have not experienced elephants in their midst for decades or centuries.

From 1998 to 2001 there were 900 human deaths due to elephant attacks in the country, an average of about 250-300 people per year that has since increased to over 400 deaths in 2010. With such a huge loss of life, apart from loss of crops, the government presently spends a substantial proportion of its conservation budget in compensatory payments (or ex-gratia payments as they are officially termed). In spite of this people have retaliated against raiding elephants by poisoning or electrocuting them; during 2006-2011 at least 200 elephants died in this fashion.

Illegal captures of wild elephant calves for trade of captive elephants are reported to take place in a few places in the northeast along the Assam-Arunachal and Assam-Nagaland border.

Ivory poaching has been one of the major threats to conservation of elephants in the country. The threat to tusked male elephants began to assume serious proportions in southern India during the 1970s and accentuated during the 80s and 90s resulting in the most skewed sex ratios in Asia. In Periyar Tiger Reserve, for instance, the adult male:female ratio skewed to about 1:100 by the 1990s (Ramakrishnan *et al*. 1998), a situation that improved to about 1:60 by 2005 (Arivazagan & Sukumar 2005). The impact of ivory poaching is also reflected on skewed sub-adult and juvenile sex ratios in many populations of the south. Over the past decade, ivory poaching has been most visible in the east-central state of Orissa but the extent and impact have not been fully evaluated.

Elephant management and HEC mitigation

Although the state forest departments had been managing elephant-human conflicts through several means such as barriers, captures and drives, the launch of Project Elephant in 1991-92 by the Indian government provided enhanced and a more steady source of financial resources and an action plan to address this problem. Compensatory (or ex-gratia) payments have been the mainstay of providing solace to people who have lost their crops, property or kin to elephant depredation and attacks. State forest departments have also been active in putting up barriers along the forest-agriculture boundary in order to prevent elephants from moving outside their natural range into cultivated areas. The use of ditches or trenches as a barrier has only met with limited success as these fail completely in areas of high rainfall. When used in conjunction with the high-voltage electric fence it seems to be more effective in dry zones with hard soil. Electric fences are the other common barriers used widely across the country; the success of such fences has again been limited at many places because of problems in satisfactory maintenance. When fences are privately owned or when local communities are involved in fence maintenance the success rate is usually much higher. West Bengal has used anti-depredation squads, equipped with a vehicle for rapid response, lights, and guns, with reasonable success in the northern sector to drive elephants entering paddy fields and tea gardens, but here again there is no guarantee of absolute success.

In recent years, the state governments in southern India have successfully utilized a large section of the tribal population for effective control of ivory poaching in Protected Areas and outside. The anti-poaching squads also perform additional functions including driving of crop raiding elephants (anti-depredation squads) and as firewatchers. A network of camps has been set up at strategic locations, manned by local tribals and headed by a permanent staff of the department. They are connected through a wireless network and provided food supplies and arms for protection.

The increasing dispersal of elephant herds or clans, as well as solitary bulls, into newer habitats has brought fresh challenges to management. States have experimented with elephant drives (as in Tamil Nadu during the 1980s) as well as capture and either maintenance in captivity (as with a large number of bulls in Karnataka since about 1987) or the occasional relocation (that has usually failed, the most recent examples being two bull elephants captured in Hassan district and relocated to Bandipur, a distance of over 150 km, in Karnataka). The occasional “rogue” elephant,

usually a bull, that has killed several people or is on the rampage has also been killed as a control measure.

Project Elephant firmly introduced the concept of landscape-level planning for the conservation and management of a long-ranging animal such as the elephant. Some success has been achieved with respect to strengthening elephant corridors, especially in the states of Karnataka and Kerala, with the help of Non-government organizations. Much more needs to be done in the direction of integrated land use and developmental planning at landscape level, that is also sensitive to local social and economic issues, in order to achieve long-term conservation of the species. A second task force appointed by the Indian government addressed some of these issues in more detail in 2010 (Rangarajan *et al*. 2010).

Captive elephants

Captive elephants were maintained in the thousands, mainly in the armies of rulers of the subcontinent, in ancient times (Bist 2002; Sukumar 1989; Sukumar 2011). The historical records indicate that peaks in captive elephant management (or more specifically war elephants) were reached during the Mauryan period in 3rd century BC and the Mughal period in early 17th century. Large numbers of elephants were captured for this purpose. For example within the time span of about one century (1868-1980) records indicate that 30,000–50,000 wild elephants were captured, especially in the northeast of the country (Sukumar 1989). The official estimate of the current numbers of captive elephants is between 3467–3667 animals (Project Elephant Directorate 2000).

Reduction in captive numbers could be attributed to many factors, including modernization in forestry operations leading to the use of machines and changed lifestyle, consequent redundancy of elephants, legal statutes banning capture of wild elephants and limited work opportunities for elephants with increased cost of maintenance.

Captive elephants kept in India can be classified based on ownership type (government-owned or private) and on the predominant work performed by the elephants. This may help in identifying ownership such as circus (owned by private companies or individuals, and the elephants used for performing before an audience), forest camps (owned by the government, maintained near forest areas), ownership by private individuals (such animals may or may not be used for work), travel-begging (either owned by private individuals/institutions, elephants used mainly for travelling and begging in cities), temples (owned by religious institutions, state run/private organizations) and zoological gardens (owned by the government, elephants may/may not be used for work).

The form of management of captive elephants varies widely with forest camp elephants kept in natural surroundings, allowed some degree of free ranging with access to a water body, and usually provided a mixture of natural fodder and supplementary food in the form of cooked grain (as in Tamil Nadu). Some privately owned elephants in states such as Assam and Kerala are fortunate to be kept on natural flooring but others are kept on concrete floors or made to walk on

"Thechikkottu Kavu Ramachandran" in Kerala
Photo by Marshal C. Radhakrishnan

asphalted roads for long periods. They are also usually stall fed. Zoo and circus elephants are kept in restricted spaces on a combination of hard and natural flooring, and either permanent or temporary shelters. Temple elephants are usually confined to shelters inside the temple premises and stall-fed. All captive elephants have some form of restraint such as ropes and chains. Veterinary care is usually best provided in government-owned forest camps and zoos, though more limited care may also be available to other elephants.

Interactions among captive and wild elephants are possible only where captive elephants are maintained in a natural environment such as forest camps. Most forest camp elephants are allowed to free-range in the forest during the night or for at least 4-6 hours when the chances of interacting with wild elephants are high. Indeed, most of the captive born elephants in forest camps are the result of mating of wild bulls with captive cows. Forest camp elephants also have the opportunity for social interactions among themselves and bonds among cow elephants and their offspring often resemble those among wild elephants.

Predominant activity of captive elephants depends on the form of management under which they are kept. Forest camp elephants are used for patrolling, tourist rides, as koonkies in conflict mitigation operations, and forestry-related work. Elephants owned by private individuals or institutions use them in religious/celebratory functions, tourist rides, and timber work. Some privately owned elephants are also used for begging money from public, and hired for weddings/celebratory functions. Apart from participation in temple rituals and processions, temple elephants are tethered within the premises, bless the public and perform temple-related rituals. Elephants in zoos are used for tourist rides, fodder collection and other activities, while circus elephants are used for performing to an audience.

Except for a few sporadic illegal capture incidents reported primarily from north-east Indian states, at present, legal capture of wild elephants is practiced only as a mitigation measure for human-elephant conflict.

In a study of nearly 800 captive elephants (carried out jointly by the Asian Nature Conservation Foundation and Compassion Unlimited Plus Action; Varma *et al*. 2008a, 2008b and 2008c), 21% were captive born. The high rates of breeding were in forest camps as well as zoos across the country, while some breeding also occurred among elephants owned by private individuals or institutions and temples.

As per Indian law, ownership certificate is mandatory for all captive elephants and micro-chipping has been introduced to facilitate this process. A sample of 1545 elephants covering 13 different states and 6 different management regimes suggests that 44% of captive elephants have ownership certificates and 48% captive elephants have been implanted with microchips.

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Current Status of Asian Elephants in Indonesia

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Introduction

Indonesia has two subspecies of the Asian elephant, the Sumatran elephant (*Elephas maximus sumatranus*) and the Borneo elephant (*Elephas maximus borneensis*). In addition to size and colour differences used to recognize subspecies of Asian elephants, *E. m. sumatranus* is recognized as a distinct subspecies by the presence of an extra pair of ribs (Shoshani & Eisenberg 1982). Patterns of mtDNA variation suggest that the Sumatran elephants are monophyletic hence an Evolutionarily Significant Unit (Fleischer *et al*. 2001; Fernando *et al*. 2003). In November 2011, the Sumatran Elephant was listed as 'Critically Endangered' by IUCN.

In order to implement elephant conservation nationwide, related legal policies have been introduced into Indonesian law. Act 5/1990 for the Conservation of Living Resources and Their Ecosystems, Act 23/1997 for the Basic Provision for the Management of Living Environment, Act 41/1999 for Forestry Management, Government Regulation No. 7/1999 for Preservation of Fauna and Flora, and Government Regulation No. 8/1999 for Utilization of Fauna and Flora were created. These acts form the basis of government regulations for nature conservation efforts.

Indonesia is one of the few Asian countries that finalized an elephant conservation strategy and action plan (Strategi dan Rencana Aksi Konservasi Gajah Sumatera dan Kalimantan 2007-2017). The development of this document was a good exercise on how multiple stakeholders can pull resources together and agree upon something that will lead the Indonesian elephant conservation effort in the next decade. The document was launched by the president of Indonesia in 2007, along with some other key species' action plans. As this document is intended to be used for a decade, a consistent monitoring process of its implementation is necessary. Every year, inline with the changes of dynamic conservation realities on the ground, the action plan has been evaluated in its implementation in different provinces, and rated based on the level of progress.

Indonesia has a multi-stakeholder forum called Forum Konservasi Gajah Indonesia (FKGI) or Elephant Conservation Forum (IECF) in English. This forum, established in 2006, has a membership representing government, NGOs, academia, and media, and has been working closely with the government as one of the major contributors to develop the national elephant conservation strategy and action plan, as well as its monitoring and evaluation.

People's perception of elephants

For centuries, the northern part of Sumatra had a tradition of elephant taming for court and ceremony (Lair 1997). The traditional tale of "Biram Sattany" tells of humans and elephants coexisting peacefully during the time of the Aceh kingdom (Djamil 1958).

In their attack on Acehnese fighters, the Fourth Division of the Marechaussee Corps of the Dutch army used elephants (Fig. 1) to carry weapons and equipment through places that could not be accessed by vehicles (Basry & Alfian 1997).

During the colonial period, elephants were also used to clear the forests for agriculture (Groning & Saller 1998). At the end of Dutch colonial rule, the tradition of taming elephants in Sumatra declined, and finally ended in the late nineteenth century (Santiapillai & Jackson 1990).

Due to unique historical and cultural associations, in some areas of Sumatra, especially Aceh, elephants have a special place in the hearts of people. Despite severe human-elephant conflict (HEC), Aceh province-wide surveys conducted of respondents from various age groups, occupations, and regions demonstrated a strong public mandate for elephant conservation in Aceh. Most of the respondents wanted to conserve elephants, and thought this should be done in specially designated elephant habitat (Jepson *et al*. 2002).

However, the wider community in Sumatra has been constantly exposed negatively to elephants through various media coverage in the context of HEC. In the long run, further exposure of elephants in various positive contexts will be needed to create some balance and strengthen wider community support. Captive elephants have played various roles, whether by supporting community livelihood through the development of elephant related ecotourism, as well as the utilisation of captive elephants in *in-situ* and *ex-situ* conservation purposes for patrolling, field surveys, research, and conflict mitigation.

Wild elephants

Past elephant distribution

Elephants in Sumatra were found at a range of altitudes, from the coastal fringes, to 2900 m. in Kerinci-Seblat (Hartana & Martyr 2002). In 1985, population estimates were between 2800 and 4800 (Blouch & Haryanto 1984; Blouch & Simbolon 1985). They were believed to persist in 44 populations scattered from Aceh in the north to Lampung in the south.

Wild Bornean elephants have only occurred in the northeastern part of the island of Borneo (Andau *et al*. 1997), and elephant range in Kalimantan has been limited to an area astride the international boundary with Malaysian Sabah.

Current elephant distribution

In 2007, elephant conservation practitioners and government representatives worked together to estimate the population based on various sources. Some estimation was done in a systematic survey, but most of the data was collected per region based on local estimation during various field exposures, especially HEC incidents. It was estimated that the number of Sumatran elephants in 2007 was between 2400–2800 individuals, which means a possible reduction of the population by 35% within the last 15 years.

In Aceh, elephants exist in moderate numbers and have a wide distribution. The distribution of elephant populations in North Sumatra is patchy, due to the barriers formed by many large-scale oil palm and rubber estates in the region (Figs. 2 & 3). Although substantial herds of elephants were reported in a number of areas within and around the Kerinci Seblat National Park until the early 1980s, poaching and habitat loss have left only two main populations extant. In Jambi province, two or more small herds survive to the west and east of Mount Sumbing, and the population probably totals around 40 animals. One herd totals fewer than 11 animals. Until the

Figure 1. Elephants being used as a mode of transportation for military purposes from Tangse to Geumpang, Pidie-Aceh during Dutch colonial time. Source: Tropen Museum.

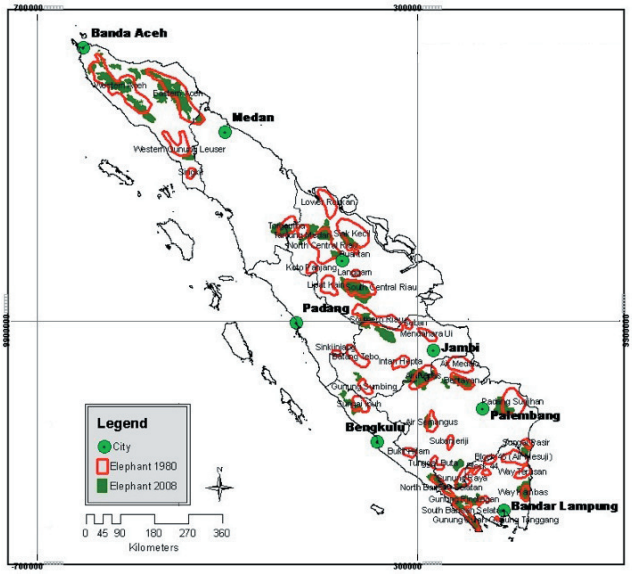

Figure 2. Sumatran elephant distribution in 1980 and 2008.

late 1980s, elephants in this area roamed between Lempur in Kerinci district, and Seremphas in Bangko district, but their range has been reduced by land clearances. Poaching for ivory has been confirmed in this area.

The current population of elephants west of the Barisan mountains in North Bengkulu district is unclear, although likely to be in excess of 100 individuals. Elephants in this area range between the Seblat river system to the south and at least as far as the Bantal river to the north. Lack of elephant corridors when lowland forests were cleared for oil palm plantations have led to conflict problems in a number of areas, notably the Retak river area, while elephants have lost access to the Air Di forests to the north.

In all areas of Kerinci Seblat, topography and altitude have been found to be the limiting factors to elephant movements. In particular, the very steep sided river valleys, which are a feature of the central area of the national park, appear to form significant barriers to elephant movements. The Barisan mountain range that runs along the length of Sumatra supports elephant populations, though at much lower densities than in the lowland areas.

In Riau, scattered populations are threatened by new development and protected areas do not have the capacity to accommodate them all. As a result of the 'Ganesha' elephant drive of 1982, when 232 elephants were forced into the area that is now a reserve, Padang Sugihen has an extremely high density of wild elephants. This area has been subject to an extensive ecological study. In fact, this reserve has a higher density of elephants than any other protected area in Asia (Nash & Nash 1985).

HEC is of particular concern in Lampung, since the elephants inhabit an area also occupied by man. Twelve populations occurred in Lampung Province in the 1980s, but WCS surveys revealed that only three were extant in 2002. Causal factors underlying this decline include human population growth; changes in land use, and HEC. Nevertheless, the surveys in the Province's two national parks, Bukit Barisan Selatan and Way Kambas, produced population estimates of 498 (95% CI = [373, 666]) and 180 (95% CI = [144, 225]) elephants, respectively. The estimate for Bukit Barisan Selatan is much larger than previous estimates; the estimate for Way Kambas falls between previous estimates. The third population was much smaller and may not be viable. These are the first estimates for Southeast Asian elephant populations based on rigorous sampling- based methods that satisfied the assumptions of the models used, and they suggest that elephant numbers in these parks are of international importance.

Figure 3. Sumatran elephant distribution and forest cover in 2006.

In the Indonesian part of Borneo it has been estimated that the population numbers 60-100 individuals who have trans-border ranges between Indonesia and Malaysia in Nunukan district (Fig. 4).

Threats

The actual number of elephant deaths is unknown due to lack of monitoring illegally killed elephants throughout Sumatra. At a minimum, 44 elephants have been killed in the last 5 years, and 12 persons have been killed by elephants.

Despite Sumatra's biological importance, only 10% of its total area is protected, leaving the majority of elephants outside protected areas (Table 1). The main nature conservation areas which offer some prospects for the survival of elephants include the Gunung Leuser National Park (9400 km^2) in Aceh and north Sumatra (Langkat), Siak Kecil Reserve (1200 km^2) in Riau, Padang Sugihan Reserve (750 km^2) in Sumatera Selatan, Way Kambas (1235 km^2) and Bukit Barisan Selatan (3568 km^2) National Parks in Lampung, and Kerinci Seblat National Park (14,846 km^2) extending over the provinces of Jambi, Sumatera Selatan, and Bengkulu.

There is clear direct evidence from two provinces (Riau and Lampung) to show that entire elephant populations have disappeared as a result of habitat loss over the past 25 years: nine populations have been lost since the mid-1980s in Lampung (Hedges *et al*. 2005) and a 2009 survey of nine forest blocks in Riau that had elephant herds in 2007 revealed that six herds had gone extinct (Desai & Samsuardi 2009). It is estimated that Sumatran elephant habitat has declined by more than 69% since the 1930s, especially in Riau and Lampung provinces. This is one of the reasons that the Sumatran elephant was listed as a critically endangered (Gopala *et al*. 2011).

During Dutch colonial times, the capturing and culling of elephants continued inline with the development of large-scale rubber, sugar, tobacco, and oil palm plantations. Legal captures as part of the government policy to address rising HEC was started in the 1980s, and brought into existence

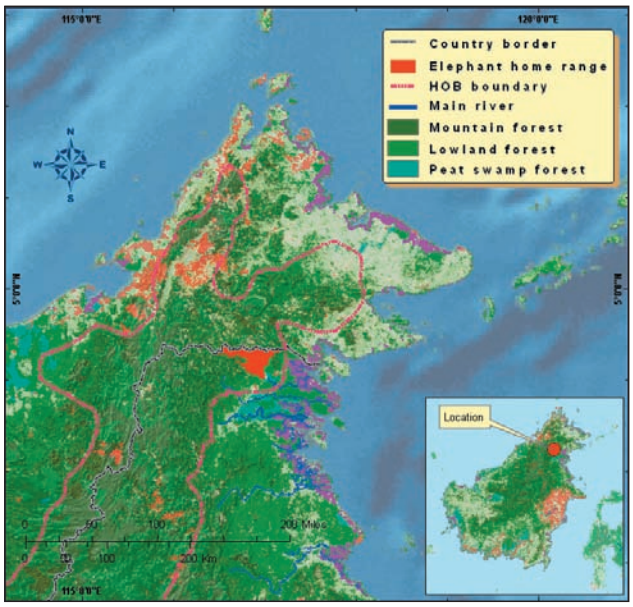

Figure 4. Elephant distribution in the Indonesian part of Borneo.

the modern elephant training camps throughout Sumatra. This policy became the main cause of wild elephant extraction for the entire island in the past years. In the last decade, capturing was still conducted mainly as part of HEC resolution. Some illegal hunting of elephants also occurs and is usually associated with HEC.

Traditionally many people have lived near or within elephant occupied areas. This leads us to expect that humans and elephants have been in contact for a long period of time. However, it has only been since the large scale clearance of forests and the development of transmigration areas in Sumatra that elephants coming into contact with people have been considered to be in conflict. This might best be explained by the scale of habitat clearance and the increased competition for arable lands having forced elephants to move to alternative areas. In some cases, where elephants are totally surrounded by human settlements (or natural barriers), elephant groups have started crop raiding and have come into frequent contact with humans, leading to lethal consequences. In cases where people have opened new gardens in the middle of elephant habitat, or when elephants permanently reside at the interface of forest and gardens, local farmers try to protect their crops using different methods including fire, loud sounds, or simply requesting the elephants to leave.

Elephant management and HEC mitigation

A consequence of most of the elephant population in Indonesia living outside current conservation areas is that elephant habitat is subject to further conversion to other land uses. The conversion of elephant habitat in the past has led to increased interaction between humans and wild elephants, thereby resulting in conflicts, which has led to Sumatran elephants becoming critically endangered. The best conservation prospects for Sumatran elephants maybe in Aceh, where elephants are widely distributed in all of Aceh's districts, and some populations in HEC areas have groups with calves (BKSDA pers. comm. 2011). The situation in Aceh is exceptional. Many areas outside Aceh in Sumatra have lost significant core elephant habitats.

Due to the large area required by elephants, conservation efforts of this species in Sumatra need to be done at appropriate levels and based on habitat needs. Conservation investment and resources need to be placed strategically at the land use planning level as a fundamental requirement. Land use planning in Aceh Province has benefited from input about elephant distribution and the needs for corridors. Based on this input, the allocation of protected forest area in the current Aceh land use planning has been proposed to be increased by 1 million ha of protected forest to a total of 2.8 million ha. This figure indicates that Aceh will protect a total forest area as large as 3.86 million ha. (BKTRP Aceh 2011).

HEC is a major threat to the Sumatran elephant. HEC results in a lack of local support to conserve this species and its habitat. The communities become less tolerant of wild elephants, leading them to use different methods to kill or capture them. In the recent past, HEC has been handled by capturing the raiding elephants, driving them or scaring them off using sound and fire, while a few plantations use modern technology such as electric fences.

In 2008 the Directorate General of Forest Protection and Nature Conservation issued a letter declaring a Moratorium on elephant capturing in Indonesia. This policy means there will be no budget allocation from the Forestry Ministry for elephant capturing, and it effectively reduced the elephant capturing (PHKA 2008)

Currently, besides various mitigation methods, which have been tried in Sumatra, a non-invasive solution has been introduced based on the concept of human-elephant co-existence based on alternative livelihoods. In most HEC areas, HEC mainly impacts community livelihoods, and only a small percentage of communities are in life threatening situations. Therefore this new concept using alternative livelihoods as a basic approach will provide an option for communities to share their landscape with wild elephants in a rather peaceful way. Four out of 18 planned community ranger groups, who live in elephant habitat in Aceh, have been supporting these elephant friendly livelihoods. Each of the groups consists of 15 – 20 people who are supported monthly for their conservation and patrol activities, as well as HEC mitigation activities (Ismail pers. comm. 2011).

Captive elephants

The tradition of managing and utilizing captive elephants in Indonesia disappeared at the end of the nineteenth century. It restarted in 1984 when the Indonesian government launched a program to capture wild elephants involved in HEC. The captured elephants were transferred to Elephant Training Centers (ETC) for taming. During this program, about 700 elephants were captured and taken to ETCs. In 2000 this program was formally discontinued. But in some provinces in Sumatra, wild elephant captures as an HEC resolution strategy were conducted until early 2009. All captures of wild elephants for taming were conducted under authority of the legal government agencies. Some of the elephants were transferred to Zoos, Safari Parks, Recreation Parks, and some to timber concessions throughout Indonesia. Today 241 Sumatran elephants are kept in such facilities all over Indonesia. In addition 243 Sumatran elephants are still kept in the ETCs in Sumatra, which were renamed as Elephant Conservation Centers (ECC). Currently there is a total population of 484 Sumatran elephants in captivity in Indonesia

About 10 years ago, some conservation NGOs together with the government conservation agency (BKSDA) in various regions started to utilize small groups of 4 – 7 elephants from the ETCs/ECCs in so called Conservation Response Units, Elephant Flying Squads, or Elephant Patrol Units located close to wild elephant habitat. In these units, elephants and their mahouts are employed for forest patrol, law enforcement, habitat monitoring, HEC mitigation, education, and eco tourism development as an alternative income, generating source for local communities. From an elephant welfare point of view these units provide the advantage that small groups of elephant can be better taken care of than in the large often not very well equipped and funded ETCs/ECCs with high numbers of elephants.

Today 9 such units, with a total of 55 elephants are managed in collaboration between conservation NGOs, government, and local communities. This strategy benefiting wild elephant conservation and captive elephant welfare has increasingly attracted the interest of the Indonesian government, and although initiated by NGOs, today the various government agencies are increasingly involved in the implementation of this concept, which is becoming a vital part of Indonesia's elephant conservation strategy.

With very few exceptions, breeding programs and management systems focused on needs for reproduction, are not implemented in any of the captive elephant locations. In most locations, the management systems applied allow elephants few opportunities for regular free socialization and interaction. Captive breeding and births which occasionally occur in some of the Zoos, Safari Parks and ETCs/ECCs are mostly incidental, rather than as a result of a management system designed and focused on reproduction. In some of the ETCs/ECCs the captive elephants at times come in contact with wild elephants, and the majority of captive born calves in ETCs/ECCs are the result of breeding between wild males and captive females. Current numbers of captive elephants successfully involved in breeding and birth rates are not sufficient for the existing captive population of Sumatran elephants to become self sustaining.

No studbook for captive Sumatran elephants exists, but the government plans to register all Sumatran elephants and has implanted microchips in most of the elephants in the ETCs/ECCs. Implanting microchips in elephants in zoos, safari parks, etc. and the registration of elephants in one central database including regular annual updating of such databases has yet to be implemented.

By Indonesian law, the elephant is a highly protected species. All such protected Indonesian wildlife is owned by the government and no private ownership is possible. Elephants kept in private facilities such as zoos, safari parks, etc. are loaned to these facilities but still remain the property of the Indonesian government.

Mahouts in the ETCs/ECCs are employed by the government, and in zoos, safari parks, etc. are employed by these institutions. Mahoutship in Indonesia is a young profession as captive elephant management only restarted in 1984, and therefore traditional knowledge and experiences forwarded since many generations are lacking. A structured education and training scheme to teach the necessary skills and knowledge about elephant training management and handling are yet to be developed.

Captive elephant management in Indonesia has benefited from capacity building of the mahouts, who are responsible for the care of captive elephants. Since 2006, Indonesia has hosted mahout workshops annually, and established a professional mahout communication forum (FOKMAS) (Nazaruddin *et al*. 2010). Through FOKMAS, mahouts have been provided opportunities to learn additional conservation related skills such as field navigation, gathering data, and monitoring wild elephant populations. FOKMAS provides input and recommendations about captive elephant management and conservation activities to the government, and has improved the care and management of elephants in captivity in Indonesia.

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Current Status of Asian Elephants in Lao PDR

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Introduction

The Lao People's Democratic Republic is a landlocked country bordered by Vietnam, Thailand, Cambodia and China. It has a total land area of 236,800 km^2 with an estimated population of just over 5.5 million people and a population growth rate of 2.3%. A low population density and rugged terrain has contributed to relatively large remaining forested areas and a rich and diverse faunal and floral assemblage. Despite this, the high population growth rate coupled with a natural resource-based economy is leading to increased pressure on remaining natural forests and biodiversity in the country. The natural vegetation types in Lao are mixed deciduous forest and semi-evergreen forest with dry forests in the south. Almost all of the mixed deciduous and semi-evergreen forests have been logged. The northern part of the country mostly consists of cultivation and degraded habitats. There is more forest in the central and southern parts.

Lao PDR has a rich culture and history in which the Asian Elephant plays a prominent role. Lao people regard the Asian elephant as a symbol of the power and potential of the forest. Statues and carvings of elephants adorn temples and houses throughout the country. The Asian elephant also features in spiritual and cultural ceremonies and festivals held throughout Lao PDR. In particular, the 'Elephant Festival' is an annual event which draws thousands of national and international visitors (Fig. 1). It brings together domestic elephants from five districts in Xayabouly Province. In 2009 there were 60 elephants at the festival. The festival aims to raise awareness of Asian elephants, their important role in the history and culture of Laos, and to promote national tourism that can generate income and help conserve domestic elephants.

For many hundreds of years elephants have helped humans to explore and exploit wild landscapes in Lao PDR. Elephants were extensively used in logging operations to transport cut timber and supplies over terrain that is impassable for vehicles. As new technologies emerge logging elephants are less required for such operations and are increasingly used in the tourism sector. Even today elephants in Lao PDR continue to carry travelers through the forests providing a unique vantage point. Researchers, naturalists, and scientists also continue to use the elephant as a means of exploring and carrying equipment.

Wild elephants

Current distribution

Current wild population is estimated to be about 600 to 800 (National Elephant Workshop, at Department of Forestry, Lao PDR, June 2009). They are thought to exist in 23 isolated and fragmented populations (Figs. 2 & 3). A recent survey conducted by the Wildlife Conservation Society and WWF Laos Program, provided an estimate of 132 elephants in the largest population in Nakai Nam Theun (Table 1). The Nakai Nam Theun population is under threat because

Figure 1. Elephant festival 2011 in Paklay.

Table 1. Estimated Asian elephant population sizes (N) in known elephant habitats, population trends, poaching intensity, HEC threat, and habitat conversion threat (HCT) in Lao PDR (WWF 2009).

No	Elephant habitat	Province	N	Population	Poaching	HEC	HCT
1	Say Phou Louag	Bolikhamxai	10	declining	low	yes	no
2	Ban Na	Bolikhamxai	30	declining	high	yes	yes
3	Boualapha	Khammoun	20	declining	no	yes	yes
5	Dong Amphan	Attapeu	30	stable	low	yes	yes
6	Dong Khanthung	Champasak	20	declining	low	yes	yes
7	Dong Phou Vieng	Savannakhet	25	declining	high	yes	no
9	Nonggouy	Bolikhamxai	5	declining	medium	yes	yes
10	Phou Khao Khouay	Bolikhamxai	15	declining	medium	yes	no
11	Nakai Nam Theun	Khammoune	132	stable	medium	yes	yes
12	Nam Et	Houa Phanh	10	declining	low	yes	yes
13	Nam Ha	Louang Namtha	20	declining	medium	yes	yes
14	Nam Kading	Bolikhamxai	15	stable	no	yes	no
15	Nam Pouy	Xayabouly	100	declining	high	yes	yes
16	Sanakham	Vientiane	10	declining	high	yes	yes
17	Nam Xam	Houa Phanh	5	declining	no	yes	no
18	Phou Dending	Phonsaly	50	declining	low	yes	no
19	Phou Loun	Attapeu	10	stable	no	yes	no
20	Phou Thun	Xe Kong	30	declining	medium	yes	yes
22	Phou Xan He	Savannakhet	10	stable	high	yes	no
23	Phou Xieng Thong	Salavannh	10	declining	no	no	no
24	Xe Ban Nouan	Salavannh	10	stable	no	no	no
25	Xe Pian	Champasak	5	declining	high	no	no
26	Xe Xap	Xe kong	30	stable	no	no	no

their best habitat will be inundated by the Nam Theun dam. Other populations in the country are believed to be smaller and most are isolated, although all remain potentially important for elephant conservation.

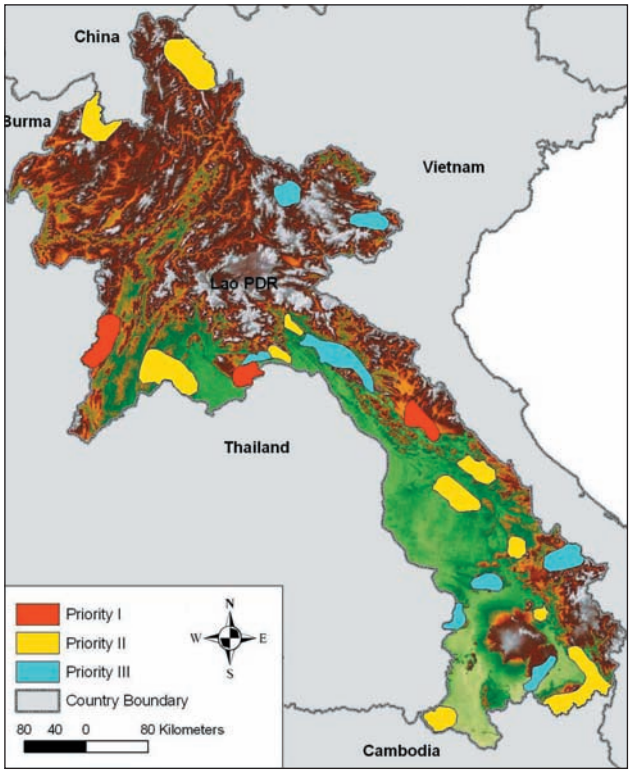

Figure 2. Priority elephant conservation landscapes.

Past distribution

Historically the Lao PDR was often described as 'Lan Xang' (Land of a Million Elephants). In the late 1980s, the elephant population was estimated to be between 2000 - 3000 animals (Venevongphet 1992). Previous surveys documented the presence of elephant populations in and around at least 23 established National Protected Areas, which cover 14% of the land area (Duckworth & Hedges 1998). A comprehensive review in 1998 indicated that healthy numbers of elephants also occurred outside of the protected area system (Duckworth & Hedges 1998).

Conservation status and threats

Conserving elephants is difficult in Lao PDR, because of the species' fragmented distribution, large ranges, crop destruction tendencies, and their value to poachers. One main problem in the conservation of elephants is conserving the geographical extent and the habitat quality of their ranges. Nevertheless, their conservation is crucial because elephants directly or indirectly affect forest structure, regeneration, and consequently other animal and plant species (Sukumar 1989; Boonratana 1997). Much of suitable elephant

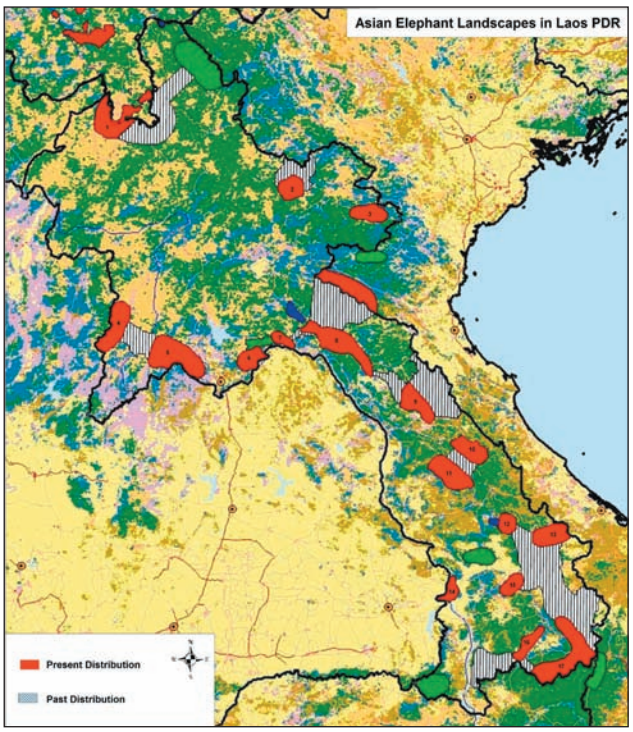

Figure 3. Past and present elephant distribution in Lao PDR.

habitat has been lost to widespread conversion of forested lands to both permanent and shifting cultivation (Santiapillai & Jackson 1990).

The legal status of elephants in Lao is dependent on the elephant's classification as "wild" or "domestic". Domesticated elephants are viewed as livestock and are managed by the national Department of Livestock and Fisheries. Wild elephant management is undertaken by the Department of Wildlife and Forestry.

The Lao PDR became signatory to the CITES convention in 2004, therefore trade and international sale of this globally endangered species is subject to regulation. The government of Lao PDR banned the capture of elephants from the wild for domestication in the late 1970s. In Lao PDR, Asian elephants are listed in the 'Restricted Species Category I' since 2001. According to the Regulation, 'Restricted Species' are rare and nearly extinct aquatic and wild life species of high value and of special importance and use for the society and the natural environment. By the same regulation, the restrictions imposed on the Restricted Species of Category I, with respect to the Asian elephant, include:

- Strictly prohibiting its removal, export and import, unless authorized by the Ministry of Agriculture and Forestry for the purpose of scientific research and experimentation, presentation as gifts to foreign guests and propagation.
- Strictly prohibiting hunting of this species in all seasons, unless authorized by the Ministry of Agriculture and Forestry for the purpose of scientific research and experimentation, and protection when such animals threaten humans and agriculture.
- Strictly prohibiting the rearing and possession of this species unless authorized by the Ministry of Agriculture and Forestry.
- Strictly prohibiting the purchase and trade of this species for the purpose of commercially supplying export-oriented processing plants and restaurants, guesthouses, pubs, hotels and markets.
- Strictly prohibiting the use of dangerous and destructive hunting methods such as using explosives, chemicals or poisons, electricity, automatic weapons, rifles, etc., which would impede the animals' reproduction.

Overall, very little quantitative information is available on elephant numbers, distribution, origins of human elephant conflict (HEC), the real costs of these conflicts, or economic impacts of HEC at local, district, provincial and national levels (FAO 2002). This makes it difficult to formulate government policies and develop management practices to deal with HEC situations.

The main threats to Asian elephants in Lao PDR, are poaching, habitat loss and HEC. Annually up to about 10 elephants are reported killed illegally from poaching and HEC (Fig. 4). Where convicted, those responsible receive fines and jail terms. Poaching involves both local and transboundary poachers. Poaching of elephants is mainly for ivory but also for other products for trade, such as trunk, feet, tail and skin. Habitat loss results from conversion of forests to agricultural lands (permanent and shifting), logging, hydropower projects and infrastructure development.

Human-elephant conflict

Incidents of conflict between elephants and humans, such as crop raiding and deaths of humans or elephants, are on the increase in Lao PDR (FAO 2002). Crop damage is the most prevalent form of HEC in Lao PDR. Elephants commonly damage rice, both dry upland and wet irrigated rice. Other crops that are often targeted during elephant raids include banana, coconut, cassava, corn, sugarcane and pineapple. During HEC monitoring in the Nakai area between 2007 and 2009 a total of 17 different crop types were damaged and destroyed by elephants. Groups of elephants can destroy large areas of a single crop in a single night. One example of this was a raid during a single night in Nakai when a small group of elephants (most likely 2 individuals) destroyed 93 banana trees (WCS pers. comm.). Elephants may also cause damage to property such as fencing, field huts, and irrigation systems

Figure 4. Elephants illegally killed in (A) Nam Pouy National Protected Area, Xayaboury province in 2008 and (B) Attapeu in 2009 .

Figure 5. Property damaged by elephants.

(Fig. 5). In the Nakai area this type of damage is prevalent in the dry season. HEC may not directly impact livelihood but can still have a negative effect upon people's lives. An example of this is people not going to the forest to collect non-timber forest products or firewood because they are afraid of encountering elephants. During the major cropping season farmers may guard their rice fields due to the threat of elephant raids and as such forgo opportunities to participate in other livelihood or village activities. In Lao some farmers no longer plant crops such as banana and pineapple because these crops are frequently raided by elephants. These indirect costs of HEC are very difficult to monitor and quantify in term of monetary cost. Nonetheless, they do impact people's livelihoods.

HEC Mitigation and Elephant Management

HEC mitigation is mainly based on guarding fields and chasing elephants from crop fields using fire crackers (Fig. 6). Some NGOs such as WWF together with the Department of Forests are active in this field. They have conducted training workshops and awareness programs for villagers. Conservation organizations (eg. WWF, WCS) and the government also conduct surveys and collect data on elephant distribution, threats etc.

Captive elephants

Lao PDR has a strong tradition of domestication and use of elephants as work animals, both in the north (Sayaboury Province) and south

Figure 6. Guarding crops with fire crackers.

(Champassak Province). The captive population of elephants in Lao PDR has been declining over the last few decades. The number of domesticated elephants in Lao PDR in late 1980s was estimated to be 1332 animals (Venevongphet 1988) and in 2000 as 864 (Norachak 2002). The current population of captive elephants is estimated to be approximately 500 individuals (Elefant Asia, pers. comm.). However their use in the logging industry and in the few elephant tourist camps makes them very important for the rural Lao economy. The decline in captive elephant population can be explained by several factors which include high mortality rates, poaching, illegal exports, and very low birth rates. Domestic elephant populations mostly rely on wild elephants for breeding. There are few young animals and perhaps less than 100 reproductive females in the captive population (S. Duffillot & G. Maurer, pers. comm.). Most captive elephants are owned privately. Generally domestic elephants are worked hard and receive poor health care, resulting in poor condition. Elefant Asia, a French NGO working in Laos since 2002 is active in promoting better management and health care of elephants.

Although work availability and demand for elephants is declining, the situation has not reached the same critical state as in other countries (e.g. Thailand). There is still time to learn from experience elsewhere, and to initiate proactive forward planning regarding the future use and role of the domesticated elephant population, especially as regards deriving socio-economic benefits (e.g. elephant-based ecotourism) and linkages with conservation of wild elephants.

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Current Status of Asian Elephants in Peninsular Malaysia

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Introduction

The Department of Wildlife and National Parks (DWNP) Peninsular Malaysia under the Ministry of Natural Resources and Environment (NRE) is the government agency responsible for the management and conservation of wildlife in Peninsular Malaysia, including elephants (*Elephas maximus*). In Peninsular Malaysia, the status of elephants was elevated from *protected* species in 1972 to *totally protected* species in 2010. According to the new status, it is an offence to hunt, take, or keep any part or derivative of an elephant without special permit; offenders are liable to a fine not exceeding RM 100,000 (USD1 ~ RM3), to imprisonment for a term not exceeding 3 years, or both. If the elephant is a female, the maximum fine is RM 300,000 or imprisonment for a term not exceeding 10 years, or both. Any person who imports, exports or re-exports an elephant or any part of an elephant without special permit commits an offence and shall, on conviction, be liable to a fine of not less than RM 30,000 and not more than RM 100,000, and to imprisonment for a term not exceeding 3 years. While, anyone who uses elephants for a zoo, circus, exhibition or for captive breeding without special permit, commits an offence and shall, on conviction, be liable to a fine not exceeding RM 100,000 or to imprisonment for a term not exceeding 3 years or to both.

Wild elephant distribution and population size estimates

The current elephant population in Peninsular Malaysia is estimated as 1223-1677 individuals (Table 1), distributed widely from the state of Kedah in the north to Johor in the south, and from Negeri Sembilan in the west to Terengganu in the east (Fig. 1). During the 19th century, elephants occurred throughout Peninsular Malaysia, except in Penang Island (Olivier 1978a). In the 1940s, elephants had almost disappeared from the west coast; only pocketed herds remained west of the railway between Gemas to Penang (Foenander 1952). By states, elephants disappeared first from Melaka, then from Perlis and Selangor.

Currently, elephants occur in seven of the 11 states of Peninsular Malaysia. The states of Perak, Kelantan, Terengganu, Pahang, and Johor sustain the bulk of the elephant population, Kedah has a smaller number of them (Table 1), and Negeri Sembilan might be the next state to lose its elephant population after one male elephant, suspected to be the last one in the state, was captured and relocated to Taman Negara National Park in February 2011.

By protected areas, Taman Negara National Park holds the largest population with at least 290-350 elephants as estimated by the DWNP (although a dung-count survey estimated this population as 631, with a 95% CI of 436-915; WCS 2008). This is mainly because Taman Negara is the largest protected area (4343 km^2), including vast extensions of lowland primary forest, and has been the main release area for translocated conflict elephants since 1983. The estimated elephant populations in other protected areas are 26 in Endau Rompin Johor National Park (489

Table 1. Past and present elephant distribution and population estimate.

State / National Park	1960-3[1]	1970-4[2]	1978[3]	1985[4]	1991[5]	2002-8[6,7,8]
Taman Negara NP	-	-	-	166	120	290-350 (631[7])
Kelantan	115	61	-	92	173	250-300
Perak	87	105	-	126	130	230-280
Johor	43	74	-	94	138	130-180 (113[8])
Pahang	236	287	-	212	205	150
Terengganu	57	43	-	37	171	120-140
Kedah	90	10-33	-	44	54	50-60
N. Sembilan	38	14	-	13	11	3
Selangor	14	9	-	6	6	0
Perlis	12	5	-	5	0	0
Melaka	0	0	-	0	0	0
TOTAL	682	601	3000-6000	795	1008	1223-1463 (*1564-1677)

Sources: [1] Medway (1965); [2] Khan & Olivier (1974); [3] Olivier (1978a); [4] Khan (1985); [5] Khan (1991); [6] Salman (2002); [7] WCS (2008); [8] WCS (2009). Estimates for [1-2] and [4-6] are based on DWNP biodiversity inventories; [3] derived from densities and available elephant range; and [7-8] from dung-count surveys.

km^2), 22 in Endau Rompin State Park Pahang (402 km^2) and 87 in the contiguous Permanent Forest Reserve (1609 km^2) (WCS 2009). There is no estimate of the elephant population in Royal Belum State Park and the contiguous Temengor Forest Reserve in Perak. Elephants are no longer present in Krau Wildlife Reserve (600 km^2, Pahang) after the remaining individuals were captured and relocated in 1991.

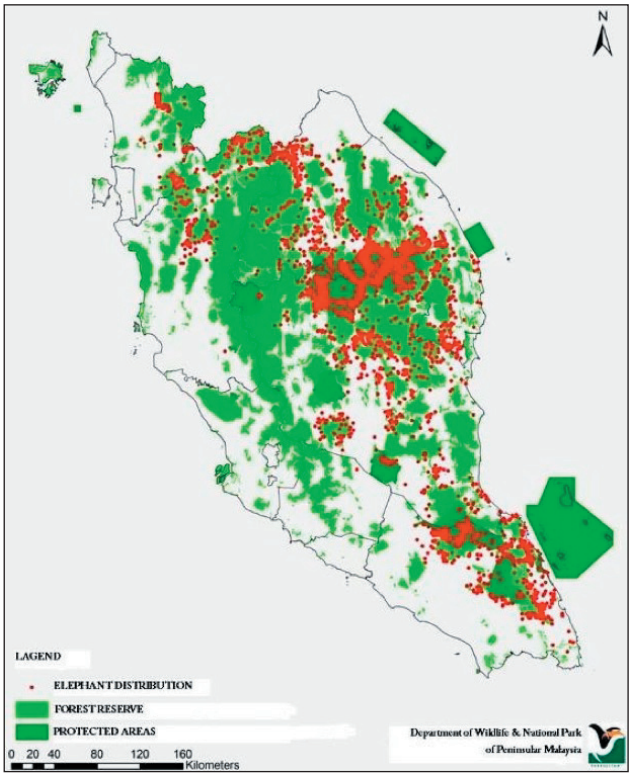

Figure 1. Distribution of elephants in Peninsular Malaysia, 2011. Elephant presence is based on footprints and HEC incident records.

The DWNP uses a combination of methods to estimate elephant population sizes. The most important method is the biodiversity inventory, conducted annually in each district (the immediate smaller administrative unit after state). Every year, the DWNP office in each district estimates its elephant population using a combination of footprint counts (tracking elephant herds and estimating group size based on the diversity of footprint sizes) and data from HEC complaint reports. State and Peninsular-level populations are estimated by adding the numbers of elephants in each district plus estimates for protected areas.

The DWNP has also conducted three large-scale dung-count surveys in collaboration with the Wildlife Conservation Society (WCS), Malaysia Program. The first of these dung-counts took place in 2007 in Gua Musang, a 1397 km^2 MIKE (CITES's Monitoring the Illegal Killing of Elephants) area in the state of Kelantan. The second dung-count survey covered the whole of Taman Negara National Park (WCS 2008), in what is to date the most complete dung survey conducted in Asia. The third survey took place in the Endau Rompin Park complex and contiguous Permanent Forest Reserves (ca. 2500 km^2; WCS 2009). The results of dung-count surveys suggest that biodiversity inventories might underestimate elephant numbers (e.g. 290-350 vs. 631 elephants, for Taman Negara). From 2012 onwards, the DWNP is planning to use non-invasive genetic

mark-recapture methods to estimate elephant numbers.

Threats

Forest loss and fragmentation

The loss and fragmentation of forest is the main cause for elephant decline in Malaysia. Southeast Asia has the highest relative deforestation rate in the tropics and Malaysia is no exception to this (Hansen *et al*. 2008). Prehistoric Peninsular Malaysia was completely covered with a mosaic of different types of natural forest. Even in the early 1950's records show that 90% of the total land area was covered by forest (FDTCP, 2007). In 2010, forest cover had been reduced to just 37.7% (Miettinen *et al*. 2011). Prior to the 1980s, vast areas of lowland forests – prime elephant habitat – were converted into oil palm and rubber plantations (Wan 1985). Further, several government agriculture land schemes such as FELDA (Federal Land Development Authority, 1956), RISDA (Rubber Industry Smallholding Development Authority, 1973) and FELCRA (Federal Land Conversion and Rehabilitation Authority, 1966) were established. The main objective of these schemes is to develop and rehabilitate the land as well as to eradicate poverty, especially in rural areas. From only 540 km^2 in 1960, oil palm plantations expanded to more than 16,000 km^2 in 1987 (NPP 2005), and over 21,870 km^2 in 2002 (Abdullah 2003). Agricultural development was accompanied by the establishment of new settlements and infrastructures (e.g. roads, highways, and large dams) that further fragmented elephant habitat.

From the 1990s, the pattern of forest conversion changed slightly as large areas of forest have been converted to other landuses, especially housing and urban areas (Abdullah & Hezri 2008). Moreover, the recent expansion of Latex-Timber Clone rubber plantations poses an emerging threat for the forests and elephants of Peninsular Malaysia (Clements *et al*. 2010).

Selective logging is another factor contributing to the degradation of elephant habitat. As demand for raw materials, including wood, increased after the World War II, the production of timber increased in Malaysia. This led to the formulation of the Malayan Uniform System (MUS) in 1948, which allowed the removal of mature timber trees in one single felling of all trees down to 45 cm dbh (diameter at breast height) for all species, which allowed selected natural regeneration of varying ages particularly in lowland forest (Anonymous 1995). Although selective logging might have a positive effect on elephant habitat by creating open spaces and promoting food-rich secondary growth, logging generally occurs in association with detrimental habitat alterations, such as the construction of roads and the increased presence of people in the forest.

Human-elephant conflict

The human-elephant conflict (HEC) is an ancient phenomenon that occurs wherever elephants and human agricultural societies coincide (Sukumar 2003). In Peninsular Malaysia it was reported as early as the 1900s (Maxwell 1907) and is currently considered a major human-wildlife conflict, second only to the conflict with long-tailed macaques. As more forests are cleared, traditional elephant ranges become fragmented and elephants have no choice but to encroach into plantations in their search for food, water, and mates. Moreover, elephants inhabiting the forest fringes neighbouring plantations find that these plantations, usually oil palm, rubber, and banana, offer easy pickings. These crop-raiding elephants cause large financial losses to plantation owners.

Between 1998 and 2010 the DWNP received 10,759 HEC complaints (mean ± SD = 828± 183 per year; Fig. 2a). The number of HEC complaints per year decreased from 1998 to 2001, and subsequently it showed a steep increase until 2009 (Fig. 2a). The reasons for these trends are unknown and it is important to note that HEC complaints recorded are not the result of systematic data collection but depend on voluntary reporting by individual farmers. Crop raiding (72.8%, N=5,218) was the most commonly reported cause of HEC reported between 2006 and 2011, followed by situations in which elephants wandered into plantations, created unsafe situations, or even entered villages

and settlements (Fig. 2b). Property damage incidents consisted of 2.6% of the complaints. In this period, 7 attacks on humans were recorded, resulting in 4 human casualties and 3 people injured (Fig. 2b). Altogether, 9 people lost their lives to elephants in Peninsular Malaysia between 2001 and 2011 (~0.85 per year). Most HEC incidents reported between 2006 and June 2011 occurred in rubber and oil palm plantations (39.5%, N=5,218), smallholder farms (33.2%), and villages (17.5%; Fig. 2c). The Orang Asli (indigenous people) reported 2.8% of HEC cases (Fig. 2c).

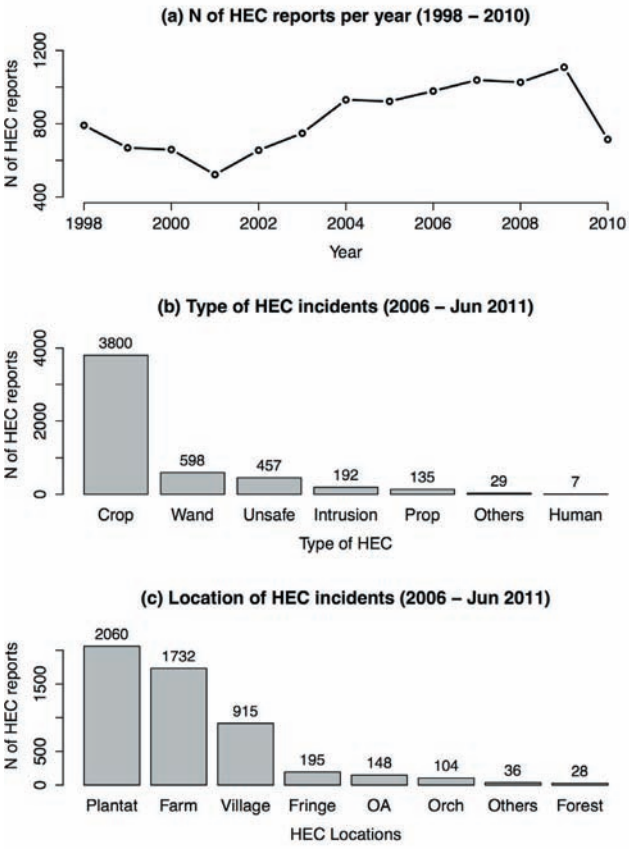

Figure 2. Characteristics of HEC in Peninsular Malaysia; (a) Number of HEC incidents reported to DWNP from 1998 to 2010; (b) Type of HEC incidents; and (c) Location of HEC incidents as reported to DWNP from 2006 to June 2011. Crop = crop damage; Wand = wandering; Unsafe = creation of unsafe situations by elephants; Intrusion = intrusion of elephants within villages and human settlements; Prop = property damage; Human = attack to humans resulting in physical injury or casualty; Plantat = Plantation; Fringe = forest fringe; OA = orang asli (aboriginal people) settlement; Orch = orchard.

Crop and property damage are the forms of HEC with the biggest economic impact. Over RM78 million in losses were reported from government-owned oil palm schemes (FELDA and FELCRA) and private companies due to HEC between 1975 and 1978 in Peninsular Malaysia (Monroe & England 1978). The loss declined in the early 1980s when initial mitigation measures were strengthened with the installation of electric fences. Salman & Nasharuddin (2003) found that the total estimated economic loss from crop damage in the state of Johor between 2001 and 2002 amounted to approximately RM 760,000 of which damage to oil palm contributed almost 94.3% of the amount. From 2005 to 2010, economic losses due to HEC were reported to be approximately RM 18.8 million. There are two approaches used to evaluate these losses: (1) the losses are reported by landowners to DWNP officers, who subsequently visit the location of the HEC incident to record and estimate the damage; and (2) crop loss assessment is done by DWNP rangers during their patrolling duty even in the absence of reports from the landowners. The economic value of the damage is estimated according to the type of crops and the extent of damage.

Legal and illegal killing of elephants

Prior to 1974, elephants were legally culled to overcome HEC (an average of 12 elephants per year were culled between 1960 and 1969; Khan 1991). Although culling was stopped in 1974, forty elephants were shot in self-defense by DWNP rangers during translocation operations in the following 28 years (i.e. 1.43 elephants per year; Salman 2002).

The illegal killing of elephants is uncommon in Peninsular Malaysia – just 18 cases have been recorded between 1974 and 2002 (i.e. 0.64 elephants per year). Frustration with repeated HEC incidents drive farmers to take actions such as poisoning and shooting elephants, of which 10 and 3 cases were reported, respectively. Wire snares used to poach wild boar and deer have resulted in the death of 3 elephants due to severe foot wounds. The removal of tusks from elephants has been reported in only 2 cases between 1974

and 2002 (Salman 2002). In spite of these low numbers, the importance of the illegal killing of elephants should not be underestimated and its monitoring needs to continue.

Elephant management and HEC mitigation

In Peninsular Malaysia, the DWNP is responsible for elephant conservation and management, as well as for the mitigation of HEC impact. DWNP policies are based on the Act 716, the Elephant Management Plan (2006), and the Action Plan for Wildlife Conflict Management (2010-2015). The philosophy of these documents is based on the '*people first*' paradigm according to which elephant management and HEC mitigation prioritize human interests over elephants' when dealing with conflict situations. The ultimate goal of DWNP is to achieve '*zero conflict*' where elephants and people live harmoniously – elephants in the Protected Areas designated for wildlife conservation and people elsewhere.

Elephant translocations

In 1974 elephant culling was banned and the DWNP established the Elephant Management Unit (EMU) with the objective of capturing and relocating elephants from areas of conflict to more suitable habitats. As a result of the translocation program, over 600 wild elephants have been captured by the DWNP between 1974 and 2010 and most of them were relocated to major conservation areas such as Taman Negara National Park and surrounding forests (Pulau Besar and Sungai Ketiar), Belum-Temengor, and Endau Rompin.

The elephant translocation program involves a huge expenditure for the DWNP. The total cost to translocate one elephant is about RM 40,000 of which *ca* 44% is spent during the capture itself and the rest during the relocation. The bulk of the cost goes to staff allowances. Other costs involved are fuel, immobilization drugs, elephant securing equipment, ammunitions, and food supply for working elephants (DWNP 2006). From 2001 to 2010, the DWNP spent RM 11,790,000 in operations to capture and translocate elephants.

Electric fencing

The DWNP is of the opinion that elephant translocation is not a suitable option in all conflict situations. To overcome HEC in areas adjacent to large elephant habitat, the DWNP has recently adopted the use of electric fencing (although electric fences have been used in the country since the 1940s; Monroe & England 1978). In 2009 and 2010, five DWNP electric fence projects were completed covering a total length of 95.3 km. About RM 4.9 million were spent for these projects, which are located in the states of Perak, Kelantan and Johor. Currently, two more electric fences are under construction in Pahang and Perak. The total cost to develop electric fencing ranges between RM 36,000 to RM 53,000 for a kilometer, depending on the topography and features of the terrain.

HEC mitigation by parties other than DWNP

HEC cannot be overcome by DWNP alone due to limitations such as shortage of personnel, budget allocation, logistics, etc. Therefore, the landowners also need to have their own initiatives to overcome the problem. Large-scale plantations can afford to install electric fencing or construct trenches along the perimeter of their plantations. They also use other deterrent methods such as cannon carbides, fire crackers, flash lights, and burning tires or logs at the main accesses used by elephants to encroach into plantation areas. These, however, are not always successful (or necessarily legal). Based on observations and interviews, approximately 95% of landowners combine several methods to protect their land from crop-raiding elephants. The most popular applications are a combination of trenches and electric fencing (Salman & Nasharuddin 2003).

The Lubok Bongor Conservation, Cultural, Social, and Welfare Society is an example of a community-based HEC mitigation initiative. It is a local NGO from Lubok Bongor, Kelantan, where farmers and entrepreneurs, assisted by the WWF Malaysia, united to conduct night patrols and deter crop-raiding elephants (Ong 2011). The number of community-based initiatives to mitigate HEC is likely to increase in Malaysia.

Restoring landscape connectivity

Forest loss and fragmentation are the main cause of HEC and elephant decline in Peninsular Malaysia. As the largest land mammals, elephants have huge home ranges, the size of which depends on habitat type, food and energy requirement, body sizes, water sources, barriers imposed, diversity of habitat and the composition of the elephant groups (Olivier 1978b; Hassan & Udadin 1985; Sukumar 1989; Burhanuddin *et al*. 1995; Salman 1998; Salman & Nasharuddin 2002). Since wildlife habitats are increasingly fragmented by roads and other type of land use barriers, the Government of Malaysia has produced the *Central Forest Spine (CFS): Master Plan for Ecological Linkages*, a plan to restore connectivity among the most important forest complexes in Peninsular Malaysia (FDTCP 2007). To achieve this objective, the DWNP has proposed to the relevant agencies to build viaducts to facilitate road crossing by wildlife. To date, three viaducts have been completed in the Aring-Kuala Berang Highway (Fig. 3). These viaducts were specifically designed to connect main landscapes for elephants: the Tembat Forest Reserve in the northern part of the highway and Taman Negara National Park in the southern part. Currently, another three viaducts are under construction in Kuala Lipis-Merapoh, Pahang road. When completed, these viaducts will connect two major forest complexes namely the Titiwangsa-Bintang-Nakawan Range and Taman Negara National Park-Timur Range. These two complexes are considered the most important ranges for the elephant population in Peninsular Malaysia.

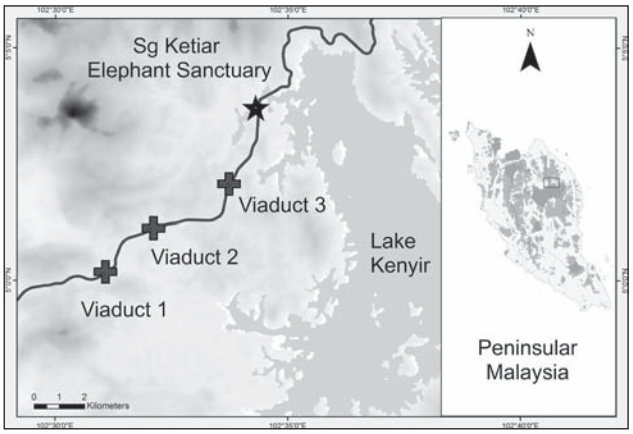

Figure 3. Location of viaducts (plus signs) and Sungai Ketiar Elephant Sanctuary (star) at Aring-Kuala Berang Highway (dark line), Terengganu.

Public conservation awareness

Public awareness regarding the importance of elephant conservation is vital to ensure that elephant management receives support from the public. Therefore, the National Elephant Conservation Centre (NECC), Kuala Gandah, the state DWNP Biodiversity Conservation Centers, and Zoo Melaka conduct wildlife conservation education and awareness programs for local communities, school children, and tourists. Moreover, at NECC an elephant-specific awareness program runs daily simultaneously with ecotourism activities (see 'Captive elephants' for more details).

Conservation research

The DWNP has conducted numerous research projects on elephants since the 1960's and continues to do so. The Management and Ecology of Malaysian Elephants (MEME) is an ongoing research project that aims to assess the effectiveness of the current elephant management strategies and to produce a scientifically sound elephant conservation strategy based on the understanding of elephant ecology and behavior as well as the human dimensions of HEC. MEME is a collaboration between DWNP, the Smithsonian Conservation Biology Institute, and the University of Nottingham Malaysia Campus. Currently, GPS satellite tracking is being used to understand the movement and habitat utilization of elephants in Peninsular Malaysia and to assess their response to translocation. Other ongoing research projects include the study of the importance of landscape configurations on the occurrence of HEC, in collaboration with Universiti Kebangsaan Malaysia; a study on the role of highway viaducts as wildlife crossing structures in the Kenyir Wildlife Corridor in collaboration with the Universiti of Malaya and James Cook University <http://myrimba.org/projects/>; and dung counts and occupancy surveys in Endau Rompin Johor State Park in collaboration with WCS Malaysia.

Captive elephants

The culture of elephant taming flourished once in Malaysia. In the 16th century, the city of Melaka was defended from the Portuguese using 20 tame elephants and, at that time, the Malay chiefs considered the possession of elephants indispensable for their dignity (Olivier 1978a). Although there is abundant evidence of mahout culture up to the 19th century, maintaining elephants in captivity eventually died out as a tradition in Peninsular Malaysia. In 1960, only two captive elephants were recorded in Malaya (Harrison 1960). This trend has reversed since the creation of EMU and the number of captive elephants increased to 20 in the mid-nineties (Daim 1995), and to as many as 62 in 2011 (Table 2). This increase is due to the policy adopted by the Malaysian Government of using elephants in ecotourism industry.

The NECC, Kuala Gandah, holds the largest captive population with 24 elephants. NECC was established in 1989 as a rehabilitation and training center for elephants involved in elephant translocation operations. In 2000, NECC opened its doors to the public and has rapidly become a major ecotourism destination, attracting 2000 visitors in 2000, 143,101 visitors in 2008, 158,763 in 2009 and as many as 178,600 in 2010. Entrance into NECC is free and – besides the opportunity to interact with elephants – the visit includes conservation awareness activities such as a permanent exhibit at the interpretation center and a movie about HEC in Malaysia. The NECC is located at the southern boundary of Krau Wildlife Reserve, a strictly protected area with no wild elephants since 1991. Therefore, there is no interaction between NECC and wild elephants other than the contact during translocation operations. The DWNP has recently opened a second elephant center (Sungai Ketiar Elephant Center) in northern Penisular Malaysia, which aims to follow the model developed in NECC. Captive elephants are also present in five public and three privately owned zoos and safaris (Table 2); while four elephants belong to a private owner in Kelantan (Table 2).

Elephant ownership in Malaysia is regulated by the Act 716 (which replaced Act 76). Before Act 76 was implemented (in 1972), there was no proper registration of captive elephants. The DWNP is the responsible agency in Peninsular Malaysia to look after the welfare of captive elephants. In order to ensure this welfare, the DWNP has produced Zoological Park Guidelines. Under the Act 716 there are two regulations that elephant owners have to comply with to ensure that captive elephants are well treated in terms of their condition and welfare. The two regulations are Wildlife Conservation (Operation of Zoo) Regulation 2011 and Wildlife Conservation (Supervision of Circus and Exhibition) Regulation 2011. The regulations include among others, sizes of enclosure, quarantine area, foods, cleanliness, animal show and exhibition and veterinary services. All elephant owners have to follow this guideline strictly. Private elephant owners have to renew their special permits annually. The condition of captive elephants is monitored by DWNP enforcement officers in each state and, if the condition and welfare of elephants are not satisfactory, the DWNP will recommend to the Ministry of NRE to revoke the special permit in accordance with the law.

Final remarks

The long-term survival of elephants in Peninsular Malaysia seems secured in the main protected areas, especially in Taman Negara National Park, Belum-Temengor, and Endau-Rompin forest complexes. Elephant survival outside protected areas is questionable and it will depend on the effective mitigation of HEC. The DWNP is currently drafting the National Elephant Conservation Action Plan. The aim of this plan is to develop a holistic management for the conservation of elephants in Peninsular Malaysia by considering various factors such as habitat availability, human interest, current government policies, participation of various agencies/ stakeholders in conservation work, *etc*. The priority of this plan is to establish a well-defined zonation of areas with different management strategies in relation to elephant conservation.

Table 2. Number of captive elephants in Peninsular Malaysia, 2011. M = males; F = females.

Name	Ownership	M	F	Total
National Elephant Conservation Center (NECC), Kuala Gandah	DWNP, Federal Government	7	17	24
Sungai Ketiar Elephant Center	DWNP, Federal Government	0	1	1
Zoo Melaka	DWNP, Federal Government	4	4	8
Zoo Taiping & Night Safari	Taiping Town Council, State of Perak	1	7	8
Zoo Negara	Zoological Park Society, State of Selangor	1	2	3
Zoo Johor	Johor Bahru Town Council, State of Johor	1	1	2
Kuala Krai Mini Zoo	Kuala Krai Local Council, State of Kelantan	1	0	1
Afamosa Animal Safari	A'Famosa Wonderland Pte. Ltd., State of Melaka	1	8	9
Danga Bay Petting Zoo	Private, State of Johor	1	0	1
Langkawi Elephant Adventures	Private, State of Kedah	1	0	1
Ibrahim Yahya	Private, State of Kelantan	1	3	4
Total		19	43	62

Creation of three types of areas is suggested: (1) strict conservation areas, (2) strict human areas, and (3) human-elephant coexistence areas. Strict conservation areas include Protected Areas where agricultural activities should be discouraged. In case of HEC inside a strict conservation area, no action would be taken against the elephant population. Strict human areas are those in which elephant populations are unsustainable in the long run and their presence results in a high cost in the form of HEC. Elephants in strict human areas can be relocated. Human-elephant coexistence areas are where agriculture and settlements meet large forest patches and where translocation of elephant is not suitable. In human-elephant coexistence areas, the management priority will be to minimize the impact of HEC, either by deterring elephant crop raiding or by increasing tolerance levels of local farmers to HEC.

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Current Status of Asian Elephants in Myanmar

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Introduction

The vast teak forests and elephants of Myanmar are legendary and have played critical roles in the country's history, culture and economy. Elephants are highly revered and are a symbol of power and good fortune. Elephants also have been a significant workforce in the country's logging industry.

Elephant protection was initiated through the Elephant Preservation Act of 1879, and expanded by subsequent laws including the Burma Wildlife Protection Act of 1936 (revised 1956), and the Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law in 1994. Wild elephants are now considered a completely protected species (Lair 1997; Myint Aung 1997; Uga 2000).

Although Myanmar's forests have long been considered an Asian elephant stronghold (e.g. Santiapillai & Jackson 1990), recent assessments revealed that this perception probably was overly optimistic and that populations have declined considerably during the last century (Table 1). In 2004, the Nature and Wildlife Conservation Division (NWCD) and the Smithsonian Institution organized a workshop to assess the current status of wild elephants and compile the most recent data (Leimgruber & Wemmer 2004). Together with a range-wide mapping workshop hosted by the IUCN Asian Elephant Specialist Group in 2008 in Phnom Phen (Hedges *et al*. 2009) these two assessments provide the most recent information on Myanmar's elephants, their status and distribution.

Wild elephants

Past elephant distribution

Historically most of Myanmar constituted prime elephant habitat, as the country was relatively sparsely populated with vast stretches of forested areas. Traditional shifting agricultural practices likely represented habitat improvements for elephants that generally prefer feeding in lightly disturbed forests (Fernando & Leimgruber 2011). The only elephant-free areas must have been restricted to densely populated settlements such as Mandalay and Yangon.

British occupation and colonization efforts in the 1800s and 1900s that placed high emphasis on large-scale timber and teak extraction resulted in the first significant pressures on wild elephant populations. During this period wild elephants were captured for use as draft animals in logging operations.

As many as 100-400 wild elephants were transferred from the wild for use in the logging industry annually (Toke Gale 1974; Olivier 1978; Caughley, 1980; Lair 1997; Myint Aung 1997; Leimgruber *et al*. 2008) utilizing traditional capture methods, mostly Keddahs. During a Keddah, wild elephants are driven into a funnel-shaped enclosure and then transferred one-by-one to a crush to be broken in (Williams 1950; Toke Gale 1974), usually through a combination of physical restraint, beatings, and food deprivation. Though we do not know of any published data on capture mortalities during a Keddah, it must be assumed to be high, probably at least 30%

(Myint Aung 1997), and potentially higher for adult elephants that resist.

Despite such significant removals of wild elephants for logging camps, wild populations were large in the early 1900s and, based on expert estimates, remained high well into the 1960s and 1970s (Table 1). However, recent efforts to model viability of wild and captive elephants in Myanmar suggest that removals at such pre-war levels are not sustainable, especially not if populations are declining from habitat loss and other development pressures (Leimgruber *et al*. 2008). This is supported by more data that indicate significant declines in Myanmar's wild Asian elephants (Myint Aung 1997; Leimgruber *et al*. 2008).

Table 1. Estimates of Myanmar's wild Asian elephant population from 1933-2004.

Year	Estimate		Source	Cited by
1933	3000		A	B
1935	10,000		C	B
1935	5000		D	B
1945	6250	*	C	B
1945	6000		E	
1956-1960	9057		F	G
1960-1961	9660		H	
1962	6500	#	B	
1962	9050	*	I	B
1962	9057		F	H
1969-1970	7340		H	
1972	6000		J	
1974	8500		B	
1977	5000		B	B
1980	6008±1000		K	L
1980	3000		J	
1980-1981	5508		H	
1982	6560		M	G
1982	6560		N	O
1982	6520		P	Q
1990	3000-10,000		Q	
1990-1991	4639	º	R	
1991-1992	4115		R	
1996	5000		S	G
1999-2000	<4000		R	
2002	6000		T	
2003	4000-5000		U,V	
2004	<2000		W	

*Extrapolation; #Official figure as quoted by Hundley; ºExcludes Kayah State.

A = Peacock (1933); B = Olivier (1978); C = Tun Yin (1959); D = Smith (1944); E = Williams (1950); F = Wint (1962); G = Uga (2000); H = Tun Aung & Thoung Nyut (2002); I = Tun Yin (1973); J = Caughley (1980); K = Hundley (1980); L = Salter (1983); M = Thet Htun (1982); N = Ministry of Agriculture and Forests; O = Sukumar (1989); P = SRUB/MAF/WPSB (1982); Q = Santiaillai & Jackson (1990); R = Myint Aung (1997); S = Forest Department (1996); T = Mar (2002); U = Lynam (2003); V = Sukumar (2003a); W = Leimgruber & Wemmer (2004).

Current distribution

A range-wide assessment of remaining elephant habitat in 2003, demonstrated that Myanmar has more potential elephant habitat remaining than any other range country (~170,000 km^2, Leimgruber *et al*. 2003). However, relatively little of this habitat (7%) is protected and Myanmar's elephants live predominantly outside protected areas.

Although there seems to be abundant elephant habitat, elephant densities are very low throughout Myanmar. Indirect recce-surveys at Alaungdaw Kathapa National Park (AKNP) and Htamanthi Wildlife Sanctuary (HWS) showed that these protected areas support only 0.001-0.024 and 0.019-0.085 elephants/km^2, respectively. The total population estimate for AKNP ranged from 2 to 41 elephants and for HWS it was between 40 to 183 elephants. Estimates were based on three-years of data from fixed width recce-dung surveys and accompanying dung decay experiments. This observation is further supported by the difficulty of finding and observing wild elephants throughout Myanmar.

Areas with increased human-elephant conflict (HEC), such as parts of the Bago Yoma or Thabeikkyin Township near Shwe-U-Daung Wildlife Sanctuary (SWS) and Gwa Township south of Rakhine Yoma Elephant Sanctuary, may be the best places to observe elephants during the harvest season when aggregations of elephants take to regular crop raiding. It is not clear whether low elephant densities throughout Myanmar are a result of lower habitat quality, habitat loss, poaching, or removal of elephants for the logging industry. The lack of adequate comparative data

from other deciduous forest regions in adjacent range countries such as Thailand also makes it difficult to assess what the baseline for wild population levels should be.

To more systematically assess the status of wild elephants and to develop a national survey and action plan for the species, the Smithsonian Institution and the Nature and Wildlife Conservation Division jointly hosted the first *National Elephant Symposium and Workshop* in 2004 (Leimgruber & Wemmer 2004). The goal of the workshop was to bring together Myanmar's elephant experts to discuss and evaluate the status of the species, and to develop an action plan for the species. The workshop's 35 experts included park wardens and rangers, foresters, university researchers, elephant veterinarians and managers from Myanma Timber Enterprise (MTE), private elephant owners, and conservationists from national and international organizations. All experts had extensive experience in finding, observing and managing wild elephants as part of their work or research. The experts collaborated to delineate an updated range map for elephants in Myanmar and estimate population numbers based on their best knowledge.

The results from this workshop overlap with the results from the more recent IUCN range-wide mapping workshop for elephants, with one distinct difference. The 2004 workshop only included areas that experts agreed had elephants and had first-hand experience in observing elephants. Experts' assertion that elephants exist in the area was considered a confirmation. The IUCN workshop improved on these methods by also recording information about the quality of the range estimate (i.e. confirmed, possible, doubtful, former and recoverable). However, the results from both workshops did not differ much and we cannot find much indication that the geographic distribution has shrunk, though population levels within range areas may have declined.

Despite low densities, elephants are still widely distributed throughout Myanmar and are found in many of the hill regions surrounding the large central plains of the Ayeyarwaddy. However, overall population seemed to have declined significantly over recent decades and the total estimate provided by the expert group during the workshop was less than 2000 wild elephants. The best areas for elephants may be the far north and south of the country where also the fewest people are found.

SOUTHEAST: There are several known elephant populations (Fig. 1; Table 2). All of these populations are relatively small and are concentrated in large forest tracts along the Myanmar-Thailand border. There is an additional area in Karen controlled territory for which presence of elephant can be considered confirmed.

CENTRAL MOUNTAINS: Wild elephants were reported for eight relatively small areas in the Bago Yoma (Fig. 1; Table 2). Most of these populations are small and have to be considered remnant populations. However, several of these areas are connected by forest corridors that may allow individuals to move between subpopulations.

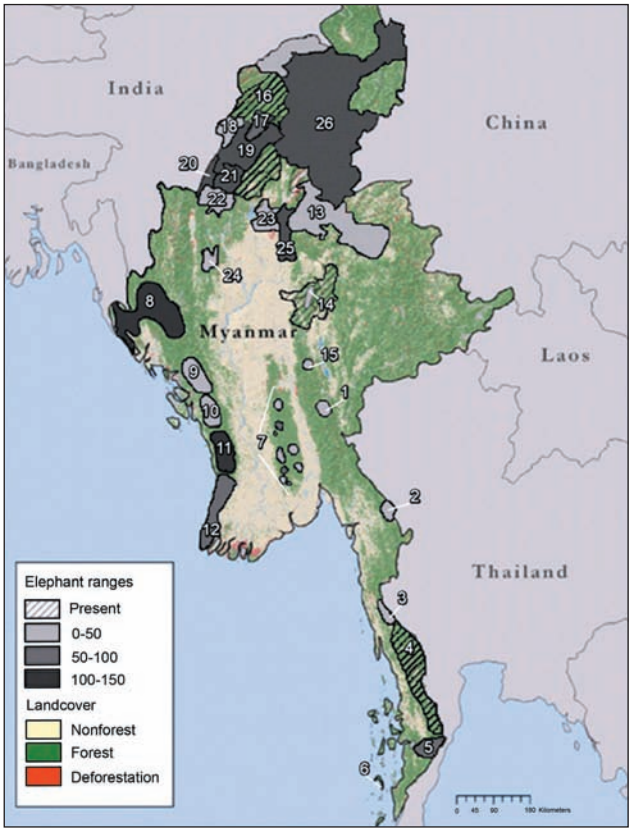

Figure 1. Status of wild elephant populations based on expert knowledge. Numbers correspond with those listed in Table 2.

Table 2. Estimates for wild elephant populations in Myanmar (Leimgruber & Wemmer 2004).

No.	Region	Area	# Elephants
1	SOUTHEAST	Kayah State	0-50
2		Karen (Kayin) State	0-20
		Mon State	0-50
3		Heinze-Kaleinaung Reserve Forest	<50
4		Myinmol Hkhat Mountain Area	unknown
5		Lenya-Mandaing-Manolon Area (Bo Kepyin & Tanintharyi)	100-150
6		Lampi Island	4
7	CENTRAL MOUNTAINS	Bago Yoma	200-240
8	SOUTHWEST (Rakhine State)	Mayyu	100
9		Ay	15
10		Taungup	30
11		Gwa Township	100-150
12		Thaboung, Pathein, Naguputaw Townships	100
13	EAST (Shan State)	Northern Shan	0-50
14		Myawaddy Area	unknown
15		Southern Shan —Southern Shan Pin Laung Area	12
16	NORTH - Sagaing Division	Kamti Township	Unknown
17		Htamanthi Wildlife Sanctuary	50-100
18		Lashe Township	0-50
19		Homalin Township	50-100
20		Tamu Township	<50
21		Phaungpyin Township	50-100
22		Mawleik Township	<50
23		Kanbalu Township	<15
24		Alaungda Kathapa National Park	<50
25	NORTH - Mandalay Division	Thabeikkyin & Simtku Townships	50-100
26	NORTH - Kachin State	Northern Forest Complex & adjacent areas	270

SOUTHWEST: The Rakhine Yoma region may be one of the strongholds for wild elephants in Myanmar (Fig. 1; Table 2). Elephants still appear to be abundant in inaccessible mountains and forests of the Rakhine stretching to the Mehu area and the border region to Bangladesh. The total number of remaining elephants may range between 350-400. In the Delta Region, wild elephants populations have completely disappeared, perhaps with the exception of remnant individuals in mangrove forest in Moulmyinkyun Township.

EAST: Shan State and the Shan Plateau make up most of these relatively densely populated and developed areas (Table 2; Fig. 1). Remaining elephant populations are very small and isolated. Conservation of these populations in the long run seems doubtful.

NORTH: The southern parts of this region border the edge of the central dry zone and are densely populated by people. Consequently, people-elephant conflicts are common. This is especially true for Mandalay Division where wild elephants remain in only two townships (Fig. 1; Table 2). In Thabeikkyin township for example, there may at times have been up to 40 wild elephants engaged in crop raiding. Other areas, although frequently degraded by mining and agricultural encroachment, may have had as many as 60 elephants. These are concentrated mostly in Chaunggyi Reserve Forest. People-elephant conflicts from these elephants occur most frequently in proximity of Zayakwin village. To reduce people-elephant conflict, MTE captured 41 elephants in 2003/2004 in this township (36 by Keddah and 5 via immobilization).

In contrast, northern Sagaing Division is less populated and developed and at least five townships have remaining wild elephant populations (Fig. 1; Table 2).

The Northern Forest Complex has to be regarded as one of the strongholds for wild elephants in

Myanmar (Fig. 1; Table 2). Based on information from the Forest Department in Kachin, the National Tiger Survey Team, and MTE data, there are only about five townships in the area that have no wild elephants. These include Naungmon, Putao, Khaungklanphu (formerly Kkaqpude), Chinare, and Injanyan. The group estimates the total number of wild elephant to be 270.

Threats to wild elephants

During the 2004 workshop, 35 experts also identified and delineated major threats to Asian elephants throughout Myanmar (Fig. 2). Habitat loss from agricultural conversion, hydro-electric developments, and mineral mining seems to be the greatest threat and often results in HEC. This type of habitat loss is on the rise and can be high locally (Leimgruber *et al*. 2003). There are three hotspots for habitat loss and HEC, including 1) the centrally located Bago Yoma, 2) the northern edge of Myanmar's Central Dry Zone, and 3) an area in northern Myanmar centered on Myitkyina and stretching from the headwaters of the Chindwin River across the forests to the Ayeyarwaddy. The number of human casualties from HEC in Myanmar, however, is low compared to South Asian range countries. Up to 12 people/year were killed in the late 1990s and early 2000s in Myanmar (Fig. 3A). HEC shows a strong positive correlation with annual deforestation rate at the state or divisional level in Myanmar (Spearman rank, $r=0.917$, $n=14$, $p<0.001$***; Fig. 3B).

The survival of Myanmar's wild elephants is tightly linked with the management and survival of the country's captive elephant population (Leimgruber *et al*. 2008). Recent population modeling demonstrated that Myanmar's captive elephant populations are not self-sustaining because mortality is too high and birth rate too low (Leimgruber *et al*. 2008). About 100 elephants need to be taken from the wild to supplement and sustain the captive herd. Such levels of removal can only be supported by wild populations that exceed 4000 animals.

Although little official information is available on live capture rates in Myanmar, incidental reports confirm that it has long been a practice to remove between 50-100 elephants from the wild each year. Often crop-raiding elephants are captured and transferred to captivity. To conserve wild elephants such practices need to be stopped and breeding in the captive population needs to be increased. Outside observers have tried to bring attention to this issue for decades (Caughley 1980), but so far this has been largely ignored by the elephant management and conservation community.

SOUTHEAST: Habitat loss from agricultural encroachment, oil palm plantation, and illegal logging are common in this region. However, the military and political situation in the border areas also has had negative impacts on wildlife and elephant populations through illegal poaching, trade, and disturbance from military operations.

CENTRAL MOUNTAINS: The Bago Yoma is surrounded by the densely populated lowlands, which are the home to roughly 80% of the country's human population. Consequently, pressures on wildlife and wildlife habitat in the area are high. Major threats to wild elephant

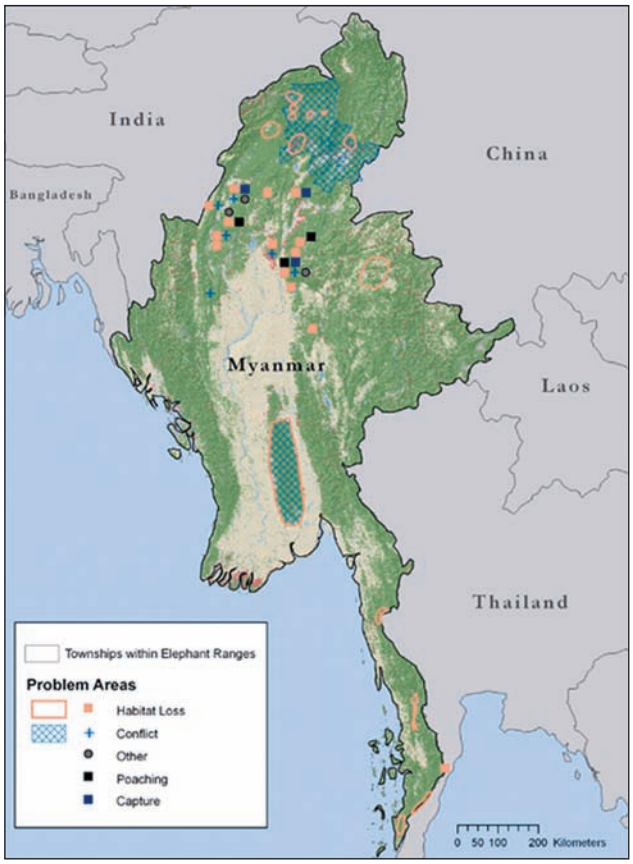

Figure 2. Threats to remaining wild Asian elephant populations in Burma.

populations include hydro-electric development (23 dams by 2004), agricultural land conversion and commercial logging. The Bago Yoma may also be one of Myanmar's regions with the highest HEC levels. The government has tried to reduce conflict by capturing "problem" elephants for their working camps.

SOUTHWEST: Major threats to wild elephant populations in the Rakhine Yoma region include habitat loss, HEC, poaching, and live-capture. Habitat loss and elephant population declines have been most severe in the region's coastal mangrove forests, resulting in the complete disappearance of wild elephants from the Ayeyarwaddy Delta during the last two decades.

NORTH: Throughout most of Sagaing and Mandalay Divisions, habitat loss from logging, charcoal production, and agricultural conversion represent the most serious threats to elephants, sometimes resulting in high levels of HEC, as

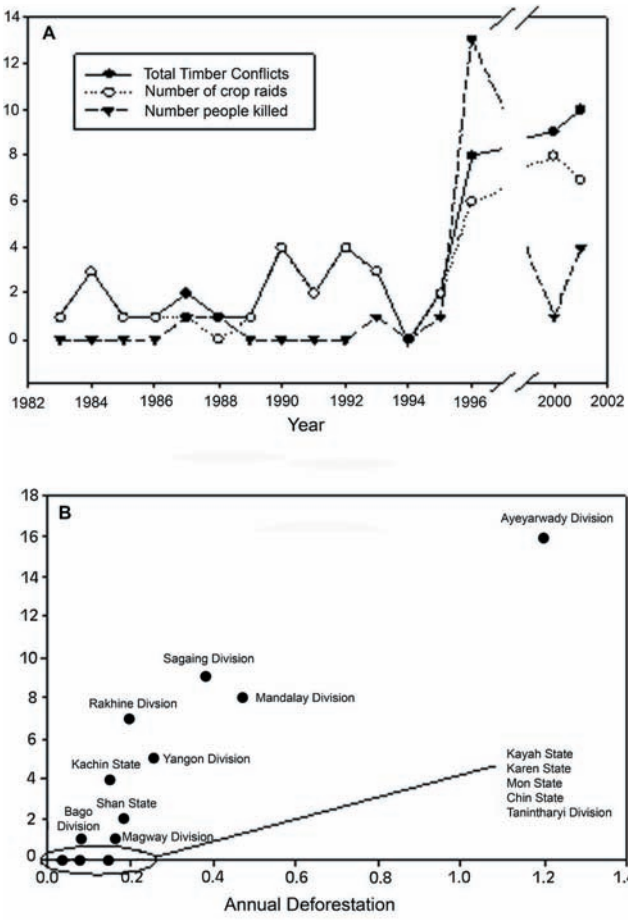

Figure 3. HEC in Myanmar. A) Increase in HEC over time; B) Annual deforestation rate and HEC (Data: Courtesy U Khin Maung Zaw).

was the case in Thabeikkyin township in the early 2000s. Increasing mining for gold may also locally contribute to elephant declines. In more remote areas poaching may also represent a threat. Unique to the area is increased live-capture of elephants by local Kachin people who have a long tradition in elephant capture and use.

Although much of the land in the Northern Forest Complex is still in pristine condition, several threats to elephant populations and other wildlife exist or are currently developing. The expert group for this region identified six major threats including habitat loss, poaching, live-capture using the traditional Melashikar lasso technique, wildlife trade to China, increased human activity and trespassing on wildlife habitats, and changes in the sex composition of the wild herds resulting from traditional capture techniques.

Elephant management and HEC mitigation

Although Myanmar has several protected areas that are designated protected elephant ranges, the country currently does not have an organized national approach to wild Asian elephant management and conservation. From 2001-2007, the Smithsonian Institution collaborated with Myanmar's Forest Department and its Nature and Wildlife Conservation Division to survey elephant populations in selected protected areas and to develop plans for a nationwide population survey. The original idea was to use the national survey to inform a national action plan for elephant conservation. While the joint project produced much useful information including population assessments for Alaungdaw Kathapa National Park and Htamanthi Wildlife Sanctuary, a satellite tracking study on elephant movement ecology, and an expert workshop to determine the elephant conservation status in 2004, the national survey and action plan were not executed because of political difficulties.

Wild elephants are protected by law in Myanmar and killing or capturing an elephant is prohibited. Officially, live-capture of elephants using Keddah techniques has also been abandoned and MTE does not conduct such operations directly. However, every year 50-100 elephants

are removed from the wild to supplement captive populations. Most wild elephants probably live outside protected areas, and HEC seems to be higher in disturbed or logged areas than adjacent to protected areas. HEC management usually is restricted to crop guarding by villagers, who also attempt to drive away elephants with noise makers and rocks. If HEC escalates the government sends MTE elephant teams to drive elephants away from crop areas and to, at least in some cases, capture "problem" elephants and transfer them into captivity. The responsible government agency is the Forestry Department and its Nature and Wildlife Conservation Division. Elephant captures as well as drives usually are executed by elephant teams under MTE or by private companies. MTE veterinary and elephant management staff probably are among the most experienced elephant experts in Myanmar.

Myanmar has a serious lack in technical capacity and resources to develop and apply other widely recommended HEC management tools, such as electric fencing, capture/translocation, or insurance and compensation schemes. A systematic nationwide assessment of remaining elephant populations, current threats to elephants, and extent and nature of HEC is urgently needed. This information should inform the previously planned National Elephant Conservation Action Plan.

Captive elephants

Myanmar is the country with the world's largest captive elephant population (Leimgruber *et al*. 2008; Lair 1997) and, perhaps, with the best developed and organized captive management system, which originated from the British colonial period. Most of Myanmar's captive elephants are being used in logging operations (Leimgruber *et al*. 2008; Lair 1997), although a few ecotourism camps were established during the past decade. About 20 elephants are currently in Myanmar's zoos, including Yangon Zoo (n=6), Hlaw Gar Garden (n=4), Mandalay Zoo (n=2), and Nay Pyi Taw Zoo (n=8). The revered Royal White Elephants that have been discovered in Myanmar during the last decade are housed at temples in Yangon (n=3) and Nay Pyi Taw (n=2).

Myanmar currently has about 4755 captive elephants (Table 3, Figs. 4-6), of these 2855 are owned by the government. Most of the government elephants are managed by the Myanmar Timber Enterprise (MTE). Approximately 1900 additional elephants are in private hands. Many of the privately owned elephants are rented by MTE during the year for logging operations. Elephant management is organized around resting and logging camps by region and each of the camps has MTE veterinarians, elephant managers, head mahouts and mahouts, called oozies in the national language. All elephants are examined at least once a month by MTE veterinary staff. Although there is a severe shortage in supplies, veterinary tools, and medicines, elephants in the logging camps usually are kept in good condition. Elephants work during the rainy and cool seasons, but are in rest camps during the hottest time of the year.

Rented private elephants are managed by their owner or the owner's oozies, but are integrated with the MTE elephants and receive the same overall management and veterinary care. MTE keeps records on every elephant via a studbook. This book is also used to record the medical and

Figure 4. Captive elephant in Myanmar (Photo: C. Wemmer).

reproductive history of each individual elephant. All privately owned elephants are registered with the Forest Department and owners are issued a license for each individual elephant.

Myanmar's captive elephant population probably was largest before World War II, when some experts estimated that there may have been ~6,000 to 10,000 work elephants held by the government and private owners (Williams 1950; Toke Gale 1974; Table 3). Disruption of logging operations and partial release of work elephants during the war reduced captive populations to about 2500 in the 1940s. Estimates of the overall captive population size vary considerably but seem to have increased throughout the 1960s and 1970s, reaching about 5500 elephants in 1980 and remaining relatively constant thereafter. It seems that most of the variation is caused by estimates of the privately held population. The government-owned population varies less and has stayed between 2500 to a little over 2900 for most of the last three decades.

Table 3. Past and present size of the captive elephant population (Leimgruber *et al*. 2008).

Year	Govt.	Private	All	Source
1910	–	2000-3000*	–	A
1935	–	1507*	–	B
1930s	–	–	6000	C
1930s	–	–	10,000	D
1945	–	–	2500#	D
1962-63	1526	–	–	E
1970	–	–	6396	F
1973	–	–	3400x	F
1973	–	–	6672	G
1974	–	–	3200 x	D
1978	–	–	3500 x	F
1980-81	2539	–	–	E
1981-82	2652	–	–	E
1982	–	–	5398	G
1982-83	2755	–	–	E
1983-84	2798	–	–	E
1984-85	2832	–	–	E
1985-86	2872	–	–	E
1986-87	2920	–	–	E
1987-88	2947	–	–	E
1988-89	2955	–	–	E
1988-89	2959	–	–	E
1989	–	–	5400	H
1989-90	2942	–	–	E
1990-91	2925	–	–	E
1991-92	2895	–	–	E
1992-93	2898	–	–	E
1993-94	2873	2718	5591+	I
1994-95	2858	–	–	I
1997	2800	–	–	I
1999-00	2715	–	–	E
1999-00	1672+	–	–	E
2002	–	–	6000	J
2011	2855	1900	4755	K

*Records for a single firm only (1910 = Bombay Burmah Trading Corporation); #Includes only adult elephants; xAlthough not stated in the text, it appears these estimates relate only to the government-owned elephants; +Registered elephants only.

A = Evans (1910); B = Hundley (1935); C = Williams (1950); D = Toke Gale (1974); E = Tun Aung & Thoung Nyut (2002); F = Olivier (1978); G = Ministry of Agriculture and Forestry (1982) as cited in Lair (1997); H = Sukumar (1989); I = Lair (1997); J = Khyne U Mar (2002); K = Zaw Oo, pers. comm.

A large proportion of Myanmar's captive elephant population is wild-caught (Leimgruber *et al*. 2008) with 335 elephants captured since 2004 (Table 4). Additionally, birth rates appear to be very low based on available published data, with only 7.1% of female elephants in MTE herds breeding. Using population viability analysis and published data on MTE elephant demography, Leimgruber *et al*. (2008) determined currently captive elephant populations in Myanmar are not self-sustaining and that these populations will decline if not supplemented from the wild. Declines will be relatively slow because of the current size of the population but to maintain current herd size, supplementation of 50-100 individuals from the wild each year would be required. Leimgruber *et al*. (2008) also used published capture rates throughout the last century to demonstrate that declines from 8000 to only about 2000 wild elephants could be solely explained by live-capture to supplement captive herds. Leimgruber *et al*. (2008) showed that continued live-capture may pose a serious risk for the survival of Myanmar's wild and captive elephants and that the best strategy would include improving current breeding rates, stopping all live-capture, and reducing the captive herd. The latter also may make sense considering that other range countries have long ended wide use of elephants in logging, as the logging industries have been modernized. In some cases, this has lead to significant animal

welfare problems, as former logging elephants have become unemployed and veterinary care, formerly provided by forest departments, is too expensive for private owners.

Conclusion

Myanmar is unique because of its large amount of remaining elephant habitat and its large captive elephant population. Additionally, there is a large number of elephant experts remaining in the country, especially in MTE and the Forest Department, but also in society represented by private elephant owners. The cumulative technical and traditional knowledge about elephant biology and management is significant but remains relatively untapped. Despite this significant expertise, capacity building tailored to the needs of these experts is urgently needed. This would include training in elephant care and husbandry, veterinary care, and elephant behaviour, ecology and biology.

Although much knowledge and even data exists in Myanmar, this data is largely inaccessible and thus, of limited value. Additionally, new

Table 4. Yearly live-capture rates (LCR) for wild elephants in Myanmar.

Year	LCR	Deaths	Releases	Source
1910-27	412			A
1910-72	228		450	B,C
1911-82	239			C
1935-41	214			B,D
1942-44	0			A
1945-62	140		281	B,C
1945-46	63		6	A,E
1946-47	144		18	A,E
1947-48	191		26	A,E
1948-49	131		24	A,E
1949-50	185		34	A,E
1950-51	156		21	A,E
1951-52	36		11	A,E
1952-53	107		27	A,E
1953-54	85		11	A,E
1954-55	60		9	A,E
1955-56	100		23	A,E
1956-57	170		28	A,E
1959-60	299		7	A,E
1960-61	283		11	A,E
1961-62	369		25	A,E
1964-65	15		1	A,E
1965-66	54		10	A,E
1966-67	129		25	A
1945-67	142		317	A
1962-72	153		50	B,C
1962-73	165			D
1969	272			D
1970	227			D
1970-71	228	64	7	F
1971-72	283	56	6	F
1972-73	201	32	17	F
1973-74	143	28	10	F
1974-75	111	21	3	F
1975-76	69	14	5	F
1976-77	82	15	1	F
1977-78	92	13	1	F
1978-79	93	13	0	F
1979-80	133	25	2	F
1980-81	122	30	10	F
1981-82	124	38	4	F
1982-83	56	8	1	F
1983-84	40	0	5	F
1984-85	41	7	6	F
1985-86	39	8	3	F
1986-87	49	3	1	F
1987-88	42	3	0	F
1988-89	26	5	1	F
1989-90	32	3	0	F
1990-91	22	0	0	F
1991-92	77	7	0	F
1992-93	17	2	0	F
1970-93	92	17	4	G
1972-82	117			H
1980-81	75			G
1981-82	76			C
1982-83	44			C
1983-84	35			C
1984-85	28			C
1985-86	28			C
1986-87	33			C
1987-88	39			C
1988-89	20			C
1989-90	29			C
1990-91	22			C
1991-92	23			C
1992-93	15			C
1993-94	13			C
1994-95	2			C
1995-04	?			
2004-05	166			I
2005-06	2			I
2006-07	3			I
2007-08	53			I
2008-09	26			I
2009-10	96			I
2010-11	9			I

A = Toke Gale (1974); B = Ministry of Agriculture and Forestry (1982) as cited in Lair (1997); C = Lair (1997); D = Olivier (1978); E = official figure as quoted by Hundley; F = Uga (2000); G = Myint Aung (1997); H = Santiapillai & Jackson (1990); I = Zaw Oo, MTE.

information needs to be collected, specifically on the wild elephant population status, using modern surveying tools. Such information is essential for future planning and management.

Most importantly, Myanmar urgently needs to develop a national plan for the management and conservation of its elephants, captive and wild. To develop this plan the Forest Department and MTE need to collect new data on the distribution, demography, and status of wild and captive elephants (government and privately owned) through new countrywide surveys. Once the data is collected the FD and MTE need to jointly convene an expert group to develop management recommendations for the government. None of these efforts, however, will come to fruition unless there is the recognition for such a plan and the political will to institute and enforce new regulations for elephant management and conservation at the highest government levels.

Acknowledgments

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Figure 5. Captive elephants in Myanmar (Photo: C. Wemmer).

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Figure 6. Captive elephant in Myanmar.

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Current Status of Asian Elephants in Nepal

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Introduction

Until the 1950s, much of the plains area of southern Nepal known as the Terai was covered by forests uninhabited by humans due to malaria. It is believed that the elephants in these forests in Nepal and elephants in north and northeast India constituted one contiguous population (DNPWC 2008). The eradication of malaria and government resettlement programs in the 1950s resulted in a rapid influx of people from the hills into the Terai. Besides, thousands of Nepalese residing in Myanmar and India came back to Nepal due to the land reform program in the 1960s (Kansakar 1979). The arrival of settlers meant the destruction of over 80% of the natural habitat (Mishra 1980), which resulted in the fragmentation of wild elephants into partially or completely isolated groups numbering less than 100 animals each (Pradhan 2007).

The Government of Nepal, over the years has been trying to address the conservation of this endangered species through various policy approaches. These include listing of elephants as a protected species in the National Parks and Wildlife Conservation Act 1973 (NPWCA 2029). Preparing Elephant Conservation Action Plans (2008) and more importantly, adopting the Terai Arc landscape level conservation program. This program aims to manage the elephants as a meta-population through restoration of corridors, thus improving their chances of long-term survival in their current habitats (DNPWC 2008). The Nepalese government has also recognized the importance of captive elephants by establishing an elephant breeding facility at the Chitwan National Park.

Wild elephants

Population distribution

Presently, the number of resident wild Asian elephants in Nepal is estimated to be between 109 and 142 animals (DNPWC 2008). They occur in four isolated populations (Eastern, Central, Western and far-western). The area inhabited by elephants is spread over 135 village development committees (VDC) in 19 districts (17 in lowland Terai and 2 in the hills) of Nepal, covering about 10,982 km^2 of forest area (DNPWC 2008). This widespread and fragmented distribution of elephants in the Terai underscores the importance of the need for landscape level conservation planning as a strategy to protect elephants and humans by maintaining forest corridors within the country (Fig. 1). In addition, in recent years there have been several incursions of over 100 elephants from the Indian state of West Bengal into Eastern Nepal.

The eastern population comprises of about 15 resident animals and migratory animals from West Bengal with herd sizes ranging from a few individuals to over 100 animals (Yadav 2002; DNPWC 2008). The resident elephants move seasonally through the seven eastern districts covering 2228 km^2 of forest area. This elephant population is confined to highly degraded and fragmented forest patches which in turn lead to very high conflict with humans. Koshi Tappu Wildlife Reserve, the only protected area in the east, is tiny with 4.59 km^2. forest. The movement of the trans-boundary herd is largely restricted to the Bahundangi area of Jhapa district and creates massive human elephant conflict. (DNPWC 2008). In November 2007, 175 elephants

including 37 calves entered Jhapa but were not reported to move beyond the boundaries of Jhapa district. It is suspected that this herd, which lives in a highly disturbed and fragmented landscape on both sides of the border ranges from Assam to Eastern Nepal through the Indian state of West Bengal.

In central Nepal (Fig. 1), it is estimated that a population of 25 to 30 elephants are largely resident within the Parsa Wildlife Reserve and Chitwan National Park (ten Velde 1997; DNPWC 2008). Occasionally these elephants move towards Mahhotarri district in the east. The elephant population is estimated to occur over a forest area of 3227 km^2. Forest habitats and corridors are mainly intact except for a few settlements in the Bara, Rautahat and Mahhotarri district (DNPWC 2008).

The western elephant population is mainly found in Bardia National Park and ranges over a forest area of 2943 km^2 spread over 36 VDCs in 3 districts (Fig. 1). This is the elephant population that has been studied the most and its origins are very interesting. Prior to 1994, there were only 2 resident elephants and a seasonally migratory herd of 12 elephants in the park (Pradhan *et al*. 2007, 2008). Elephant numbers then started to increase, probably due to immigration from India. In 1994 rangers in Bardia NP counted 45 animals. Pradhan (2007) carried out the first systematic sampling for elephant numbers using non-invasive genetic microsatellite techniques. He estimated 50 elephants in the Karnali floodplain and over 30 in two separate herds in the Babai Valley, a total of 80 animals within Bardia NP. He also found that females and calves had high kinship coefficients indicating mother-offspring relationships and the overall population genetic variability was moderately low (ca. 60% heterozygosity) when compared with US zoo animals (80%). This can be explained by a limited number of founders from one single population in 1994. In contrast, most of the sub-adult males were not related, either among themselves or with the adult females suggesting non-random locational dispersal (Pradhan 2007). This also indicates that the Khata (Nepal) - Katarniaghat (India) corridor is functional and landscape level biodiversity management benefits elephants.

The elephants in the far western population range over an area of 2583 km^2 of forests, mainly in churia foot hills of Nepal, which includes Suklaphanta Wildlife Reserve and 28 VDCs in 2 districts (Fig. 1). It is believed that 3 – 5 elephants permanently reside inside Nepal while the rest migrate seasonally from the bordering districts in the Indian state of Uttar Pradesh. These elephants

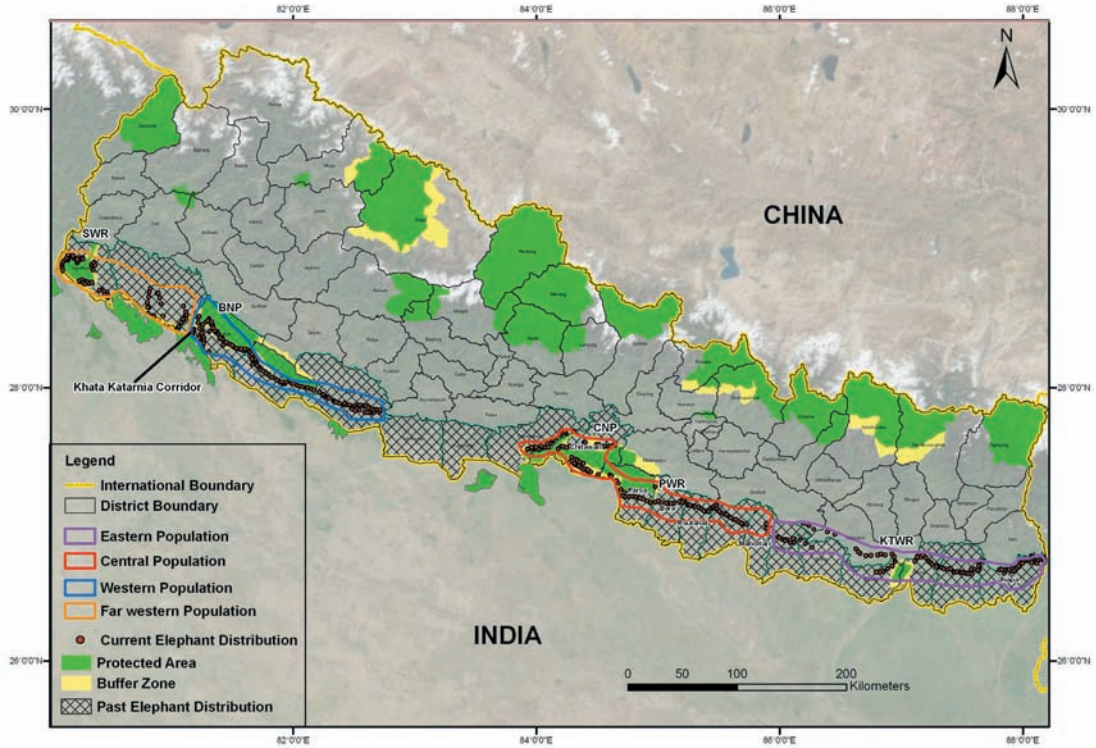

Figure 1. Past (coloured lines) and current (dots) elephant distribution in Nepal.

are believed to be part of a population of 1500 elephants in the Indian states of Uttarakhand and Uttar Pradesh (Rangarajan *et al*. 2010).

Threats

Elephant range in Nepal is under constant threat of being fragmented into smaller areas (DNPWC 2008). Most of the forest corridors in eastern Nepal are highly fragmented. The situation is slightly better in western Nepal where there is connectivity between forests along the north-south direction (Bardia National Park - Katarnia, Basanta-Dudhwa) and along the east-west direction a narrow band – the Churia foothill forest connects Bardia National Park to the Suklaphanta Wildlife Reserve and further west to the forests of the Uttarakhand state in India. These forest corridors have proven to be the vital link for migrating elephants, as they move back and forth between the Indo-Nepal transboundary areas in the west (ten Velde 1997). However, the future of these corridors is uncertain due to the increasing human population. Forests outside the protected areas have suffered extensive depletion, due to the demands of human populations living along the fringe of the forest.

HEC in Nepal

The major cause for increasing human elephant conflict (HEC) is the increasing fragmentation of remaining forests and rapid increases in the elephant population due to migration from India. Moreover, the fertile Terai with intensive agriculture next to the existing elephant habitat is proving to be a fatal attraction to elephants. Inefficiency of the current protection measures, and behavioural flexibility of elephants enabling them to quickly modify their foraging strategies in response to protective measures are also believed to be major reasons for increasing HEC.

The growing human population, coupled with the declining forest area, is bringing people and wildlife into closer contact, with detrimental impacts on both. Therefore addressing the vulnerabilities to communities from large mega herbivores like elephants is one of the greatest conservation challenges faced by the country. Crop raiding and more recently human casualties have become major issues related to HEC.

Among crops, paddy is the most raided crop in Nepal. A study conducted by Shrestha *et al*. (2007) on the Jhapa, Bardia and Sukla areas showed strong correlation between economic loss due to crop damage with settlement coverage (i.e. percentage of the transformed land) and with the degree of fragmentation. Two peak seasons for crop raiding were identified, one during maize or wheat maturing time (June – July) and other during paddy maturing time (Sep. – Nov.). Most of the crop raiding and property damage by elephants were reported to occur at night.

Eastern Nepal is the most affected area by HEC due to the seasonal migration of elephants from India. An average household in Jhapa district lost USD 430 (Nrs. 30,000) to elephants. In a period of five years (2003 to 2007) 20 people have died due to elephant attacks and in retaliation 12 elephants were killed in 2006 (DNPWC 2008).

HEC is comparatively less in Central Nepal as the small elephant population largely remains within the protected areas i.e. Parsa Wildlife Reserve and Chitwan National Park. However, data shows that three elephants were killed during the period of 2005 to 2007. Recently human casualties have been increasing with 11 people dead due to elephants in and around CNP and PWR in the last 10 months (Rupak Maharjan, Park Ranger, pers. comm.). The reasons for this sudden spike are not known.

Similarly, the trend in the number of HEC incidents in western Terai is on the rise. In 1999 alone 117 houses were damaged. Only 2 persons had been killed and 4 injured in the 1980s (Bhatta 2003) as a result of HEC. However in the last four years 10 persons have died, 33 injured and 900 houses damaged due to HEC. Retaliation has not been as severe as in the east; only two elephants were killed in retaliation (by electrocution) in western Nepal to date. Studies by Yonzon *et al*. (2003) in far western Nepal showed that HEC was widespread and occurred over an area of 893 km^2 covering 17 VDCs of Kanchanpur district and 32 VDCs of Kailali district.

Unlike other South Asian countries, retaliatory killing of elephants has not yet reached a critical level in Nepal, except for the killing of 6 elephants in the east in 2006. However, future occurrence of retaliatory killing cannot be ruled out as people's patience with repeated losses due to HEC runs out. There is also a clear indication that for the long-term survival of a species like the Asian elephant in Nepal, mitigation activities have to percolate to the household level even if the conservation approach adopted is landscape level or is community based (Bhatta 2003).

The Government of Nepal with the help of WWF Nepal Program initiated the Terai Arc Landscape Program with the vision of maintaining ecological integrity and bringing livelihood security to the people who live in the landscape. The TAL Program is a priority program of the Government of Nepal and has been included in the 10th Plan. Root Causes Analysis of Terai Arc Landscape outlines human-wildlife conflict as one of the direct causes of biodiversity loss and environment degradation (WWF Nepal 2003).

Despite the severity of the problem of human-elephant conflict in Nepal, there is no national level strategy document to guide mitigation measures in different parts of the country except the new relief fund guideline endorsed by the Government in 2010. Most mitigation measures in Nepal are reactive and implemented to control the crisis situation that develops after a major conflict incident.

At the site level, some of the initiatives that are being implemented to minimize HEC caused by human casualties and damage of property are:

Physical barriers: These include wildlife watchtowers, trenches, fences; deterring devices and also promotion of traditional methods used by the local community.

Power fences: Electric fences were first piloted in Bardia National Park and Suklaphanta Wildlife Reserve in 2000. However fence equipment was stolen and its effectiveness could not be assessed. The main lesson learnt from this piloting was that, community ownership is mandatory for these measures to be sustainable. Since then the Government of Nepal is working with local community based organization in erecting electric fences and this seems to be one of the effective tools to minimize HEC, but still maintenance is a major challenge for sustainability.

Local practices: Most common local practices used in affected villages are: fire, noise, domestic elephants, firecrackers and deterring squads of humans and elephants.

Relief schemes: In order to compensate local communities and to ensure their participation in conservation, the Government of Nepal endorsed a relief fund policy for wildlife victims in 2010. This policy provisioned about USD 2000 (NRs 150,000) for human death and up to USD 715 (NRs 50,000) for injuries due to wild animals. Besides, some protected areas (Chitwan National Park, Bardia National Park) have access to emergency funds, which provides immediate relief to people attacked by wildlife.

Buffer zone development program: The National Park and Wildlife Conservation Act 1973 mandated that 30 to 50 % of the income derived by national parks and wildlife reserves has to be plowed back to local buffer zones around protected areas. The main objective of this program is to make the local people guardians and supporters of conservation. The money is spent through local Buffer Zone Users Committees in various activities related to conservation, community development, conservation awareness and income generation activities.

Elephant drives: This method has been piloted in the Madi Valley of Chitwan National Park. A central level squad with park personnel, security people and kunki elephants has been formed to react immediately and provide relief from raiding elephants at the problem site. Informants were recruited at the village level, through VCDs, to inform the movement of elephants to park HQ as well as to local people as an early warning system. User group committee level squads have also been established to assist the central level team when it is in action.

Elephant Conservation Action Plan for Nepal

Recognizing threats in conserving elephants, the Government of Nepal endorsed "The Elephant Conservation Action Plan 2008", a guiding document that identifies the highest priority conservation actions for overall management of the elephant in Nepal. The plan aims to save the elephants in the wild from extinction, immediately address habitat loss and to mitigate associated people-elephant conflict. Therefore the action plan mainly focuses on crisis management as the population is already fragmented, and resolving human elephant conflict. The plan emphasizes landscape level conservation and creating/maintaining ecological corridors, so that fragmented elephant populations can be linked for genetic viability. Besides, it also emphasizes management of captive elephants in Nepal.

Captive elephants

Domestication of elephants in Nepal has a long history. Prithivi Narayan Shah, the first king of the Shah Dynasty provided seven adult elephants annually from 1743 to 1775 to the East India Company for invading Parsa-Mahotari through the Makawanpur Battle (JBK 1985). Likewise, it has been recorded that 315 elephants were used by a Rana ruler in a single hunt in Chitwan Valley in 1930. In the past, there used to be 31 elephant camps throughout the lowlands of Nepal. The capture and training of wild elephants was a common practice. A total of 10 wild elephants were captured for domestication during 1954-1970. However, data shows the number of domesticated elephants was decreasing in trend up till 1970s (Fig. 2).

Since 1978, management responsibility of domesticated elephants has been given to the Department of National Parks and Wildlife Conservation (DNPWC). Due to the increasing demand for elephants for patrolling and park management duties and the difficulty of legally procuring elephants from India, an elephant breeding center was established in CNP in 1986.

At present, there are altogether 208 captive elephants in Nepal (Table 1, Source: DNPWC, CNP, NTNC) out of which 94 government elephants are in various PAs in the Terai, namely Koshi Tappu Wildlife Reserve, Parsa Wildlife Reserve, Chitwan National Park, Bardia National Park and Suklaphanta Wildlife Reserve. The National Trust for Nature Conservation (NTNC), a national NGO possesses 8 elephants in their field station in Chitwan, Bardia and Central Zoo, Kathmandu. The majority of private elephants are in and around Chitwan National Park, and are mainly used for tourism purposes. Government elephants are mainly used for patrolling and research purposes whereas private elephants are mostly used for forest excursions and for entertaining tourists in buffer zones of parks and reserves.

Elephant tuberculosis is a chronic disease that affects captive elephants worldwide. In Nepal tuberculosis in captive elephants was first identified in Chitwan National Park in 2002 (Gairhe 2002). In the period of seven years (2002-2009) altogether seven captive elephants died due to tuberculosis (DNPWC 2011). To address this the Government of Nepal started surveillance on elephant Tuberculosis in 2006 and started TB treatment in 2008 by standardizing treatment protocol. Recently the Government of Nepal endorsed the Nepal Elephant Tuberculosis Control and Management Action Plan, which aims to minimize the risk of TB transmission from captive elephants to the wild by managing tuberculosis at the captive-wild interface (DNPWC 2011).

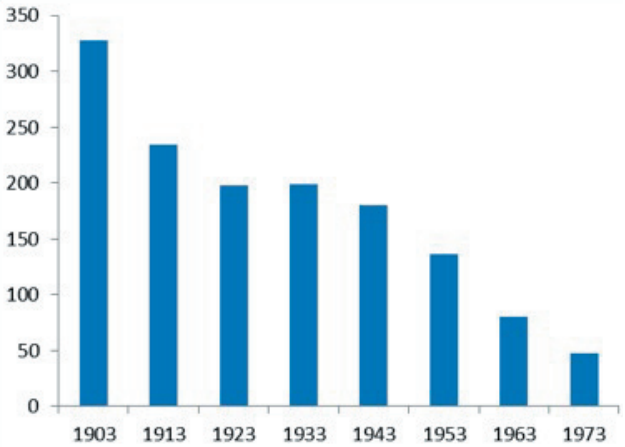

Figure 2. Captive elephant population over time.

Table 1. Domesticated elephants in Nepal.*

	Gov.	NTNC	Private	Total
Chitwan NP	52	5	98	155
Bardia NP	16	2	8	26
Parsa W	10			10
Koshi Tappu W	8			8
Suklaphanta W	8			8
Central Zoo		1		1
Total	94	8	106	208

*NP=National Park, W=Wildlife Reserve, Gov. =Government

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Current Status of Asian Elephants in Sri Lanka

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Introduction

Sri Lanka holds an important position with regard to Asian elephant conservation. Well over 10% of the global Asian elephant population in less than 2% of elephant range (Leimgruber *et al*. 2003), makes Sri Lanka the range country with the highest density of elephants. It also has one of the highest human densities among range-countries. Therefore successes and failures in Sri Lanka can provide critical insights into mitigating human-elephant conflict (HEC) and conserving elephants. In addition Sri Lankan elephants are recognized as a distinct subspecies. Although genetic support for a sub-specific distinction is low, Sri Lanka has the highest genetic diversity of Asian elephants (Fernando *et al*. 2000; Fleisher *et al*. 2001).

Sri Lankans have a very close association with elephants that extends back millennia. Characterization of elephants such as the division into 'castes', and the management of captive elephants has been the subject of many ancient treatises (Jayewardene 1994; Wisumperuma 2004). Elephant motifs have been widely used in Sri Lankan art since ancient times (Wisumperuma 2004). They are a prominent feature of stone and wooden carvings, many fine examples of which can be found in the ancient cities of Sri Lanka such as Polonnaruwa, Anuradhapura and Kandy as well as contemporary places of worship (Fig. 1). In ancient history, captive elephants were heavily utilized for labour, war, and religious and cultural activities (Jayewardene 1994; Wisumperuma 2004). In more recent times their use as work animals has decreased drastically.

Elephants hold a central position in the country's two main religions Buddhism and Hinduism as well as in Sri Lankan culture. The elephant is considered a symbol of physical and mental strength, intelligence, responsibility, good luck and prosperity. Elephants are kept in a number of temples and feature prominently in annual pageants named 'peraheras' (Fig. 2). The most famous is held in August in the city of Kandy, which features up to a hundred richly caparisoned elephants festooned with lights, together with thousands of drummers, musicians, dancers, torch bearers etc. The highpoint of the Kandy perahera is the ceremonial exposition of the tooth relict of the Lord Buddha carried on the back of a majestic tusker of the highest 'caste'.

Elephants in Sri Lanka are protected under the Fauna and Flora Protection Ordinance and recent amendments to it makes taking the life of an elephant illegal under any circumstances. Catching or killing a wild elephant carries a fine

Figure 1. Painting at the anicent Reswehera temple in the Northwest.

of Rs. 150,000-500,000 (US$ 1400-4500) or imprisonment of 2-5 years or both. A national policy for the conservation and management of wild elephants was developed in 2006 (available online at: <www.dwc.gov.lk>) but has not yet been effectively implemented.

Wild elephants

Estimates of elephant numbers

Estimates for Sri Lanka have ranged from 1500 in 1951 (Norris 1959), 1600-2200 in 1969 (McKay 1973), 2000-4000 (Olivier 1978), 5000 in 1978 (Hoffmann 1978) to 2700-3200 in 1990 (Santiapillai & Jackson 1990). Most of these estimates were based on 'educated guesses'. Since 1994 the Department of Wildlife Conservation (DWC) has conducted a number of 'elephant censuses' by counting elephants at water holes in the dry season. The numbers derived from such counts have been 1967 countrywide in 1993 excluding the North (Hendavitharana *et al*. 1994); 1076 in the Northwest and part of the northern region in 2004; 2149 in the North-central region and part of the East in 2008; and 5879 in the entire island in 2011 (DWC data).

Past elephant distribution

Sri Lanka is an island of 65,000 km^2. The southwest quarter of the island known as the 'wet zone', receives rain throughout the year. The rest of Sri Lanka has seasonal rainfall and is known as the 'dry zone'. Central mountains rise up to about 2500 m. The natural vegetation is dry evergreen forest in the dry zone, rain forest in the wet zone and montane forest in the mountains.

Prior to human presence, most of the country was covered in mature forest and elephants probably inhabited the entire island. Elephant densities were likely in the range of 0.1-0.2 elephants/km^2 with a total of around 6,000-12,000 elephants. The advent of people and especially the rise of a 'hydraulic civilization' based on irrigated agriculture in the dry zone around 2500 years ago caused significant environmental changes and likely impacted elephant numbers and distribution profoundly. In the centres of civilization conversion of natural habitat to permanent cultivation and settlements would have excluded elephants entirely. However shifting cultivation and the construction of innumerable fresh water reservoirs for irrigated agriculture would have enriched the habitat for elephants, allowing higher densities in fringe areas. Large numbers of elephants were captured and domesticated for local use and export. With the rise and fall of kingdoms and shifting of centres of civilization, elephant populations would have alternately become locally extirpated and abundant (Fernando 2006b).

Figure 2. Elephants at the Nawam Maha perahera in Colombo.

The ancient civilization collapsed and the dry zone was largely abandoned around the 13th century. Prior to this, human presence in the wet zone was sparse and it would have been covered in mature forest. Elephants would have inhabited the entire area but at low densities. The biggest change in elephant distribution and numbers in the history of Sri Lanka probably occurred during the colonial period from the 1505 to 1948. During this period the wet zone became heavily settled and converted to commercial agriculture of coffee, tea, rubber and coconut. Elephants were declared vermin and many thousands were shot (Jayewardene 1994; Wisumperuma 2004), eliminating them from the wet zone. During this period, elephant densities and numbers would have increased in the dry zone due to the regenerating habitats and innumerable abandoned reservoirs.

Re-developing and re-populating the dry zone based on irrigated agriculture commenced in early 20th century with the construction of mega reservoirs, rehabilitation of ancient irrigation systems and resettlement of people, which gathered momentum with independence in 1948 and continues to date (Fernando 2006b).

Current elephant distribution

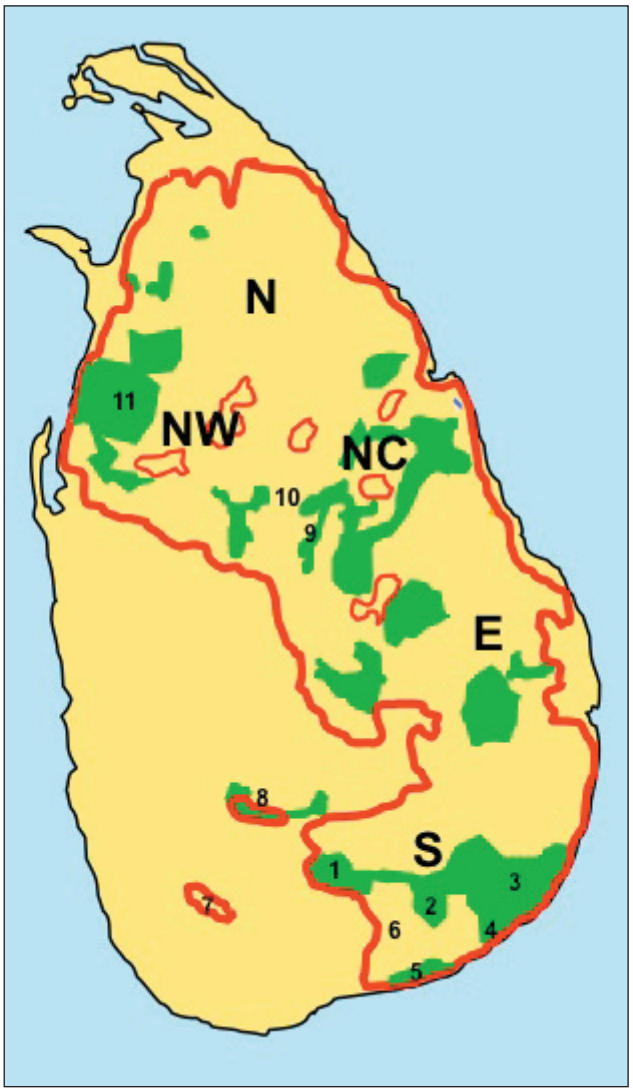

Figure 3. Current elephant distribution in Sri Lanka. Areas of distribution are demarcated by a heavy red line. Elephants are absent in polygons demarcated by a thin red line. Green polygons denote DWC protected areas. Numbers and letters indicate areas referred to in the text: N=North, NW=Northwest, NC=North-central, S=South, 1=Udawalawe NP, 2=Lunugamvehera NP, 3=Yala NP, 4=Yala NP Block I, 5=Bundala NP, 6=Mattala, 7=Sinharaja, 8=Adam's Peak, 9=Minneriya-Kaudulla NPs and Hurulu Reserve, 10=Kala Wewa, 11=Wilpattu NP.

Elephants are found over almost the entire dry zone in an area approximately 60% of the island (Fig. 3). Development activities have a major impact on elephant densities and distribution at a fine scale, with permanent settlements and cultivations excluding elephants entirely. However, given that their home ranges in Sri Lanka are 50-250 km^2 (Fernando *et al*. 2008a) elephants in Sri Lanka can still be considered a single contiguous population. It does not make sense to give exact elephant numbers for a particular park or administrative area given the many shortcomings of counts (Fernando 2008) and as elephant home ranges are not limited to such areas but overlap with adjacent areas. Elephants are also not limited to protected areas and higher densities are found outside where food and water is more plentiful. However, the best opportunities for observing them are in the national parks where animals are habituated to tourists.

South: Over a thousand elephants are present in the south. Elephant herds and males can easily be observed at all times of the day and year in the Udawalawe National Park. The presence of up to 20 adult males who are fed by people, lined up along the electric fence on the park boundary bordering a major road is a unique sight. Research based on individual identification estimated a population of 804-1160 elephants in the Udawalawe National Park at a density of 1.02-1.16 elephants/km^2 (de Silva *et al*. 2011). Other national parks (NP) in the area such as Yala, Lunugamvehera and Bundala also hold elephants. Based on individual identification, around 200 elephants use Yala Block I (Fernando unpublished data). However their home ranges are not limited to Block I but extend over adjacent areas. Based on individual identification and demographic assessment (Fernando *et al*. 2010, unpublished data), there are over 400 elephants in the Mattala area south of the Udawalawe NP which is contiguous with the Bundala NP and Wilmanne Sanctuary. Those elephants live mainly outside any protected area. The Mattala area has been identified as a 'Managed Elephant Range' where elephants will continue to remain and its implementation will be a landmark for elephant management in Sri Lanka.

East: Over a thousand elephants are found in the east. The majority are outside national parks. As a result of the armed conflict that took place in the area over the past three decades, many villages and cultivation areas were abandoned and became excellent elephant habitat. The post-war resettlement of people in the east is likely to result in a new area of high HEC.

North-central: The area contains well over 1000 elephants. The home ranges of most of them encompass both protected areas and areas outside. However, a large part of the 'outside' ranges also lie in state land under the Forest Department. The annual 'gathering' of over 400 elephants in the reservoir beds of Minneriya and Kaudulla to feed on lush grasses as the water recedes in the dry season has been termed one of the greatest animal wonders on earth (Lonely Planet 2011). These large herds can be observed during June-October. During the rest of the year they can be observed in the nearby Hurulu Forest Reserve and Eco-park.

Northwest: There are over a thousand elephants largely outside protected areas dispersed throughout the landscape occupying the same space as humans. Crops are raided regularly and probably constitute a significant part of the diet of most adult males and some herds. Herds with more than 100 elephants can be observed at some reservoirs such as Kala Wewa in the dry season. However elephants are difficult to observe in this region as they are used to high conflict and come into open areas mostly after dark.

North: Little information is available on elephants in the northern areas. A larger part of the north is still covered in mature forests hence elephant densities are likely to be low with perhaps a few hundred elephants in total. However, as in the East, the area was largely abandoned during the war and elephant numbers may have increased in response to habitat changes. Resettlement is starting now and is likely to cause increased conflict in the future.

Central and Southwest: A small remnant population of about 15-20 elephants survive in the sub-montane Adams' Peak wilderness area of the wet zone in the central highlands. About three elephants are also reported to remain in the Sinharaja rain forest complex in the Southwest. These are the only wild elephants in the wet zone. They are almost surrounded by tea cultivations and settlements. Although not very far from elephant populations in the dry zone, they are probably cut off from them.

Threats in the country

The major threat to elephants in Sri Lanka is habitat loss and fragmentation through conversion to settlements and permanent cultivation. The influx of people into areas inhabited by elephants results in increased interaction and conflict, leading to the death of over 200 elephants annually with a trend of increasing numbers (Fig. 4). Most of these elephant deaths are caused by gun shot injuries from farmers defending their crops and trap guns (Table 1). A new addition is 'hakka-patas' - a small pressure mine concealed in fruits or vegetables, which shatters the jaw on being bitten down upon. During and in the aftermath of the war, death and injuries of elephants due to landmines were reported in the north and east.

The north-western and north-central areas have the highest levels of HEC in Sri Lanka. With continued conflict, elephants appear to become more accustomed to it, tolerate higher levels of conflict and to raid crops even more frequently and aggressively. Consequently HEC becomes locked in an increasing spiral of escalation. HEC is least in the North where elephant and human

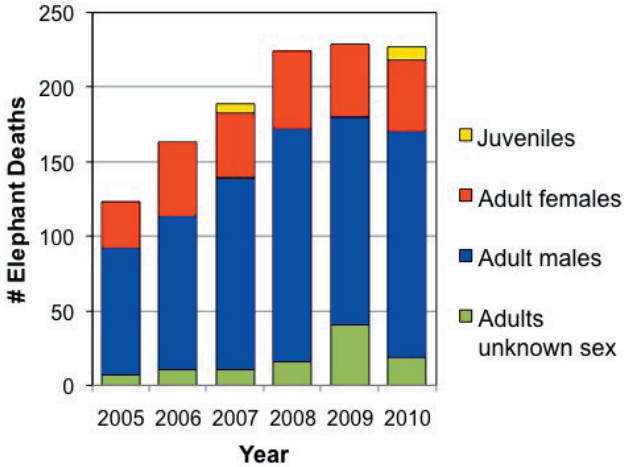

Figure 4. Demographic details of annual elephant deaths recorded 2005-2010 (DWC data).

Table 1. Causes of elephant deaths recorded annually 2005-2010 (DWC data).

Year	2005	2006	2007	2008	2009	2010	Total
Shot	73	93	85	123	113	87	574
Unknown	14	16	40	30	49	30	179
Electrocuted	9	21	19	20	19	17	105
Train accidents	14	7	23	18	14	14	90
Natural (old age)	3	4	16	22	8	2	55
Poisoned	0	3	6	10	4	8	31
Hakka-patas	0	0	0	0	0	11	11
Other	10	19	0	1	21	58	109
Total	123	163	189	224	228	227	1154

densities are low. HEC appears to be increasing across Sri Lanka and is likely to become severe in the East in the near future.

Habitat loss due to developmental activities continues to occur at an ever increasing pace especially with the drive for post war 'development'. Large scale irrigation schemes based on damming the remaining rivers and attendant irrigated agriculture of extensive areas continue to be designed and implemented. 'Development' of large extents of natural habitat currently occupied by elephants for commercial agriculture, by private enterprises, multinational companies and the government, for banana, pineapple, corn, sugar cane, rubber etc. are mooted as part of the development drive. Medium scale development based on the building of small rain fed reservoirs funded by government and non-government agencies also continues apace as do fine scale but widespread development from encroachment of state land for farmsteads by individuals. All these developmental activities result in fragmentation and loss of elephant habitat, and increase in human-elephant interaction and conflict.

The main cause of HEC is crop raiding by elephants. Elephants raid practically all food crops grown (Fernando *et al*. 2005; Ekanayake *et al*. 2011). The greatest depredation is of paddy, which is also the most widely cultivated food crop. Others such as corn, sugar cane, finger millet; vegetables such as pumpkin, sweet potato, beans, pulses; and fruits such as banana, water melon and mangoes are among crops that are frequently raided. In recent years, there has been an increasing trend of elephants knocking down coconut palms and teak trees, which cause comparatively high economic losses, hence greater negative perception of elephants. Similarly damage to house and property from elephants trying to access stored grain is of major concern to people who have to contend with elephants.

In the last six years on average 71 people died annually as a consequence of HEC (Fig. 5). Many human deaths due to elephants are preventable. The causes include drunkenness, walking or riding bicycles and motorbikes in areas with elephants in the night and confrontation of raiding elephants. Some deaths occur during house damage by elephants.

Elephant management and HEC mitigation

For over six decades the approach to elephant conservation and HEC mitigation in Sri Lanka has been the restriction of elephants to protected areas under the DWC. A system of protected areas connected by corridors was proposed in

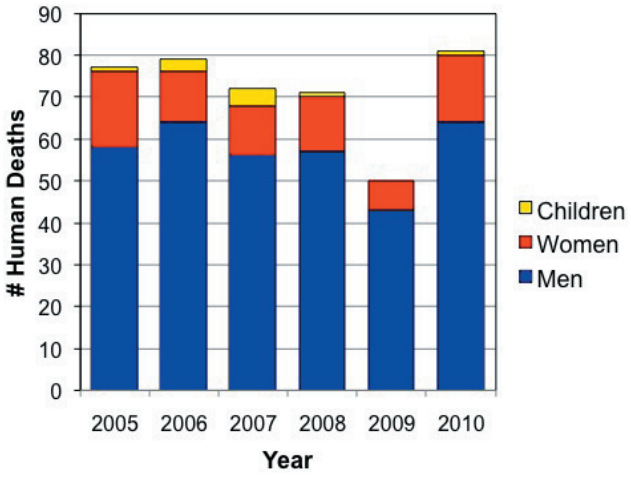

Figure 5. Demographic details of human deaths caused by elephants 2005-2010 (DWC data).

Table 2. Annual cost and number of 'elephant thunders' used by the DWC for distribution, chasing elephants and elephant drives 2007-2011 (DWC data).

Year	# thunders	Cost Rs.	Cost US$
2007	275,000	20,000,000	182,000
2008	275,000	20,000,000	182,000
2009	355,000	25,000,000	227,000
2010	514,000	42,000,000	382,000
2011	514,000	42,000,000	382,000
Total	1,933,000	149,000,000	1,355,000

1959 (Somasuntharam *et al*. 1959), which served as a blue print for management. It was based on the belief that the best habitat for elephants was undisturbed forest - hence the protected areas, and that elephants migrated long distances - hence corridors linking protected areas allowing movement between them. Most of the corridors were never established. The current protected area system under the DWC covers about 13% of the land consisting of a number of isolated parks, the largest of which are Wilpattu (ca. 1500 km^2) and Yala (ca. 1000 km^2).

The Centre for Conservation and Research (CCR) in collaboration with the DWC has so far radio-tracked approximately 50 elephants. The data obtained has shown that elephants in Sri Lanka do not migrate long distances, have well defined home ranges of 50-250 km^2 with high fidelity, and that their preferred habitat is disturbed forest (Fernando 2006a; Fernando *et al*. 2008a). Surveys have shown that over 70% of elephant range and a larger percentage of elephants occur outside DWC protected areas (DWC survey in 2004; Fernando 2006b).

The only agency responsible for managing elephants is the DWC, which also is tasked with almost the sole responsibility for mitigating HEC. The main methods used for the prevention of raiding and to mitigate HEC are - crop guarding, chasing elephants from the vicinity of crop fields and villages, elephant drives, capture-translocation and electric fencing (Fernando 2006a; Fernando *et al*. 2008b).

Crop guarding: Farmers build and occupy watch huts on the ground or trees during cultivation periods. Shifting cultivation fields in addition are ringed by a thorn and brushwood fence.

Chasing elephants: The government through the DWC distributes elephant thunders (large firecrackers 30 cm x 2.5 cm diameter) to villagers free of charge (Table 2). Where the villagers are unable to chase away elephants, DWC officials are deployed. However, with repeated exposure, elephants get habituated to thunders, become refractory to being chased and react aggressively towards attempted chasing, leading to even more raiding, aggression and escalation of conflict.

Elephant drives: Elephant drives aim to clear a large area of all elephants. It may involve dozens to hundreds of people and take from days up to a year or more to complete. Small to mid sized drives are done frequently (Table 3), while the last major drive was conducted in 2005-2006 in the south under the JBIC funded Walawe Left Bank Development Project, taking 1.5 years to complete and costing US$ 1.6 million. Although many drives have been conducted, none has been able to eliminate elephants from a given area (Jayewardene 1994). Drives may cause increase in HEC by making elephants more aggressive. Drives are also detrimental to conservation as herds driven into parks and fenced-in suffer high mortality and morbidity (Fernando 2006a).

Capture-translocation: In the last 5 years 68 elephants have been translocated in Sri Lanka (Table 4). All elephants subject to capture-

Table 3. Details of elephant drives conducted by the DWC by year (DWC data).

Year	# drives	# elephants chased	Cost Rs.	Cost US$
2007	4	86-91	445,000	4,100
2008	4	242-252	5,000,000	45,500
2009	12	341-354	3,500,000	31,800
2010	11	438-453	5,300,000	48,200
Total	31	1107-1150	14,245,000	129,600

Table 4. Elephant translocations by year 2007-2011 (DWC data).

Year	# translocations	# deaths
2007	13	0
2008	10	1
2009	18	1
2010	25	1
2011	2	1
Total	68	4

translocation are adult males. The identified individuals are darted with an anaesthetic, captured, transported by truck to a protected area and released (Fig. 6). Monitoring by GPS collars has shown that capture-translocation also does not mitigate HEC as most translocated elephants continue to cause HEC. Sometimes it even results in more intense conflict and its wider propagation. The current recurrent cost to translocate one elephant is around Rs. 270,000 (US$ 2500). Capture-translocation operations have an elephant mortality of approximately 6% due to accidents (Table 4).

Electric fencing: The DWC has currently deployed over 1200 km of electric fencing. The approximate cost per km is Rs. 500,000 (US $ 4500). A total of 600 km of new electric fencing has been erected under the DWC in 2009-2011. Electric fences are effective only if they are located properly (elephants only on one side of the fence), constructed to appropriate specifications and well maintained. Most electric fences do not fulfil one or more of the above criteria and consequently have short life spans of a few months to about a year. Elephants that challenge and learn to break ineffective fences also tend to break well maintained fences leading to electric fencing becoming unsuccessful. The DWC and a number of non-governmental organizations such as SLWCS, CCR, JICA, CARE, Practical-Action etc. have been promoting community based and managed fences on village boundaries as an alternative more successful approach. In addition, CCR has developed and deployed low-cost temporary fencing for paddy fields.

Capture and domestication: Capturing problem elephants and bringing them into captivity has been tried a few times in the past as a HEC mitigation method. However, it resulted in high mortality of the captured elephants leading to protests from environmental groups. In addition it cannot be done in a scale relevant to HEC mitigation, for logistic and financial reasons. Capture-domestication is currently not used as an option for HEC management.

Culling: Although over 200 elephants get killed due to HEC annually, these deaths are technically illegal and culling as government policy is not a socio-culturally and politically acceptable option in Sri Lanka.

Compensation and Insurance: Currently a compensation scheme for death, injury and property damage due to elephants is conducted by the DWC, with Rs. 100,000 (US$ 900) being paid in case of death (Table 5). Compensation and insurance for crop losses have been tried but have not been very successful so far.

Awareness programs: A few conservation NGOs conduct awareness programs. The Biodiversity and Elephant Conservation Trust has a schools program covering many elephant areas (Jayewardene 2011) and Born Free Sri Lanka conducts awareness in selected villages. The DWC also has a few schools and village awareness programs.

Table 5. Annual compensation [in Rs.] paid by DWC (DWC data).

Year	Deaths	Injuries	Property damage	Total [Rs.]	Total [US$]
2005	4,600,000	490,000	1,730,000	6,820,000	62,000
2006	6,090,000	740,000	2,850,000	9,680,000	88,000
2007	5,000,000	980,000	5,940,000	11,920,000	108,400
2008	5,680,000	1,160,000	7,000,000	13,840,000	125,800
2009	6,580,000	1,030,000	9,030,000	16,640,000	151,300
2010	11,990,000	1,050,000	25,690,000	38,730,000	352,100
Total	39,940,000	5,450,000	52,240,000	97,630,000	887,600

Future management

Surveys of elephant distribution and HEC, and monitoring of elephants with GPS-collars has clearly demonstrated that the approach of limiting elephants to protected areas has failed and that it is neither effective in conserving elephants or mitigating the HEC. This finding was the basis of a new strategy advocated by the National Policy in 2006. The policy proposes an alternative approach of human-elephant coexistence and management of elephants both in and outside protected areas, with regulation of shifting cultivation, prevention of crop raiding by community based electric fencing, and landuse planning. However, affecting a change in paradigm as espoused by the National Policy takes time Creating awareness across all stakeholders in elephant conservation and HEC is critical for its realization.

Captive elephants

Captive elephants have been a central feature of Sri Lankan civilization since antiquity. Ancient kings maintained stables of elephants that numbered in the thousands, including hundreds of war elephants (Wisumperuma 2004; Kurt & Garai 2007). The techniques on how to control captive elephants were a part of the education of princes in Sri Lanka (Kurt & Garai 2007). Initially all elephants belonged to the King. In the colonial period the Portuguese and Dutch rulers had a monopoly over the ownership of all domesticated elephants. Later the Dutch allowed the local Chieftains, who captured wild elephants for their colonial masters as tribute, to keep one or two. This is how the tradition of elephant keeping by private owners started in Sri Lanka.

Elephants were captured by nooses set in the ground by 'Pannikans' a group that specialized

Figure 6. Male 'Nalagiri' being loaded on a truck to be transported to a National Park.

in such captures, 'kraal' or 'kedah' operations during the colonial period and after (Jayewardene 1994; Katugaha 2008), and more recently by drug immobilization. The last kraal was held in 1950 (Katugaha 2008). Elephant captures by private individuals was terminated at the same time. However, private captures were again allowed in 1972-1974 and a few elephants captured by DWC were given out till the 1980s (pers. comm. Edmund Wilson). Currently elephants are kept by temples, private owners, the National Zoological Gardens at Dehiwala, the Pinnawela Elephant Orphanage and the Elephant Transit Home at Udawalawe. Some temples and private owners have been given young elephants from Pinnawela. Illegal wild captures are thought to supplement the captive population (Jayantha 2011).

Captive elephants in Sri Lanka do not have any opportunities to interact with wild elephants. There have been very few births in captive elephants outside of the Pinnawela Elephant Orphanage (Jayantha 2011). Currently there are around 112 captive elephants in Sri Lanka with temples and private owners. Captive elephant numbers have decreased steadily over the years

Table 6. Surveys of captive elephants (excluding Pinnawela and ETH).

Year	Surveyor(s)	Males	Females	Unknown	Total	Owners
1955	P.E.P. Deraniyagala	NA	NA	NA	670	NA
1970	Jayasinghe & Jainudeen	NA	NA	NA	532	378
1982	DWC	183	161	0	344	NA
1994	Dr. Cheong	148	166	2	316	154
1997	J. Jayewardene & S. Rambukpotha	107	107	0	214	136
2002	J. Jayewardene	101	88	0	189	131

(Table 6), due to the death of older elephants which is not offset by the small numbers added to the captive population by releases from Pinnawela and illegal captures.

Pinnawela Elephant Orphanage

HEC results in baby elephants becoming orphaned due to the mother's death or abandonment. The Pinnawela Elephant Orphanage was set up in 1975 to take care of such orphans. Started with five orphaned baby elephants, the addition of orphans continued till 1995 when the Elephant Transit Home (ETH) was created by the DWC. Since then, orphaned babies have been taken to the ETH and addition to the Pinnawela herd has been mostly through births occurring there. So far Pinnawela has recorded 69 births – 38 males and 31 females. Currently there are 88 elephants (37 males and 51 females) in Pinnawela representing 3 generations. There are 48 mahouts (handlers) to look after them.

The female and young elephants in Pinnawela are free to range as a herd during the day in an area of a few acres. They are herded to water twice a day in the river. The females are individually chained in stalls in the night. Adult males are chained and managed individually, similar to privately owned elephants (Fig. 7). They also do some work such as transporting feed. Calves born in Pinnawela are not bottle fed but a few from ETH are kept at Pinnawela and bottle fed as a tourist attraction. Pinnawela draws a large number of local and foreign tourists.

Elephant Transit Home

The ETH was set up to take care of orphaned elephants until they are fit enough to be released back to the wild. Orphaned elephants brought to the ETH are treated and taken care of for about three years. The mortality rate of arrivals is around 40% (de Silva & de Silva 2007). They remain as a group during the day and are kept in a stall for the night. They are bottle fed every 4 hours throughout the 24 hours. An entrance fee is charged from visitors to the ETH and they can observe elephants being bottle fed. An information centre set up in collaboration with the Dilmah Trust, provides information on elephants to visitors.

From 1998 to 2011 a total of 76 elephants have been released in 11 batches with 4-11 elephants in each batch. Till 2010 all releases were to the adjoining Udawalawe NP. Since then some elephants have been released to the Maduru Oya NP and Lunugamvehera NP due to concerns of overcrowding in Udawalawe. Observations conducted on the batch of 11 elephants (7 females, 4 males) released in 2004 in three locations in Udawalawe, found one male and one female integrating into wild groups, seven forming a 'juvenile group' of their own, one female injured and brought back to the ETH and one female returning to the ETH by herself (Jayantha 2006).

The Temple of the Tooth

The single largest group of elephants outside Pinnawela is at the Temple of the Tooth in Kandy. The 11 elephants kept are all males and consist of 2 tuskers from India, 2 tuskers from Myanmar, 1 tusker from Thailand, and 3 tuskers and 3 non-tuskers from Sri Lanka. The elephants only take part in pereheras.

The Millenium Elephant Foundation

The Millennium Elephant Foundation is a private enterprise in Pinnawela, which serves more or less as a retirement home for working elephants. Tourists are provided short rides and there is a program that caters to 'volunteers' - mostly

Figure 7. Blind male 'Raja' captured and tamed at Pinnawela Elephant Orphenage.

foreigners who like to work with the 7 elephants kept there.

Zoological Gardens

The National Zoo in Dehiwala in the suburbs of the capital city Colombo currently holds 8 Sri Lankan elephants consisting of 2 males (1 juvenile, 1 adult) and 6 adult females. The zoo also has one African elephant male.

Management of captive elephants

Other elephants held by temples and private owners are mostly single animals. They are mainly used in pereheras. A few elephants still work in handling logs etc. and some are engaged in giving rides to tourists especially in Habrana (Fig. 8). Elephant owners lobby for legalizing wild captures and releasing elephants from Pinnawala or the ETH on the argument that the captive population is declining and that it is essential to maintain the cultural and religious traditions associated with elephants.

All captive elephants are supposed to be registered at the DWC, but it is more observed in the breach. Mahouts remain mostly traditional. Management of captive elephants is based on their subjugation, chains and free use of the ankus. While there have been discussions of starting a mahout training schools, none have materialized.

Veterinary care for captive elephants is provided by the University of Peradeniya Veterinary Faculty, DWC and private veterinarians. Some owners and mahouts prefer traditional medicine to western. The DWC is conducting TB testing of captive elephants and elephants tested are also microchipped. Currently approximately 20 captive elephants have been thus microchipped.

There has also been much discussion of a National Policy and guidelines for captive elephant management but again none are in force.

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Figure 8. Elephant 'Monika' taking tourists for a ride (Kandalama).

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The Management of Asian Elephants in Non-range Regions

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Introduction

Approximately 25% of the global Asian elephant population is currently in captivity (Desai 2008). While most captive Asian elephants are found in Asia, several non-range regions manage small populations of Asian elephants. Regional studbooks indicate that Australia and New Zealand manage approximately 30 Asian elephants, Europe counts about 330, and there are approximately 360 Asian elephants in the Americas (North, Central, and South). There are less than 100 captive Asian elephants in various other non-range Asian countries, i.e. Japan, South Korea.

The large number of Asian elephants in captivity leads to a need for structured, consistent management to provide the best care possible. In non-range regions, standards of elephant husbandry and management are addressed by guidelines suggesting more opportunities for socialization, larger spaces with natural substrates, and better handling techniques (Olson 2004). Overall there is a need to recognize concerns about captive elephant care and welfare, and to implement improved standards of husbandry, handling, and management allowing captive elephants to achieve a maximum of their natural behaviours and social interactions.

It is important to better leverage opportunities in these small non-range elephant populations for study, public awareness, advocacy, and fundraising programs in support of the conservation of wild Asian elephants and their habitats. The impact of such programs should be constantly evaluated and improved to ensure successful public education and awareness, as well as effective support of conservation actions.

Management

Captive Asian elephants have been displayed in menageries, zoos, and circuses since antiquity. Historical records indicate that a Syrian king kept some of the earliest zoo elephants in the 9th century B.C. (Sillar & Meyler 1968). The first documentation of elephants in circus occurred in Rome around 250 B.C., when these animals were not only used in combat spectacles involving gladiators and wild animals, but also participated in circus (Sillar & Meyler 1968). Single or small numbers of elephants were reported in European menageries for centuries, and the first Asian elephant to be displayed at a modern European zoo was in 1772 in Vienna, Austria. In contrast, the first Asian elephant to arrive on the American continent was a single animal brought to New York in the late 1700s from India (Goodwin 1951). In Australia, the first Asian elephant arrived in 1883 at the "Acclimatisation Society of Victoria" which later became the Melbourne Zoo; this young animal, about 6 years old at the time, came from Calcutta, India.

In non-range regions, captive Asian elephants are primarily used for exhibition, performance, and education in zoological institutions, commercial organizations (circus), and private facilities. In the past decade, improvements in animal welfare and management systems have been the focus for these elephants. As welfare and management concepts go hand in hand, there is a need to address these systems which originate from two basic ideas: "free contact" management where

staff and elephants share the same space, and "protected contact" management where staff and elephants are separated by some form of barrier (Olson 2004). Variables such as gender, age, and disposition of the exhibited elephants, staff expertise, and enclosure design and size all contribute to the management style used by a facility. Every management system has innate pros and cons for the exhibited elephants and staff; these need to be carefully considered when developing captive elephant programs. Currently most non-range facilities manage their elephants using a combination of these two basic systems; however in the majority of these facilities adult male elephants are generally managed in a "protected contact" system, in contrast to the "free contact" system used with captive adult male elephants in Asian range countries.

Successful captive elephant management relies on a clear strategy, as well as outlining proper protocols, and standards. Practical elephant standards have been developed by professional zoological organizations in non-range regions (AZA 2003; ARAZPA 2004; Olson 2004; EMA 2006; EAZA 2007) to address the physical and social environment of these animals. Written protocols are important for success as these tools aid the consistency of elephant management programs; periodic review of the policies ensures that standards are met and even improved where needed.

Veterinary medicine and science

Most captive elephant facilities in non-range regions have preventative veterinary programs in place that include issues such as regular vaccinations, blood and fecal testing, TB trunk wash, vitamin and mineral supplementation. In addition to these various medical issues, the needs for pest control and dung removal are also addressed (Olson 2004). Due to the availability of plentiful and rich fodder, some of these facilities manage overweight elephants which can contribute to various problems, e.g. birth problems, joint and foot problems, as well as arthritis (Fowler & Mikota 2006; Lewis *et al*. 2010). It is interesting to note that one disease, elephant pox, identified in Asia and in several European facilities (Baxby & Ghaboosi 1977), has not been diagnosed in captive elephants housed in other non-range regions such as North America. The cause for this region specificity is not known.

One of the challenging veterinary issues for facilities managing captive Asian elephants in non-range countries is the elephant endotheliotropic herpes virus (EEHV), which seems to mainly affect young animals and often results in fatalities. EEHV is a particular concern in facilities with reproduction programs, as it can affect captive born elephant calves, in particular those of the Asian species. EEHV was originally identified in zoo elephants in Europe, and has now been found in multiple wild and captive elephant populations in various regions (Ossent *et al*. 1990; Wiedner & Schmitt 2009). Diagnosis is only achieved via blood testing of an elephant with an active case (Latimer *et al*. 2007; Richman 2007), and very few animals have survived treatment. Intensive study continues in order to determine transmission, and improve prevention and treatment options.

Another recent focus of captive elephant veterinary research, particularly in the U.S., is tuberculosis (*Mycobacterium tuberculosis*) (TB). Currently the best TB diagnostic tool is a trunk wash culture (Olson 2004). Studies into alternative methods of diagnosis continue, as techniques used in other species are either not possible or dependable with regards to elephants (Wiedner & Schmitt 2009). Further studies on the treatment of TB in elephants are critical as several of the drugs normally used to treat TB in humans are very toxic for elephants (Wiedner & Schmitt 2007). It is important to consider that TB is not only a potential hazard for humans working closely with elephants, but that elephants could also be infected by exposure to TB positive humans, so effective diagnostic and education protocols are essential for staff responsible for captive elephant management.

Captive elephants in non-range regions have contributed greatly to the knowledge about Asian elephant physiology, biology, and communication. Detailed monitoring of elephants in these regions

has led to interesting biological discoveries; for example, the observation of liquid originating from elephant ears was first documented and studied in elephants in a North American facility (Riddle *et al*. 2000).

Modern instrumentation and technology also contributes to a better understanding of the species: the first recordings of infrasound produced by Asian elephants were done at a zoo in the U.S. (Payne *et al*. 1996); the use of ultrasound in elephants, allowing scientists to visualize internal organs, was developed in Germany (Hildebrandt *et al*. 1998, 2000) and first trialed at many zoological institutions; highly sensitive instrumentation providing detailed chemical analyses of biological samples was first used in the U.S. elephant population (Rasmussen 1999); and thermal imaging to measure from a distance the external temperature of elephants was initiated and developed in zoos in Europe and North America (Weissenboeck 2006). Much of this technology is now helping further studies of wild Asian elephants, such as the use of auditory recordings to provide a quantitative description of vocal communication in de Silva (2010).

Scientists studying captive Asian elephants in North America, Europe, and Australasia identified connections linking chemical signals and specific behaviours between females, males, mother-to-offspring, female-to-male and vice-versa (Rasmussen & Schulte 1998; Rasmussen & Krishnamurthy 2000). Elephant breath has also been closely studied in the captive environment. Over several years, numerous breath samples from captive male elephants (African and Asian) in the U.S. were analyzed (Rasmussen & Riddle 2004), and compared to endocrine data, confirming overall health and musth status. Data collected from captive male Asian elephants in non-range countries has contributed many details about musth physiology (Rasmussen *et al*. 2002; Greenwood *et al*. 2005), complementing studies of wild musth male Asian elephant behaviour (Desai & Johnsingh 1995).

Most captive Asian elephants in facilities outside of range countries were born in wild populations. Currently, Asian elephants are rarely exported outside of range countries, so the role of reproduction is vital to sustain these small captive populations, and regional breeding programs have been established (Olson 2004). In non-range countries, captive elephant breeding programs rely on low numbers of reproductively viable animals, and require studbooks and science to ensure the genetic diversity and health of these small populations (Olson 2004). In these regions, scientific study has supplemented the knowledge of female and male reproductive physiology (Hildebrandt *et al*. 2006), enabling successful and repeatable assisted reproduction, i.e. artificial insemination. Facilities in North America and Europe with a focus on reproduction have already produced second-generation (F2) offspring with both parents also born in captivity in these regions (Riddle 2002).

Education and awareness

Every facility managing Asian elephants outside of their natural range shares the responsibility to further public education and awareness about elephant conservation. This is best accomplished by supporting education and fundraising programs, promoting awareness of problems and issues facing wild Asian elephants, and sharing information (Riddle *et al*. 2003). Every facility managing captive elephants reaches members of the public and should promote important educational concepts about wildlife and the environment. Such public awareness helps motivate support for conservation and habitat protection policies (Nagendran & Riddle 2009).

It is also important to continually enhance the capacity of staff directly responsible for captive elephants (i.e. elephant managers, zoo veterinarians, keepers) via ongoing education and support of professional opportunities. Building networks is an important tool for creating better communication and improving professional awareness. Such captive elephant manager groups now exist. In 1988, elephant keepers in North America created the Elephant Managers Association (EMA), which has grown to an international membership of approximately 500 individuals and institutions, hosting annual elephant management conferences. The EMA

promotes the need for inter-professional dialogues to benefit captive elephant management. The association has developed guidelines for care and husbandry (EMA 2006), and is active in legislative issues addressing elephant welfare. The EMA served as a model for the development of other regional elephant manager groups, such as the European Elephant Keepers and Managers Association (EEKMA), established in 1997 in Vienna, Austria.

Conclusion

Discussions and efforts to identify and address concerns regarding captive elephant populations in non-range regions should continue. This will ensure that high standards of welfare and husbandry are implemented in every management system. Compliance with these standards is also an important consideration for improved management strategies.

The importance of communication and exchange of information between captive elephant managers in non-range regions and field conservationists in Asia should not be underestimated. Captive Asian elephants in facilities outside of their natural range contribute to conservation via biological information, public awareness of the threats facing wild elephants, and support of conservation actions. The many opportunities presented by captive Asian elephants in non-range regions must be acted upon to benefit all Asian elephant populations, now and in the future.

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Current Status of Asian Elephants in Vietnam

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Introduction

Elephants have an enormous cultural and religious significance in Vietnam. Historically, images of elephants and of national heroes were often associated. During the Nguyen Dynasty from 1802 – 1945, domestic elephants graced the Royal Courts and were revered by some of Vietnam's ethnic minorities. The Vietnam people are proud of this big animal. Images of elephants are still inherent in traditional cultures of ethnic minorities in the Central Highlands, especially in Buon Don district, Daklak province.

Currently, Vietnamese elephants are listed as critically endangered in the Red Book of Vietnam, in addition to their listing in annex I of CITES. Laws relating to wildlife conservation forbid the local people to catch wild elephants. However the local people still conserve and respect the traditional expertise of elephant taming as a cultural feature of the community. Correspondingly, elephants remain a legend and symbol of Buon Don, Daklak province, which holds the largest number of wild elephants in Vietnam. Every year in March, the 'elephant festival' is held there and attracts many foreign and domestic tourists.

During the Vietnam War elephants were employed in transporting. After the war, domestic elephants continued to be used in agricultural production and other daily activities of local people such as transporting, logging, and participating in celebrations and festivals. Along with the modernization of society, the role of domestic elephants in Vietnam has changed to serving in the tourism industry, circuses and zoos while continuing to participate in celebrations and festivals.

Wild elephants

Distribution

Field research and information from local people suggests that elephants were distributed almost throughout the mountainous and highland regions in the west of Vietnam before 1980. From then on the areas of elephant distribution have declined continuously. By 2002 there remained approximately 11 to 20 areas that sheltered elephants (Heffernan & Trinh Viet Cuong 2004). Currently, the number of areas with elephants has decreased to 8 or 9. These areas with small populations of elephants lie in remote areas of the Northern and Southern parts of Central Vietnam, along the Lao–Vietnamese border, the Central Highlands along the border with Cambodia, and the Eastern part of South Vietnam.

According to data sources and estimates from researchers in the Institute of Ecology and Biological Resources, Forest Inventory and Planning Institute, Forest Protection Department (FPD) and experts of WWF, FFI, Birdlife, etc. the number of wild elephants in Vietnam are declining (Table 1).

Since 2004 there have not been any countrywide surveys of wild elephants. Occasional reports of the presence of wild elephants have been received from locals in Nghe An, Ha Tinh, Quang Binh and Quang Nam provinces in the North and South of Central Vietnam; Kon Tum, Gia Lai, Daklak provinces in the Central Highland; and Binh Thuan, Dong Nai in the East of South Vietnam. In almost all of the above instances, natural forest areas where wild elephants could occur lie within protected areas. For example the Pu Mat National Park (NP) in Nghe An, the

Table 1. Estimated numbers of wild elephants in Vietnam (Trinh Viet Cuong *et al*. 2002).

Time	Number of Elephants
1975 – 1980	1500-2000
1990 – 1992	400-600
1993 – 1995	258-305
1997	160-170
1997 – 2000	85-114
2004	76-94

Vu Quang NP in Ha Tinh, the Phong Nha Ke Bang NP in Quang Binh, the Song Thanh natural reserve in Quang Nam, the Chu Mom Ray NP in Kon Tum, the Kon Ka Kinh in Gia Lai, and the Yok Don NP in Dak Lak. The remainder of elephant habitat is scattered and degraded forest belonging to forestry companies, especially in Binh Thuan and Dong Nai provinces.

Daklak province in the Central Highland has the largest elephant population. The Department of Forest Resources and Environment Management (FREM) of Tay Nguyen University in December of 2009 reported on the elephants in Daklak province. They conducted a survey of elephant tracks (Fig. 2) then established regression equations to simulate the relationship between age and hind footprint length of elephants. Based on the information of the frequency of tracks and statistical analysis they estimated the number of wild elephants to be around 83 to 110 individuals. The elephants live mainly in natural forests of Yok Don NP in Buon Don District and forest enterprises located in Ea Soup and Ea H'Leo districts (Figs. 3 & 4). The number of wild elephants in Yok Don NP is around of 55 to 63 individuals. Around 24-42 individuals ranged in forest areas belonging to Ea H'Mo and Ya Lop enterprises and approximately 4-5 individuals in forest areas of Chu Pha Enterprise. The study divided elephants into several age groups, based on physiological and biological characteristics and possibility for taming (Table 2).

The estimated number of elephants for Daklak province by the FREM study was more than

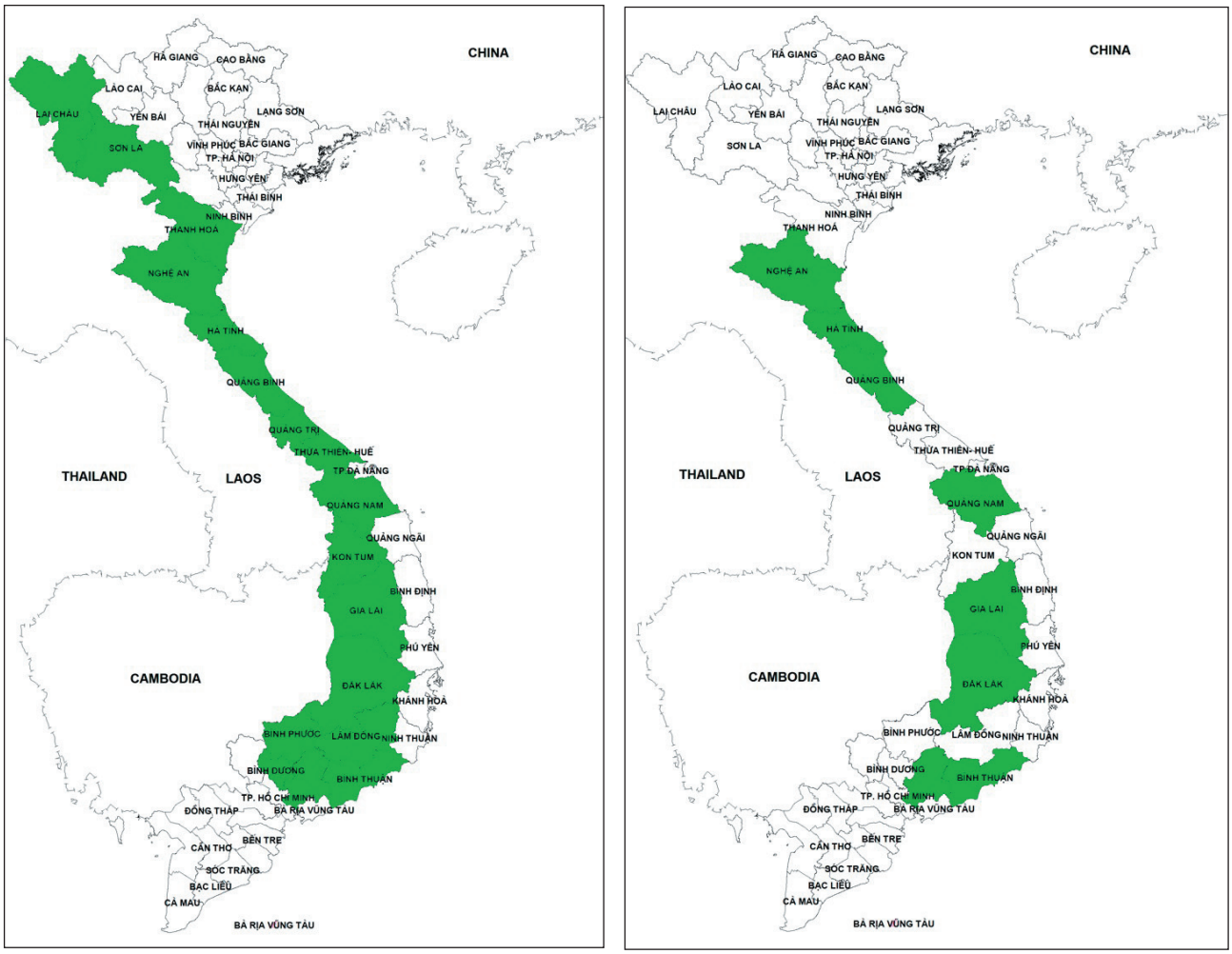

Figure 1. Maps of provinces with wild elephants before 2000 (left) and in 2011 (right).

Table 2. Age level divisions [years] of elephants in Daklak (FREM 2009).

Age	Characteristics of age class
< 5	Babies, possibility for taming high
5 – 15	Young, non-reproductive
16 – 45	Middle aged, reproductive
46 – 55	Old, reproductively weak
> 55	Very old & weak, post-reproductive

that suggested by the IUCN in 2004 (76-94 countrywide). This is possibly explained by two factors: 1) The FREM estimate is the outcome of a detailed field survey in Daklak province 2) the number of wild elephants in Daklak may have increased due to natural breeding and transfer between deciduous forest areas between Cambodia and Vietnam. Yok Don NP where most of the elephants in Daklak are found is a fairly large and safe area ensuring the viability of wild elephant herds. Some of the elephants in Daklak probably move between Vietnam and Cambodia, while others are resident. Some of them venture into adjoining agricultural areas causing conflict.

According to the FREM estimate there are around 39 individuals of age class 16-45 years in the Daklak population, which are the potential individuals for breeding and population development in the wild (Fig. 5). The 7-10 babies if captured for taming would preserve the longstanding tradition of elephant capture and training, and supplement the domestic elephant numbers of local ethnic minority people. This is considered an issue in conservation both of elephants and local ethnic groups.

Threats in the country

From 1989 to 1999, 60 deaths of wild elephants were recorded due to human-elephant conflict (HEC), poaching and unknown causes. The deaths occurred in forest areas belonging to 15 districts of 9 provinces, comprising of: Lai Chau, Nghe An, Quang Nam, Kon Tum, Binh Định, Đak Lak, Đong Nai, Binh Thuan, and Ba Ria – Vung Tau (Trinh Viet Cuong *et al*. 2002). According to Heffernan & Trinh Viet Cuong (2004), the main reasons leading to the depletion of elephant

Figure 2. Measure wild elephant footprints in Yok Don NP (FREM 2009).

populations are:

- Almost all natural forests in the country are exploited for collecting wood and non-timber forest products.
- Forest clearance for agriculture, industrial plants and residences.
- Ivory poaching and resultant impacts on the reproductive competence of the wild elephant population.
- Poaching of elephants for other elephant products, such as tail hairs, feet, skin etc.

Figure 3. Fresh dung of wild elephants in the bamboo forest in Buon Don (FREM 2009).

Figure 4. Elephant habitat: semi-deciduous forest in Ea Soup, Daklak (FREM 2009).

In addition, HEC, natural deaths and emigration to other areas also probably add to the population decrease.

Human-Elephant Conflict

Human elephant conflict is one of the principal threats to the survival of elephants in Vietnam (Heffernan & Trinh Viet Cuong 2004). Rapid human population growth with socio-economic development has had a great negative impact on the viability of wild elephants. Continued deforestation leads to increasing HEC with different levels of HEC occurring in all areas with elephants. There were 26 deaths of people reported in the period from 1993 to 2004 due to HEC (FPD 2004). HEC also inflicts a heavy toll on the local economy and rural livelihoods through damage to house and property and loss of crops.

Elephant management and HEC mitigation

Elephant conservation in Vietnam depends essentially on international and national laws. The Vietnam Government with the support of international conservation organizations makes an effort to conserve elephants. Elephant management is the responsibility of the Forest Protection Department and Provincial Forest Protection Departments.

Some of the activities that have been undertaken for elephant conservation are:

- In 1992, the first wild elephant survey project was implemented in Thanh Hoa province. From 1993–1994, surveys were implemented in Nghe An province.
- In 1996, the action plan "Rescue of elephant species threatened with extinction in Vietnam" was established by the Forest Protection Department in cooperation with FFI Indochina (Dawson 1996). The objectives of this plan were to help the survival and development of remaining wild elephant populations, and reduction of HEC. The plan chose three priority sites that were considered practical areas for elephant conservation, in Nghe An, Quang Nam and Daklak provinces.
- In the Red book of Vietnam, elephants were listed as 'Vulnerable' in 1992. In 2007 it was changed to 'Critically Endangered'.
- In decrees such as No.18/HDBT, 1992; No.48/CP, 2002 and No.32/ND-CP, 2006 for determining the list of rare and precious fauna and flora, and regulation for their management and protection, elephants are listed in the IB group, which means that all exploitation hunting, killing, selling, etc. are strictly prohibited.
- In 1994, Vietnam became a signatory to the Convention on International Trade of Endangered Species (CITES). Since then, elephants have been included in Annex I. All exporting and importing of elephants and their products for commercial purposes are prohibited.

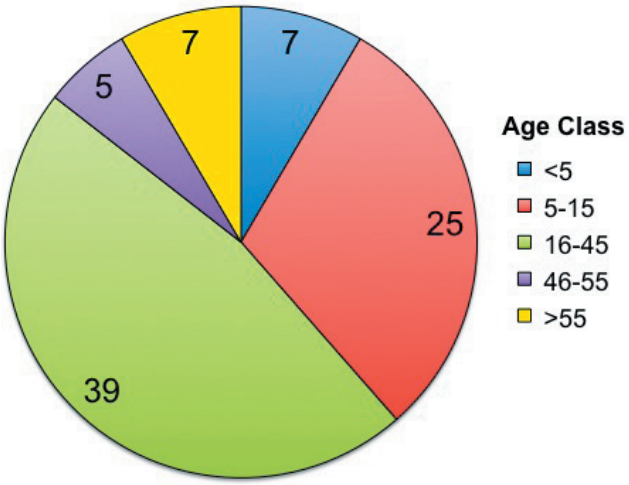

Figure 5. Estimated number of wild elephants of different age classes in Daklak province (2009).

- The Government has established a protected area network, and there are seven national parks and nature reserves from Son La province (in the North) to Dong Nai province (in the South). The most important protected areas are Pu Mat Nature Reserve in Nghe An province, Yok Don NP in Daklak province and Cat Tien NP in Dong Nai province.
- An elephant conservation project was proposed in 2009 in Daklak province, which links natural conservation with traditional culture related to elephants. This project was initiated in 2011. Hopefully this will be the start of detailed activities for elephant conservation in Vietnam.

HEC mitigation depends on enhanced awareness of communities to be cautious, but there are not enough activities undertaken to address this issue.

Electric fencing being a very expensive solution has not been adopted in Vietnam as it is not possible to deploy electric fences even in protected areas or locations with serious HEC because of the cost.

In 2001, due to damage to crops and huts of local people in Tanh Linh district, Binh Thuan province, the Forest Protection Department coordinated with the police, scientists and with support from Malaysian experts translocated three elephants from Binh Thuan to Daklak province. The translocation was successful but no monitoring was done and no information about them was available after release.

Figure 6. A domestic female elephant in the Daklak province (FREM 2009)

Table 3. Number of domestic elephants in Daklak province (Source: FPD in Daklak 2011).

Year	Number
1985	502
1997	115
2000	84
2006	64
2009	61
2011	54

As a HEC mitigation measure, the government also compensates for part of damages that occur from elephant depredation.

Captive elephants

In Vietnam, domestic elephants are mainly concentrated in the Daklak province (Fig. 6). The highest numbers were in Buon Don and Ea Soup districts where the ethnic minorities such as Laos, M'Nong, and J'rai have long held the tradition of catching and taming wild elephants. Now some of them are sold to other locals in Daklak for example - to Lak district for tourism. Domestic elephants are also held in zoos, circuses, and tourist areas nationwide.

Currently, there are 82 domestic elephants in Vietnam comprising of 21 males and 61 females. Of that, 28 individuals (2 males and 26 females) are in zoos, circuses and tourist areas such as Ha Noi, Hochiminh City, Hue, Binh Duong and Lam Dong provinces (Fig. 7, Pham Manh Dung 2011). The remaining 54 elephants are in Daklak province. In 2000, there were 165 individuals countrywide. Therefore the number of domestic elephants has decreased by half in ten years. The decline in the number of captive elephants is mainly due to the decrease of domestic elephants in Daklak province (Table 3).

Reasons for the decrease of domestic elephants

- Natural forest areas, where elephants could be grazed, have reduced therefore there is not enough food and essential resources for elephants.
- Before 1997, the owners were mainly local people. However because of serious difficulties in caring for elephants, many of them sold their elephants. From 2000, with

the development of tourism, many locals sold their elephants to tourist companies.

- Currently most domestic elephants belong to tourist companies. They are active throughout the day and are exhausted after work. They are not provided enough time for rest, sufficient food, and other necessary conditions for their life.
- Some individuals have died because they were old and weak.
- Some individuals have been attacked and killed to collect ivory, and tail hairs.
- Lack of specialized veterinary and health services care for elephants.
- Elephants belonging to private owners or companies are widely dispersed. Correspondingly, there is no chance for reproduction.
- The law prohibits catching of wild elephants for taming to supplement the domestic herd.

Form of ownership and management

Apart from elephants in the zoos and circuses that are government agencies, nearly all domestic elephants owned privately belong to local people or tourist companies. Before 1995, the owners of all domestic elephants in Daklak were local people. They caught, tamed and took care of elephants based on traditional expertise. The elephant is a sacred and precious property for them. They brought up elephants not only for farming, transporting and logging, but also as a representation of prosperity and authority of the owners and conservation of their traditions. The local people let elephants wander in natural forests for a long time. They only found and brought the elephants back to the village when they needed to use the elephants for work or for particular events. That way elephants could find plenty of food, natural medicines and enough nutrition for their proper health. Also, some of the female elephants could breed naturally with wild bulls.

Now domestic elephants are used mainly for economic purposes, with a focus on tourism and festivals. Of the 54 domestic elephants in Daklak currently, only 30 belong to local people. Consequently there are less and less local owners with traditional expertise. If there is no successful elephant conservation, then the "elephant legend" in Daklak and the Central Highland of Vietnam will disappear.

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Figure 7. Domestic elephants in The Saigon Zoo (Pham Manh Dung, 2011).