ISSN 1014-2789

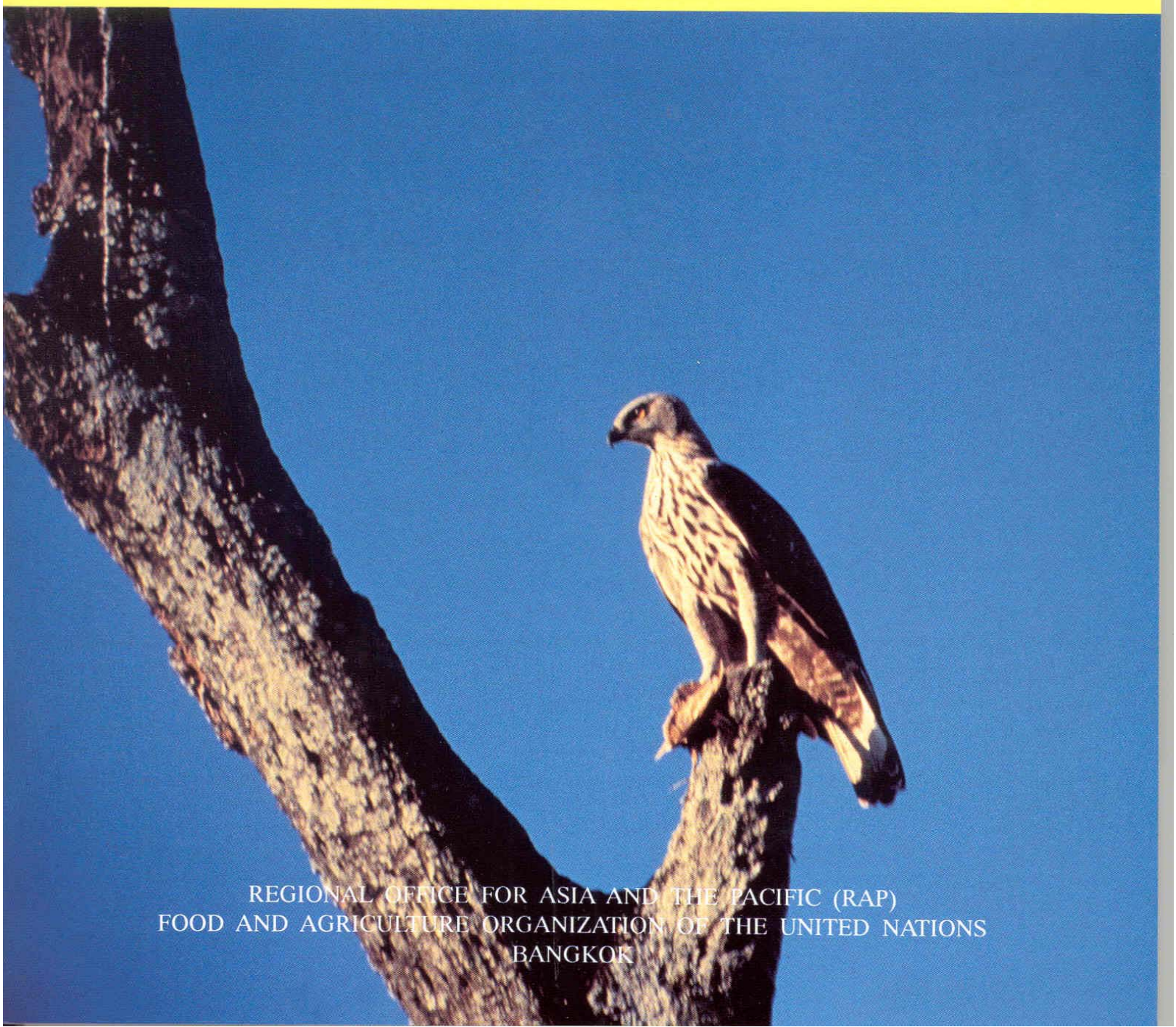
FEATURING FOREST NEWS

TIGER PAPER

Regional Quarterly Bulletin on Wildlife and National Parks Management

Vol. XXX: No. 4

October-December 2003



REGIONAL OFFICE FOR ASIA AND THE PACIFIC (RAP)
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
BANGKOK

Contents

TIGERPAPER

FOREST NEWS

THE CHANGEABLE HAWK EAGLE (*Spizaetus cirrhatus*) IN NORTHEAST INDIA AND BHUTAN

by Anwaruddin Choudhury

Introduction

The Changeable Hawk Eagle (*Spizaetus cirrhatus*) is a large eagle with broad wings and a long and broad tail. It has a crest that may not be conspicuous. However, the subspecies found in peninsular India has a prominent crest. The adults are characterized by boldly streaked underparts, which is an unmarked pale buffy. The Changeable Hawk Eagle occurs in two morphs in the northern race found in northeast India – one dark and one pale. The dark morph may be confused in the field with the Black Eagle *Ictinaetus malayensis*. The species occurs over the greater part of India from Himalaya to Kerala, as well as the Andamans. It is also found in Nepal, Bangladesh and Sri Lanka. It has been recorded in India as an uncommon resident, while in Bhutan the only reference is of a 19th century collection there (Ali and Ripley, 1987; Grimmett *et al.*, 1998).

Distribution and Status

In northeastern India, among all the Hawk Eagles (*Spizaetus* and *Hieraaetus* spp.), the Changeable Hawk Eagle was relatively more abundant. It has been recorded in Assam, Arunachal Pradesh, Meghalaya, Nagaland, northern West Bengal and Sikkim. It certainly occurs in Manipur, Mizoram and Tripura as well. Although it was recorded as being uncommon in India and scarce in Nepal (Grimmett *et al.*, 1998), it was common at least in Assam until the early 1990s. It used to be encountered in light forest, wooded countryside, at the edge of dense forest and in trees amidst jhum (shifting cultivation practiced by the hill tribes) clearings, salix swamps and grasslands. Seen singly or in pairs, especially during nesting, it is still seen regularly in some of the protected areas of Assam. It has been recorded from altitudes of 50 m to up to 1,900 m elevation in the region. In Assam, it has been found to be common in Kaziranga, Manas, Dibru-Saikhowa, Nameri and Orang national parks, and in Burhachapori, Laokhowa, Marat Longri and Sonai-Rupai wildlife sanctuaries. It has also been recorded in Chakrasila, Barnadi, Bherjan-Borajan-Podumoni, Gibbon (Hollongapar), Nambor and Pabitora wildlife sanctuaries. There were also a large number of sightings outside the protected areas (Choudhury, 2000). In Arunachal Pradesh, there were records from Tezu (Singh, 1995) and Pakhui (Pakke) wildlife sanctuary. In Meghalaya it was recorded in Balpakram and in Jaintia Hills, with a historical record from Khasi Hills. It has also been sighted in Kohima, Zunheboto and Phek districts of Nagaland (Choudhury, 2001). Although it has not been sighted in Bhutan (Inskipp *et al.*, 1999), it has definitely been observed by this author at two places. A bird flew from Buxa Tiger Reserve in northern West Bengal to Bhutan near Bhutanghat in 1995, and subsequently on many occasions between 1995 and 2001, lone birds were seen at Mathangui in Royal Manas National Park, and also in flight from Assam's Manas National Park towards the Bhutanese park in the same location.

Breeding was recorded in the protected areas of Assam and also outside near Dhakuakhana in Lakhimpur District in 1990-91. In the last mentioned area, the nesting was observed in a light woodland area in the countryside.

However, sightings have become less frequent than a decade ago, indicating that the eagles are becoming rarer.

Threats

Habitat destruction through the felling of trees and jhum cultivation, the felling of nesting trees, and opportunistic poaching for the pot are the main threats faced by the Changeable Hawk Eagle. Tree felling is done mainly for timber, furniture and firewood. In the hill areas or in

northeastern India, jhum is the main form of cultivation. With the increase in the human population, the jhum cycle has been shortened from more than 10 years to less than 5 years, thus putting tremendous pressure on the forests. Many of the illegally logged areas are subsequently encroached for settlement. In the countryside where the species is still seen, the nesting as well as perching trees are cut for various domestic uses. Hunting of almost all species of birds for the pot is still a major factor in the hilly areas of the region, while it also takes place to a lesser extent in the plains. Although the impact of pesticides in this part of India is not known and is also relatively lower than in other parts of the country, it certainly has had some effect on raptors elsewhere, which is evident from their gradual decline, even from the protected areas. Pesticides are also widely used in tea plantations and nobody knows their impact on the birds, especially the raptors.

Discussion

That all the larger raptors are vanishing is apparent from the decline seen in different protected areas such as Kaziranga and Orang, where there is regular birdwatching. Besides the general causes such has habitat loss and poaching, pesticides may be playing a major role in their decline as has been observed elsewhere. A detailed study is overdue in this regard. The example shown by the vultures in recent years was alarming and every effort needs to be made to prevent a similar fall in the population of other raptors. An awareness drive for the conservation of raptors should be launched among the potential hunting areas in the hills of northeast India to stop opportunistic shooting.

References

Ali, S. and S.D. Ripley. 1987. **Compact handbook of the birds of India & Pakistan.** Oxford University Press, Bombay.

Grimmet, R. Inskipp, C. and T. Inskipp. 1998. **Birds of the Indian Subcontinent.** Christopher Helm (Publishers) Ltd., London.

Choudhury, A.U. 2000. **The birds of Assam.** Gibbon Books & WWF-India NERO, Guwahati.

Choudhury, A.U. 2001. **Some bird records from Nagaland, north-east India.** *Forktail* 17:91-103.

Inskipp, C., Inskipp, T. and R. Grimmett. 1999. **Birds of Bhutan.** Christopher Helm (Publishers) Ltd., London.

Singh, P. 1995. **Recent bird records from Arunachal Pradesh, India.** *Forktail* 10:65-104.

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DISTRIBUTION OF CHIROPTERAN FAUNA IN AND AROUND THE BIKANER OF GREAT INDIAN DESERT

Ashok Purohit and K. R. Senacha

Introduction

Bats belong to Order Chiroptera, the second largest order of Class Mammalia, which is further divided into two sub-orders, viz. Megachiroptera and Microchiroptera. Out of 1,001 bat species reported from around the world, 187 species belong to the sub-order Megachiroptera, while Microchiroptera contains the remaining 834 species. Bats have been reported from almost all the geographical areas of the world except for the Arctic and Antarctic, extreme desert areas, and a few isolated oceanic islands (Mickleburgh *et al.,* 1992; Hutson *et al.,* 2001). Bats represent more than 20% of all mammal species of the world. In many countries bats are major contributors to mammalian biodiversity, while in some, particularly small oceanic islands, they are the only indigenous mammals and may play a vital role as "keystone" species in ecosystem (Cox *et al.*, 1992). The majority of bat species, including most of those in the suborder Michrochiroptera, are insectivorous, although some species are carnivorous, a few are piscivorous, and three species of vampire bat are sanguivorous. Bats of the Old World suborder Megachiroptera are predominantly frugivorous, but also consume nectar, flower, leaves and occasionally insects. The New World family Phyllostomidae has a similar plant diet, but some species may incorporate a greater proportion of insects than the Megachiroptera. Bats are the only mammals with the capacity for powered flight (Altringham, 1996), and the Michrochiroptera, together with the Megachiropteran genus *Rousettus*, have evolved a system of echolocation, by means of which they orient themselves and find their food, and which has enabled them to roost in situations where light intensity is low (Racey, 1999).

Throughout the world, bats play essential roles in keeping populations of night-flying insects in balance. Just one insectivorous bat can catch hundreds of insects in an hour, and large colonies catch tons of insects nightly, including beetle and moth species that cost farmers and foresters billions of rupees annually, not to mention mosquitoes in our backyards. Throughout the tropics the seed dispersal and pollination activities of fruit- and nectar-eating bats are vital to the survival of rain forests, with some bats acting as "keystone" species in the lives of plants crucial to entire ecosystems. In addition, the guano of bats, which they scatter over the farming fields and forest lands during foraging activities, is known to be one of the best bio-fertilizers of the world. Wild varieties of many of the world's most economically valuable crop plants also rely on bats for survival. Some of the better known commercial products are fruits such as bananas, breadfruit, avocados, dates, figs, peaches, and mangoes. Others include cloves, cashews, carob, balsa wood, kapok (filler for life preservers), and even tequila. Most of the plants from which these products come are now commercially cultivated, but the maintenance of wild ancestral stocks is critically important. They are the only source of genetic material for developing disease-resistant strains, rejuvenating commercial varieties, and for producing new, more productive plants in the future. The value of tropical bats in reforestation alone is enormous. Seeds dropped by bats can account for up to 95 percent of forest re-growth on cleared land. Performing this essential role puts these bats among the most important seed-dispersing animals of both the Old and New World tropics. Studies of bats have contributed to the development of navigational aids for the blind, birth control and artificial insemination techniques, vaccine production, and drug testing, as well as to a better understanding of low-temperature surgical procedures (Tuttle, 1988).

India harbours 109 species of bats, consisting of 13 Mega and 96 Microchiropteran species (Bates and Harrison, 1997). The Great Indian Desert was known to have only two Microchiropteran species (*Rhinopoma hardwickii,* and *Rhinolophus lepidus*) in the early 1960s (Prakash, 1963). Since that time until the middle of 2001, no one has studied the distribution and ecology of the bats of this

region. In these four decades, this arid region of the Thar Desert has seen tremendous changes in its eco-biogeography. A rapid increase in the human population, introduction of Indira Gandhi Nahar in the district of Jaisalmer, implementation of advanced technology to enhance agricultural production, massive growth in construction of new buildings, renovation of historical monuments and urbanization have caused inhospitable changes in the distribution and availability of the bat species in this area.

Environment of the study site

Our study site, the Bikaner (28^0 01' 22 N and 73^0 19' 13 E) lies in the northwestern part of Rajasthan. Climatically it is a semi-arid region. During the summer the temperature ranges between 25^0 C to 45^0 C, while in May it can rise up to 48^0 C. The annual average rainfall is 300 mm, distributed over less than twenty rainy days. This wide range of climatic conditions has formed different types of habitat for the Chiropterans in and around the Bikaner city. The vegetation of the area is typical desertic shrub forest represented by *Acacia senegal, Prosopis juliflora, Euphorbia caducifolia, Ziziphus nummularia, Salvadora persica, Capparis decidua, Callotropis procera, Anogeissus pendula, Maytenus emarginatus, Calligonum polygonoides* and *Commiphora wightii.* The main crops of the region include *Vigna radiata*, *Vigna aconitifolia*, *Cyamopsis tetragonoloba*, *Sesamum indicum* and *Pennisetum typhoides*. Wheat (*Triticum sativum*) and barley (*Hordeum vulgare*) have been added due to the introduction of Indira Gandhi Canal. (Rahamani,1997).

Material & methods

The authors made a meticulous survey of Bikaner and its surroundings within the limits of a 20 km radius from October 2001 to October 2002 to find out the current status of bat roosts. After locating the sites, a few specimens were collected by using an insect net and preserved in seventy percent alcohol. They were identified on the basis of morphological measurements of various body parts. This identification was further confirmed by two leading Indian bat taxonomists, Dr. Y. P. Sinha of ZSI Patana, and Dr. Paul Bates of Harrison Zoological Museum, Kent England.

A well-planned survey was undertaken during which information about the various bat roosts was collected from the local people. A bat detector was used to locate the minute roosts and a Global Position System (GPS) was used to assess the global position of the roosting sites. A Digital Minimum-Maximum Thermometer and a Digital Lux Meter were used for the microclimatic study of the bat roosting sites and video-graphic counts, and the capture re-capture method was followed for the population dynamics.

Observations and discussion

Not much more has been done towards bat research in Bikaner district of the Great Indian Desert. Prakash (1963) did the initial work on the bat ecology of this region during the early 1960s and reported the two species of Microchiropterans, viz. *Rhinopoma hardwickii hardwickii* and *Rhinolophus lepidus lepidus* from the deep and dark tunnels in the earth, which are excavated for "Fuller's earth". But he had not mentioned the exact location and name of these sites. After his report, no further studies of the eco-status of bats of this region were made.

From October 2001 onwards, the authors started to work on this aspect and located nine new roosting sites of four Microchiropteran bat species, viz. *Rhinopoma hardwickii, Rhinopoma microphyllum kinneari, Rhinolophus lepidus* and *Pipistrellus tenuis*. This study is the first to report the presence of Greater mouse tailed bat *Rhinopoma microphyllum kinneari* and Indian pygmy bat *Pipistrellus tenuis* (*P. mimus*) from Bikaner. Detailed accounts of each roosting site are described below:

(1) Junagarh Fort (28^0 01' 22 N and 73^0 19' 13 E)**:**

The biggest historical monument of Bikaner city. The construction of this monument was started by Maharaja Sh. Rai Singh in 1588 and was completed by Maharaja Sh. Ganga Singh in the year 1943. Nowadays the Maharaja Sh. Rai Singh Trust manages it. Like other forts of the Great Indian Desert, this one also serves as a permanent roosting site for the microchiropterans. Various old and unattended sections of the fort have big colonies of *Rhinopoma hardwickii* (Fig.– 3). Ghantaghar Kee

Pedi Kee Nal and various ruined unattended rooms of Rani Mahal are the portions of the Main Palace which contain the solitary roost of *Rhinopoma hardwickii,* whereas Fansi Khana, Kal Kothari, Chhapakhana and three rooms attached to the fort wall contain mixed colonies of *Rhinopoma microphyllum kinneari* and *Rhinopoma hardwickii.*

(2) Jalmahal, Sagar Village (28^0 01' 14 N and 73^0 23' 35 E)**:**
A semi-underground and unattended building lies on a bank of Devikund Sagar of Sagar Village. It has three long rows partially divided into various sections. The last and inner-most row is serving as a permanent roost for three microchiropteran species, viz. *Rhinopoma microphyllum kinneari, Rhinopoma hardwickii* and *Rhinolophus lepidus.* We found individuals of all three species roosting close to each other.

The roosting behaviour of *Rhinolophus lepidus* is quite different than that of the other two species at the site. The former is shy in nature and preferably roosts on the ceilings rather than walls (Fig.- 5) While facing external stimuli (especially human intruders) they move their ears very frequently and remain at the same place, looking towards the intruder until it approaches nearer. As Then they become disturbed and start to make rounds here and there inside the roost. In contrast, *Rhinopoma microphyllum kinneari* and *Rhinopoma hardwickii* face the external stimulus in a different way. As soon as a human intruder enters the roost, they become alert. At first they watch the intruder, moving their tails in a pendulum-like manner (*R. m. kinneari*), and then they either crawl away or finally fly away into another compartment.

(3) Water Overflow Tunnel, Devikund Sagar, Sagar Village (28^0 01' 11 N and 73^0 23' 34 E)**:**
Devikund Sagar is the only public water reservoir of Sagar village and is surrounded by a huge boundary wall on its three sides. As mentioned above, it has a big temple on one of its banks that is a site for *Rhinopoma microphyllum kinneari, Rhinopoma hardwickii* and *Rhinolophus lepidus*. Fifteen meters from the temple is a man-made water overflow tunnel. It is dark, unattended, forty feet long, four feet wide and seven feet high. The ceiling and the upper portion of the inner-most walls of this tunnel is occupied by a colony of *Rhinopoma hardwickii* consisting of almost one hundred and fifty individuals. Although Jalmahal and this tunnel lie almost adjacent to each other, no individuals of *Rhinopoma microphyllum kinneari* or *Rhinolophus lepidus* have been found to roost in the tunnel. It is noteworthy to quote here that this tunnel is not as spacious as that of the Jalmahal and the humidity is comparatively high, whereas the temperature is lower at the Jalmahal than in the tunnel.

(4) Public Well, Sagar Village (28^0 01' 10 N and 73^0 23' 35 E)**:**
A deep, dark and unattended public well, situated almost thirty meters away from the water overflow tunnel of Devikund Sagar, is serving as one of the biggest Microchiroptran roosts of Sagar Village. The circular periphery wall of this well is demarcated into twenty sections of about five feet length each. Section numbers three to fifteen are occupied by a mixed colony of *Rhinopoma microphyllum kinneari* and *Rhinopoma hardwickii,* out of which *R. m. kinneari* dominates. This well is completely dried out and is has not been used for water draining for many years. As a result it has become surrounded by the wild growth of *Prosopis juliflora*.

The number of bats fluctuates from winter to summer at all three of the Microchiropteran sites of this village. The comparative study of their population fluctuation at three sites has revealed that this well serves as the winter roosting site for these Microchiropterans.

(5) Annapurana Mata Mandir, Pawan Puri (27^0 59' 33 N and 73^0 20' 19 E)**:**
Annapurana Mata Mandir of Pawan Puri area is one of the temples of the city and is sited near the most famous Nagalechia Mata temple. It is situated in a deep pit and one of the sandy sidewalls of its yard has a man-made tunnel forty feet long, four feet wide and seven feet high. From the back of this temple to the entrance of a second opening, the sandy ceiling of this tunnel is thinly populated with individuals of the Microchiropteran bat species *Rhinopoma hardwickii*. According to talks held with the temple authority, these bats have been living here for more than fifty years, but every year during the winter they disappear from the site and reappear in February or March. So we can predict that this is a permanent roosting site for the microchiropterans, which shows the local migration of the species during the winter.

(6) Laleshwar Mahadev Mandir, Shiv Badi (28^0 00' 01 N and 73^0 21' 13 E)**:**
Laleshwar Mahadev Mandir, situated in the Shiv Badi area, is a famous temple of the city, which exhibits an exclusive prototype of carved art. It has a big campus adorned with various types of flowering plants cultivated in its backyard. Just adjacent to the backside of the cultivated area is a ruined muddy building meant to provide shelter for the temple cows. Various crevices have appeared in the boundary wall of this building and serve as the preeminent roost for the Indian pygmy bat *Pipistrellus tenuis*. As these bats live in dark, unapproachably deep crevices, it is not easy to estimate their population, but repeated visual and video monitoring of the roost at the time of emergence have revealed that there are more than thirty in number.

(7) Dauji ka Mandir, Near Kot Gate (28^0 00' 56 N and 73^0 18' 21 E)**:**
A temple situated in the heart of Bikaner city, it lies in the main market near Kot gate. The backside corridor walls of the temple and ceiling of the covered gallery of the mini market lying just adjacent to this corridor have been serving as permanent roosting sites for the Microchiropterans for many years now. The roosting place of these bats has become completely dark due to the deposition of their excreta over the course of time. The species identified from this roost are the Greater mouse-tailed bat *Rhinopoma microphyllum kinneari* and Lesser mouse-tailed bat *Rhinopoma hardwickii*. The bats of this roost, especially those roosting in the gallery of the mini market, are a living example of the fact that the few colonies of bats of this species have become adapted to living in very close proximity to the human population.

(8) Girdhari Lal Ji ka Lakadi Ka Bada (28^0 04' 38 N and 73^0 19' 21 E)**:**
It is the private premises of Sh. Girdhari Lal, situated almost forty to fifty meters away from the Dauji ka Mandir. Basically it is a wooden workshop established by the owner almost fifty years back. One of its storerooms is occupied by the Lesser mouse-tailed bat *Rhinopoma hardwickii*. According to the owner, these bats have been living there for the last forty-five years and display a seasonal fluctuation in their population.

(9) Session Court Building (28^0 00' 18 N and 73^0 19' 21 E)**:**
The sidewalls and the ceiling of the staircase of the Session Court building of this city were found to be sparsely populated with a spread out colony of the Microchiropteran bat *Rhinopoma hardwickii*. Interestingly, while interacting with the humans, bats at this site show a distinctive behaviour. We had seen that these bats do not react to disturbances in the same way as bats of the same species roosting at the isolated roosting sites.

In summary, it can be said that the Bikaner, one of the biodiversity hot spots of the Great Indian Desert, is not well bestowed with chiropteran biodiversity. It lags far behind Jodhpur (the entrance gate of the Great Indian Desert) in

terms of the number of bat species living there.Whereas Jodhpur is known to have seven Microchiropteran species (*i.e. Rhinopoma microphyllum kinneari, Rhinopoma hardwickii, Taphozus perforatus, Taphozus nudiventris, Hipposideros fulvus, Rhinolophus lepidus* and *Pipistrellus tenuis*) and one Megachiropteran (*Pteropus giganteus giganteus*) species, Bikaner has only four Microchiropteran species viz., *Rhinopoma microphyllum kinneari, Rhinopoma hardwickii, Rhinolophus lepidus* and *Pipistrellus tenuis* (Purohit and Senacha, 2002). But it is worthwhile to note here that in contrast to Jodhpur, which has lost three Microchiropteran species (*Megaderma lyra lyra, Hipposideros fulvus* and *Tadarida aegiptiaca*) in last four decades, Bikaner has added two new species viz., *Rhinopoma microphyllum kinneari* and *Pipistrellus tenuis* to what was reported in 1963 (Purohit and Senacha, 2002; Prakash, 1963). *Rhinopoma hardwickii* dominates the remaining microchiropteran species of the study area. A total of nine microchiopteran roosting sites were located at Bikaner in this study.

Conservation Status

All four Microchiropteran species reported from this region viz., *Rhinopoma microphyllum kinneari, Rhinopoma hardwickii, Rhinolophus lepidus* and *Pipistrellus tenuis* are assessed as being of the least concern in South Asia (Molur S. *et al*., 2002). But, if we talk about the conservation status of these Microchiropterans in and around Bikaner of Great Indian Desert, these species might face a severe threat in the near future because out of nine existing roosts, two are surrounded with the wild growth of *Prosopis juliflora,* which has proven its fatality to the Microchiropteran species at Jodhpur (Purohit *et al*., 2002). It is also worthwhile to note here that twenty-five dead Microchiropteran bats (*Rhinopoma microphyllum kinneari*) were reported entangled in the thorns of *Prosopis juliflora* (Vilaiti Babul) grown at the only entrance of the Mandore tunnel (A permanent Microchiropteran roost), Jodhpur (Purohit *et al.,* 2002).

Conclusion

Overall, we can say that *Rhinopoma microphyllum kinneari, Rhinopoma hardwickii*, *Rhinolophus lepidus* and *Pipistrellus tenuis* are the only Microchiropteran species inhabiting the area in and around Bikaner of the Great Indian Desert (The Thar). No Megachiropterans have been reported to date. *Rhinopoma microphyllum* kinneari and *Pipistrellus tenius* are being reported here for the first time from this region; thus, it seems that this region is not very rich in chiropteran biodiversity.

Acknowledgments

We are extremely thankful to the Department of Science and Technology, New Delhi, for providing us with equipment and a financial grant for this study under Project No.- SP/SO/C-28/99. We are also grateful to the wildlife officials of the city for granting permission to conduct the study and Dr. Q. H. Baqri, Additional Director, ZSI, Jodhpur, for providing a GPS Unit. We also wish to express our deep gratitude to Dr. B.S. Gaur for his guidance and to Dr. Anil Chhangani and Mr. Vijay Krishna Vantipalli of our department for their valuable help during the study. Mr. Amit Sharma and Keshav Bihari Vyas of our laboratory also are to be thanked for their help in finalizing the paper.

References

Altringham, J. D. 1996. **Bates – Biology and behaviour.** Oxford University Press,Oxford.

Bates, P. J. J. and D. L. Harrison. 1997. **Bats of the Indian Subcontinent.** Harrison Zoological Museum, pp. 1-258. England.

Cox, P.A., Elmqvist, T., Pierson, E.D. and W.E. Rainey. 1992. **Flying foxes as pollinators and seed dispersers in Pacific Island ecosystems.** In: D.E. Wilson & G.L. Graham (Eds). *Pacific Island Flying Foxes: Proceedings of an International Conservation Conference*, pp. 18-23. US Fish and Wildlife Service Biological Report 90(23). US Department of the Interior, Fish and Wildlife Service, Washington DC.

Hutson, A.M., Mickleburgh, S.P. and P.A. Racey. (compilers).2001. **Microchiropteran Bats: Global Status Survey and Conservation Action Plan.** IUCN/SSC Chiroptera Specialist Group. IUCN, Gland, Switzerland, and Cambridge, UK.

Mickleburgh, S.P., Hutson, A.M. and P.A. Racey (Eds). 1992. **Old World Fruit Bats.**

An Action Plan for their Conservation. IUCN/SSC Chiroptera Specialist Group. IUCN, Gland, Switzerland.

Molur, S., Marimuthu G., Sriniwasulu C., Mistry S., Hutson A.M., Bates P.J.J., Walker S., Priya K.P. and A.R.B. Priya (Eds). 2002. **Status of South Asian Chiroptera Conservation Assessment and Management Plan.** Workshop Report, held at Department of Animal Behaviour and Physiology, M.K.University, Madurai, 21-25 January 2002.

Prakash, I. 1963. **Taxonomic and biological observation on the bats of the Rajasthan desert.** Records of the Indian Museum, 59 (parts 1&2): 149-170.

Purohit, A., Gaur, B. S. and K. R. Senacha. 2002. ***Prosopis juliflora*, an emerging threat for the microchiropterans of the Thar desert.** *Bat net – CCINSA Newsletter,* 3(2): 7-8.

Purohit, A. and K. R. Senacha. 2002. **A review of microchiropteran eco-status in Mandore garden, Jodhpur.** *Journal of Nature Conservation*, 14 (2) : 251-262.

Racey, P.A. 1999. **Bats**. The UFAW Handbook on the Care and Management of Laboratory Animals, Seventh Edition (Ed. Trevor Poole): 246 – 261.

Rahmani, A. R. 1997. **The effect of Indira Gandhi Nahar Project on the avifauna of the Thar desert.** *J. Bombay Natural History Society*, 94(2): 233-266.

Tuttle, M. 1988. **The World of Bats. America's Neighborhood Bats**, University of Texas Press.

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Greater mouse-tailed bat (Rhinopoma microphyllum kinneari) at Junagarh Fort, Bikaner. (Photo: Ashok Purohit)

SUSTAINABLE INTERVENTIONS FOR SUPPRESSING ILLEGAL WILDLIFE TRADE IN THAILAND

by John Parr

At the time of writing (November 2003), a combination of high profile raids and complimentary statements focusing on illegal wildlife trade have been made by concerned government agencies. These initiatives clearly indicate that the Thai Government is making a determined effort to stamp down hard on these illegal activities in the run-up to the 13th convening of Parties to the Convention of International Trade in Endangered Species to be held in Bangkok in October 2004.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973) regulates international trade in wild animals and plants which are listed in three Appendices to the Convention. The treaty prohibits international commercial trade in species that are threatened with extinction. It is also a trade regulation treaty in the sense that it allows a controlled international trade in species whose survival is not yet threatened, but may become so (as long as critical management and scientific determinations of sustainability are made).

The Convention operates by a permit system. With a few exceptions, it prohibits international trade in specimens of species included in any of the Appendices without the prior granting of a CITES permit. It lays down strict management and scientific conditions that must be satisfied before a permit is granted, and it requires each Party to establish one or more Management Authorities and Scientific Authorities which, between them, are responsible for ensuring that the conditions have been satisfied and, if they have been, for granting permits.

If one looks at the interpretation of the Convention by convening Parties, through reviewing national legislation on wildlife trade in different countries, it appears that only those government agencies *with a direct mandate for wildlife trade* have responded to the Convention by modifying their own particular piece of national legislation. For example, in Thailand, the Plants Act (1975), establishes a Management Authority, establishes an advisory Scientific Authority, and shoulders the responsibility of issuing permits. The Wild Animals Reservation and Protection Act (1992) made progress to address similar responsibilities concerning the faunal issues.

Apart from specifying the requirements for Management and Scientific Authorities, the Convention does not prescribe or recommend other aspects of the institutional arrangements for implementing CITES at the national level, which are specific to each country's system. In particular, there is no reference to what has emerged as a clear need - the need for an interagency committee. As a direct consequence, the all-important law enforcement agencies - particularly the police and customs - have been largely left out of "the debate" in numerous countries, and have consequently had difficulty grasping CITES issues.

Indeed, these interagency committees have only just been initiated in places like the UK, and Sweden for approximately a decade, although the US has had an informal committee of this nature for even longer. A quite extraordinary and fascinating scenario that seems to have evolved from the content of the CITES Convention itself.

If one takes time to dwell on the government agencies in Thailand that should be most actively involved in tackling the illegal wildlife trade issues, it is relatively straightforward to come up with a short-list of concerned government agencies. Immediately, the three Departments that handle the listings of threatened and endangered species, namely the Department of National Parks, Wildlife and

Plant Conservation - for terrestrial fauna, the Fisheries Department - for aquatic fauna, and the Department of Agriculture - for plants spring to mind. All three agencies have established their respective management authorities with direct responsibilities for handling the permit systems operated under the Convention.

In addition, the two law enforcement agencies - the Customs Department and the Police Department - both have substantial numbers of officers operating at entry points (airports, ports and border crossings) as well as throughout the country, with particularly strong mandates to apprehend offenders dealing in illegal (wildlife) trade. Furthermore, individuals from the Justice Department will have the ultimate task of determining the seriousness of the crimes committed and the penalties imposed.

Undoubtedly, an interagency committee comprising representatives from these six government departments has the potential, on paper, to draw up a holistic, powerful, long-term strategy to address illegal wildlife trade.

Indeed, if a checklist of possible activities, or policies, is drawn up in which these six agencies might cooperate, the full potential of this body is appreciated. Some areas where cooperation would be helpful include the production of educational materials about schedules of species by the three management authorities for law enforcement agencies; production of education materials and outreach strategies by the three management authorities for the general public; advice from scientific authorities on species listings, possible additions, and trends in populations of near-threatened species; interagency cooperation at airports, ports and border crossings; interagency cooperation for domestic trade, particularly rural markets and trading outlets; information exchange and databases on illegal wildlife traders; promoting informants' networks at community/provincial level on illegal traders; training courses by management authorities for law enforcement officers; and training courses for protected area staff by police/border patrol police in law enforcement issues.

Of direct relevance to the significance of establishing an interagency committee, an official CITES Mission visited Thailand from 26-30 August 2002, at the behest of the CITES Standing Committee (Switzerland, 2002). This mission produced a report of its findings. Interestingly, it's *first* recommendation was that "Thailand should consider a multi-agency specialized crime unit, led by the police, but incorporating customs and CITES officials (RFD, Fisheries and Plants) and perhaps FDA, to coordinate enforcement and international liaison. Such a unit need not be operational but could focus on intelligence gathering, and dissemination, risk assessment, target profiling."

Ultimately, unless an interagency body is established and fully functional, we may continue to witness piecemeal interventions, which may not be conclusive in suppressing illegal wildlife trade within the country in the long-term. Fortunately, the commitment is clearly present to move forward within our Thai Government

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CHALLENGES FACED IN TIGER CONSERVATION IN MANAS NATIONAL PARK OF ASSAM, INDIA

by Bibhab Kumar Talukdar

Introduction

Manas Wildlife Sanctuary was established in 1928 with an area of 391 km^2. It became a World Heritage site in 1985 under Criterias ii, iii and iv of the World Heritage Convention. Subsequently, its area was increased to 500 km^2 when it was upgraded to a national park in 1990 by the Assam government. The park spans the Manas River and is bounded in the north by the international border with Bhutan, to the south by the populated regions of North Kamrup, and to the east and west by forest reserves.

The three major types of vegetation in the park are:

a. tropical semi-evergreen forests in the northern part of the park, with common trees including *Aphanamixis polystachya, Anthocephalus chinensis, Syzygium cumini, S. oblatum, Bauhinia purpurea, Cinnamomum tamala* and *Actinodaphne obvata*;
b. tropical moist and dry deciduous forests (the most common type), characterized by trees such as *Bombax ceiba, Sterculia villosa, Dillenia indica, D. pentagyna, Careya arborea, Lagerstroemia parviflora, L. speciosa, Terminalia bellirica, T. chebula, Trewia polycarpa* and *Gmelina arborea*; and
c. extensive alluvial grasslands in the western part of the park, comprising many different grass species, together with a variety of tree and shrub species (e.g. *Dillenia pentagyna, Phyllanthus emblica, Bombax ceiba*, *Clerodendrum* sp., *Leea* sp., *Grewia* sp., *Premna* sp. and *Mussaenda* sp.). The grasslands can be subdivided into wet alluvial and highland savanna types. There is also a considerable variety of aquatic flora along river banks and in the numerous pools (Jain and Sastry, 1983).

Dry deciduous forests represent early stages in succession and are replaced by moist deciduous forests away from water courses, which in turn are succeeded by tropical semi-evergreen climax forest. Grasslands cover about 50% of the park. Some 393 species of dicotyledons, including 197 trees, and 98 species of monocotyledons have been identified (Jain and Hajra, 1975).

Manas has also been declared as a tiger reserve under Project Tiger. Besides Royal Bengal Tiger (*Panthera tigris*), it harbors over 50 species of mammals, 21 of them under Schedule 1 of the Wildlife (Protection) Act 1972. The park is home to over 450 species of birds (Deb Roy, 1990), 36 species of reptiles and 7 species of amphibians. Among the avifauna, the Bengal florican population was estimated at 34 in 1984 in the national park (Ali *et al.*, 1985) and 80 individuals with 24 male territories were identified within the park during 1988 and 1989, the first confirmed record for India (Narayan *et al.*, 1989). Manas was a potential site for tiger conservation, but during 1990-1996, due to political unrest in the area, the populations of many key species including rhinoceros, tiger and elephant were reduced due to poaching. In the present study, an analysis was made of the current state of the tiger in Manas Tiger Reserve, taking into account the pre-1990 and post-1990 period of political unrest. The study was done through field visits to the national park and also through discussions with forest officials, villagers and other persons knowledgeable about Manas to assess the successes and failures of tiger conservation by the state government. The study was conducted from June 2002 to December 2002.

Tiger Estimates in Manas

The first attempt to estimate the tiger population in Manas was carried out by the Assam Forest Department in 1972. Only 10 tigers were

recorded, and although the official figures listed all of them as males, the presence of females might have been overlooked due to shortcomings in the survey methods. A summary of tiger estimates in Manas is given in Table 1.

Table 1: Tiger estimates in Manas National Park, Assam (Source: Forest Dept.)

Year	Males	Females	Cubs	Total
1972	10	0	0	10
1975	20	16	5	41
1976	28	17	6	51
1988-89	18	31	4	53
1991-93	32	37	12	81
1994-95	29 (+ 4 in Buffer Zone)	44 (+ 8 in Buffer Zone	7 (+ 2 in Buffer Zone)	80 in core & 14 in Buffer Zone
1996-97	27	54	8	89
2000-01	22	38	5	65

Manas is often regarded to be one of the key sites for tiger conservation. However, since the ethnic disturbance erupted in 1988, the killing of tigers and rhinos has continued unabated. The rhino population was almost exterminated by poachers and there was a significant loss of tigers to poachers during the period.

Table 2: Tigers killed by poachers in Manas National Park (Source: Forest Department of Assam)

Year	Number of tigers killed
1988-89	3
1991-93	8
1994-95	9
2001	1

The number of tigers in Manas showed a sharp decline between 1997-2001. That may have been due to intense poaching and also because of other causes like habitat destruction, which has forced the tigers to move to other, less optimal habitats where they are more vulnerable to poachers.

The problem of tiger poaching in Manas seems to be acute and many more cases probably go undetected by the park managers as nothing remains after the tigers are killed, making it difficult to estimate the actual number of tigers killed. There is a tendency to blame the park managers for not keeping accurate records of tigers poached, but it is a difficult task when there is no evidence if the poachers leave nothing behind. In the case of rhinos and elephants, at least the carcasses are usually left behind so it can be estimated how many were

killed and whether the deaths were due to poaching or natural causes. For instance, if a rhino is found dead with no horn, then it could be assumed that poachers were involved. Similarly, if an elephant is killed and the ivory or body parts are left untouched, then the animal probably died of natural causes. But if a tiger is killed by poachers, everything from skin to bones is taken away. Hence, tiger protection has become more difficult for the park managers as the animals can be killed by silent methods like poisoning.

Tiger conservation has been found to be a very challenging task, especially in areas with high ethnic disturbances. When forest camps are attacked and staff are killed, the morale of the park managers is low and they become more concerned for their own safety then that of the animals. Moral support from the Forest Department would improve the morale of the staff and a greater understanding of the trauma of the field staff is needed. If the problems faced by the park staff are understood and follow-up actions are initiated, Manas could still become a key site for the conservation of tiger and other key mammals.

Villagers living on the fringes of the park need to be motivated to support tiger protection. In addition, joint patrolling with the staff of Royal Bhutan Manas National Park and the Assam counterparts in the international border areas and sharing of intelligence may help to reduce tiger poaching. The state government of Assam needs to establish a special task force to deal with tiger poaching, not only in Manas but also in other parts of the region.

Acknowledgments

The author wishes to thank the Field Director and staff of Manas Tiger Project for their support during the study. He is also grateful to the Ashoka Trust for Research in Ecology and the Environment for encouragement and support.

References

Ali, S., Daniel, J.C. and A.R. Rahmani. 1985. **Study of ecology of certain endangered species of wildlife and their habitats.** *The Floricans*. Annual Report 1, 1984-85. Bombay Natural History Society, Bombay. p.79-83.

Deb Roy, S. 1990. **Manas – A monograph**. Regional Expert Consultation on Management of Protected Areas in the Asia-Pacific Region. Food and Agriculture Organization of the United Nations. 31 pp.

Jain, S.K. and A.R.K. Sastry. 1983. **Botany of some tiger habitats in India.** Botanical Survey of India, Howrah. 71 pp.

Jain, S.K. and P.K. Hajra. 1975. **On the botany of Manas Wildlife Sanctuary in Assam.** *Bulletin of the Botanical Survey of India,* 17:75-86.

Narayan, G., Sankaran, R., Rosalind, L. and A.R. Rahmani. 1989. **The Floricans *Houbaropsis bengalensis* and *Sypheotides indica*.** *Annual Report 1988-89.* Bombay Natural History Society. 39 pp.

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ASSESSMENT OF HABITAT SUITABILITY FOR ASIAN ELEPHANTS IN TEKNAF GAME RESERVE, BANGLADESH

by Richard E. Salter and M. Khairul Alam

Introduction

Asian elephants occur in Bangladesh primarily along the northern and eastern borders, both as year-round residents and moving seasonally between the adjacent hill tracts of India and Myanmar and similar habitats in the Garo Hills, Chittagong Hill Tracts, and Teknaf Peninsula (Santiapillai and Jackson, 1990; IUCN Bangladesh, 2000). Most of the available estimates put total numbers at perhaps a few hundred animals. Although the population of elephants occurring in Bangladesh is small in comparison to most of the 12 other countries within this species' range, it represents a significant management challenge in terms of maintaining sufficient areas of habitat, and mitigating human-elephant conflicts in cropland and adjacent forest areas. The current status of Asian elephants is listed as endangered over their total range (Hilton-Taylor, 2000), and as critically endangered in Bangladesh (IUCN Bangladesh, 2000).

The Teknaf Peninsula of extreme southeastern Bangladesh, and immediately adjacent areas to the north, represent some of the most important elephant habitat remaining in the country. In recognition of this, the Government of Bangladesh established the Teknaf Game Reserve in 1983, comprising ~11,000 ha of land under the administrative control of Cox's Bazar Forest Division. Although this designation provides only very limited (and largely theoretical) protection for elephants and other wildlife populations, and no protection of habitat beyond normal forest management practices, it does provide a basis for further conservation planning, and possible upgrading to a higher protection status. Management recommendations have been developed under the Forestry Master Plan (GoB 1992), the Forest Resources Management Project (BCAS 1997; Rosario 1997) and most recently under the Forestry Sector Project (Tecsult 2001). The latter recommended expansion of the protected area to 22,632 ha, upgrading of the area's status to wildlife sanctuary (which would provide more scope for the protection of both wildlife and habitat), and adoption of a participatory approach to management including sustainable use of forest resources by the surrounding rural population.

Long-term retention and balancing of conservation and resource production values in the Teknaf area will require a spatially-based land use planning and management approach. A cornerstone of this approach needs to be a clear understanding of the value of the area for elephants, including quantitative assessments of: 1) population size and distribution; 2) current suitability of habitats for use by elephants; and, 3) how future habitat suitability might change as a result of human land use. The first of these requirements, elephant population estimates and distributional assessments, has recently been addressed (Islam, 1998; IUCN Bangladesh, 2001), and the methodology can easily be replicated in the future for monitoring purposes. This paper addresses the related planning and management requirements of assessing current habitat suitability for elephants, and how habitat suitability can be retained and improved through the implementation of land use management measures.

Description of the Area

The Teknaf Game Reserve as currently gazetted occupies the middle part of the Teknaf Peninsula, from Ukhia south to the town of Teknaf. It consists of gently sloping to rugged hills and cliffs running down the central part of the peninsula, with a north-south length of 30 km and an east-west width of 2-6 km. The Reserve is accessible from Cox's Bazar along its entire eastern edge by an all-weather road, and from the western side along an unbroken stretch of beach from Cox's Bazar to Teknaf, which is

currently used as a road by light four-wheel drive vehicles during low tide.

The Reserve and immediately adjacent coastal areas comprise a broad variety of habitats within a relatively compact area, including representative but increasingly fragmented and degraded examples of evergreen and semi-evergreen hill forests within the Reserve, tidal mudflats and mangrove vegetation along the Naf River to the east, and broad sandy and rocky beaches along the Bay of Bengal bordering the Reserve to the west. These habitats support what is considered to be the highest biodiversity in Bangladesh –a documented total of 290 species of plants, 55 species of mammals, 286 species of birds, 56 species of reptiles and 13 species of amphibians (Wahab and Faizuddin, 1984; Khan, 1989; Rashid *et al.,* 1990; Khan *et al.,* 1994). The wildlife fauna includes approximately half of the mammal species found in Bangladesh (including 8 of the 10 primate species), and 4 species of nesting marine turtles.

The Reserve area has long been known for its elephants, and was established specifically for their protection. Elephants are still widely distributed in the area, and although numbers very likely have declined the Reserve and adjacent parts of the Teknaf Peninsula still support an important population, with total numbers variously estimated as 15-56 (Islam 1998) to 100 or more (1983 estimate in Rashid *et al.* (1990) and current estimates by Forest Department personnel). These elephants are part of a larger population scattered over the Chittagong Hill Tracts and down through the Teknaf Peninsula, and contiguous with populations in adjacent parts of India and Myanmar. Estimates of both the Reserve population and the total country population of elephants are very crude, but the Teknaf population probably represents 20-30% or more of the total number of elephants currently remaining in Bangladesh (most recently estimated as 74-205 animals by Islam (1998)).

Intensive human use has resulted in the degradation or conversion of much of the original wet evergreen and semi-evergreen forest cover in the Reserve. The most recently available mapping (based on 1995 aerial photography, and mid-1999 field checking) indicates that "scattered trees" is now the predominant cover type (Table 1), with high forest being limited to areas that are at least partially protected by steep topography. Levels of human use are very high, and there is currently a downward trend in forest condition from high forest to low forest, and from low forest to scattered trees and brushland. Main habitat conversion and/or degradation factors are increasing development of a road network, resulting in increasing ease of access and removal of forest resources; illegal logging of valuable timber species; conversion of degraded forest areas to plantations, including clearing and burning of extensive areas and establishment of monocultures of exotic species; grazing by livestock; repeated burning of understory vegetation; widely dispersed but intensive harvest of fuelwood, bamboo and other forest products for subsistence use and for sale by the surrounding rural population; heavy (and illegal) use of fuelwood by adjacent brickfields; conversion of riparian and lowland habitat to agriculture by forest villagers; and encroachment by agriculture along the edges of the Reserve. Extensive hunting and trapping of wildlife also occurs, including poaching of elephants.

Management proposals prepared by the Forestry Sector Project included regazettement to include an additional 11,670 ha of Forest Department land immediately to the north of the current Reserve area. This extension would add large areas of high forest, low forest and long-rotation plantations to the Reserve (Table 1). The proposals also included a buffer zone along the eastern edge of the extension, comprising mostly low forest and plantations where the management focus would be on intensive production of replacement resources, particularly fuelwood, poles and timber, and on maintaining suitability as elephant habitat.

Table 1: Forest and land use cover in Teknaf Game Reserve, and proposed extension and buffer

zone

Land use/cover type[1]	Gazetted Reserve area		Proposed extension		Proposed buffer zone	
	Area (ha)	%	Area (ha)	%	Area (ha)	%
High forest	887.5	8.1	2790.5	23.9	9.4	0.2
Low forest	1511.1	13.8	3636.0	31.2	1368.3	33.0
Scattered trees	4393.4	40.1	119.4	1.0	67.3	1.6
Brush	423.4	3.9	269.7	2.3	230.8	5.6
Long-rotation plantations:						
>50 years old	22.6	0.2	68.4	0.6	0.0	0.0
#50 but >25 years old	398.6	3.6	1607.9	13.8	12.1	0.3
#25 but >10 years old	546.2	5.0	1235.7	10.6	396.8	9.6
#10 years old	1154.8	10.5	796.2	6.8	605.0	14.6
Short rotation plantations:						
>10 years old	106.6	1.0	61.1	0.5	80.8	2.0
#10 years old	164.2	1.5	121.4	1.0	401.7	9.7
Failed plantations	713.0	6.5	531.5	4.6	905.3	21.9
Forest Research Institute area	0.0	0.0	0.0	0.0	16.7	0.4
Agriculture/encroachment	640.2	5.8	415.3	3.6	46.8	1.1
Open/eroded areas	0.0	0.0	6.7	<0.1	0.0	0.0
Water/pond/swamp	1.1	<0.1	9.9	<0.1	0.0	0.0
Total	10,962.7	100	11,669.7	100	4141.0	100

[1] *cover type and area based on 1995 aerial photography, mid-1999 field checking and updated plantation areas*
[2] *long rotation plantations are mostly teak mixed with other species*
[3] *short rotation plantations are mostly Acacia mixed with other species*

Elephant Habitat Requirements

The first step in developing the elephant habitat suitability assessment was a review of relevant field studies and other literature (primarily Seidensticker (1984), Sukumar (1989), Dudley (1993) and included references) to identify what environmental features are the best descriptors of habitats used by this species. This focussed on: 1) the life requisites of food, cover and special habitat requirements such as space (minimum area) and juxtaposition of habitat components; and, 2) the effects of habitat change.

In summary, high quality elephant habitat is characterized by:

- close proximity of seasonal foraging areas, water (for drinking and bathing) and mineral licks;
- availability of a mosaic of habitat types, including forests, forest clearings, forest scrub, savanna, grasslands and alluvial floodplains;
- availability of preferred food plants (primarily grasses, but including browse, fruits, palms and succulents);
- low levels of habitat alienation and fragmentation (*e.g.,* as resulting from permanent agriculture; plantation forestry; clear-felling; overharvesting of plant resources for fodder, fuel and timber; competition from domestic livestock; human settlement; road construction);
- contiguous areas of habitat sufficiently large to support a genetically viable population (probably several hundred km^2 over the short-term); and,
- retention of seasonal movement corridors.

With regard to habitat change, key considerations are that:

- conversion of evergreen forest from climax to seral stages can result in an increase in browse and forage production and hence increased carrying capacity for elephants, but carrying capacity may subsequently decrease if secondary forest is further degraded to the scrub stage;
- selective logging in closed canopy forest can result in positive habitat changes, to the extent that light-demanding plants that also

are elephant food species (*e.g.,* bamboos and other grasses) become established in disturbed areas;

- occasional ground fires in forested areas can increase forage availability, but regular fires reduce carrying capacity by degrading tree cover and species composition;
- clear-felling for plantations causes adverse habitat changes, although elephants may also forage to some extent on plantation species such as teak and *Eucalyptus*, and adverse changes may be reduced where the scale of plantations is limited, and forage plants are maintained in the understory;
- heavy removal of fuelwood ultimately degrades natural vegetation cover, reduces standing biomass, and reduces food availability for elephants; and,
- elephants that lose parts of their home range to agricultural production, or that otherwise are confined to highly fragmented habitats, are prone to becoming crop raiders.

Assignment of Habitat Suitability Values

The Bangladesh Forest Department maintains a centrally-operated database (RIMS, or Resource Information Management System) that contains geo-referenced information on land use type, land use area and (for plantations) year of establishment and species planted. This database and associated mapping covers all forest land in Cox's Bazar Forest Division, dividing it into land units (map polygons) having uniform vegetation cover. The gazetted Game Reserve area, proposed extension and buffer zone are divided into a total of 435 polygons, providing an established spatial framework for habitat suitability assessment.

As noted above, the first step in the habitat suitability assessment was to identify what environmental features are the best descriptors of habitats used by elephants. The next step in the assessment was to develop a standard table for assigning habitat suitability values to each land use type. Measures of habitat structure (stand maturity, canopy closure, food abundance) are not available for individual polygons, but were inferred from cover type, species composition and stand age descriptors in the database, and on the basis of limited field checking. A judgement of how well these inferred measures match the habitat requirements of elephants was then used to assign generic habitat suitability index (HSI) values to each generalized land use type (Table 2). This provides a first approximation of the overall suitability of habitat in any given polygon, on a scale of 0.0 (indicating no habitat value) to 1.0 (the best possible habitat conditions).

Table 2: Generalized descriptors of land use types and assigned Habitat Suitability Index values

		Inferred value of:			
Land use type	**Predominant stand age**	**Canopy closure**	**Availability of browse, fruit and/or succulents**	**Availability of bamboo and other grasses**	**Assigned HSI value for elephants**
High forest	old	closed, large crowns	moderate	low-moderate	0.7
Low forest	mid to old	near closed, small crowns	moderate-high	moderate-high	1.0
Scattered trees	young	open	low-moderate	high	0.8
Brush	young	no canopy	low-moderate	moderate	0.6
Long-rotation plantations:					
>50 years old	old	closed	moderate	low	0.5
#50 but >25 years old	mid	near closed	moderate	low	0.5
#25 but >10 years old	young-mid	open	low-moderate	low	0.3
#10 years old	young	open	low	low	0.1

Short rotation plantations:					
>10 years old	young-mid	near closed	low-moderate	low	0.3
#10 years old	young	open	low	low	0.1
Failed plantations	young	no canopy	low	low	0.2
Forest Research Institute area	young-mid	open-nil	low	low	0.2
Agriculture/encroachment	young	no canopy	nil	nil	0.0
Open/eroded areas	not applicable	no canopy	nil	nil	0.0
Water/pond/swamp	not applicable	no canopy	nil	low	1.0

In assigning HSI values, consideration was given to existing models of habitat carrying capacity, primarily those of Olivier (1978) and Sukumar (1989). Olivier's model depicts an increase in elephant density across forest formations, from evergreen forest (low carrying capacity and low elephant density) to deciduous forest (high carrying capacity and high density), and along a second gradient within forest formations, with carrying capacities and elephant densities increasing from climax forest with closed canopies through to seral forests with open canopies. Sukumar's model shows: 1) a curvilinear increase in observed elephant densities, from evergreen to semi-evergreen to moist deciduous through dry deciduous forests, with densities declining in scrub vegetation; and, 2) higher densities in secondary as compared to primary stages of evergreen, semi-evergreen and moist deciduous forests, approximately equal densities in primary and secondary stages of dry deciduous forest, and reduced densities in secondary as compared to primary stages of dry scrub. Key factors underlying carrying capacities in both of these models are forage/browse production, and the proportion of that production that is physically available (within foraging/browsing height) to elephants.

Consistent with these models, the assignment of HSI values in Table 2 assumes that there is a direct relationship between habitat structure (*i.e.,* as described by stand age, canopy closure and food abundance) and utility as elephant habitat, and that there is a continuum from the best habitats (open forest with high food abundance) downward to habitats having little or no value (disforested habitats with low food abundance). It also needs to be borne in mind that the assigned HSI values in Table 2 are "averages" for the given land use type. Actual value as elephant habitat is likely to differ among polygons of the same land use type (*e.g.*, within low forest, one patch will have a somewhat higher or lower value than any other patch, depending on the distribution and abundance of preferred foods and other resources) but these differences are considered unlikely to be important within the overall accuracy level of the assessment.

Land use type descriptions and the rationale behind assignment of HSI values are as follows:

Low Forest (HSI 1.0): Low forest polygons are segregated during air photo interpretation as areas of largely continuous forest cover characterized by trees with "small crowns". Low forest polygons may include both open deciduous forest typical of west-facing slopes, and evergreen forests in which the overstory has been removed. Numerous gaps and openings invaded by secondary vegetation are likely to be present due to illicit timber felling, and in some locations as a result of cyclonic damage.

Observations indicate that low forest is likely to retain an optimum mix of foods derived from mature trees and associated understories, and from early to mid-seral growth in open areas. As low forest represents the highest carrying capacity available in the study area, it is assigned an HSI value of 1.0, and HSI values of all other types are scaled against this.

Scattered Trees (HSI 0.8): Areas designated as scattered trees are typically former forest degraded by timber felling and fuelwood cutting, to the extent that only scattered trees of low economic value (*e.g., Ficus* spp.*, Swintonia floribunda*) remain. Dense secondary vegetation is more or less continuous, comprising bamboos, bananas, and tree and shrub regeneration. The scattered trees cover type can be considered to be equivalent to low forest with most of the tree cover removed, and with correspondingly denser growth in the shrub/understory stratum. It is assigned a reduced HSI value relative to low forest, as it represents a reduction in diversity (but not necessarily overall quantity) of foods available from mature trees and the understory stratum.

High Forest (HSI 0.7): High forest polygons are segregated during air photo interpretation as areas of largely continuous forest cover characterized by trees with "large crowns". They comprise multi-storied evergreen forests characterized by emergent garjan (*Dipterocarpus turbinatus*) up to 60 m in height. Numerous gaps and openings invaded by secondary vegetation are likely to be present due to illicit felling of garjan and other high value species. Remaining stands are limited to inaccessible areas and/or steep topography. Relative to low forest and scattered trees, high forest is assigned a reduced HSI value because growth of bamboos and other preferred forages can be expected to be relatively poor beneath high, closed canopy cover, and also because some fruits and browse may be out of reach even to elephants where tree growth is high.

Brush (HSI 0.6): The brush cover type comprises secondary growth resulting from continuous and heavy felling for fuelwood, or regrowth following burning and/or shifting cultivation. Remaining cover is devoid of trees and consists primarily of bamboos, sun grass (*Imperata* spp.), assam lota (*Eupatorium odoratum*) and other invasive species typical of cleared and/or burned areas. The brush cover type is assigned a reduced HSI value relative to forest and scattered trees because it represents a more or less complete loss of tree cover and food species associated with the tree stratum, and an advancing stage of habitat degradation. Although in some areas of brush cover the availability of bamboos and other preferred forages may remain high, in others coarse grasses and weedy growth predominate.

Long-rotation Plantations (HSI 0.1-0.5): This cover type comprises plantations of high value timber species (primarily teak (*Tectona grandis*) but including dhakijam (*Syzigium grande*), garjan, mahogony (*Swietenia mahogoni*), telsur (*Hopea odorata*) and other species). Preparation for planting involves felling and burning of all existing vegetation (ecologically equivalent to preparation for shifting cultivation) followed by periodic hand weeding of potentially competitive volunteer regrowth for up to three years. Harvesting is via a clear-felling system typically when the stand is 40-50 years of age, and is normally followed by immediate replanting. Long-rotation plantations are assigned only low to mid-range HSI values because although they include some species that provide browse and fruits (*e.g.,* teak, *Artocarpus chaplasha*), species diversity is much reduced compared to natural forest. Also, periodic weeding greatly decreases the potential availability of bamboos and other preferred forages, at least in young stands.

Mid-aged to mature stands of long-rotation plantations (25 to 50+ years old) are comprised of trees similar in stature to natural forest, and with the cessation of weeding and thinning some stands will have a relatively well-developed understory of volunteer species. Hence mid-aged to mature long-rotation plantations are considered to have potentially moderate value as elephant habitat (assigned HSI 0.5), but less value than natural cover types as a result of reduced species diversity. Younger stands of long-rotation plantations are assigned stepped down HSI values to reflect lower species diversity and standing biomass relative both to older stands and natural cover types.

Short-rotation Plantations (HSI 0.1-0.3): This cover type comprises plantations of fast-growing species, primarily akashmoni (*Acacia auriculiformis*), eucalyptus (*Eucalyptus* spp.) and koroi (*Albizia* spp.). As for long-rotation plantations, preparation for planting involves felling and burning of all existing vegetation, followed by hand weeding of potentially competitive volunteer regrowth for a period of up to three years. Harvesting is via a clear-felling system typically when the stand is 10-15 years old. Short-rotation plantations are assigned low HSI values because fruiting trees

are not normally planted as short-rotation crops, and the rotation period is too short for the natural ingress and maturation of fruiting species. Short-rotation plantations do provide a potential source of browse, but only from a very limited species mix, and primarily in near-mature plantings that have the tallest and best-developed trees. As in long-rotation plantations, availability of bamboos and other preferred forages can be expected to be minimal due to management interventions.

Failed Plantations (HSI 0.2): Failed plantations represent lands from which all natural cover has been removed, and on which planted tree cover has failed to develop due to site conditions or competing land uses (*e.g.,* livestock grazing, agricultural encroachment). Plantations that fail are likely to do so within the first few years of their establishment. They can subsequently be expected to have a greater diversity and biomass of volunteer vegetation growth than tended plantations of the same age due to cessation of weeding, and hence are assigned a higher HSI value (0.2 *vs* 0.1 for young plantations). Depending on site conditions and whether or not they are replanted, failed plantations would be expected to continue to develop toward the brush vegetation type.

FRI Area (HSI 0.2): The Forest Research Institute area comprises research plots (38.8 ha) in the proposed buffer zone used for experimentation with plantation species. It has become heavily degraded recently and is currently almost denuded of tree cover. To avoid an unnecessarily detailed breakdown of this small area, it is assigned an average HSI value of 0.2, equivalent to failed plantations.

Agriculture (HSI 0.0): Agricultural areas comprise former forest land that has been converted to cropland, primarily for the production of rain-fed rice or vegetables. Although such areas may be very attractive to elephants when crops are ripening, the presence of agricultural areas is actually deleterious as they are a direct cause of increased human-elephant conflicts. All agricultural areas are assigned an HSI value of 0.0 to reflect their null value as "natural" elephant habitat.

Open/Eroded Areas (HSI 0.0): These comprise small unvegetated areas, presumably resulting from human land use, and are assumed to have no value as elephant habitat.

Water/Pond/Swamp (HSI 1.0): Where delineated as a separate cover type, waterbodies are assigned an HSI value of 1.0, reflecting the need for permanent water sources as an essential component of elephant habitat. Other permanent water sources (springs and permanent streams) are most likely to be maintained under continuous forest cover, and their value is incorporated in the overall assigned HSI value of the low and high forest types.

Habitat Suitability Assessment

A key feature of the HSI approach to habitat assessment is that it permits the incorporation of area measurements; multiplying the HSI value by area yields habitat units (HUs), which can be summed to obtain a measure of the habitat value of large, diverse areas within which a series of HU values has been calculated. This permits an evaluation of spatial changes in habitat availability over time, and/or in response to different management regimes.

For purposes of this habitat suitability assessment, the standard HSI ratings (Table 2) and calculation of habitat unit values were applied to two scenarios:

1. A "pre-development" scenario representing a recreation of conditions that would prevail had no plantation development or other human uses of forest occurred in the area (*i.e.*, if all of the area had remained covered by mature evergreen and semi-evergreen forest). For purposes of this scenario, it was assumed that all of the area had an HSI value of 0.7 (*i.e.,* equivalent to high forest) prior to development.

2. A "current" scenario representing current area and types of forest cover, including plantations and other land uses, as determined from the RIMS database and limited field checking. This scenario utilized the cover type areas in Table 1, and the HSI values in Table 2, to derive HU values for each land use type (Table 3).

Table 3: Current Habitat Units in Teknaf Game Reserve, and proposed extension and buffer zone

Land use/cover type[1]	HSI	Gazetted Reserve area		Proposed extension		Proposed buffer zone	
		HUs	%	HUs	%	HUs	%
High forest	0.7	621.2	9.4	1953.4	26.8	6.6	0.3
Low forest	1.0	1511.1	23.0	3636.0	49.9	1368.3	68.4
Scattered trees	0.8	3514.7	53.4	95.5	1.3	53.8	2.7
Brush	0.6	254.0	3.9	161.8	2.2	138.5	6.9
Long-rotation plantations:							
>50 years old	0.5	11.3	0.2	34.2	0.5	0.0	0.0
#50 but >25 years old	0.5	199.3	3.0	804.0	11.0	6.0	0.3
#25 but >10 years old	0.3	163.9	2.5	370.7	5.1	119.0	5.9
#10 years old	0.1	115.5	1.8	79.6	1.1	60.5	3.0
Short rotation plantations:							
>10 years old	0.3	32.0	0.5	18.3	0.3	24.2	1.2
#10 years old	0.1	16.4	0.2	12.1	0.2	40.2	2.0
Failed plantations	0.2	142.6	2.2	106.3	1.5	181.1	9.0
Forest Research Institute area	0.2	0.0	0.0	0.0	0.0	3.3	0.2
Agriculture/encroachment	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Open/eroded areas	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water/pond/swamp	1.0	1.1	<0.1	9.9	0.1	0.0	0.0
Total current habitat availability[1]		6583.1	100	7281.8	100	2001.5	100

[1] *pre-development habitat availability is estimated as 7674 HUs in the gazetted Reserve area, 8169 HUs in the proposed extension, and 2899 HUs in the proposed buffer zone*

Observations from Habitat Suitability Assessment

1. Current habitat availability for elephants in the gazetted Reserve is an estimated 86% of the original (pre-development) level (*i.e.,* 6583 of 7674 HUs). Although vegetation cover has been altered substantially, the estimated net loss of elephant habitat has been relatively modest because human use of the area has improved habitat suitability for elephants where high forest has been converted to low forest and scattered trees, which are more preferred habitats. However, where further conversion has occurred (*i.e.,* to brush, plantations, other cleared areas) there has been a reduction in habitat suitability, and hence overall availability, to below pre-development levels. At present, most of the elephant habitat within the Reserve is provided by the scattered trees cover type (~53% of HUs), followed by low forest (~23% of HUs) and high forest (~9% of HUs).
2. Addition of the proposed extension to the Reserve would more than double the amount of elephant habitat under conservation management (*i.e.,* from 6583 HUs to 13,865 HUs). Most of the extension area habitat is in the low forest and high forest cover types (~50% and 27% of HUs, respectively). Similar to the gazetted Reserve, an estimated 89% of the pre-development elephant habitat that originally occurred in the proposed extension area remains (*i.e.,* 7282 of 8169 Hus).
3. Within the gazetted Reserve area and proposed extension area combined, 8590 ha of natural vegetation cover (38% of area) have been converted to other land uses, primarily forest plantations and agriculture. Although they comprise a large proportion of the Reserve/extension, these primarily low and moderate suitability areas currently provide only ~15% of total HUs.
4. Within the gazetted Reserve and proposed extension, 1062 ha (~5% of area) are classified as non-habitat, 5431 ha (~24%) as low suitability habitat (HSI=0.1-0.3), 6469 ha (~29%) as moderate suitability habitat (HSI=0.4-0.7), and 9671 ha (~43%) as high suitability elephant habitat (HSI=0.8-1.0).
5. In the proposed buffer zone, elephant habitat has been reduced to ~69% of pre-development levels. Two-thirds of current habitat in this zone is provided by low forest. A total of 2465 ha of the original natural vegetation cover has been converted to plantations and agriculture; although these currently occupy ~60% of the land area, they provide only ~22% of total buffer zone HUs.

Discussion

The habitat suitability assessment system presented herein provides a quantitative, defensible basis for: 1) extending the Reserve area to create a more viable conservation unit; 2) developing and implementing management programmes for the extended Reserve area; and, 3) monitoring the impacts of habitat management, and modifying management programmes as necessary. The main caveats in its use are that it assumes that the land cover database is accurate and up-to-date, and that assumptions regarding "average" values of stand age, canopy closure and food availability, and hence the derived HSI value for each cover type, are valid.

Rationale for Reserve Extension

The habitat suitability assessment shows that extending the Reserve as proposed would more than double the amount of elephant habitat under conservation management. Although even the extended Reserve would not provide all of the habitat needs of a viable elephant population, it would better guarantee habitat security for a much larger proportion of the elephants that currently use the area. Assuming that these elephants are primarily migratory, this would be a major contribution to both national and international (trans-border) elephant conservation efforts. Also, because the extension area consists largely of closed canopy forest, it is likely to be of high conservation value to a broad array of plant and animal species that require densely forested areas. Given the very high levels of biodiversity that have previously been documented in this part of Bangladesh, the establishment of effective conservation management over an extended area is a high priority for the conservation of both elephants and other elements of biodiversity.

Development of Management Programmes

The results of the habitat assessment suggest some first principles for the development of elephant habitat management programmes:

- the focus of habitat protection and improvement activities in the extended Reserve area would most profitably be on habitat areas that are currently classified as having high or moderate suitability for elephants. These include all remaining natural cover types and long-rotation plantations more than 25 years old. Management programmes in these areas should focus on maintaining or improving habitat suitability for elephants, and other species where possible, using a combination of natural succession and habitat management interventions such as enrichment planting, thinning and controlled burning.
- current short-rotation plantation areas and young long-rotation areas in the extended Reserve area can continue to be used for production forestry by Forest Department, and/or converted to sustainable production areas for use by the surrounding rural population, without significant additional impacts on habitat availability for elephants.
- all natural and converted cover types in the buffer zone can also continue to be used for production forestry by Forest Department, and/or used for sustainable harvest of forest products by the surrounding rural population, without significant additional impacts on habitat availability for elephants. However, overall habitat availability in the buffer zone needs to be maintained and monitored to ensure that seasonal migration routes on the north and east are not cut off.

The preliminary land use zoning scheme developed for the Reserve by the Forestry Sector Project (Tecsult 2001) is compatible with these principles, and provides an initial basis for spatially based habitat management. The following zones have been roughly delineated:

- a large ecosystem management zone totalling approximately 11,500 ha, or ~51% of the gazetted Reserve and proposed extension (Figure 1). This zone would be divided into a northern part comprising mostly low forest and high forest, and a southern part comprising mostly scattered trees, but also incorporating all remaining high forest and low forest that still occurs in the currently gazetted Reserve area. The main management objectives would be: 1) long-term protection and rehabilitation of remaining forest cover; and, 2) consistent with objective 1, retention of habitat suitability for elephants.
- the ecosystem management zone would be largely surrounded by a habitat management/sustainable use zone of ~11,000 ha, comprising mostly existing long and short-rotation plantations, failed plantations, brush, and areas already

converted to agriculture. The primary objective in areas zoned for habitat management would be restoration and/or manipulation of habitat for elephants and other selected wildlife species. The primary objectives in sustainable use areas would be sustainable use of plantations, sustainable use of natural vegetation cover where such use is compatible with biodiversity conservation objectives, and management of agricultural use and habitation, all also including implementation of measures to minimize human-elephant conflicts.

- a large external buffer zone (4141 ha) comprised primarily of plantations and low forest along the northeastern edge of the extended Reserve, providing for sustainable use of plantations and natural vegetation as a means of relieving human use pressures on the Reserve proper, and potentially providing a linkage with habitat used by elephants for seasonal migrations into and out of the Reserve area. This would require active management to ensure that a mix of habitats appropriate for multiple use objectives is maintained.
- an elephant movement corridor linking the buffer zone with forested lands to the north and east in Lama Forest Division, the Chittagong Hill Tracts, and Myanmar. As currently delineated this corridor consists primarily of forest plantations and agricultural (including encroached) land, but it has not been included in the habitat assessment because much more work needs to done on selecting the optimal location, including ground surveys and interviews with local residents to determine actual areas used by elephants for migratory movements.

It is anticipated that assessment of current and potential habitat suitability for elephants will be a critically important tool both for fine-tuning all zonal boundaries and for guiding the development and implementation of management activities.

It needs to be emphasized that although our assessment indicates that elephant habitat availability in the proposed extended Reserve is still high, this is primarily because elephants prefer secondary habitats. However, in the absence of management intervention, habitat availability can be expected to decline as existing low forest and scattered trees are degraded to brush cover, and as an increasing area is converted to plantations and agriculture. Also, current habitat availability is already much lower for other species that require mature, contiguous forest cover (*e.g.,* only an estimated 25% of pre-development habitat remains available for hoolock gibbons, and ~42% for capped langurs), and all indications are that remaining forest cover is rapidly being degraded by uncontrolled land use, resulting in continuing habitat loss. Hence management interventions will also need to consider the needs of other species, especially those that require closed canopy forests, to ensure a balance between maintenance of productive successional habitats, as preferred by elephants, and the climax habitats that will be critically important for attaining broader biodiversity conservation objectives. An optimal management strategy might be to keep a large part of the area under high suitability elephant habitat (but still largely usable by capped langurs), other parts of the area under high suitability capped langur habitat (but still largely usable by elephants), and the remainder, including the buffer zone, for forest products production/sustainable use (but still usable by elephants to the extent possible). Attention also needs to be paid to maintaining corridors and linkages between habitat patches.

Monitoring and Modification of Management Programmes

The RIMS database on which the habitat suitability assessment is based is updated periodically to reflect plantation fellings, the establishment of new plantations, and any plantation failures, based on reporting from FD field staff. Because it is a map-based system, the vegetation cover at any given point can easily be checked on the ground, and changes to the database made as appropriate. Gross vegetation cover can also be monitored by means of new aerial photography or satellite imagery. Updating of the database also permits repetition of all or part of the habitat suitability assessment, simply through changing the assigned HSI value of polygons where a change in vegetation cover has occurred, and recalculating HU values.

It is anticipated that monitoring and modification of management programmes would involve a three step process:

1. setting of management targets; *i.e.,* what

mix of vegetation cover types is desired, when and where, and calculation and mapping of habitat suitability values/habitat units on this basis;
2. periodic reassessment of existing vegetation cover, and recalculation and mapping of habitat suitability values/habitat units to assess progress against targets; and,
3. revision of management initiatives as necessary to meet targets and objectives.

Modification of management programmes also could involve further development and fine-tuning of the assessment methodology. For example, the model used in this analysis employed just one variable (land use/cover type) for determining habitat suitability for elephants. This provides an adequate first approximation of habitat suitability for the purposes of regional-scale planning and management implementation, but the model could also be fine-tuned by adding additional variables (*e.g*., measured abundance of preferred forages, habitat patch size, habitat contiguity) for more local level, on the ground application.

Conclusions

Habitat suitability assessments focussing on key wildlife species are currently widely employed for attaining biodiversity conservation objectives within the context of sustainable land use management (*e.g.,* USFWS, 1981; Verner *et al.*, 1986; Roloff and Haufler, 1997; Roloff and Kernohan, 1999). In Bangladesh, habitat suitability assessments for capped langurs and hoolock gibbons have recently been developed as an aid to management planning and implementation in protected areas in Sylhet Forest Division (Tecsult, 2000a, 2000b; Salter and Alam, 2003), and are applicable in other evergreen and semi-evergreen forest areas elsewhere in the country.

The habitat suitability assessment procedures described herein add the capability for estimating and monitoring the value of the (primarily) secondary vegetation inhabited by Asian elephants. With appropriate modifications to account for additional cover types, the methodology could also be widely applicable elsewhere within the regional distribution of this species.

References

BCAS. 1997. **Biological survey. Final report.** Prep. for Forest Resources Management Project by Bangladesh Centre for Advanced Studies, Dhaka.

Dudley, J.P. 1993. **Community ecology of the Asiatic elephant.** *Gajah* 10: 5-10.

GoB. 1992. **Forestry Master Plan. Conservation.** Ministry of Environment and Forests, Government of Bangladesh. Asian Development Bank TA No. 1355-BAN.

Hilton-Taylor, C. (compiler) 2000. **2000 IUCN red list of threatened species.** IUCN, Gland, Switzerland and Cambridge, UK. xviii + 61 pp.

Islam, M.A. 1998. **Elephant population survey in Chittagong and Cox's Bazar areas of Bangladesh.** Prep. for Bangladesh Forest Department by Department of Zoology, Jahangirnagar University, Savar, Dhaka, Bangladesh.

IUCN Bangladesh. 2000. **Red book of threatened mammals of Bangladesh.** IUCN – The World Conservation Union. xii + 71 pp.

IUCN Bangladesh. 2001. **Action research for conservation of Asian elephants in Bangladesh.** IUCN – The World Conservation Union.

Khan, A. 1989. **Wildlife of Cox's Bazar Forest Division and its potential as a biodiversity reserve.** Pages 118-112, *in:* G.M.M.E. Karim, A.W. Akonda and P. Sewitz. *Conservation of wildlife in Bangladesh.* Proc. First International Symposium cum Workshop for Conservation of Wildlife in Bangladesh, Dhaka, 1-4 December 1986.

Khan, M.S., M.M. Rahman, A.M. Huq, M.M.K. Mia and M.A. Hassan. 1994. **Assessment of biodiversity of Teknaf Game Reserve in Bangladesh focussing on economically and ecologically important plant species.** Bangladesh J. Pl. Tax. 1:21-33.

Olivier, R.C.D. 1978. **On the ecology of the Asian elephant.** D.Phil Thesis, Cambridge University, U.K. 454 pp.

Rashid, S.M.A., A. Khan and M.A.R. Khan. 1990. **Mammals of Cox's Bazar Forest Division (South), Bangladesh, with notes on their status and distribution.** *J. Bombay Nat. Hist. Soc.* 87(1).

Roloff, G.J. and J.B. Haufler. 1997. **Establishing population viability planning objectives based on habitat potentials.** *Wildlife Society Bulletin* 25(4):895-904.

Roloff, G.J. and B.J. Kernohan. 1999. **Evaluating reliability of habitat suitability index models.** *Wildlife Society Bulletin* 27(4):973-985.

Rosario, E.A. 1997. **The conservation management plan of the protected areas other than those in the Sundarban forests in Bangladesh.** Final report. GOB/WB Forest Resources Management Project, Technical Assistance Component. Mandala Agricultural Development Corporation, Dhaka, Bangladesh.

Salter, R.E. and M.K. Alam. 2003. **Use of capped langur habitat suitability analysis in planning and management of upland protected areas in Bangladesh.** *Tigerpaper* XXX(1):13-22.

Santiapillai, C. and P. Jackson. 1990. **The Asian elephant: an action plan for its conservation.** IUCN, Gland, Switzerland.

Seidensticker, J. 1984. **Managing elephant depredation in agricultural and forestry projects.** A World Bank Technical Paper. The World Bank, Washington, D.C.

Sukumar, R. 1989. **The Asian elephant: ecology and management.** Cambridge University Press, Cambridge.

Tecsult. 2000a. **First Five Year Management Plan for Lawachara National Park.** Volume 1: Management Plan and Volume 2: Background and Support Material. Forestry Sector Project (1997/8-2003/4), Forest Department, Ministry of Environ-ment and Forests, Dhaka. ADB Project BAN No. 1486. TECSULT in association with SODEV, NRP, HCL and EPC.

Tecsult. 2000b. **First Five Year Management Plan for Rema-Kalenga Wildlife Sanctuary.** Vol.1: Management Plan and Volume 2: Background and Support Material. Forestry Sector Project (1997/8-2003/4), Forest Dept., Min. of Environment and Forests, Dhaka. ADB Project BAN No.1486. TECSULT in association with SODEV, NRP, HCL and EPC.

Tecsult. 2001. **Participatory conservation management planning for Cox's Bazar Forest Division. Teknaf Game Reserve.** Forestry Sector Project (1997/8-2003/4), Forest Department, Ministry of Environment and Forests, Dhaka. ADB Project BAN No. 1486. TECSULT in association with SODEV, NRP, HCL and EPC.

U.S. Fish and Wildlife Service. 1981. **Standards for the development of habitat suitability index models.** U.S. Dept. Int. Fish Wildl. Serv. Rel. No. 1-81, 103 ESM.

Verner, J., M.L. Morrison and C.J. Ralph. 1986. **Modeling habitat relationships of terrestrial vertebrates.** University of Wisconsin Press, Madison.

Wahab, M.A. and M. Faizuddin. 1984. **Mammals of Cox's Bazar Forest Division with their status and distribution.** Univ. J. Zool. Rajshahi Univ. 3:35-41.

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DISTRIBUTIONAL STATUS OF HOOLOCK GIBBON (*Bunopithecus hoolock*) AND THEIR CONSERVATION IN SOUTHERN ASSAM, INDIA

by Jayanta Das, Jihosuo Biswas, Rekha Medhi, Joydeep Bose, Dilip Chetry, Pranab Bujorborua and Farzana Begum

Introduction

Southern Assam is the most diverse primate habitat of the entire Indian subcontinent. Cachar, Karimganj and Hailakandi are the three southern most districts of Assam with areas of 3,786 km^2, 1,327 km^2 and 1,839 km^2 respectively. Fifteen Reserved Forests come under the jurisdiction of 2 Forest Divisions (Silchar and Karimganj) in the above three districts. Eight species of non-human primates, viz. Slow loris (*Nycticebus bengalensis*), Assamese macaque (*Macaca assamensis*), Rhesus macaque (*Macaca mulatta*), Stump-tailed macaque (*Macaca arctoides*), Pig-tailed macaque (*Macaca leonina*), Capped leaf monkey (*Trachypithecus pileatus*), Phayre's leaf monkey (*Trachypithecus obscurus phayrei*) and Hoolock gibbon (*Bunopithecus hoolock*) are found in these forest divisions, but no conservation efforts have been taken up to preserve the richest primate habitat of India.

Field studies on the distribution on non-human primates of southern Assam had been carried out by Choudhary (1988, 1996), but the findings are from fragmented or isolated field observations. This study aims to find out the distributional status of Hoolock gibbon in southern Assam, and try to identify their habitats for the conservation of non-human primates in general, and Hoolock gibbon in particular.

Method

Two observers in each group, along with local guides, followed on an average 12 km of existing forest trails each day. The presence of gibbons was confirmed by direct sightings and song records. Whenever Hoolock groups were sighted details of the age, sex and the group composition were recorded. Age and sex categories were identified following the age classification of gibbons proposed by Leighton (1987).

Study Areas

Southern Assam is bounded by the North Cachar Hills district of Assam and Meghalaya in the north, by Bangladesh to the west, Mizoram and Tripura states in the south, and Manipur and Nagaland states to the east.

Results

The results of the study were calibrated from the 509.48 km walk in Silchar Forest Division in the 1,520.94 km^2 Reserved Forest area, and the 537.02 km walk in Karimganj Forest Division in the 881.30 km^2 Reserved Forest.

Distribution of Hoolock Gibbon

Distribution of Hoolock gibbon was confirmed in 3 out of 7 Reserved Forests in Silchar Division, and 5 out of 8 Reserved Forests in Karimganj Division. Sighting density of Hoolock gibbon was highest in Patharia Reserved Forest and lowest in Singla Reserved Forest, both in Karimganj Forest Division.

Group Structure and Composition

The median group size of gibbons in this area was found to be 3 (range 2-6) from the 15 well-identified groups, excluding 7 solitary individuals. The gibbon population of southern Assam was comprised of 74.42% adults, 16.28% juveniles and 9.3% infants. The sex ratio was 1.28:1. Since the Innerline Reserved Forest in both the divisions is a continuous forest bordering Mizoram, the calculations were made considering both the Reserved Forests as a

single unit.

Threats to Hoolock Gibbon

Habitat destruction was observed to be the pre-eminent threat factor to the gibbons, along with hunting in the bordering areas. Felling of trees for commercial use, bamboo extraction for paper mills, reduced cycle length of juhm cultivation, pan juhm (piper leaf cultivation) and clearing of forests for agricultural land use are the major factors for the habitat loss. Moreover, there is no protected area that can provide legal protection for this species and its habitat.

Discussion

Hoolock gibbon is a canopy-dependent arboreal species, and the sole representative of the lesser apes in India. The westward distribution of this species is restricted by the Debang-Brahmaputra river system in northeast India (Tilson, 1979). Habitat loss and breaks in the continuity of the forest canopy restricts the Hoolock gibbon to smaller pockets, even within a forest, making the population more prone to extirpation at a faster rate than other primates, as they have intergroup spacing, small group sizes, a longer birth interval and late sexual maturity (Geissmann, 2001).

During the 1046.5 km transect walk, only 14 groups of Hoolock gibbon were sighted, with an average density of 0.014 groups per km walk. The local abundance of the species in only 8 Reserved Forests, low sighting density, and less infants in the groups (9.3%), are clear indications of a stressed population.

A few of the factors that have been identified as being responsible for this stress are as follows:

- illegal infiltration of people, either from the neighboring states or countries, and clearing of forest, especially in Singla, Tilbhum, Patharia, Innerline Reserved Forest for agriculture;
- increased family members of the forest villagers clearing forest for more cultivable land;
- "pan" juhm practiced by the Khasi tribes, especially in Barak Reserved Forest;
- reduced cycle length of juhm cultivation due to increased population;
- conversion of local tribes to Christianity, with the change in culture emerging as a major threat to primates;
- expansion of tea estates in Tilbhum, North Cachar Reserved Forest; and
- cross border hunting in Innerline and Upper Jirry Reserved Forests by the Mizo and Manipuri tribes.

These two Forest Divisions of southern Assam are most important from the conservation point of view, as they are the abode of 8 non-human primate species and hence, the most diverse primate habitats in the country. For the effective conservation of non-human primates of this region, specific areas must be brought under the Protected Area network. The following Reserved Forests with a total area of 1,578.45 km^2 have been identified as potential habitats for the primates and they should be upgraded to Wildlife Sanctuaries for the conservation of the primate diversity of this region:

a. North Cachar Reserved Forest
b. Innerline Reserved Forests (of both divisions)
c. Patharia and the Reserved Forest
d. Longai Reserved Forest.

As Hoolock gibbon is a canopy-dependent species, protection of the forest canopy will automatically protect the species therein, whether primates or other wildlife species. Therefore, Hoolock gibbon must be focused on as a 'flagship species' for the future conservation efforts in this region.

Acknowledgment

The authors are thankful to Prof. P.C. Bhattacherjee and Dr. S.M. Mohnot for providing technical and moral support during the study. They are also express their gratitude to the Principal Chief Conservator of Forests and Chief Conservator of Forest (Wildlife) of Assam for granting permission to carry out the study, and to other forest officials of Silchar and Karimganj Forest Divisions, especially Mr. Sargaary and Mr. A. Rava, for providing logistical support during the fieldwork. Thanks are also extended to Prabal Sarkar, all the field assistants, Mahadeo Das, Uttam Talukdar,

Kanak Thakuria and the people who provided us with accommodations. This research is part of a cooperative program of the Ministry of Environment and Forest, Government of India, and the U.S. Fish and Wildlife Service (Grant Agreement No. INT/FWS-22).

References

Choudhary, A. 1988. **A primary survey in southern Assam, India.** *Primate Conservation*. 9:123-125.

Choudhary, A. 1996. **A survey of Hoolock gibbon (*Hylobates hoolock*) in southern Assam, India.** *Primate Report*. 44:77-85.

Geissmann, T. 2001. **Preliminary results of a primate survey in northeastern Vietnam, with special reference to gibbons.** *Asian Primates*. 7(3 and 4):1-4.

Leighton, D.R. 1987. **Gibbons: Territory and Monogamy.** In: Smuts, BB, Chenny, D.L., Seyfarth, R.M., Wrangham, R.W. and T.T. Strusaker (Eds.) *Primate Societies*. The University of Cambridge Press, Chicago and London. pp.135-145.

Tilson, R.L. 1979. **On the behavior of hoolock gibbons (*Hylobates hoolock*) during different seasons in Assam, India.** *J. Bombay Nat. Hist. Soc*. 76:1-16.

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Table 1: Distribution and sighting density of Hoolock gibbon in Reserved Forests of southern Assam

Division	Reserved Forest Area (km^2)	Presence of Hoolock gibbon	Presence of other diurnal primates	Transect length (km)	Sighting density of Hoolock gibbon
Silchar	1. Upper Jiri (63.26)	X	RM	28.5	0
	2. Lower Jiri (36.43)	NS	N.S	N.S.	0
	3. Barak (204.38)	X	CL	97	0
	4. Sonai (35.95)	X	X	10	0
	5. Innerline (966.01)	yes	CL,RM,AM,PLM,	258.48	0.031
	6. Kathakhal (140.98)	yes	CL	51.5	0.019
Karimganj	7. Barail (73.93)	yes	RM	64	0.031
	1. Innerline (113.96)	yes	CL,PTM,	31.02	0.031
	2. Longai (151.51)	yes	PLM,STM		
			CL,RM,AM,P	83.5	0.036
	3. Singla (138.04)	yes	LM	101.5	0.01
			CL,RM		
	4. Badsahitila (75.13)	X	RM	32	0
	5. Patharia (76.47)	yes	CL,RM,AM,PLM,	15.5	0.065
	6. Dohalia (38.74)	X	RM	10.5	0
	7. Tilbhum (17.95)	X	RM,PLM	27.5	0
	8. North cachar (270.50)	yes	CL,RM,AM,STM	235.5	0.017

Note: X=no; NS=not surveyed; sighting density=individual/km; CL=Capped langur; PLM=Phayre's leaf monkey; RM=Rhesus macaque; AM=Assamese macaque; PTM=Pig-tailed macaque; STM=Stump-tailed macaque

Table 2: Group structure and composition of Hoolock gibbon

Group	Reserved Forest	Adult			Juvenile	Infant	Grand Total
		M	F	Total			
1	Longai	1	1	2	1		3
2		1	1	2	1		3
3		1	1	2		1	3
4	North Cachar	3	1	4		1	5
5		1	1	2		1	3
6	Barail	1	1	2			2
7	Innerline	1	1	2			2
8		1	1	2	1		3
9		1	1	2		1	3
10		1	1	2			2
11		1		1	1		2
12		1	1	2			2
13		2	1	3	1		4
14		1	1	2	1	1	3
15		1	1	2	1	1	3
Total		**18**	**14**	**32**	**7**	**6**	**43**

BIODIVERSITY OF BHITARKANIKA MANGROVE FOREST

by Dileswar Nayak

Introduction

The state of Orissa has extensive mangrove forests located in the deltaic formation of major rivers along the coastal plain. Bhitarkanika mangrove forest is situated at the confluence of the Baitarani and Brahmani rivers and comprises a single continuous patch of estuarine forest in Orissa. The mangrove of Mahanadi in the south of Bhitarkanika extends from the Hansua River in the north to the Devi River mouth in the south. Both these mangrove areas are being managed by an extensive mangrove forest division (Wildlife) of Orissa, with headquarters at Rajnagar in Kendrapara District. Bhitarkanika and the northeastern part of Mahanadi delta are contiguous and form a single ecological unit. Bhitarkanika still has a rich mangrove forest with diverse flora and fauna, but the mangroves of the Mahanadi delta have begun to degrade considerably due to habitat destruction by human settlement, prawn culture and over-exploitation of the forest for fuel fodder and timber, as well as the establishment of a port and factories at Paradeep. Efforts are beginning to be made to restore degraded mangrove areas along with the conservation of existing mangrove vegetation.

Distribution of mangrove in Orissa

As per satellite survey mapping (Orissa Remote Sensing Application Center, 1989), the distribution of mangrove vegetation in different regions of Orissa is given in Table 1.

Table 1: Distribution of mangrove vegetation in different river mouths and estuaries of Orissa

Location	Area (km^2)
Subarnarekha mouth	2.250
Banipahi area from Chudamani to Dhamara mouth in Bhadrak coast	15.787
Bhitarkanika area between Dhamara and Maipur River	70.999
Bhitarkanika area near Hansua River	88.562
Mahanadi delta area between Hansua mouth up to Paradeep port	38.562
Devi and Jatadhar Rive mouth	1.999
Total	218.059

Flora

The mangroves of Bhitarkanika are luxuriant and contain the maximum number of mangrove species in the Indian subcontinent. Haines (1921-1925) has reported the occurrence of 45 mangrove taxa and their associates from the Mahanadi delta, Chandipur and Chilika Lake. Mooney (1950) collected and added twelve more mangrove taxa during a short trip to Mahanadi delta. As many as 63 mangrove species and their associates are reported to occur in Mahanadi delta, which extends from Paradeep to Dhamara in Bhitarkanika (Banerjee, 1985). The mangrove vegetation exhibits distinct zonation patterns in which each zone is dominated by 1 or 2 mangrove species.

The mangrove species occurring in Bhitarkanika exhibits a two-story system (Choudhury, 1990; Patnaik *et al.*, 2000), which means a top story and middle story, while the ground flora is either poor or practically absent. The forest is a semi-evergreen type (tidal swampy forest). The top story is comprised of the following species: *Soneratia apetala, Avicennia officinalis, Avicennia alba, Heritiera fomes, Xylocarpus moluccensis* and *Excoecaria agallocha*. The middle story contains *Brownlowia tersa, Aegiceras corniculatum, Kandelia candel, Rhizophora apiculata, Cynometra iripa, Flagellaria indica, Bruguiera gymnorrhiza, Bruguiera cylindrica, Phoenix paludosa, Ceriops decandra, Acanthus ilicifolius,* and *Lumnitzera racemosa*.

Along the fringes of the creeks and channels *Cyperus malaccensis* and *Myriostachya wightiana* are gregarious, whereas in the river slopes, enjoying full tidal inundation, *Porteresia coarctata* is a common element. Some mangrove species like *Cerbera manghas, Acanthus volubilis* and *Heritiera kanikensis* are found only in the Bhitarkanika Wildlife Sanctuary area. Of these, the two latter species are endemic to Orissa. Their protection and conservation are the need of the hour. In the salt marshes, *Salicornia brachiata, Suaeda maritina, Suaeda nudiflora* and *Sesvium portulacastrum* are generally found.

Dominant mangrove species in the Mahanadi delta are *Rhizophora mucronata, Rhizophora decandra, Avicennia alba, Excoecaria agallocha* and *Bruguiera cylindrica*. Species like *Tamarix truopii, Lumnitzera racemosa*, etc. occur moderately, while *Bruguiera parviflora, Bruguiera gymnorrhiza, Xylocarpus granatum* and *Kandelia candel* were found to be rare.

Fauna

The mangrove forests provide a variety of habitats and ecological niches for numerous species of wildlife. The faunal diversity in Bhitarkanika is extremely high in comparison to other mangrove forests of Orissa. The animals

that are associated with mangroves cover a wide range of vertebrates and invertebrates, including protozoans and zooplankton. The vertebrate fauna includes a wide variety of fishes, amphibians, reptiles, birds and mammals, including aquatic mammals.

Among the mammalian fauna, the leopard (*Panthera pardus*) thrives in this area, but its existence is doubtful at present. However, the local people reported that there was a good population of panthers in Bhitarkanika and incidents of attacks on man and animals (domestic) were narrated by them. Other carnivores include fishing cat (*Felis chaus)* and hyena (Hyaena hyaena). The herbivores include chital or spotted deer (*Cervus unicolor*). Other mammalian fauna present in the mangrove are wild boar (*Sus scrofa*), Rhesus macaque (*Macaca mulatta*), Indian porcupine (*Hystrix indica*), otter (*Lutra perspicillata*) and marine mammals such as dolphins and porpoises.

Bhitarkanika Wildlife Sanctuary is home to 174 species of birds (Pandav, 1996). Now the mangrove wetland serves as a potential habitat for more than 190 species of birds including grey heron (*Ardea cinerea*), purple heron (*Ardea purpurea*), darter (*Anhinga rufa*), large egret (*Ardea alba*), night heron (*Nycticorax nycticorax*), lesser adjutant stork (*Leptoptilos javanicus*), painted stork (*Mycteria leucocephala*), rare blacknecked stork (*Ephippiorhynchus asiaticus*), spoonbill (*Platalea leucorodia*), brahminy kite (*Haliastur indus*), white-bellied sea eagle (*Haliaeetus leucogaster*), Pallas's fishing eagle (*Haliaeetus leucoryphus*), osprey (*Pandian haliaetus*), red jungle fowl (*Gallus gallus*), golden plover (*Pluvialis dominica*), lesser sand plover (*Charadrius mongolus*), curlew (*Numenius aquata*), red shank (*Tringa totanus*), little stint (*Calidris sp.*), rare white-collared kingfisher (*Halcyon chloris*) and brown-winged storkbilled kingfisher (*Pelargopsis amauroptera*).

Migratory birds (ducks and geese) that visit the sanctuary include ruddy shelduck (*Tadrona ferruginea*), garganey (*Anas querquedula*), pintail (*Anas acuta*), lesser whistling teals (*Dendrocygna javanica*), little grebe (*Podiceps ruficollis*), spottedbilled pelican (*Pelecanus philippensis*) and lesser flamingo (*Phoenicopterus roseus*).

Bhitarkanika is one of the few sanctuaries in the world where a number of rare and endangered reptilian species are thriving in good numbers, but there is still much human pressure on their habitats. Bhitarkanika holds the largest population of the endangered estuarine crocodile in India. According to the latest census, the creeks of Bhitarkanika are home to about 1,330 estaurine crocodiles (*Crocodylus porosus*). In 1975, the Forest Department, Government of Orissa, established a saltwater crocodile research and conservation center at Dangmal in the heart of the sanctuary with the purpose of quickly multiplying the population using the ' grow and release' technique (Kar, 1981). To strengthen the depleted population in nature, 2,100 captive-reared young crocodiles have been released into the rivers and creeks of the sanctuary (Kar & Bustard, 1989). The mass nesting or 'arribada' (a Spanish term meaning mass arrival) of Olive Ridley turtles has been taking place for a long time at Gahirmatha beach, which is about 35 km long. It is the largest turtle rookery of its kind in the world (Bustard, 1976). A minimum of 0.5-7.4 lakh (lakh=100,000) female turtles visit the beach for nesting each year. Mass nesting usually occurs once or twice in a nesting season during the period from late December to April.

Snakes (Order: Squamata) present in the area include some deadly poisonous species such as king cobra (*Ophiophagus hannah*), banded krait (*Bungarus fasciatus*), common krait (*Bungarus caeruleus*) and other *Bungarus* sp. Among the non-poisonous snakes are the Indian rock python (*Python molurus*), rat snake (*Ptyas mucosus*) and the water snake. The lizards present include the largest Indian lizard – the colour monitor (*Varanus salvator*), which occurs in good numbers inside the sanctuary. *Varanus flavescens* is seen in the higher grounds of the sanctuary (Biswas & Kar, 1982). Other lizards present include chameleons (*Chameleon zeylaniues*)?, garden lizards (*Calotis versicolor*), etc.

Mangrove areas support an interconnected food web which directly sustains the fisheries. Algae

and detritus sustain the shrimps and prawns, which provide food for species such as *Lates* sp., catfish, etc. Prawns such as *Penaeus indicus*, tiger prawns (*Penaeus monodon*) and crabs such as the mud crab (*Scylla serrata*) are exploited in large numbers by the fishermen, both in the breeding and non-breeding seasons.

Threats to the National Park

Some of the threats to the National Park include:

- the changing land use pattern due to the encroachment of forest lands for agriculture, aquaculture, human settlements and other developmental activities;
- increasing populations of both humans and cattle, exerting pressure on the forest and wildlife;
- overfishing in the tidal creeks, rivers and estuaries;
- the tendency towards speedy modernization in lifestyles and development of communication facilities both inland and in the water system; and
- construction of fishing jetties, fish handling centers, fishing harbors, ports, etc. in and around the sanctuary.

Conclusion

The survival of several species of rare and endangered flora and fauna is dependent on the continued existence of this ecosystem. The mangroves on the coast are important not only for the conservation of wildlife, but also for the protection of human beings in the hinterlands from the fury of severe cyclones and tidal surges. Without the mangroves, the next cyclone may prove more disastrous for Orissa. This ecosystem should be preserved at all costs from various biotic and abiotic interferences.

References

Anonymous. 2002. **Mangrove conservation and restoration.** M.S. Swaminathan Research Foundation, Chennai, Department of Forestry, Government of Orissa, Food and Agriculture Organization, Rome.

Biswas, S. and S.K. Kar. 1982. **The new records of the species belonging to the genus Varanus Merion, 1980 (Reptilia); Sauria (Varanidae) from Orissa.**

Dash, M.C. and C.S. Kar. 1990. **Turtle paradise Gahirmatha: An ecological analysis and conservation strategy.** Interprint, New Delhi.

Kar, C.S. and G.R. Sathpathy. 1996. **Mangrove ecosystem and its biodiversity in Orissa with special reference to Bhitatkanika.**

Kar, C.S. and M.C. Dash. 1984. **Conservation and status of the workshop on sea turtle conservation.** Central Marine Fisheries Research Institute, Cochin.

Kar, S.K. and C.S. Kar. 2002. **Mangrove conservation and restoration.** Proceedings of the mangrove ecosystem and its biodiversity – an overview.

Pandav, B. 1996. **Birds of Bhitarkanika mangroves, eastern region.**

Times of India. 2003. **Crocodile menace haunts villagers.**

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FOREST NEWS

Vol.XVII:No.4

ASIA-PACIFIC FORESTRY COMMISSION TO MEET IN FIJI: CATCH THE WAVE

Mention Fiji and most people think of pristine white-sand beaches, idyllic turquoise ocean waters, and coconut trees gently swaying in the tropical breeze. Others may consider the islands' reputations for sumptuous traditional feasts, care-free nightlife, and fun-loving hospitable people with ready smiles. For a few, the islands may conjure up fantasies of landing a record marlin or massive tuna off the back of a luxury fishing boat, or playing a round of golf on links where one of the world's masters perfected his game.

But mention Fiji and probably not too many people think of forests and forestry. And yet, did you know that roughly half the total land area of Fiji is covered with forests? Many of the country's forests are strictly managed for watershed protection purposes, while others are managed for commercial purposes – making a major contribution to the country's economy.

By most measures, Fiji is small – with only 1.8 million hectares of land, it's roughly one-tenth the size of Cambodia; Indonesia is one hundred times larger. Fiji's population stands at just 850,000 people. But don't let the small size and population fool you; over the years, Fiji has left its mark in the forestry arena in many ways and the country continues to demonstrate innovative management and creativity in forestry far beyond what might be expected.

The islands have extensive rich natural forests and nearly 100,000 hectares of commercial plantations (primarily *Pinus caribaea* and *Swietenia macrophylla*). A vibrant forest industry turns an annual timber harvest of 500,000 cubic meters into sawnwood, poles, wood-based panels, chips, and – increasingly – value-added products for both domestic and export markets. Exports of wood products average nearly US$25 million a year, contributing 4.4 percent to the total merchandise export account. Fiji was one of the first countries to formulate a national Code of Logging Practice (1990), details of which provided the basis for several other codes in the region (including *the Code of Practice for Forest Harvesting in Asia-Pacific* developed by the Asia-Pacific Forestry Commission in the late 1990s).

More than 80 percent of Fiji's forests – including nearly all the country's natural forests – are under customary (*mataqali*) ownership. Most of Fiji's plantations are managed by the Fiji Hardwood Corporation and Fiji Pine Ltd. Combined, these various tenure regimes provide a fascinating range of management challenges and opportunities.

The Asia-Pacific forestry community will have a rare opportunity to observe first-hand Fiji's forests and dynamic forestry sector in early 2004, when the 20th session of the Asia-Pacific Forestry Commission (APFC) is convened in Nadi, 19-23 April. Mark your calendars and plan to attend this important meeting.

One of the key agenda topics to be discussed at the

APFC session will be innovative ways to finance sustainable forest management. With forestry issues gaining more importance in national and global fora, there is growing debate about how to finance forest management in an efficient and effective manner. In response, new financing mechanisms are emerging and information on various sources of financial resources for sustainable forest management is more readily available through modern information technology tools. These new financing mechanisms and ways to identify funding for forestry activities will be introduced at the session. Participants will be invited to share ideas and discuss how to secure and manage required resources for sustainable forest management.

Also on the agenda will be consideration of forest conventions and agreements – both regional and global – as mechanisms for enhancing cooperation in the forest sector at all levels. The APFC session will review the processes and achievements of international forest policy dialogues and various forest conventions formulated since the United Nations Conference on Environment and Development (UNCED) in 1992, with an emphasis on regional initiatives and how to make them more effective in feeding into global frameworks. The discussion will focus on the relevance and effectiveness of regional agreements, both formal and informal, and explore opportunities for how regional agreements can enhance cooperation in Asia and the Pacific.

Other agenda items will include a review of activities of APFC and FAO over the past two years, updates on recent developments in member countries, and an in-session seminar on the process and findings of the *In Search of Excellence* initiative (see an announcement in *Tigerpaper* Vol.XXX:No.3). A special open forum will be convened the evening of 21 April to give representatives from NGOs, donor organizations, projects, and other organizations an opportunity to inform colleagues of current and planned activities in the region.

In addition to regular agenda items, at least two pre-session workshops will precede the 20th session of the APFC general meeting. One of them is the *Regional Workshop on Implementation of the Proposals for Action of the Intergovernmental Panel on Forests (IPF) and Intergovernmental Forum on Forests (IFF) and Strengthening National Forest Programmes*, which will be convened 16-17 April. Implementation of the IPF/IFF proposals for action is one of the key recommendations of the United Nations Forum on Forests (UNFF). APFC (with support from FAO and the Collaborative Partnership on Forests), potentially provides an important framework for supporting the implementation of the IPF/IFF proposals for action by facilitating the exchange of experiences, building networks and enhancing cooperation at national and regional levels. The regional workshop will discuss ways to accelerate work on the IPF/IFF proposals for action in the context of the priority issues recognized by the Asia-Pacific region.

A second pre-session workshop will be organized as a follow-up to the *Asia-Pacific Forest Invasive Species Conference*, held in August 2003 in Kunming, China. Based on the proposals for regional cooperation developed at that conference, the workshop in Fiji will discuss specific details related to the establishment of the Asia-Pacific Forest Invasive Species Network and an associated Working Group. Proposed functions and a work plan will be elaborated during the one-day workshop, to be held 17 April.

Other side meetings may also be arranged in conjunction with the main APFC meeting in Fiji. In addition, exhibits and displays will be prepared by various international and Fijian forestry organizations to highlight a wide range of activities in the region.

Our Fijian hosts are currently planning two separate field trips to add spice to the APFC agenda. Visits are being planned to mahogany plantations and harvesting areas, a coconut wood furniture factory and showroom, pine plantations, and separate processing facilities converting softwood and indigenous hardwood resources into a wide range of products. Opportunities will also be made to observe local ecotourism development,

and to enjoy the fascinating culture of the Fijian people and spectacular beauty of the islands.

The Ministry of Fisheries and Forests of the Government of Fiji will be the official host of the APFC session. Staff of the Ministry, and numerous individuals in related organizations, are poised to extend a hearty "Bula" (traditional greeting) to all in April.

The Asia-Pacific Forestry Commission is one of six regional commissions supported by FAO. The objectives of the APFC are to:

- provide advice on forestry policy formulation;
- review and coordinate implementation of forest policy at the regional level;
- exchange information on best management practices and solutions to technical challenges; and
- develop recommendations for member countries and FAO on forestry-related issues.

The members of the APFC (currently comprised of 28 countries in Asia and the Pacific) meet every two years in general session to review forestry developments in the region, discuss problems of mutual concern, and set new agendas for inter-sessional work. Active participation of international NGOs and the private sector in all APFC activities is encouraged.

Formal invitations for the 20th APFC session have been extended to the Commission's 28 member countries, and to international organizations working in the region. For more information on the session, please contact Patrick Durst, Senior Forestry Officer (Asia and the Pacific), who also serves as FAO Technical Secretary for the APFC, at the address below:

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GLOBAL FOREST RESOURCES ASSESSMENT 2005

FAO has been carrying out global forest resources assessments since 1948 as one of its mandates. The last three assessments were implemented at ten-year intervals in 1980, 1990 and 2000. After the completion of the Global Forest Resources Assessment 2000 (FRA 2000) and the issuance of its Main Report in 2001, the Committee on Forestry (COFO), in its 2001 and 2003 sessions, recommended that FAO should carry out a 5-year interval assessment to relate it to international forestry processes. Thus, the Global Forest Resources Assessment update for 2005 (FRA 2005) has been designed. FAO drafted the *Terms of Definitions and Guidelines for Country Reporting* and conducted a National Correspondents Training from 17-21 November 2003 in Rome. National-level information collection work will begin in January 2004, and is targeted for completion at the end of the year. In order to provide technical guidance to the countries in the Asia-Pacific region, two regional workshops will be held in Bangkok (April 2004) and Beijing (October 2004). Parallel to the national information collection, the global FRA will continue to develop its monitoring of forest cover changes on a greatly increased number of sample plots (over 10,000). After validation of the results, the FRA 2005 outputs will be released in July 2005.

SYNERGIES BETWEEN REDUCED IMPACT LOGGING AND FOREST CONSERVATION

Where and how is it possible to achieve symbiosis between timber harvesting and forest conservation? What are the essential requirements and technical skills needed to bring this about? Practical responses to these questions will be pursued under a new project involving Lao PDR, Myanmar and Vietnam. The Japan-funded project, to be executed by FAO, will support planning and implementation that combines utilization and conservation systematically and synergistically.

Launched in July 2003, the project (GCP/RAS/192/JPN) "Enhancing Sustainable Forest Harvesting in Asia" builds on earlier FAO-assisted initiatives in sustainable forest management and reduced impact logging (RIL). Under this approach, the rational use of resources goes hand-in-hand with forest conservation. RIL aims at reducing negative environmental impacts while still supplying the timber requirements of local communities and national economies. The project will support improved methods and skills to replace outmoded, destructive logging practices that merely satisfy short-term financial objectives while ignoring the well-being of downstream populations, maintenance of wildlife habitats and the interests of future generations.

RIL is a fundamental concept of sustainable forest management, but putting the concept into practice poses numerous challenges. Previous FAO-assisted development of national forest harvesting codes and practical guidelines for implementing the codes has established a framework for moving effectively from concept to reality. With assistance provided by the new project, forest agencies in Lao PDR, Myanmar and Vietnam will now begin the difficult task of promoting understanding, acceptance and application of codes and guidelines by all sectors – from high-level decision makers who formulate policies, down to forest workers and at all levels in between.

Accurate assessment of current practices, a review of past and present outcomes in forest harvesting, and a careful analysis of training needs comprise the initial tasks in project implementation. These will be followed by initiatives focusing on demonstrating and promoting best practices, and developing the skills for effective application of these practices in the field. To help ensure transparency and broad-based participation by all sectors, each country will organize Sustainable Forest Management Partnership Committees (SFMPCs) that will meet regularly to monitor progress, identify problems and formulate solutions.

Conflicts between conservation and utilization can be resolved with patience, determination and sincerity. The new RIL project will play an important role in the process of reconciling different perspectives to help ensure that present and future generations in Lao PDR, Myanmar and Vietnam share the benefits of enlightened forest management.

For information about the project, contact:

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EXCUSE ME, WHAT DOES RIL COST?

Since the early 1990s, considerable interest has developed in the application of reduced impact logging (RIL), especially in tropical forests where damage associated with logging is widely considered to be incompatible with sustainable forest management. Initial experiences with the application of RIL have been promising. Unfortunately, the answer to the question of whether RIL is financially viable compared to conventional logging remains ambiguous, as this depends on a number of local factors, including topography, markets and prices, scale of operation and the costing approach. This ambiguity helps to explain the hesitation of many governments and logging operators to commit to adopting RIL practices. Ideally, timber harvesting operators should calculate the costs and benefits of switching from conventional logging to RIL themselves in order to answer cost-related questions.

Until recently, operators lacked a tool that could assist them in analyzing costs and benefits. This has changed with the release of RILSIM, a software package for financial analysis of alternative logging systems. Aside from allowing operators to compare logging costs – based on local conditions, wages, equipment, production rates, prices and other factors – RILSIM has also been designed as a teaching tool, with a help system that describes the principles of financial analysis and guides users through each stage of a simulation run. RILSIM is available free of charge and by the end of 2003, close to 500 copies had been distributed worldwide. The software can also be downloaded from the following website: http://www.blueoxforestry.com/RILSIM/rilsim-download.htm.

Under the umbrella of the Asia-Pacific Forestry Commission (APFC), with financial support from the USDA Forest Service and in collaboration with the Sarawak Timber Association (STA) and the School of International Tropical Forestry of the University Malaysia Sabah (UMS), FAO organized a series of five promotion and training seminars in Malaysia. The main purpose of the events was to familiarize participants with RILSIM, through introductory hands-on training sessions, and to obtain feedback on the usefulness of RILSIM under local conditions.

More than 130 participants from the private and public sectors – including university students – attended the five seminars that were held in Kuching and Bintulu (Sarawak) and Kota Kinabalu (Sabah) in November 2003. Most participants assessed the seminars as "very good" or "excellent" and were able to operate RILSIM by the end of the training sessions. In fact, many participants became proficient in the software application before the training sessions were over.

While using RILSIM does not pose a problem, the availability of data is a potential barrier to its wider application. Many participants were not sure whether all the necessary input data are currently available in the required form. Although the cost components are quite comprehensive, participants also indicated that there are additional costs that could be integrated. Participants also asked for the inclusion of economic indicators that they are more familiar with. As is quite normal for new software, RILSIM has a small number of minor flaws that sometimes complicate its use. The problems were noted and will be addressed.

Excuse me, what will be the next steps? The next two steps include incorporating the various comments received since RILSIM's release, and especially during the seminars, and to develop a new version. The RILSIM Steering Committee will discuss this matter when they meet in February 2004. Second, the five seminars were only a beginning. More will be held in 2004.

REGIONAL WORKSHOP ON FORESTS AND CLIMATE CHANGE: PREPARING FOR DECISIONS ON LAND USE AND FORESTRY AT COP 9[1]

The Food and Agriculture Organization (FAO), the United Nations Environment Programme (UNEP) and The World Conservation Union (IUCN) have organized a series of regional workshops in Latin America, Africa and Asia, in order to assist countries to prepare for the upcoming climate change negotiations. The "Regional Workshop on Forests and Climate Change: Preparing for Decisions on Land Use and Forestry at COP 9," was held 16-17 October 2003, in Manila Philippines. Thirty-three participants from 16 countries attended the regional workshop for Asia.

The objectives of the workshop were to:

- clarify unresolved issues related to forestry and land-use, in the international climate change negotiations;
- identify national and regional positions in relation to climate change negotiations;
- promote increased understanding and synergies between climate and forest experts; and
- improve communication among countries on issues related to forestry and climate change.

Issues to be addressed at COP 9

A number of issues need to be resolved at COP 9, which will significantly shape the role of forestry in the climate change convention. These issues will influence the type of forestry projects undertaken, as well as the economic attractiveness of forestry projects. This summary gives an overview of the main issues still under negotiation that were discussed at the workshop. It also gives an overview of the main recommendations made at the workshop with regards to capacity building.

Non-permanence

One of the key issues for COP 9 is the accounting for non-permanence of carbon sequestration. Negotiators have to decide which of the crediting approaches, in the negotiation text, will be selected. For the temporary credits, questions remain with regards to the validity period and times of renewal of temporary credits. For insured credits, the length of insurance coverage beyond the crediting period is under discussion.

Baselines, additionality and leakage

Another key issue determining the economic attractiveness of projects is related to baselines. The discussion on additionality is closely related to the baseline issue, but is not only limited to forestry projects. Recent decisions of the Executive Board have clearly indicated that baseline methodologies will have to show that the project would not have been implemented and therefore does not represent the baseline.

Small-scale projects

The participants indicated that small-scale projects are of extreme importance for the Asia region, where small-holdings are very common. While there seems to be a general desire to include such projects in the Clean Development Mechanism (CDM), it is proving difficult to define the criteria for small-scale projects and develop simplified modalities and procedures. Therefore, the development of such procedures is rather unlikely

[1] *Conference of the Parties to the UN Framework Convention on Climate Change (UNFCCC)*

to happen in the short-term.

Socio-economic impacts

Different approaches for addressing socio-economic and environmental impacts of afforestation and reforestation in the CDM are on the table for negotiation in Milan. While host countries have the prerogative to define sustainability criteria for CDM projects, a list of default criteria to be included in an environmental and socio-economic impact assessment is under discussion. The discussion is centered on whether or not it is necessary to develop additional impact assessment methodologies, when most countries already have some form of guidelines that incorporate the most important criteria.

IPCC Good Practice Guidance

The IPCC Good Practice Guidance (GPG) on methods to estimate, measure, monitor and report changes in carbon stocks and anthropogenic greenhouse gas emissions and removals from forestry projects will be submitted to COP 9. One of the questions concerning the GPG which needs to be addressed is if its use should be voluntary or obligatory within the framework of the CDM.

Harvested wood products

A recent technical paper by UNFCCC brought the issue of harvested wood products (HWP) on the agenda. Accounting for HWP is supposed to improve the current accounting, which assumes that all carbon removed from forests is emitted immediately on the spot. In spite of the recent discussion on HWP, the subject will only become a relevant implementation issue after the first commitment period.

Capacity building and follow-up activities for the region

One of the main results of the discussions was that capacity building on practical issues concerning CDM forestry projects is of great importance. Participants identified a number of necessary actions at the national level, like the development of national sustainability criteria and the establishment of a DNA clearing house. The need for further collaboration and networking in the Asia-Pacific region on forest and climate change issues was emphasized, to enable the identification of common interests and areas of understanding. In the area of research, the identification of focal persons and in-country specialists was mentioned as one of the key issues.

FORESTRY ISSUES AFTER COP9 OF THE UNFCCC

Carbon sink projects under the Clean Development Mechanism:

- Only afforestation and reforestation eligible – agricultural sink projects excluded.
- Definitions "forest," "afforestation," "reforestation" for domestic activities apply under the CDM. "Reforestation" occurs on land that was not forest prior to 1990.
- Bundling of individual parcels of land allowed (important for small-scale projects).
- Permanence of carbon sequestration ensured via two options:
  1. tCERs: temporary carbon emission reduction units, which expire after at most 10 years;
  2. lCERs: temporary carbon credits which are valid for the crediting period of the project or the project lifetime

Both CERs need to be replaced after their expiration date; in addition, lCERs need to be replaced if reversal of sequestration has occurred during the crediting period.

- ¢ Leakage: increase of all green house gases outside the project boundary, measurable and attributable to the project; subtracted from project sequestration.
- ¢ Net greenhouse gas removal is defined as the difference between actual project net greenhouse gas removal, minus baseline net carbon stock changes minus leakage.
- ¢ Small-scale forestry projects: now eligible – defined by maximum annual sequestration of 8000 tCO_2 or 2180 t C. Will enjoy simplified and special facilitating conditions decided by COP10, based on submissions by countries and observers until 28.2.2004. Technical paper prepared by Secretariat.
- ¢ Socio-environmental impacts in and outside project boundary analyzed; if significant, formally assessed according to host country procedures.
- ¢ Project lifetimes are maximally 30 years or 3 times 20 years.
- ¢ Potentially invasive alien species and genetically modified trees are treated according to the rules of the host and investor country.

Harvested Wood Products

- ¢ The current state of discussions contained in the Secretariat's Technical Paper and the IPCC Good Practice Guidance. Parties to submit views and preferences. Workshop on the topic planned in the second half of 2004. HWP unlikely to be included in the first commitment period.

IPCC Good Practice Guidance for LULUCF

- ¢ Annex I (industrial) countries use the GPG for reporting under the UNFCC (National Communications of greenhouse gas emissions and removals of sinks, annually).
- ¢ COP10 will decide about those parts of the GPG which refer to reporting under the Kyoto Protocol, e.g. projects, domestic afforestation, reforestation, deforestation and forest management.
- ¢ Non-Annex I (developing) countries merely encouraged to use the GPG "to the extent possible" and "as appropriate" in national communications. (The extent possible is often constrained by the unsatisfactory state of national forest assessments.)
- ¢ IPCC GPG to be subject of capacity building by UN organizations.

NATIONAL FOREST PROGRAMMES – SUPPORT FROM THE FACILITY

The National Forest Programme Facility – in short "Facility" – was launched in late 2002. Hosted by FAO in Rome, it provides support at the national and regional levels to assist in the development and implementation of national forest programs.

In 2002 and during the first half of 2003, progress made by the Facility in the Asia-Pacific region was slow as it took time to raise awareness of the Facility's existence, establish a partnership with the Facility and obtain funds. Activities picked up during the second half of 2003. The list of partner countries has recently been expanded, when China, Indonesia, Mongolia, the Philippines and Thailand were joined by Pakistan and Vanuatu. The new members are now called upon to publicly announce the partnership with the Facility so that a variety of forestry stakeholders can participate and implement the planned activities.

Numerous activities are ongoing in the first set of partner countries:

- In the Philippines, where community-based forest management (CBFM) forms the cornerstone of the national forest programme, activities have been designed to assist in elaborating solutions to problems in implementing CBFM at the field- level, improving delivery services to communities, reducing bureaucratic requirements and removing disincentives for growing, felling, marketing and processing timber. Furthermore, the Facility will assist in designing a more supportive policy environment working closely with the Forest Management Bureau of the Department of Environment and Natural Resources, local NGOs, and training institutions.
- In Mongolia, the national forest programme is in its infancy and therefore the Facility support is directed at strengthening institutional capacities. Activities consist mainly of workshops, training seminars and study tours to enable the representatives of the Ministry of Nature and Environment to prepare Mongolia's forest programme by effectively involving a broad spectrum of forestry stakeholders.
- In Thailand, the Royal Forest Department reviewed its Forestry Sector Master Plan, whose preparation goes back almost fifteen years. A national team was formed to review the relevance of the "old" plan in view of the global and domestic changes in forestry. The review involved numerous representatives of NGOs, the private sector and international organizations and recommended that the most urgent need was the reform of forest policies.
- In China, the Chinese Academy of Forestry (CAF) is reviewing the Simao Forestry Action Programme (SFAP) to accertain the applicability and usefulness of the main features of the SFAP approach for other regions across the country. Building on the lessons learned, the Research Institute of Forestry Policy and Information of CAF has recently embarked on the formulation of a forestry sector strategy for Ningxia Hui Autonomous Region. Collaboration with representatives of local prefectures forms a cornerstone of all the activities and is viewed as crucial in building a consensus on regional visions and strategies for forestry.

For more information on national forest programmes in the Asia-Pacific region, the Facililty, please contact:

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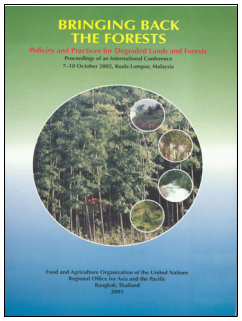
Mr. S. Appanah, NFP Adviser, Bangkok, Thailand; E-mail: simmathiri.appanah@fao.org
Mr. T. Enters, NFP Facilitator, Bangkok, Thailand; E-mail: thomas.enters@fao.org

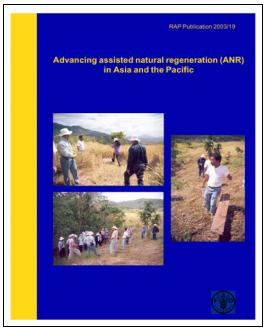
NEW RAP FORESTRY PUBLICATIONS

BRINGING BACK THE FORESTS
Policies and Practices for Degraded Lands and Forests
RAP Publication 2003/14



Forests are important natural resources that fuel the continuous economic and social development of many countries. However, land and forest degradation has become so devastating in the Asia-Pacific region that it is now bringing severe environmental and economic problems, and is beginning to threaten the livelihoods of millions of people. The need to rehabilitate these lands and forests is growing. New rehabilitation techniques are being developed to increase biodiversity and ecological services, and initiatives are purposefully linked with social development programs. While much knowledge has been gained from these initiatives, they have not been widely publicized or adopted. The International Conference on Bringing Back the Forests: Policies and Practices for Degraded Lands and Forests was therefore designed to bring together all the stakeholders, including the project planners and implementers, as well as beneficiaries, to exchange experiences and knowledge and to promote successful approaches. This volume, the proceedings of the conference, is a collection of some of the most valuable papers that have been recently produced on the subject. Professionals and practitioners in forest rehabilitation should find this volume valuable.

ADVANCING ASSISTED NATURAL REGENERATION (ANR) IN ASIA AND THE PACIFIC
RAP Publication 2003/19



Deforestation and the degradation of forests continue to cause serious problems in many regions of the world. The situation is particularly acute in the tropical forests in Asia and the Pacific. A variety of measures have been tried in the past to address the problem, with varying degrees of success. One of the silvicultural tools employed is assisted natural regeneration (ANR), a variation of enrichment planting, which was first developed for tropical forests with poor natural regeneration. Assisted natural regeneration, however, has not received the attention it deserves. The technology is based on the ecological principle of secondary forest succession, utilizing natural processes and promoting the regeneration of indigenous species. Because ANR relies on natural processes, it is especially effective in restoring and enhancing biological diversity and ecological processes.

Assisted natural regeneration is well developed in the Philippines and is increasingly utilized to restore former forested areas that have become degraded and covered by *Imperata cylindrica* grass. The same principles are also being used to address the problems of poor regeneration in logged-over forests in several other Southeast Asian countries. The value of the ANR techniques is that they are easily understood by the field staff, involve species of high economic value, employ good silvicultural properties, and the costs of production, planting and tending are kept low.

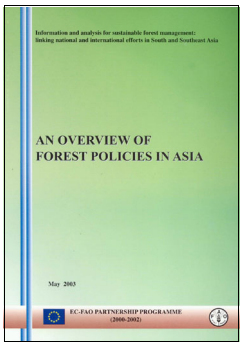
FAO has been promoting these techniques in the region, through long-term demonstration plots, study tours and technology transfer. To highlight the opportunities and potential of ANR, FAO and partner organizations convened a workshop and study tour in the Philippines in April 2002. The discussions and presentations at the workshop underscored the importance of ANR in the broader context of sustainable forest management and the potential for cost-effective rehabilitation of forestlands through more aggressive implementation of ANR. To enhance awareness and understanding of the concepts and practices of ANR, and to encourage wider application, FAO is pleased to publish this compilation of papers highlighting experiences with ANR in the region. The papers deal with the technical, environmental and social dimensions of ANR, and describe selected country initiatives. The publication represents one element of FAO's ongoing efforts to promote more effective forest rehabilitation and restoration for the benefit of local people.

AN OVERVIEW OF FOREST POLICIES IN ASIA (MAY 2003)
EC-FAO Partnership Programme (2000-2002)

Although the importance of tropical forests was recognized long before the United Nations Conference on Environment and Development, since 1992 attention has focused increasingly on how to bring about sustainable forest management and how to formulate and implement supportive forest policies.

Numerous reviews have indicated that the forestry sector continues to be plagued by deforestation and forest degradation caused by a variety of factors – many of which are beyond the direct control of the forestry community. Macro-economic and extra-sectoral policies affect forests and forestry to a considerable extent. For decision makers in forestry, it is fundamental to take note of them and to observe trends so that forest policies are not made in a vacuum.

A recurring theme in most countries is that the contributions that forests make to local, national and global economies are undervalued. While the rhetoric has shifted from timber production to multiple-use forest management, governments fail to realize that the broadening of management objectives requires an increase and not a decrease in financial inputs and human resources.



Political commitment and increased budget allocations are required to increase the effectiveness and impact of forest policies. However, foresters cannot blame only a lack of support for obvious shortcomings in forestry. They have to make better use of available policy instruments to translate policies into strategies, programs and actions – in other words, to implement policies. Stakeholder involvement in

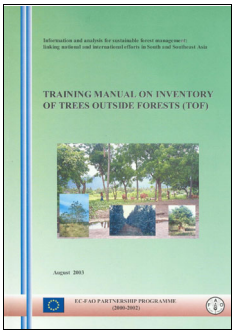
policy review, formulation and implementation needs to be taken more seriously and formalized. This requires a change in attitudes, openness to rethink institutional arrangements and willingness to address necessary reforms of public sector agencies.

Finally, policies will fail if they are based on inadequate information and – in extreme cases – on concealing or sanitizing the facts. Data collection needs to become purposeful, relevant information needs to be generated and circulated widely and monitoring systems need to be put into place to sound alarm bells when things are going wrong.

TRAINING MANUAL ON INVENTORY OF TREES OUTSIDE FORESTS (TOF) EC-FAO Partnership Programme (2000-2002)

According to FAO's definition, trees outside forests (TOF) are those trees that do not belong in the category of forests or forested land and wooded land. They may be located on other lands such as farmlands, human settlements and bare lands, which explains why they have received far less attention, especially from foresters, than they deserve. However, TOF not only provide an array of environmental services and play a crucial role in meeting rural – and even urban – people's needs, but also increasingly contribute to supplying the commercial sector, especially the wood-based industries, with much needed wood and fibers. Therefore, it is surprising that the question "How many trees are there outside the forests?" continues to receive mainly a shrug of the shoulders. Hardly any one knows the answer to this question and even fewer people are familiar with inventory methods for TOF. As a result, TOFs have been overlooked in official reporting and in most situations nobody knows whether their numbers are increasing, stable or declining.

The neglect of the past is rapidly changing, as TOFs have made their appearance on the development stage. With support from the EC-FAO Partnership Programme on Information and Analysis for Sustainable Forest Management, the Forest Survey of India (FSI) conducted a "Training workshop on trees outside forests" in April 2002. At the same time, FSI started



preparing a training manual on TOF, which was published a few months ago. The manual takes the reader step by step through the TOF inventory process, starting with definitions and an overview of existing inventory methods. It provides guidance on organizing teams for data collection in the field and data processing and analysis. In the annex, the authors provide numerous examples of data collection forms and detailed instructions for their completion. It is hoped that the use of the manual will considerably contribute to answering the question "How many trees are their outside the forest?"

ASIA-PACIFIC FORESTRY CHIPS AND CLIPS

MONEY LAUNDERING LAWS BENEFIT FORESTS

The Indonesian government has announced amendments to the country's money laundering laws to include crimes against forests such as illegal logging. The amendment will place an onus on banks to report transactions suspected of being connected with crimes against the environment, thereby enabling the targeting of large-scale illegal loggers.
– CIFOR Media Release –

LARA CROFT TOMB RAIDER... AND CONSERVATIONIST

Cambodia has approved a forest conservation project funded by Hollywood actress, Angelina Jolie. Ms. Jolie's first Tomb Raider movie was partially filmed around Angkor Wat, and she fell in love with the surrounding countryside. Ms. Jolie will donate US$1.5 million to a project aiming to protect 60,000 hectares of forests in northwestern Cambodia. The project will educate villagers about conservation awareness, demarcate conservation areas, and train local rangers.
– RECOFTC Community Forestry E-News –

CLASH OF THE TITANS

Indonesian Minister of Forestry, Muhammad Prakosa, has urged the European Union to screen imported Malaysian wood products, and reject any that are suspected of being made from logs cut illegally from Indonesia's forests. Mr. Prakosa suggested that "most of them are made of logs taken from illicit sources." His Malaysian counterpart, Primary Industries Minister Lim Keng Yaik reacted by saying that to ask the EU not to buy Malaysian timber is very bad. He said that most Malaysian timber is certified to prove it comes from sustainable sources.
– The Jakarta Post –

MILL CLOSURES IN INDONESIA

Difficulties in obtaining logs and a decline in prices for wood products are forcing the closure of plywood and mouldings mills in Jambi province, Indonesia. At least four plywood and moulding factories will be closed. Earlier this year, around three-quarters of the 60 sawmills in Muara District were closed due to scarcity of logs. There are no longer forests in the area to supply logs to independent processors.
– KompasCyber Media –

IDENTITY CARDS FOR OLD TREES

The local government of Li'nan city, China, has issued identity cards for thousands of old trees as a means of protecting the trees from damage and improving their management. All the trees have been inspected, photographed, and their details location and vital statistics entered into a GPS system and a database. The oldest tree in the scheme is a 2,000 year old Chinese Juniper.
– Model Forest Approach News –

FORESTS REHABILITATING PEOPLE...

The Philippines Department of Environment and Natural Resources has set aside areas in the Cagayan Valley for tree planting by people on prison probation as part of a criminal rehabilitation scheme. Probationers will plant trees as a means of repaying their debts to society.
– RECOFTC Community Forestry E-News –

...AND PEOPLE REHABILITATING FORESTS

Indonesia has issued a Joint Ministerial Decree establishing a National Movement for Forest and Land Rehabilitation. The new program will be implemented in 21 critical watersheds over a 5-year period, with a total area of 3 million hectares.

Under the scheme, the government will provide seeds to communities and institutions, including the armed forces, to undertake rehabilitation. However, the government has already conceded that the full planting target for 2003 is unlikely to be met.
– Joint Decree Document –

FOREST FIRE DAMAGE INCREASING

Uncontrolled agricultural and urban expansion, as well as increased recreational use, are increasingly damaging forests, according to FAO. The 2003 fire season has been one of the worst in recorded history, with 60 million hectares of forests burned in Australia alone. The worst fire hotspot is in sub-Saharan Africa, where more than 170 million hectares are burned annually.
– FAO News Release –

CHINESE FORESTRY IN THE FUTURE

China has published a decision by the State Council on speeding up forestry development. Targeted areas include improved forest management, expanding forests onto marginal farmlands and increasing the productivity and income from forests. National forest cover is forecast to be 19 percent by 2010.
– ITTO Market Information Service –

U.S. INITIATIVE AGAINST ILLEGAL LOGGING

The United States announced a new international initiative to assist developing countries to combat illegal logging. The strategy includes addressing the sale and export of illegally harvested timber, and in fighting corruption in the forest sector. The United States will work with the private sector, NGOs and countries in order to identify and reduce threats to protected forest areas and other high value conservation forests. The initiative will focus on three critical regions – the Congo Basin, the Amazon Basin and Central America, and South and Southeast Asia.
– WWF News Release –

JAPANESE-INDONESIAN BILATERAL AGREEMENT ON ILLEGAL LOGGING

Japan and Indonesia have signed a bilateral agreement to combat illegal logging and illegal trade of forest products. The agreement is similar to those signed with the British (April 2002) and Chinese (December 2002) governments. Japan and Indonesia have committed themselves to: combat illegal trade of illegally harvested timber, improve forest law enforcement, improve economic opportunities for the local communities, increase awareness of threats to the environment and promote sound management practices.
– Illegal logging website –

MISPERCEPTIONS ABOUT WATER

Despite designation of 2003 as the *International Year of Water*, an English university professor argues that there are still widely held misperceptions about the relationship between forests and water that may be causing the wastage of billions of dollars on watershed reforestation projects. Professor Ian Calder notes that upland afforestation actually reduces annual stream flows – by around 20 percent in the United Kingdom. In countries such as South Africa, these adverse effects on water resources have led to restrictions on tree planting.
– Guardian Unlimited –

NEPAL: COMMUNITY FORESTRY UNDER THREAT

A recent decision by the Nepal government to impose a 40 percent tax on revenues earned by community-managed forests might shatter the country's thriving community-based forest management and lead to widespread deforestation. The government decision has led to widespread criticism from user groups and donor nations.
– RECOFTC Community Forestry E-News –

INDONESIA TO MAP FORESTS

The Indonesian Forestry Ministry and the National Coordinating Agency for Surveying and Mapping have signed a Memorandum of Understanding to

map the country's forests. The project will last five years and will commence with pilot projects in South Kalimantan and West Kalimantan.
– The Jakarta Post –

BAMBOO – A BOOMING INDUSTRY

China's bamboo-based industries are currently flourishing – riding a wave of popularity for bamboo products worldwide.. China's bamboo resources are the most extensive in the world, accounting for some 30 percent of the global total. Bamboo plantations cover 4.21 million hectares, with stocks of approximately 127 million tons. The total annual value of bamboo production exceeds 20 billion yuan. Bamboo is widely used in construction, paper making, food, furniture, packing, transportation, medical care and tourism.
– ITTO Market Information Service –

THAILAND: TOURISM THREAT TO WILD PLACES

The government's new "asset capitalization" policy, which includes plans to promote tourism in protected forests, is being criticized by several environmental organizations. Critics note that the although the policy could prove to be a commercial success, there are concerns about the impact on the natural environment. On the other side of the debate, park officials, villagers and local officials see such development as a welcome chance to earn income and enhance livelihoods in rural areas.
– RECOFTC Community Forestry E-News –

CHINA TURNS FARMLAND INTO FOREST

Since 1999, China has converted some 13.4 million hectares of hillside farmland into forest, according to the latest survey from the State Forestry Administration. The project to turn farmland into forest covers 25 provinces, autonomous regions and muncipalities and is aimed at solving the problem of land erosion. In the past five years, the Chinese government has allocated 23.6 billion yuan (US$3 billion) to the project, of which 16.8 billion yuan was used as compensation to farmers.
– RECOFTC Community Forestry E-News –

ASEAN PACT ON COMBATING FOREST FIRES TAKES EFFECT

An agreement signed by the members of the Association of Southeast Asian Nations (ASEAN), designed to prevent harmful forest fires came into force in November 2003. The agreement, negotiated in 2002, calls for a series of state-backed steps including the use of heat-sensing satellites and a crackdown on arsonists and irresponsible plantation owners. The pact is the first legally binging agreement of its kind to address regional forest fire issues. The agreement includes provisions for monitoring, technical cooperation, information exchange and simplified customs and immigrations procedures for emergency response and disaster relief.
– Associated Press, 25 November 2003 –

AFGHANISTAN TO CREATE NATIONAL PARK

Afghanistan plans to create a national park in the eastern province of Nuristan to prevent further degradation of the country's natural resources after over two decades of war. The Wakhan corridor, a remote rugged area in the Pamir plateaus bordering China will also receive special attention. Several international aid agencies, including FAO and the UN Environment Program (UNEP), are developing initiatives to protect and preserve the environment in the two areas.
– Xinhua News Agency, 11 December 2003 –

INTERNATIONAL MOUNTAIN DAY

The United Nations General Assembly has designated 11 December (from 2003 onwards) as "International Mountain Day." This decision results from the successful observance of the UN International Year of Mountains in 2002, which increased global awareness of the importance of mountains.

FAO ASIA-PACIFIC FORESTRY CALENDAR

16-17 February 2004. Hanoi, Vietnam. ***What does it take to accelerate tree planting by the private sector? Sub-regional workshop on the impact of incentives on plantation development.*** Contact: Patrick Durst, Senior Forestry Officer, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand; Tel. (662) 697-4139; Fax: (662) 697-4445; E-mail: Patrick.Durst@fao.org

2-5 March 2004. Cebu City, Philippines. ***Joint FAO/ITTO Expert Consultation on Criteria and Indicators for Sustainable Forest Management.*** Contact: Froylan Castaneda, Forest Resources Development Service, FAO Headquarters, Viale delle Terme di Caracalla, 00100 Rome, Italy; Tel: 06 53834; E-mail: Froylan.Castenada@fao.org

March (June?) 2004. Zheijiang, China (dates and venue to be confirmed). ***Development of Timber Certification in China: Progress and Issues.*** Contact: Patrick Durst, Senior Forestry Officer, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand; Tel. (662) 697-4139; Fax: (662) 697-4445; E-mail: Patrick.Durst@fao.org

16-22 April 2004. Australia. ***FAO Advisory Committee on Paper and Wood Products.*** Contact: Wulf Killmann, Director, Forest Products Division, FAO Headquarters, Viale delle Terme di Caracalla, 00100 Rome, Italy; Tel: 06 53221; E-mail: Wulf.Killmann@fao.org

16-17 April 2004. Nadi, Fiji. ***Regional Workshop on Implementation of IPF/IFF Proposals for Action and Strengthening National Forest Programmes.*** Contact: Simmathiri Appanah, National Forest Programme Adviser for Asia and the Pacific, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand; Tel. (662) 697-4136; Fax: (662) 697-4445; E-mail: Simmarthiri.Appanah@fao.org

17 April 2004. Nadi, Fiji. ***Workshop on Asia-Pacific Invasive Species Network***. Contact: Patrick Durst, Senior Forestry Officer, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand; Tel. (662) 697-4139; Fax: (662) 697-4445; E-mail: Patrick.Durst@fao.org

19-23 April 2004. Nadi, Fiji. ***20th Session of the Asia-Pacific Forestry Commission.*** Contact: Patrick Durst, Senior Forestry Officer, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand;Tel. (662) 697-4139; Fax: (662) 697-4445; E-mail: Patrick.Durst@fao.org

17-21 May 2004. Beijing, China. ***27th FAO Asia-Pacific Regional Conference.*** Contact: Biplab Nandi, Senior Food and Nutrition Officer, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand; Tel. (662) 697-4143; Fax: (662) 697-4445; E-mail: Biplab.Nandi@fao.org

14-18 March 2005. Rome, Italy. ***17th Session of the Committee on Forestry.*** Contact: Doug Kneeland, Programme Coordinator, Programme Coordination Unit, FAO Headquarters, Viale delle Terme di Caracalla, 00100 Rome, Italy; Tel: 06 53925; E-mail: Douglas.Kneeland@fao.org

FOREST NEWS is issued by the FAO Regional Office for Asia and the Pacific as part of TIGERPAPER. This issue of FOREST NEWS was compiled by Patrick B. Durst, Senior Forestry Officer, FAO/RAP.

FORESTRY PUBLICATIONS: FAO REGIONAL OFFICE FOR ASIA AND THE PACIFIC (RAP)

For copies, please write to: *Forestry Section, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand.*

1. Leucaena Psyllid in the Asia Pacific Region: Implications for its Management in Africa (RAPA Publication 1994/13)
2. Asia-Pacific Tropical Forestry: Ecological Disaster or Sustainable Growth? (RAPA Publication 1994/18)
3. Workshop Report: Reform of the Forestry Sector: Towards a Market Orientation in China, Laos, Mongolia, Myanmar, and Vietnam (RAPA Publication 1995/4)
4. Beyond Timber: Social, Economic and Cultural Dimensions of Non-Wood Forest Products in Asia and the Pacific (RAP Publication 1995/13)
5. A Guide to the Identification of Diseases and Pests of Neem (*Azadirachta indica*) (RAP Publication 1995/41)
6. Non-Wood Forest Products in Bhutan (RAP Publication 1996/6)
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8. The Khao Kho Story: Reclaiming the Barren Hills of Thailand's Central Highlands (RAP Publication 1996/27)
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13. Directory of Selected Tropical Forestry Journals and Newsletters (2nd Edition) RAP Publication 1997/17 - FORSPA Publication No.19/1997.
14. Forest Dependent Survival Strategies of Tribal Women: Implications for Joint Forest Management in Andhra Pradesh, India (RAP Publication 1997/24)
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19. Asia-Pacific Forestry Towards 2010 - Executive Summary: The Asia-Pacific Forestry Sector Outlook Study (RAP Publication 1998/22)
20. Asia-Pacific Forestry Towards 2010 - Report of the Asia-Pacific Forestry Sector Outlook Study

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21. Regional Strategy for Implementing the Code of Practice for Forest Harvesting in Asia-Pacific
22. Trees Commonly Cultivated in Southeast Asia - An Illustrated Field Guide 2nd Edition. (RAP Publication 1999/13)
23. Decentralization and Devolution of Forest Management in Asia and the Pacific (RAP Publication 2000/1 - RECOFTC Report No.18)
24. Asia-Pacific Forestry Commission Fifty Years (RAP Publication 2000/2
25. Development of National-level Criteria and Indicators for the Sustainable Management of Dry Forests in Asia: Workshop Report (RAP Publication 2000/07); Background Papers (RAP Publication 2000/08)
26. Forests Out of Bounds: Impacts and Effectiveness of Logging Bans in Natural Forests in Asia-Pacific (RAP Publication 2001/08); Executive Summary (RAP Publication 2001/10)
27. Regional Training Strategy: Supporting the Implementation of the Code of Practice for Forest Harvesting in Asia-Pacific (RAP Publication 2001/15)
28. Trash or Treasure? Logging and Mill Residues in Asia and the Pacific (RAP Publication 2001/16)
29. Proceedings of the International Conference on Timber Plantation Development
30. Monograph on benzoin (Balsamic resin from *Styrax* species) (RAP Publication: 2001/21)
31. Applying Reduced Impact Logging to Advance Sustainable Forest Management (RAP Publication: 2002/14
32. Report of the Asia-Pacific Forestry Commission 19th Session (RAP Publication: 2002/21 FO/APFC/2002/REP)
33. Communities in Flames: Proceedings of an International Conference on Community Involvement in Fire Management (RAP Publication: 2002/25)
34. Giants On Our Hands (RAP Publication: 2002/30)
35. Community-based fire management: case studies from China, The Gambia, Honduras, India, the Lao People's Democratic Republic and Turkey. (RAP Publication 2003/08)

Periodicals

- Tigerpaper/Forest News
- APANews