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Sloth bear (Photo: Chhangani)

FOOD AND FEEDING OF SLOTH BEAR (*Melursus ursinus*) IN ARAVALLI HILLS OF RAJASTHAN, INDIA

by Anil Kumar Chhangani

Introduction

There are three species of bears found in India. Sloth bear (*Melursus ursinus*), Brown bear (*Ursus arctos*) and Himalayan black bear (*Selenarctos tibetanus*). Sloth bear is more widely distributed throughout India than Brown bear or Himalayan black bear, but due to forest fragmentation and habitat loss the sloth bear population is now isolated in the Indian sub-continent. In the Aravalli Hills of Rajasthan, they still maintain their populations in areas like Mount Abu Sanctuary, Ranthambhor National Park and Keladevi Sanctuary, where sizeable populations of sloth bears are found.

This paper describes the food habits of the sloth bear in Kumbhalgarh Wildlife Sanctuary and the consumption of a variety of plant parts in different seasons. Data was collected during a long-term eco-behavioral study of Hanuman langur (*Semnopithecus entellus*) from 1994 to 2000.

Study Site

The Kumbhalgarh Wildlife Sanctuary lies between 20°5' and 23°3' N latitude and 73°15' and 73°45' E longitude, about 200 km south of Jodhpur in the west Aravalli Hills of Rajasthan, India. The total area of the sanctuary is 585 $km^{2.}$ The altitude ranges from 900 to 3,785 feet above sea level. Kumbhalgarh Wildlife Sanctuary has distinct winter, summer and monsoon seasons. During the summer, the temperature fluctuates between 30-35°C, and may rise up to 46°C during May and June. The mean temperature in winter is 5°C, which may go down to 2°C in December-January. The average rainfall is 725 mm, with a maximum of 950 mm and a minimum of 403 mm.

The forest is broadly of the dry deciduous or woodland type, dominated by *Anogeissus*

latifolia, A. pendula, Boswelia serrata, Lannea coromandelica, Wrightia tinctoria, Acacia senegal, A. catechu, Zizyphus mauritiana, Butea monosperma, etc. The undergrowth mainly consists of *Z. nummerlaria, Adhatada vasica, Grewia tenex, G. glavescens, Capparis separaia, Lantana indicus*, etc. Some climbers and grasses are also found.

The main fauna of the sanctuary includes leopard (*Panthera pardus*), hyaena (*Hyaena hyaena*), Indian wolf (*Canis lupus*), jackal (*Canis aureus*), four-horned antelope (*Tetracerus quadricornis*), chinkara (*Gazella g. bennetti*), porcupine (*Hystrix indica indica*), sambar (*Cervus unicolor*), blue bull (*Boselaphus tragocamelus*), toddy cat (*Paradoxorus hermaphordiatus*), jungle cat (*Felis chaus*), fox (*Vulpes bengalensis*), crocodile (*Crocodilus palustris*) and rock python (*Python molurus*).

Materials and Methods

In this study, data was collected on an ad libitum basis as well as by using the scan sampling methods of Altmann (1974). Night observations were also made from machans (observation posts) in trees in different parts of the sanctuary. Methods were designed for estimating the availability of different "phytophases" of food plants taken by sloth bear. The crown density method of Koelmeer (1959), Struhsaker (1975), Marsh (1981) and Newton (1988) was used for studying the phenology of food plants consumed by bears.

There is little information available on the food habits of sloth bear in nature. The main food items were found to be fruits, insects and nectar (Prater, 1971; Prue and Napier, 1977; Laurie and Seidensticker, 1977). In some cases the scat analysis method was used to understand the dietary composition of sloth bear by Lander *et al.* (1976) and Maehr and Brady (1948). Martin *et al.* (1946) used the aggregate volumetric percentage method to calculate food items. But in a long-term study or with a large amount of data hours, the proportion of time spent is more acceptable. The measure used in this study was to determine the feeding effort by bears rather than the food intake.

Results

This study revealed that sloth bears are able to successfully exploit both plant and animal resources available in and around the Kumbhalgarh Sanctuary area.

Sloth bears manage to get natural and cultivated plant food from the ground as well as from trees. Some 22 natural plants and 18 cultivated plant species were observed to be consumed by sloth bear in different seasons in the sanctuary. These 40 plant species were consumed in the form of young and mature leaves, flower buds, flowers, unripe/ripe fruits and also their seeds, bark, ariel roots and young stem shoots. Plant parts of different species consumed round the year and bears were also observed feeding on a few insects like honey bees (*Apis dorsata*), ants, termites, and on carcasses of dead wild and domestic animals.

Discussion

The results of this study clearly suggest that sloth bears are omnivorous in habit, as reported in several other studies (Prater, 1971; Laurie and Seidensticker, 1977; Johnsingh, 1986; Bhaskaran, 1990; Gokula and Vardharajan, 1995; Choudhary, 2000). It shows the ability of the sloth bear to exploit plant and animal resources available to them. But, compared to plant foods, the animal food is consumed in small proportions, because insect food is not available to the sloth bears of Kumbhalgarh Wildlife Sanctuary. In the study area, the increasing agricultural activities in and around the sanctuary provide them with opportunities for supplementary food from crop fields, which they seem to relish (Chhangani, 2000). Sloth bears often climb trees to consume arboreal food which is rich in food contents like flowers, fruits and seeds. These food stuffs are available year round, including the dry months when the ground cover is almost disseminated due to overgrazing by livestock (Chhangani and Mohnot, 1997).

In earlier studies by some scientists it was found that the sloth bear's diet comprised more animal food (Laurie and Seidensticker, 1977; Gokula and Varadharajan, 1995). Maehr and Brady

(1984) observed that the amount of insects in the Florida black bear's diet was higher in spring compared to other foods.

However, the present study suggests that animal food is consumed less because of its limited availability, particularly termites and other insects. The insect fauna, in particular termites, need sandy ground, good moisture and good ground cover. But in the rocky areas like Kumbhalgarh Wildlife Sanctuary, or in gravel areas, the termites are normally absent (Rathore, pers. comm). About 80% of Kumbhalgarh Wildlife Sanctuary is comprised of rocky hills. The forest is dry-deciduous with high temperatures in summer going up to 45°C (Chhangani, 2000). Kumbhalgarh Wildlife Sanctuary is thus not suitable for insect fauna, particularly termites, which are an important part of the diet of sloth bears (40.5%) (Gokula and Varadharajan, 1995).

The higher proportion of plant food in the diet of sloth bear indicates that it is predominantly vegetarian as indicated in some previous studies (Prater, 1971; Johnsingh, 1986; Baskaran, 1990). The sloth bear is an opportunistic feeder. It eats whatever is available in different seasons, including natural, cultivated, animal food (insects) or carrion. However, it maintains its omnivorous food habit.

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Table 1: Natural plants eaten by sloth bears

Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1. Acacia leucophloea	RF	–	YL	–	–	–	–	FB	FB	FL	UF	RF
2. Terminalia arjuna	–	–	–	YL	ML	–	FB	FL	UF	UF,RF	RF	–
3. Ficus benghalensis	RF	–	UF	RF	AR	AR	AR	UF	UF	RF	RF	RF
4. Zizyphus mauritiana	RF	RF	YL	YL,ST	YL	–	–	–	–	–	RF	RF
5. Grewia flavescens	–	–	YL	YL	ML	ML	FL	UF	RF	ML	ML	–
6. Grewia damine	–	–	YL	–	ML	UF,M	RF,ML	RF	ML	ML	ML	ML
7. Ficus racemosa	–	YL	YL	UF	RF	L	AR	AR	UF	RF	AR	–
8. Tamarindus indica	UF	UF,RF	YL,RF	YL	–	RF	–	–	–	FL	FL	FL
9. Syzygium cumini	–	YL	YL	YL,UF	UF	ML	RF	RF	RF	–	–	–
10. Zizyphus nummularia	RF	RF	YL,RF	ST,YL	YL,M	UF,RF	YL	–	FL	UF	UF,RF	RF
11. Bauhinia racemosa	ML	YL	YL	YL	L	ML	FL	FL	YL,UF	YL,SE	SE	SE
12. Dichrostachys cinerea	–	–	YL	YL	YL	ML	ML	ML,FL	FL	UF	UF	ML
13. Lantana camara	UF	FL	FL	FL	ML	ML	–	YL	YL	FL	FL	UF
14. Butea monosperma	YL	YL,FB,	YL,RB,	FL,YL,	UF	–	BR	–	–	–	–	GU
15. Ficus religiosa	–	GU	GU	GU	FL	BR	–	–	–	RF	RF	–
16. Boswellia serrata	–	–	YL	UF	–	–	ML,FL	ML,FL	–	–	–	–
17. Cordia gharaf	–	–	–	YL	YL,FB	YL,FB	–	–	–	–	–	–
18. Mangifera indica	–	–	–	FL	UF	RF	–	–	–	–	–	–
19. Annona squamosa	–	–	–	FL	FL,UF	UF,GU	–	–	UF	RF	–	–
20. Bombax ceiba	–	–	–	–	YL	YL	–	–	–	–	–	–
21. Aegle marmelos	–	FB	FB,FL	FL	YL,UF	YL,RF	RF	RF	–	–	–	–
22. Diospyros melanoxylon	YL	–	–	YL	UF	RF	RF	–	–	–	–	–
23. Bamboo		YL	YL	--	UF	RF						
24. Mahua												

Key: YL=young leaves; ML=mature leaves; FB=flower buds; FL=mature flower; UF=unripe fruits; RF=ripe fruits; SE=seeds; GU=gum; BR=bark; AR=arial root; ST=stem

Table 2: Cultivated plants eaten by sloth bear

Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1. *Cyamopsis tetragonoloba*	–	–	–	–	–	–	YL	ML,FL	UF	RF	RF	
2. *Triticum aestivum*	UF	UF	–	–	–	–	–	–	–	–	YL	
3. *Cicer arietinum*	UF	RF	RF	–	–	–	–	–	–	–	–	
4. *Phaseolus radiatus*	–	–	–	–	–	–	YL,ST	ML	UF	MF	–	
5. *Medicago sativa*	–	–	–	ML	ML	ML	ML	–	–	–	–	
6. *Zea mays*	–	–	–	–	–	–	–	ML	UF	RF	–	
7. *Vigna aconitifolia*	–	–	–	–	–	–	–	ML	UF	MF	–	
8. *Saccharum officinarum*	–	ST	ST	S	–	–	–	–	–	–	–	
9. *Cucumis sativus*	–	–	RF	RF	RF	–	–	–	–	–	–	
10. *Lycopersicon lycopersicum*	RF	RF	–	–	–	–	–	–	–	–	FL,UF	
11. *Brassica oleracea* L. Var. Capitata	ML	ML	–	–	–	–	–	–	–	YL	YL,ML	
12. *Brassica oleracea* L. Var. Botrytis	FL	–	–	–	–	–	–	–	–	YL		
13. *Citrullus lanatus*	–	–	–	–	–	–	–	FL	FL	UF		
14. *Picidium grajava*	–	–	–	–	–	–	–	YL,ML	ML	FL		
15. *Punica granatum*	–	–	–	–	–	–	–	YL,ML	ML,FL	FL,UF		
16. *Carica papaya*	–	–	–	FL	UF	UF	–	–	–	–		
17. *Tagetes erecta*	FB	FB,FL	FL	–	–	–	–	–	–	–		
18. *Rosa indica*	FB	FL	FL	–	–	–	–	–	–	–		

A STUDY ON THE LOSS OF BENGAL TIGER (*Panthera tigris*) IN FIVE YEARS (1996-2000) FROM BANGLADESH SUNDARBANS

by Mohammad Osman Gani

Introduction

Once, the Bengal tiger (*Panthera tigris tigris* Linnaeus 1758) had a wide range of occurrence in the forests of Bangladesh. It was seen in all the major forests of Bangladesh until the late 1940s. But in recent years, there have been no authentic reports of the existence of Bengal tiger in the tropical forests of Chittagong, Chittagong Hill Tracts, Sylhet and Cox's Bazar (Anon, 2000). The last Bengal tiger was killed in the reserved forests of Masalong of Chittagong Hill Tracts in the year 1976, in Cox's Bazar reserved forests in 1974, and in Sylhet forests in 1968. Bengal tigers are presently found only in the Sundarbans mangrove forest which is situated in the southwestern part of the country from latitude 21°27' to 23°30' North and longitude 89°02' to 90°00' East. The total area of Bangladesh Sundarbans is about 601,700 ha (Canonizado and Hossain, 1998).

Tamang (1993) estimated 362 Bengal tigers in the Sundarbans mangrove forests. Besides Bengal tigers, there are also spotted deer (*Axis axis*), barking deer (*Muntiacus muntjak*), rhesus monkey (*Macaca mulatta*), wild boar (*Sus scrofa*), red jungle fowl (*Gallus gallus*), otter (*Lutra perspicillata*), estuarine crocodile (*Crocodylus porosus*), rock python (*Python molurus*) and a number of birds and fishes in the Sundarbans.

The local people kill tigers if they come into their villages, out of a sense of protection for human and livestock, and for revenge for previous attacks. Poachers are also known to be active, but data on these incidents remain scant.

Vicomte Edmond de Poncins reported from a trip to the Sundarbans in the year 1892 that there were many Bengal tigers in the Sundarbans mangrove forests. The Forest Department and District Civil Administration encouraged the killing of tigers at that time. He also mentioned that Rs.50.00 was given as a reward to the shooters for every tiger shot in the Sundarbans (de Poncins, 1935). It is known from the 1931 Management Plan that 452 Bengal tigers were killed from 1912 to 1921 (Curtis, 1931). The Divisional Forest Officer of the Sundarbans Division used to recruit professional hunters for the posts of Boatman and Forest Guards. Their services were used to kill tigers, especially man-eaters or tigers who were disturbing people near the timber coupe during harvesting operations. The poachers commonly used shotguns for killing Bengal tigers. Hunters also use muzzle loaders and rifles to shoot tigers (Anon, 2000). Poisoned baits are also used by poachers against tigers.

Sometimes a Bengal tiger is ordered to be killed after being declared a man-eater, but records of repeated man killing is required before the Forest Department will declare a man-eater. The last Bengal tiger to be declared a man-eater was killed in 1989 at Kachikhali, Sundarbans East Sanctuary. Between 1975 and 1999, tigers killed a total of 544 people – an average of 22 people per year (Reza, 2000).

Objectives

The objectives of the present study on the loss of Bengal tiger are:

- Identification of the age and size group of tigers killed by villagers and poachers.
- Determining the relationship between tigers entering villages and tide levels.
- Assessment of the health status of tigers entering villages from autopsy reports.
- Report on behavioral observations of tigers entering villages hunting for prey and killing people.

- Ascertaining the present extent of poaching.
- Development strategies to reduce the killing of tigers and minimize human-tiger conflicts in the peripheral zone.

Methodology

Data on tiger killing were collected from the office of the Conservator of Forests, Khulna Circle; Divisional Forest Officer, Sundarbans Division, Khulna; Range Offices and Revenue Station Offices. Autopsy reports were also collected from the aforesaid offices. The official figures on tiger killing in the registers of the Sundarbans, Patuakhali and Jessore Forest Division were also used for this study. Data for 5 years were analyzed to get the objectives of the study because the register of the Forest Department on tiger deaths was not accurate. Information from the register was verified by field surveys and searches of other records to obtain the actual figure of tigers killed during the study period to avoid any confusion. Thus, a five-year period was used to determine the extent of tigers killed.

The length of tiger skins was measured. Information about the causes of tiger deaths were obtained from autopsy reports. Villagers were questioned during field visits to Datinakhali, Daingmari, Sharonkhola, Baraitoli and Amorbonia, which are all located along the fringe of the Sundarbans Reserved Forests. Tidal data were collected from the Bangladesh Tide Table published annually by the Bangladesh Inland Water Transport Authority to ascertain the tide level while tigers crossed rivers on the way to the villages.

Results and Discussion

A total of 23 Bengal tigers were killed between 1996 and 2000 from the Sundarbans. Fourteen tigers entered villages from the adjacent forests by crossing rivers or canals. Villagers killed 12 of them directly and an official of the Bangladesh Rifles (BDR, a paramilitary force responsible for border security) killed one. One tiger came out of the forest and took shelter in an isolated place close to the village on the berm of a flood protection embankment. It was very sick and unable to move due to paralysis. The villagers did not kill this tiger as it could not enter the village. It was later rescued and brought to a Military Zoo, where it died under treatment. One tiger was killed in the farmhouse of a feudal lord on the grounds of self-defense, which was considered as poaching. It was observed that 65% of the tiger deaths occurred in the villages and 35% occurred in the forest. Moreover, the villagers directly killed 12 tigers, which is 52% of the total killings, followed by poachers who killed 10 tigers (44%) and one tiger tided from old age sickness, which may be considered as a natural cause of death. The data on the prey that the tigers went after in villages was also analyzed. The tigers killed 4 cows, 6 domestic pigs, 16 goats, 3 dogs and 2 ducks in the villages between 1996 and 2000. In addition, the tigers that entered the villages killed 2 people and injured another 12 during the same period, mostly during daytime.

The people were killed and injured while the tiger was being attacked by the villagers, who assembled from all directions with sticks and spears, giving the animal no space to escape. So the tiger jumped on the mob, killing and injuring some people. The author witnessed a similar incidence at Datinakhali. The tigers entering the villages may be termed as cattle-lifters rather than man-eaters.

The skin length (without tail) of the tigers killed in the villages was analyzed and on that basis the animals were divided into sub-adult and adult categories. Skins less than 1.37 m long were considered as sub-adult and those longer as adult. It was observed from the data that 6 (43%) sub-adult and 8 (57%) adult tigers entered villages in a period of five years. It is assumed that the sub-adults entered the village after they had dispersed from their natural area and were searching for a new territory. The sub-adults were in good health except for one animal that was sick from nematode infestation. Adult tigers enter the villages due to old age, sickness and injury (Rishi, 1992), when they are unable to hunt prey. Of seven tigers autopsied, four (one sub-adult and 3adult) had huge nematode colonies in their stomachs. Veterinary surgeons also reported that 2 tigers were infested with ticks and had liver problems.

The time of day that the tigers entered the villages was recorded from the reports prepared by the field forest officials on human/tiger conflicts. In thirteen cases, it was observed that the tigers entered the villages either at night or very early in the morning. This may be due to the secretive behavior of tiger. The majority of tiger crossings (62%) of rivers and canals were at near high tide or within two hours of high tide, when the velocity of the current was low. Local people hypothesize that tigers prefer to cross at high tide because at low water the tiger must cross wider and higher banks with deep mud. There are two explanations why tigers prefer crossing at high tide. The first reason is that tigers want to avoid soft mud at low tide. The other reason is that tiger prefer to cross when the current is not strong so that they can be sure to reach the desired place on the opposite bank.

Local people also have some traditional beliefs regarding the reason for tigers entering villages. An elderly resident of Datinakhali village, the same location of the attack on the tiger described earlier, believed that the tiger's appearance was inevitable. The tradition holds that if a tiger kills someone in the forest and that person is removed and buried close to the village, the tiger will return to claim its prey within seven days and perhaps kill more people. This proved to be exactly the case in Datinakhali. Seven days earlier a fisherman had been attacked and killed by a tiger in the forest and had been buried close to the village.

Forest Department records indicate that professional poachers killed nine tigers during the study period. This is evidenced by the recovery of four carcasses from the forest and five skins from adjacent villages and urban areas. Only one skin showed signs of a gunshot wound, suggesting that poison was used on the other four tigers. Forest Department officials do not know the current level and method of poaching. It is definitely a serious problem, however, and much more effort is needed to understand the whole process and develop a practical means to control it.

Present status of tiger conservation in Bangladesh

The shooting and killing of Bengal tigers continued until the end of 1972, even after it had been declared an endangered species in 1969 by the International Union for the Conservation of Nature and Natural Resources (IUCN). The Bangladesh Wildlife Preservation Ordinance was promulgated in 1973 and amended in 1974 to become the Bangladesh Wildlife (preservation) (amendment) Act 1974. Killing and hunting of tigers, deer and other threatened and endangered wildlife of the country is totally prohibited under this Act. There are at present three wildlife sanctuaries in the Sundarbans, known as Sundarbans East, South and West sanctuaries, which cover an area of 139,000 ha. Unesco declared the entire area of the sanctuaries as a World Heritage Site in 1997. A protected area management plan was prepared for the sanctuaries under the World Bank-financed Forestry Resources Management Project. Presently, the Biodiversity Conservation in the Sundarbans Reserved Forests Project is under implementation and a number o f studies will be conducted with the objective of conservation of the Bengal tigers of Sundarbans.

Measures for tiger conservation: Recommendations

Villagers and poachers respectively killed 52 and 44% of the total tigers killed in Sundarbans. There is an urgent need for the protection of tigers from villagers as well as poachers. The measures for tiger conservation are discussed below.

Community Awareness Programme

There is an urgent need to introduce community awareness programmes in the nearby villages of the forest where there are human/tiger conflicts that result in the killing of tigers. The awareness programme will help to build a positive attitude toward tigers. It is important that villagers understand that the Bengal tiger is the star species of Sundarbans and the national animal of Bangladesh. It should be protected, otherwise it will soon become extinct from Sundarbans. It is equally important that forestry officials practice a community awareness programme in reducing human/tiger conflicts, especially those cases outside the forest. The awareness programme

must be organized in villages to educate people to change their antagonistic attitudes towards tigers.

Community-based Conservation

"Tiger Conservation Committees" have recently been created in communities suffering from frequent tiger conflicts. They are composed of local villagers, elected members of Union Councils, Forest Department officials and the local elite. Villagers who volunteer for night patrol with forest guards are listed and a roster for patrol duty is prepared and posted on the notice board of the local Forest Department office. Normally two armed forest staff and four villagers do the patrol duty jointly along the fringe and alert the villagers about their safety and responsibilities in the case of tiger intrusions into the village. The party normally patrols at night during high tide, as they know from past experience that this is the most common time for tigers to enter. If a tiger is seen, the patrol party uses firecrackers and drum beating to detour the tigers. The "Tiger Conservation Committee" has to do more functions like educating people through motivation on tiger conservation besides patrolling.

Anti-poaching Activities

The anti-poaching networking is an important measure to assess the nature and magnitude of poaching as well as to adopt a strategy to combat it. At present, this does not exist in the Sundarbans Division. Secret registers are maintained where the names and addresses of known poachers are recorded, but there is not systematic surveillance by Forest Department officials at local or national levels. More training and logistical support is required for Forest Department personnel working in the field.

Compensation to villagers

Villagers consistently complain to Forest Department offices that "your" tiger killed and injured our people and livestock from the village. In justifiable cases, the Forest Department needs to provide adequate compensation for the loss of livestock and to bear the cost of treatment of injured persons.

Fencing of Critical Areas

It is known that there are certain villages, like Datinakhali and Daingmari, where there is a high frequence of tiger intrusions compared to other areas. It was found that five out of 23 tigers were killed in Datinakhali village in a period of five years. The village is located on a narrow bulge of land, created due to the meandering course of the river, with forest all around except on the village side. This kind of location may be misunderstood by the tiger during high tide, as it may think that it is moving from one section of the forest to another section as the village is not visible due to the presence of an embankment outside the forest. This may be seen as a mirage. Detailed investigation is needed as one tiger is killed every year in this village as a result of human/tiger conflicts. A fence may be built along the riverbank of the bulge on the forest side to prevent the intrusion of tigers into Datinakhali. The geographical location of Daingmari is similar to Datinakhali and similar measures may be adopted to avoid human/tiger conflicts.

Excavation of a canal along the boundary

Numerous rivers and channels separate Sundarbans from adjacent private lands along its northern boundaries. Over time, approximately 16 km of one such river, the Bhola, has filled with silt and now acts as a bridge between forest and village. As a result, there is frequent trespassing of both people and livestock into the forest. Tiger intrusions into the village are also more frequent. Thus, there is an urgent need to dredge the river and restore the separation. Seven km have already been opened up through manual digging and the rest should be opened as quickly as possible.

Tiger immobilization and relocation

The tigers entering the village may be shifted to the forest through darting operations. Darting needs equipment, training of the Forest Department staff and testing of the method before implementation. Baiting traps may be

used to catch tigers to be shifted deep into the forest from the fringe areas (Rishi, 1992). This kind of arrangement will boost the morale of the villagers who will see that the Forest Department is actively taking back "their" tiger into the forest.

Strengthening of existing rules and regulations
Under the Bangladesh Wildlife (preservation) (amendment) Act 1974, there are provisions for imprisonment from six months to two years and fines from Tk. 500.00 (US$9.00) to Tk. 2,000 (US$36.00) for killing wildlife. The killing of any kind of wildlife is a bailable offense under this Act. There is a need for a separate section to deal with the crime of killing important and critically endangered wildlife such as the Bengal tiger, estuarine crocodile, elephant, masked finfoot, clouded leopard, etc. Stiffer penalties need to be imposed which are not open to bail.

Creation of a Tiger Unit

Within the Forest Department, a special tiger unit with trained officers and staff is required. This unit could be placed under the Ecotourism and Wildlife Management Division to carry out a variety of tasks related to tiger management including routine censuses, community awareness program, compensation to villagers and an anti-poaching campaign. It can also be responsible for tiger immobilization and relocation.

Training

There is a need for training of Forest Department staff on all kinds of conservation measures needed. Forest Department staff are to be trained in protection, anti-poaching activities, darting and participatory conservation programs. A veterinary doctor may also be trained to perform autopsies and conduct medical check-ups of the tranquillized tigers.

Currently a register is maintained in the office of the Divisional forest Officer, Sundarbans Division, for recording information of dead tigers. It contains very simple information like length, height and date th tiger was killed and is not a structured database. This register should be expanded to include important information like sex, weight, nature of death, place of occurrence and time of entry into villages.

Conclusion

The Bengal tiger is the flagship wildlife species of the Sundarbans, and is also the national animal of Bangladesh. The Sundarbans is the last home of the Bengal tigers within the territorial jurisdiction of Bangladesh. It is essential to minimize the killing of Bengal tigers either by the villagers or poachers. There is a need for strong action and commitment for the conservation of Bengal tigers, otherwise it will disappear like the rhinoceros, hog deer, and wild buffalo, which have all disappeared from the Sundarbans due to the lack of conservation measures.

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BIODIVERSITY IN THE SHENNONGJIA NATIONAL NATURE RESERVE OF CHINA

By Li Zhaohua and Mohsin Hafeeze

Introduction

The Shennongjia Reserve, established in 1982, is a comprehensive national nature reserve focusing on the protection of mountainous forest ecosystems and rare species such as golden monkey, tiger, golden-dotted leopard, golden vulture, white crane and dove tree in subtropical China. Due to its biodiversity significance and unique integrated vertical spectrum of vegetation, Unesco's Man and Biosphere programme selected the Reserve as a member of the international reserve network in 1990.

The earliest western scientist to appreciate the biodiversity of Shennongjia was probably Augustine Henry, an officer of the Chinese Imperial Maritime Customs Service stationed at Yichang from 1882 to 1889. He collected plant samples in Lao Junshan, now the eastern part of the Reserve in July 1888. Among his herbarium specimens collected from Western Hubei, many new genera and a great number of new species were discovered (Cui, 1996). After Henry, E. H. Wilson, an American horticulturist was sent to China four times to collect plant specimens, seeds, and lily bulbs between 1900 and 1910. He devoted himself to collecting in the mountains of Western Hubei, including the Shennongjia ranges, from February 1900 to April 1902. Among his valuable collections, two new genera, 225 new species and 162 new varieties of woody plants were described in the Cambridge-published volume "*Plantae Wilsonianae*" (Sargent, 1913-1917). Since then, the remarkable flora and fauna of Shennongjia have been recognized allover China, and the world as well (Zheng, 1993).

Natural Features

The Shennongjia National Nature Reserve, located at the eastern terminus of the Daba mountain range in North-western Hubei (110º03'05" - 110º33'50"E, 31º21'20" - 31º30'20"N), comprises 70,467 ha of steep rugged mountains and elevations that range from 420 m to 3,105.4 m above sea level (Zhu, 1999). The land form of the mountain slopes is very complex, also affected by strong erosion and shearing, but the mountain tops are usually flat and open, forming sub-alpine terraces which are normally occupied by bamboos, grasses, shrubs and conifers (Ban, 1995; Li, 1995).

The regional climate of the Reserve is a transitional type between temperate zone and subtropical zone, mainly controlled by the north subtropical circulation. However, there is a complex climate gradient corresponding to elevations. From the foot of the mountains (500 m) up to the highest peaks (3,100 m), the average annual temperature declines from 14.4ºC to 4.8ºC, while the mean annual precipitation increases from *ca*. 800 mm to *ca.* 2,500 mm (Zhu, 1999). The south-facing slopes usually get more and warmer precipitation than the north-facing slopes.

There are six kinds of soil types in the Reserve: mountainous yellowish brown soil (northern facing slope: < 800 m, southern facing slope: < 600 m), mountainous brown soil (N: 800 – 1,800 m, S: 600 – 1,200 m), mountainous darkish brown soil (N: 1,800 – 2,200 m, S: 1,200 – 1,800 m), brown coniferous forest soil (N: 2,200 – 2,600 m, S: 1800 – 2200 m) and mountainous meadow soil (N: 2,200 – 3,100 m, S: 2,600 – 3,000 m)(Zheng, 1986). Darkish brown coniferous forest soil occurs on the summits over 3000 m (Cui, 1996).

The unique geographical and environmental conditions in the Reserve give birth to many complicated ecosystems, such as forest ecosystems of multi-climax or multi-succession series, scrub ecosystems, mountainous grassland ecosystems, bamboo forest ecosystems, marsh

ecosystems, and mountainous aquatic ecosystems. These ecosystems, as well as the extreme topographic relief coupled with the elevation ranges, provide habitats for an incredible diversity of flora and fauna.

Fauna

There are 75 species of mammal animals in the Reserve belonging to 53 genera in 22 families. The species make up 68.81% of the mammal fauna of Hubei and 15.03% of China respectively. Among them, 14 species are listed as State key protected wildlife, including 3 species in Category I (first priority endangered species), *viz*. golden monkey (*Rhinopithecus roxellane*), southern Chinese tiger (*Panthera tigris amoyensis*) and golden-dotted leopard (*Panthera pardus fusca*). The monitoring of wildlife during the past two decades suggests that since the establishment of the Reserve, the population of golden monkey has increased from 420 in 1980 to 501 in 1990, and 720 in 1999 (Huazhong, 1980; Zhu, 1992; Zhu *et al*., 1999), while the population of golden-dotted leopard has been stable at around 15–22 animals; however, the survival of tigers is questionable since there is no direct evidence from the field to confirm whether they were still alive or not after 1995.

In the 1980s, only 197 species of birds were recorded in the Reserve. This number increased to 238 in the early 1990s (Cui, 1996). A recent survey (Zhu *et al*., 1999) recorded 308 bird species in the reserve ranges, which accounts for 67.84% of the bird fauna in Hubei, or 25.97% in the country. Among the avifauna, a total of 51 species are State-protected birds including two species, golden vulture (*Aquila chryaetos*) and white crane (*Ciconia ciconia*) in Category I.

There are 23 species of amphibians in the Reserve falling into 11 genera of 7 families. Amphibians are mainly distributed in the low mountains, and only 3 species are living in areas with elevations over 2,000 m. Two species, giant salamander (*Andrias davidianus*) and tiger frog (*Rana tigrina rugulosa*), are State key protected wildlife in Category II. Traditionally, giant salamander was a favorite food in Chinese recipes, which triggered the shrinking of the wild population due to illegal catching over the past three decades

Up to 1999, 40 species of reptiles were discovered in the Reserve, including 23 species of snakes. There are no reptiles in the Reserve listed as State key protected wildlife, but the Province gives protection to 10 species.

There were 47 species of fishes originally distributed in the Reserve, including 5 newly recorded species in Hubei. Since the Reserve is located at the middle reaches of Yangtze River and upper reaches of Han River, the fish fauna obviously falls within these two river systems: 15 species in the Yangze River system, 21 species in the Han River system and 9 species common to both.

Only 560 species of insects have been identified in the Reserve, of which three species, *Luehdorfia chinensis huashanensis*, *Bhutanitis thaidina*, and *Carabus lafossei*, are State key protected wildlife in Category II.

Flora

There are 2,762 species (varieties) of vascular plants belonging to 872 genera in 193 families in the Reserve, among which 297 species of 75 genera in 34 families are ferns, 30 species of 18 genera in 6 families are gymnosperms, and 2,435 species of 779 genera in 159 families are angiosperms (Zheng, 1993; Zhu, 1999). The geographical component pattern of flora (criteria according to Wu, 1991) is quite complex, in which 34% species belong to a global distribution type, 19% to tropical and subtropical types, 17% from tropical to temperate zone types, 18% to holo-temperate types and 0.3% endemic to China, including 42 species solely endemic to the Shennongjia Reserve

The Reserve holds 34 species of national protected plants, which account for 54.8% of the totals in Hubei and 8.7% in China respectively (Li, 1992; Ge, 1997). Among them, dove tree (*Davidia involucrate*) is ranked in Category I, and another 15 species, including the famous Ginkgo tree (*Ginkgo biloba*), goose-palm tree (*Liriodendron chinense*) and lotus tree

(*Cercidiphyllum japonicum*) are in Category II. Additionally, the local flora contains 150 species of wild fiber plants, 208 species of wild oil-bearing plants, 190 species of wild starchy and carbohydrate plants, 180 species of wild perfume plants, 160 species of wild vegetables, 253 species of wild flowers and over 1600 species of wild medical plants (Zhan, 1994).

The flora of mosses in the Reserve was virtually unknown before 1990, since there were only 5 species officially recorded up until then (Cui, 1996). A recent survey (Liu, 1999) preliminarily documented 135 species of mosses in the Reserve, and most of them are new records from Hubei. So far, 735 species of fungi and 191 species of lichens have been recorded in the Reserve, including 10 new species, 5 new varieties, and 113 new records in China. The incomplete understanding of the biodiversity of lower plants urgently calls for more research.

Generally, the biodiversity in the Shennongjia has been well preserved since the establishment of the Reserve. However, since the Reserve is separated into two scattered, isolated locations and both hold quite lot of valuable wild plants and wildlife, illegal poaching, logging and collecting are still contribute to the decrease and degradation of the local biodiversity. Meanwhile, biodiversity conservation has recently confronted a challenge from the rapidly developing tourism enterprises. Thousands of tourists and vehicles crowd the core areas of the Reserve every year (Li, 1994). Thus, a new issue about the rational utilization of biodiversity is emerging.

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A PRELIMINARY SURVEY ON THE STATUS OF BINTURONG (*Arctitis binturong*) IN TRISHNA WILDLIFE SANCTUARY, TRIPURA

by Atul K. Gupta

Introduction

Binturong (*Arctitis binturong*) is highly endangered and rarely encountered carnivore species belonging to the family Viverridae. Five species of viverrids are reported from Tripura (Menon 1975, Agarwal and Bhattacharjee 1977; Gupta 1999), namely, large civet *(Viverra zibetha*), small civet (*Viverricula indica*), palm civet (*Paradoxurus hermaphroditus*), spotted linsang (*Prionodon pardicolor*), and binturong. Binturong is one of the biggest viverrids, and is exclusively distributed in the Indo-Chinese and Indo-Malayan sub-regions. It is also reported from the eastern Himalayas, Myanmar, Thailand, Malay Peninsula, Sumatra, Java, Borneo and Palawan (Pocock, 1939). In India, it is reported from all seven northeastern states. It is common in the forests, both in the plains and hills throughout Arunachal Pradesh to Tripura (Choudhury, 1999). In Tripura, it is reported from some parts of West and South districts (Gupta 1999). Binturong forms a very distinct genus whose place in the natural system has not been satisfactorily decided. It was originally classed with racoons, and may be considered a sort of link between the plantigrade and digitigrade carnivores with some distant analogies to lemurs. Two subspecies, namely *Arctitis binturong albifrons*, and *Arctitis binturong binturong,* have been identified.

Though distributed throughout the entire northeastern states, the binturong is nowhere common. Lack of surveys and periodic monitoring of this species has further led to a total absence of information, not only about its population status, but also about its ecology and behavior. Indirect incidental accounts of the presence and absence of binturong is only available from status survey reports of other species (Rai and Johnsingh, 1991; Laidlaw, 1994). No reports are available on any prior research on binturong. Similarly, nothing is known about the population status of this species in Tripura, northeast India. Its occurrence in Tripura is confirmed, however, owing to its presence in the State zoo where all exhibited specimens are locally procured. The author had also encountered this species on several occasions in the past in different places in Tripura during various field tours and while conducting detailed ecological studies on primate species in the State. Specifically directed conservation action plans on binturong have not been reported from Tripura or anywhere in its range areas elsewhere.

This brief survey report is based on a short pilot study that was undertaken to document the population status of binturong in Trishna Wildlife Sanctuary (TWLS), Tripura, Northeast India. The specific aim of this pilot short project was to study the distribution, composition and population density of binturong in Trishna Wildlife Sanctuary and identify the main conservation problems central to this species. It was also visualized that this pilot study would further help in investigating the population status of other sympatric viverrids, and small mammalian species sharing habitat with binturong.

Study Area

Trishna Wildlife Sanctuary (194.708 km^2) is situated in the southwestern end of Tripura, adjacent to Bangladesh between $23^0$12' - $23^0$32' N latitude and $91^0$15' - $91^0$30' E longitude. The Sanctuary lies in the South Forestry Circle of Tripura Forest department and South and West Tripura Districts (Anon., 1994). The Sanctuary was notified in 1988 as per the provisions of the Wildlife (Protection) Act, 1972.

June is generally the hottest month and January the coolest. The mercury does not go beyond up 40°C or below 5°C. The average rainfall in the

study area for the year is ca. 2400 mm, well distributed throughout the year. Approximately 63% of the total annual precipitation is, however, received between June and September. Due to the well-distributed rainfall and warm climate, the relative humidity in this area is quite high and on an average varies from 68% to 75%. During the monsoon months, the relative humidity usually rises above 85%.

The sanctuary is rich in biological diversity. The faunal diversity is comprised of six primate species, including slow loris (*Nycticebus coucang*), hoolock gibbon (*Bunopithecus hoolock*), pig tailed macaque (*Macaca nemestrina*), rhesus macaque (*Macaca mulatta*), Phayre's langur (*Trachypithecus phayrei*) and capped langur (*Trachypithecus pileatus*). The sanctuary also has one of the two known gaur (*Bos gaurus*) populations in the State and other faunal species of high rainfall forest ecosystem (e.g. wild pig *Sus scrofa*, barking deer *Muntiacus muntjak*, jackal *Canis aureus*, wild dog *Cuon alpinus*, sloth bear *Melursus ursinus*, large Indian civet *Viverra zibetha*, leopard *Panthera pardus*, etc.). Most of these are endangered either locally or at the regional and/or national level. The sanctuary is also rich in floral diversity represented mostly by tropical semi-evergreen and moist deciduous species.

In the north and northeastern parts of the Sanctuary, there are sal (*Shorea robusta*) forests interspersed with bamboo forests and grassy 'blanks' where *jhumming* (shifting cultivation) was practiced years ago and well before this sanctuary was notified. This is mostly a tribal inhabited area, and consequently had and still has a higher intensity of traditional hunting pressure. In the southern part of the sanctuary are patches of semi-evergreen forests along with few patches of moist-deciduous and degraded forests. This area also has pure patches of *Dipterocarpus turbinatus* for few kilometers on both sides of the main road leading to the sanctuary headquarters (Joychandpur). *Shorea robusta*, *Artocarpus chaplasha*, *Dipterocarpus turbinatus*, bamboos and other miscellaneous tree species dominate the Rajnagar range in the southern part of the sanctuary. Grassy blanks and crop fields are found interspersed with the forested areas across the sanctuary area, mostly in the buffer zone.

Methods

There are many methods to determine the number of animals per unit area of a given species (Dekker *et al*., 1991), and each one varies in accuracy, bias, precision, and in the amount of time or equipment needed to obtain the required data/information. The choice of census method may also depend on the general habits of the target species to census, e.g. nocturnal versus diurnal, solitary versus group-living, calling versus non-calling, etc. The choice of the method may further vary with the type of results desired, e.g. absolute versus relative density. Direct and indirect are the two broad categories of the census methods and since binturong is a solitary and nocturnal species, indirect census methods were considered more suitable. The line transect method was used both for actual sightings and to study the signs (feces) left by binturong.

In this method, three line transects of different lengths (ranging between 1.8 to 2.2 km) were established covering core area of the sanctuary. A total transect length of ca. 5.8 km was covered during the survey (T1-Rangamura to Joychandpur: 2.2 km; T2-Lake No. 2 to Ramdas Para: 1.8 km; T3-Lake No. 2 to MKPur to New road along the core area: 1.8 km – **Total: 5.8 km).** These transects were walked twice a day – once in the late evening (1800 – 2000) hours using the spotlights (night tracker) and the second time in the morning (0530 to 0730) hours of the immediate proceeding day. All the transects were scanned at normal walking speed. The process was repeated twice a month for three months (May, June, and July) and once in August. An optimal gap of 7 to 10 days was provided in between two consecutive census operations.

Prior to conducting the census, a few days were spent at a local zoo (Sepahijala Zoo) observing the captive specimens of binturong and other viverrids that were likely to be encountered during the survey. This helped in making proper identification and differentiation of binturong fecal matter from the feces of other species.

Results

The survey did not yield very good results in terms of direct sightings, although many indirect signs confirmed the presence and absence of binturong at any given area. Only 12 individuals were recorded from direct sightings and mostly from transect number 3. Out of 23 fecal counts, most were recorded from transect number 2. Due to very low census counts of binturong, no attempts have been made to calculate their density either from direct or indirect sighting data.

Except for hoolock gibbon, the other four species of primates were recorded from all three transects. None of the other faunal species were present in all three transects, representing an unequal distribution of the faunal species. Transect number 1 covered the largest area under survey, but was poorest in terms of binturong and other faunal species. Transect number 2 was the richest in the number of binturong and other faunal species. However, the results on other faunal species in this survey were incidental and can not be taken as an actual representation of their density in TWLS.

Table 1: Results of the binturong survey in Trishna Wildlife Sanctuary, Tripura

(a) Direct sightings

Transect Number	Length (km)	Direct sightings (no. of animals)							
		May		Jun		Jul		Aug	Total
		1*	2*	1	2	1	2	1	
T1	2.2	-	1	-	1	1	-	1	4
T2	1.8	1	-	-	1	-	1	-	3
T3	1.8	2	1	-	1	-	1	-	5
Total	**5.8**	**3**	**2**	**-**	**3**	**1**	**2**	**1**	**12**

(b) Indirect sightings

Transect number	Length (km)	Indirect signs (no. of fecal signs**)							
		May		Jun		Jul		Aug	Total
		1*	2*	1	2	1	2	1	
T1	2.2	1	2	1	-	-	-	1	5
T2	1.8	1	1	1	1	2	2	2	10
T3	1.8	1	1	1	1	2	1	1	8
Total	**5.8**	**3**	**4**	**3**	**2**	**4**	**3**	**4**	**23**

1* & 2* first and second fortnight

** = number of fecal signs recorded correspond to equal number of individuals

Table 2: Population status of other faunal species recorded in different transects in Trishna Wildlife Sanctuary

Species	Number of individuals in different transects		
	T1	T2	T3
Bos gaurus	4	1	-
Sus scrofa	5	5	2
Hylobates hoolock	-	-	2(1)
Trachypithecus phayrei	9(1)	12(20)	6(10)
Trachypithecus pileatus	7(1)	17(2)	5(1)
Macaca nemestrina	15(2)	32(3)	10(1)
Macaca mulatta	10(1)	8(1)	16(1)
Felis chaus	-	1	-
Muntiacus muntjak	2	-	-

Herpestes urva	-	1	-
Herpestes edwardsi	-	1	-
Hystrix indica	2	1	1
Lutra lutra	-	1	-
Felis bengalensis	-	-	1
Panthera pardus	-	1	-
Viverricula indica	1	1	-
Cuon alpinus	-	-	1
Canis aureus	1	1	-

T1 to T3 = Transects one to three
( ) = number of groups/troops

Discussion

Morphology, ecology, and behaviour

The binturong is easily distinguished from other civets by its tufted ears, long shaggy coat similar to that of a bear, and the thick tail at the base covered with large bristling hairs longer than coat hair. It is the only viverrid and higher Old World mammal with a prehensile tail longer than its body length. Head and body together measure 28 to 33 inches, while the tail measures 26 to 27 inches. The general body colour is deep black with a white border at the ears; a few brown hairs are scattered over the head and on the anterior surface of the forelegs. It has large gland between the anus and genitals which secretes an oily fluid of an intense but not fetid odour.

The binturong lives in dense forests. In its habitat, it is nocturnal, solitary, and mainly arboreal, creeping along the larger branches using its prehensile tail. It is more wild and retiring than other viverrids. It spends the day curled up in a hole in a tree, its head well tucked under its bushy tail, only coming out at dusk to seek food. Although the binturong is a heavy animal it is a skillful climber. Its sharp curved claws are useful in grasping uneven surfaces along a tree. The prehensile tail is used when the animal climbs about the branches and when it hangs head down. Infants are able to support themselves by their tails alone. The binturong runs like a bear on the ground, putting the entire sole of the foot down. The slinking motion that is normally characteristic of viverrids is not found in binturong. They race about with surprising agility. Smell is the most important sense, but its vision and hearing are also well developed. The ears twitch in response to the slightest sound and the animal will raise its head and orient it in the direction of the sound. When on the prowl, they howl and make a hissing sound by expelling air through partly opened lips. Because of its secretive nocturnal mode of life, the animal is rarely seen and nothing is known of its breeding habits in the wild. Both parents care for the young and remain in contact with them until they start moving independently. The diet is a combination of animal and plant matters and may include small animals, birds, insects, and fruits.

Conservation issues

The history of conservation of forests and wildlife is not very old in Tripura. Before merging with the Indian Union, Tripura was a princely-ruled state. Very little attention was given to the conservation and protection of the vast forest and wildlife resources in the state. Exploitation of forests was the major source of economy and wildlife hunting was a common sport by the privileged class, in addition to being the source of livelihood for many tribal groups. Although the National Wildlife (Protection) Act, 1972 was adopted by the state government in 1973, serious attempts at wildlife conservation were only initiated in 1986 when the first wildlife sanctuary was notified in the state, followed by three more in 1988. Presently, four wildlife sanctuaries impart necessary protection and conservation measures to a varied biodiversity of flora and fauna in the state. However, no specific attempts had been taken to address the conservation problems of individual species of highly endangered status until the

author undertook and completed one such study on three highly endangered primate species in Tripura. There has been, therefore, no conservation action plan drawn up for binturong in Tripura.

Recognising its endangered status in the wild, the binturong has been placed in the Schedule I and Part 1 of the Wildlife (Protection) Amendment Act, 1991. The main conservation issues concerning binturong are related to the rapid decline in its population following hunting, habitat fragmentation, deforestation, and replacement of primary forests with secondary, bamboo, and *Imperata cylindrica* (thatch grass) forests.

The results of this survey indicate that the population status of binturong is on the decline even in its prime range habitat. Although no comparative data on their population size/ status is available from other areas in Tripura and elsewhere, going by the experience of the author himself and based on the reports from forest staff and local people, encounters with this species have declined to a larger extent than before. This may be an indication of the decline in their population in the state. The main factors associated with this decline in their population are not difficult to ascertain: habitat destruction, fragmentation of primary forests into small patches, hunting by tribal groups, shifting cultivation, and diversion of forest land for non-forestry purposes are the main reasons.

Recommendations

This is the first survey on this highly endangered species carried out anywhere in its entire distribution range in India. As a long-term measure, this preliminary survey in TWLS can be repeated in three sanctuaries in the state. A detailed study on the conservation ecology and behaviour of binturongs in their representative and human-induced altered habitats can also form an outcome of this short study. Information on the population status and data on the ecology and behaviour of binturong can be central to the formulation of definitive plans and strategies by wildlife managers for the conservation of this highly endangered species. It is very important to further consolidate this information and initiate a detailed ecological study for gathering long-term data on various aspects of the behavioral and conservation ecology of this species. This will help in drafting a definitive conservation plan for this species. I also propose a behavioral study of this species under captive conditions, which could provide information on some key aspects otherwise difficult to study in the wild as the species is nocturnal. The information generated from this study in captivity and strategies for *ex-situ* conservation of this species can also be worked out as a complement to *in-situ* conservation measures.

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NEST AND NESTING ACTIVITIES OF THE WHITE IBIS (*Threskiornis melanocephalus* Latham) IN BHAVNAGAR, GUJARAT

by I.R. Gadhvi and V.C. Soni

Introduction

The Indian white ibis (*Threskiornis melanocephalus* Latham) is found throughout India. It is a colonial breeder, nesting on moderate to tall-sized trees such as *Prosopis, Acacia* and various species of *Ficus* which stand in or near water (Ali & Ripley, 1983; Hancock *et al.*, 1992; Dharmakumarsinhji, 1955).

According to Ali and Ripley (1983) the breeding season of the white ibis in north India is June to August, whereas in south India it takes place from November to February. In Sri Lanka the white ibis breeds during December to April and in West Java from April to August (Hancock *et al.*, 1992). According to Dharmakumarsinhji (1955) the white ibis breeds in Saurashtra during late June to October, depending on the monsoon. The present observations were recorded to determine the breeding season of white ibis in the Bhavnagar area.

The selection of a nesting site is considered to be the most important factor in reproductive success among many bird species (Coulson, 1968; McCromon, 1978; Ryder and Ryder, 1981; Rendell and Robertson, 1989; Li and Martin, 1991; Tuomenpuro, 1991). It was recorded that in some ibis species, reduced reproductive success was due to poor nest site selection (Burger and Miller, 1977; Frederick, 1986, 1987a); therefore, studies on the nesting requirements of bird species are fundamental to understanding the management implications for conservation.

Nest site selections of several colonial ibises nesting in mixed species heronries were studied by Kushlan (1976), Burger and Miller (1977) and Burger (1978a, 1978b, 1979). However, the nesting ecology of Indian white ibis is poorly known except for a few brief accounts by Ali and Ripley (1983) and Hancock *et al.* (1992). The nesting activities of white ibis were studied to find out what factors affect the selection of the nesting habitat and nesting tree and their importance to the management of the species for conservation purposes.

Study Area

The present study was carried out during 1993 to 1997 at Bhavnagar City in India's Gujarat State. Bhavnagar is located in the southeastern portion of the Saurashtra region of Gujarat. Bhavnagar City and its outskirts in a 20 km radius comprised the study area. Bhavnagar has a 120 km muddy sea coast which provides an ideal feeding ground for many wetland birds. The eastern side of the study area is surrounded by the Gulf of Khambhat.

Vegetation Type

The entire Saurashtra region is drought-prone and often faces the problem of irregular rains. The vegetation growth is therefore severely limited by aridity. Moreover, an increasingly heavy demand for wood by the human population and overgrazing by livestock has drastically reduced the regenerative capacity of the vegetation to such an extent that nowadays large trees are scarce in most parts of Bhavnagar District. However, many of the surviving trees were planted during the time of the princely state as roadside plantations. In addition, other large trees survive in privet premises.

Methods

According to the secondary data available in field guides (Dharmakumarsinhji, 1955; Ali and Ripley, 1983), the breeding season in the study area is June to October. Therefore, the study area was thoroughly surveyed from March to September during the study period. Nesting colonies were located by observing the activity of the birds. The other tree species within a 100m radius of a nesting tree were identified to analyze the preference for a particular nesting tree. The height of the nesting tree and girth of the tree trunk at breast height (GBH) were measured. The canopy cover was measured by taking four opposite points from the tree trunk to the end of the most extended respective branches and computing the average. Nest heights were measured as the distance from the bottom of the nest platform to the ground. Trees of less than 3m height in city areas were not included in the survey as it was observed that in urban areas ibises do not nest in trees shorter than 3m because of the continuous movement of people near the nesting site.

The nest building behavior of an active pair of ibises was studied by monitoring the nest site from early morning to late evening for at least four consecutive days. Nidification activities such as the number of hours of labor for nest construction, the amount of nesting material collected during the busy hours of nidification, average time spent in gathering sticks for nest building, average time taken to carry the nesting material from its source to the nest, nest inspection and rearrangement activities by nest occupants were recorded to determine the role of both sexes in nesting activities.

As ibises are known to reuse nests to a certain extent, only five nests from different nesting trees were examined to observe the nest composition and dimensions. The observations include the number and frequency of nesting material to determine any preferences for particular nesting materials. The nesting materials were identified up to species level when possible. Nesting material other than plant species were also recorded. Data on abandoned nests were collected on nest diameter, cup diameter, cup depth, and the type and quantity of nesting material to determine the average nest size and its different dimensions. Nest diameter was measured across the middle part of the nest periphery from one end of the edge to the widest edge of the other end. Sticks extending beyond the cup of the nest were excluded from the measurement (Sykes, 1987). The depth of the nest cup was measured from the center of the nest bottom to the horizontal plane of the rim.

Results and Discussion

Nesting season

Only one distinct nesting season of the white ibis was observed during the study period, i.e. April to October. However, in the years 1994 and 1995 when unusually high precipitation was recorded, very early nesting was reported in January 1995. Due to the heavy rains during the monsoon of 1994, the ideal nesting place was available on an island in Krishnakunj Lake of Victoria Park. In January 1995, 159 pairs started nesting. This was the maximum number of pairs recorded breeding during the study period, whereas in the year 1996 not a single pair nested in the study area. In 1997, the minimum number of nests (15) were recorded in the usual breeding season of April to October.

According to Lack (1968) the breeding season is characteristic of the geographical area rather than a particular species. Accordingly, the breeding season of the white ibis varied over different geographical areas. Usually nesting takes place after the rains and varies according to the monsoon. The species nests from December to April in Sri Lanka. Eggs have been found from April to August in West Java (Hancock *et al.*, 1992). Ali and Ripley (1983) described the nesting season of white ibis as variable between June to August in north India and between November and February in south India.

Improved breeding conditions due to good rain favor vigorous reproductive activities (Chavda, 1997). A similar phenomenon was observed among white ibis during the high rainfalls of 1994 and 1995. As a result, the next breeding season commenced just two months after the completion of the nesting season in October 1994, i.e. in January 1995. During the 1995

breeding episode the highest number of pairs (159) nested and the breeding season continued to August, making it the longest breeding season in the study period. Thus, the immediate repetition of vigorous reproductive activities would have affected the breeding efficiency of the white ibis. This could be responsible for the nesting failure in the following year (1996) and for the fact that very few pairs (15) nested in 1997.

Selection of nesting site

On the commencement of breeding activity, parties of 10 to 50 white ibises, mostly male, begin to fly over the nesting area. While in flight the birds are silent. The flock visits a few large trees, spending approximately 15 to 45 minutes on each tree. Finally a nesting tree is selected.

It was observed that the white ibis does not have a very strong site-fidelity. Each breeding season the majority of nesting sites were changed. The selected nest sites were characterized by a significantly high richness of the canopy cover that provides an ideal nesting platform. The most preferred nesting site was on *Prosopis chilensis* on the island in Krishnakunj Lake in Victoria Park Reserved Forest, where 46.76% of the total number of nests during the entire study period were recorded in a single breeding season in 1995. The nesting site on the island was available only during that year, as the lake remained dry during the rest of the study period. In the remaining two nesting seasons, the majority of the nests were recorded in the busy city areas where only *Ficus religiosa* trees were available. Parasharya (1984) reported a similar phenomenon in the case of reef heron (*Egretta gularis*), where the scarcity of large trees near their foraging sites forced the birds to nest in busy urban areas. This confirms that certain vegetative characteristics were important in the selection of the nesting habitat by the white ibis. *P. chilensis* is usually available in the outskirts of Bhavnagar city, but they were more preferred when they were available on safe sites like the island in Krishnakunj Lake.

The white ibis reused a few nesting sites. Previous experience is also important in habitat selection among the birds (Klopfer, 1963). Many bird species are reported to remain or return to previously used nesting areas (Catchpole, 1972; Greenwood and Harvey, 1976; Harvey *et al.*, 1979; Newton, 1979; Aumann, 1989; Warkentin *et al.*, 1991). This is probably because the familiarity with the area may permit the birds to take advantage of favorable foraging, predator avoidance and nesting sites that enhanced reproductive success (Hinde, 1956; Greenwood and Harvey, 1982). This seems to be the possible factor for the nesting sites that are frequently used by white ibis.

Numerous reports exist of the establishment, decline or disappearance of colonies. The data on the American white ibis (*Eudocimus albus*) suggests that in some cases the change of nesting locations, particularly long distance displacement, is related to variations in feeding resources (Kushaln, 1975). Colonial nesting birds of semi-arid environments, including ibises, undergo similar movements (Carrick, 1962; Ward, 1969).

Among the white ibis at Bhavnagar, the food availability and foraging areas remained almost unchanged throughout the study period, even though the majority of the nesting colonies shifted every breeding season during the study period. This could be to avoid predators and the achieve maximum breeding success.

Nesting tree selection

In Bhavnagar, 41 trees were recorded near the nesting site. Out of these, white ibis utilized only nine species of trees for nesting. The maximum number of nests were recorded from *P. chilensis* (46.94%), which was due to the recorded number of nests (146) in 1995 at the Victoria Park nesting site, but *F. religiosa* was also frequently used (37.32%), probably because *F. religiosa* are the only trees that are religiously protected and provide the ideal height and canopy for the ibis to nest upon. The white ibis is known to build nests on medium-sized trees that are standing in or near water bodies. Nests of this species were also found on top of partially submerged shrubs (Ali and Ripley, 1983). In 1995 when Krishnakunj Lake was full, the ibises nested on the *P. chilensis* on the island in the lake. The water around the island provides

safety from ground predators and the tops of *P. chilensis* form an ideal nesting platform. The thorny twigs of *Prosopis* strengthen the nest against storm winds and heavy rain. The thick canopy also prevents the chicks from falling directly to the ground. In all other years during the study period, *F. religiosa* was the preferred nesting tree. The canopy cover of *F. religiosa* provides protection by minimizing the direct heat from the open sky (Morse, 1980). In addition, the dense canopy reduces the thermal stress to the vulnerable young ones, particularly when the tree is located away from the water. A well-covered nest does not require the wing shading provided by the parents to their chicks, which benefits the parents considering the energy cost.

The nesting colonies observed in Khijadiya Bird Sanctuary near Jamnagar and Chhari Dhandh area (Taluka Lakpat) of Kachchh were located on a clump of *Prosopis* trees standing in the water (Tiwari, J.K. pers. comm.). This suggests that nesting on *Prosopis* trees is an adaptive behavior as the nests are less likely to collapse.

Nest position

All the nests on *P. chilensis* were positioned on the top of the canopy (n=146), while the nests on *F. religiosa* were situated on the secondary crotches and usually nests were supported by an average 3.1 twigs (crotches) (SD=1.04, n=50). Usually the nests were situated on the upper side of the canopy. The mean distance from the tree trunk to the nest was 2.2±0.85m (n=50).

Actually, the position of the nests on a tree was found to depend on the characteristics of the tree species used for nesting. Nests located on Tamarind and on *Feronia elephantum* were positioned very close to the main trunk in the primary crotches (n=5) or secondary crotches (n=4). The nests on the remaining tree species were located on the secondary crotches (n=10).

Reuse of nests

The white ibis usually changes nesting sites every breeding season, so only 2.92% of the nests were recorded as being reused by the ibis in consecutive breeding seasons. All the reused nests were located on *F. religiosa* trees at the Old Port Road. All the reused nests of white ibis were built in the preceding breeding season. Such old nest structures were reused without any alteration or with only minor renovations.

Reuse of old deserted nests or the taking over of active nests has been recorded among many bird species as the consequence of a scarcity of nest sites or materials (Dusi, 1968; Burger, 1978a, 1978b; Dhinsa, 1983). The white ibis occasionally (2.92%) reused its conspecific deserted nests, perhaps to save time and energy that would be invested in building a new nest. The stealing of nest material from adjoining nests was observed in only six cases so far, usually in the absence of the neighboring bird which had gone to collect nesting material.

Extra-pair copulation most often occurs when the male is absent from the nest for the collection of nest material (Frederick, 1987b; Aguilera and Alvarez, 1989). Therefore, the time and energy saved by reusing a nest could be used by the male for other important reproductive activities such as protection of the nest and mate guarding.

It was sometimes observed that a few pairs which were not able to select a proper nesting site in a colony in a new location were forced to leave and reuse their old nests, making small colonies of 3-4 nests in nearby trees. Thus, reusing old nests was apparently an adaptive behavior among white ibises.

Nesting materials

The white ibis usually collects the nesting materials from various trees to weave a large and untidy nest (n=5). A total of 25 plant species were recorded from the nests. Besides the plant materials, iron wires and a small amount of plastic threads and pieces of plastic bags were also recorded as being used in nest building.

The major portion of the nesting material belonged to the tree on which the nest was located (n=5). On an average, 49.98±12.94% of the bulk of the nest material was the twigs and leaves of the nesting tree. An average 5.6 different species (4 to 8) of nest materials comprised more than 5% of the bulk of the nest. An exception was a nest on *P. chilensis* that was comprised of 3.9% of iron wires. In general the

nests were lined with grass, leaves and plastic threads.

The number of sticks varied from 180 to 240 (x=210.2, SD=22.32, n=5, excluding lining material). Seven to 14 different species of nesting materials were utilized for a nest.

Size of nest

The diameter of the nest rim ranged from 26.65cm to 39.28 cm (x=30.47, SD=1.57, n=5). The depth of the nest cup was 2.12 to 4.22cm (x=3.83, SD=0.68, n=5). The weight of the nest varied from 391.20g to 902.37g (x=687.81, SD=345.92, n=5).

Nidification

During the study period, a total of 50 pairs of white ibises were observed building and renovating nests. It was noticed that the ibis spent about 45 to 240 minutes (180.5±79.28) in a day for nidification. The pairing off started as soon as the birds started roosting on the nesting tree, and the nest building process began just after sunrise before leaving for foraging. It rarely took place during the afternoon or evening. Additions of nesting material while changing over the shifts was seen during the later stage of the nesting cycle.

Mating took place often during the nidification and the sexes could be differentiated and identified with by the body size, and particularly from the size of the bills. It was observed that the male was responsible for collecting all the nesting material, whereas both partners participated in the arrangement of the nesting material. On an average, 14.8±12.4 sticks for nesting material were collected per day. In the majority of cases the nesting material was collected from the nesting tree.

The whole process of nidification took 12 to 29 days (23.09±3.19) to complete the nest. If an old nest was available, it was used with or without renovation. For renovations additional nest material was added. In such cases the nest construction was interrupted and the nest material was not added every day. Therefore it was difficult to determine the accurate period of nest building in such cases.

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Erratum

There was a typographical error on the cover of the previous issue of Tigerpaper. The volume number was listed as XXXIX:No.1, when it should have been XXIX:No.1.

WILDLIFE SURVEY OF PHAKHEL, PURUNDI, RAKESKHOLA AND DANDAKHOLA (NEPAL)

by Paras Mani Acharya

Introduction

This paper describes the results of a wildlife survey conducted to establish baseline information on the Phakhel area between 2-8 October 1999. Phakhel falls in the Chandragiri range and represents a true midland ecosystem still rich in wildlife. An approach on foot was possible for the ecology team and during the survey period the team followed the trail passing through the forest from Purundi to the Dandakhola region. The altitude of the surveyed area ranged from 1,870 to 2,110 meters about sea level.

The present study recorded a total of 16 mammal species in the Phakhel area. Rhesus macaque (*Macaca mulatta*) , porcupine (*Hystrix indica*), yellow-throated marten (*Martes flavigula*), jackal (*Canis aureus*), rufous-tailed hare (*Lepus nigricollis ruficacudatus*), orange-bellied squirrel (*Dremomys lokriah*), barking deer (*Muntiacus muntjak*), jungle cat (*Felis chaus*) and leopard (*Panthera pardus*) were the most commonly sighted animals. Leopard cat (*Felis benghalensis*) and Chinese pangolin (*Manis pentadactyla*) occur in the forests of Phakhel and are protected in Nepal. The mammals described in this paper include both actual sightings by the team members and reports by local inhabitants.

There are no Himalayan black bear (*Ursus thibetanus*) or wild pigs (*Sus scrofa*) in the Phakhel area. Informants reported that the Himalayan black bear has not been sighted in the forests of Phakhel since 1989, which may be due to extreme habitat loss and illicit hunting and poaching. Leopard (*Panthera pardus*) is a common predator resident of Phakhel. They may prey on domestic animals including cattle (calves) that graze in forest areas. According to local informants, sightings of leopards were more frequent in Simpanidol of Dandakhel. It was reported that in 1999 a leopard had killed 3 goats and two calves that were grazing near the forest of Simpanidol of Dandakhola.

The leopard cat is rare and its numbers are rapidly declining due to habitat destruction and degradation. In July 1999, a leopard cat was seen in mixed *Quercus semicarpifolia* forest at Dandakhel (Man B. Baiba, pers. comm.). It reportedly frequently kills poultry in the villages of Dandakhel.

Another common predator is the jungle cat, which enters villages and raids the poultry. Indian fox (*Vulpes benghalensis*) and jackal were frequently seen in the Dudechaur and Lamagaon areas.

Barking deer is an important ungulate resident of the forests of Phakhel and common in Dandakhel and Kathunge forest. Sightings of were higher in the Dandakhel and Kathunge.

The yellow-throated marten is another common predator throughout the forests of Phakhel. The local people have reported that it often visits the village area and primarily raids poultry. During the survey period, a fresh scat of yellow-throated marten was observed at an altitude of 1,770 m.

Porcupine occurs in the rocky cliffs at Dandakhel and Chihandanda. Local people say they are often sighted above 1,920 m.

According to the local people, rhesus macaque inhabits the mixed *Quercus semicarpifolia* forest at Chilledol and Talku.

The only flying squirrel that was common was the giant flying squirrel, often seen alone at Dandakhel.

Avifauna

A total of 159 bird species (122 residents, 10 passage migrants, 17 summer visitors, 10 winter visitors) were recorded from Phakhel, Purandi, Rakaskhola gaon, Dandakhel and Markhu areas. Of these, 116 species are common.

The status of the threatened birds are taken from BirdLife International's 1994 publication **Birds to Watch 2**, which is the official source for birds on the IUCN Red List (Collar *et al.*, 1994) and replaces the list in Groombridge (1993).

The observed birds were grouped into three categories to determine their status, i.e. endangered (E), breeding forest birds with internationally significant populations (ISP) and near threatened. The status of nationally threatened birds is according to Birds Conservation Nepal's 1996 publication **Threatened Birds of Nepal** (Baral *et al.*, 1996). In IUCN terminology (1996), endangered species have a very high risk of extinction in the wild in the near future.

Near threatened species are close to qualifying for vulnerable. Threatened species of Nepal include two critically endangered, two endangered, 10 vulnerable and 37 near threatened species (Collar *et al.*, 1994). The pied thrush (*Zoothera wardii*), a species for which Nepal may be especially important , is listed as near threatened (Collar *et al.*, 1994). Two nationally threatened species were found: grey-sided laughing thrush (*Garrulax caerulatus*) and the pigmy blue flycatcher (*Muscicapella hodgsoni*), which are listed as endangered and vulnerable respectively (Baral *et al.*, 1996).

There are 33 species that are considered to be breeding forest birds, for which Nepal may hold internationally significant populations (Inskipp, 1989).

Wildlife Conservation Issues

Hunting

Hunting of wildlife by local people is rampant in the area. Formerly there was one Royal Hunter in Ward No.1 of Phakhel. They particularly target the muntjac and the kalij pheasant (*Lophura leucomelana*). Muzzle loading guns are popular and are locally made and readily available. Hunting is also done by the military.

Crop depredations

Incidences of crop raiding by wildlife in the Phakhel area are reported to be high. Damage is mainly done by rhesus macaques, porcupine, and orange-bellied squirrel. The major crops affected are maize, potato and soybean. According to local informants, porcupines are more of a problem at elevations between 1,900-2,100 m.

Villagers in Phakhel VDC complain that the Himalayan tree pie (*Dendrocitta formosae*) and magpies (*Urocissa flavirostris* and *U. erythrorhyncha*) cause considerable damage to maize crops in the area.

Local farmers chase and shoot the animals to prevent damage. The affected crop areas adjoin the forest area.

Livestock depredations

Depredations to livestock are caused mainly by leopards, yellow-throated martens and jungle cats. Livestock depredations by leopards is high in the area, suggesting that leopards are common. They commonly prey on calves, goats and oxen.

Charcoal making

Charcoal making practices by the Tamang are intense in the forests of Phakhel VDC. Charcoal makers prefer mostly Angeri (*Lyonia ovalifolia*) to make charcoal and this tree species is now threatened. Lately the charcoal makers have also begun to use *Quercus semicarpifolia, Rhododendron arboreum* and *Pinus roxburghii*. It is estimated that 16 trees are needed to produce 50 kg of charcoal.

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Table 1: Phakhel breeding bird species for which Nepal may hold internationally significant populations

Species	Reported or observed in 1999
Black-throated jay (*Garrulus lanceolatus*)	x
Striated bulbul (*Pycnonotus striatus*)	+
White-browed tit babbler (*Alcippe vinipectus*)	+
Nepal babbler (*Alcippe nipalensis*)	x
Scaly breasted wren babbler)*Pnoepyga albiventer*)	x
Black-chinned babbler (*Stachyris pyrrhops*)	x
Grey-cheeked warbler (*Seicercus poliogenys*)	+
Large-billed leaf warbler (*Phylloscopus magnirostris*)	+
Grey-headed warbler (*Seicercus xanthoschistos*)	x
Chestnut-headed ground warbler (*Tesia castaneo-coronata*)	+
Aberrant bush warbler (*Cettia flavolivaceus*)	x
Rufous-caped bush warbler (*Cettia brunnifrons*)	+
Orange-barred leaf warbler (*Phylloscopus pulcher*)	x
Black-faced warbler (*Abroscopus schisticeps*)	x
Golden bush roin (*Erithacus chrysaeus*)	x
Pied ground thrush (*Zoothera wardii*)	+
Plain-backed mountain thrush (*Zoothera mollissima*)	+
Grey-winged blackbird (*Turdus boulboul*)	+
White-tailed nuthatch (*Sitta himalayensis*)	x
Nepal tree creeper (*Certhia nipalensis*)	x
Black-capped sibia (*Heterophasia capistrata*)	x
Yellow-naped yuhina (*Yuhina flavicollis*)	x
Stripe-throated yuhina (*Yuhina gularis*)	+
Rufous-vented yuhina (*Yuhina occipitalis*)	+
Grey-backed shrike (*Lanius tephronotus*)	x
White-throated laughing-thrush (*Garrulax albogularis*)	x
Black-faced laughing-thrush (*Garrulax affinis*)	x
Striated laughing-thrush (*Garrulax striatus*)	x
Yellow-bellied flowerpecker (*Dicaeum melanoxanthum*)	x
Yellow-bellied fantail flycatcher (*Rhipidura hypoxantha*)	x
White-browed blue flycatcher (*Muscicapa superciliaris*)	

x = observed; + = reported

Table 2: Protected Mammals, Birds & Reptiles in Nepal

Scientific Name	Common Name	Status	
		IUCN	CITES

Mammals			
Sus salvanius	Pigmy hog	EXN	I
Ailurus fulgens	Red panda		I
Antilope cervicapra	Blackbuck	V	III
Bos gaurus	Gaur	V	I
Bos mutus	Wild yak	E	I
Bubalus arnee	Wild water buffalo	E	III
Canis lupus	Tibetan wolf	V	I
Caprolagus hispidus	Hispid hare	E	I
Cervus duvauceli	Swamp deer	E	I
Elephas maximus	Asiatic elephant	E	I
Felis lynx	Lynx	E	II
Hyaena hyaena	Striped hyaena	E	
Macaca assamensis	Assamese monkey		II
Manis pentadactyla	Chinese pangolin		II
Moschus chrysogaster	Himalayan musk deer	E	I
Ovis ammon	Great Tibetan sheep	I	I
Panthera tigris	Bengal tiger	E	I
Panthera uncia	Snow leopard	E	I
Pantholops hodgsoni	Tibetan antelope		I
Pardofelis nebulosa	Clouded leopard	V	I
Platanista gangetica	Gangetic dolphin	V	I
Prionailurus bengalensis	Leopard cat		II
Prionodon pardicolor	Spotted lingsang		I
Rhinoceros unicornis	One-horned rhinoceros	E	I
Tetracerus quadricornis	Four-horned antelope		III
Ursus arctos	Brown bear		I
Birds			
Buceros bicornis	Great horned hornbill		I
Catreus wallichii	Cheer pheasant	E	I
Ciconia ciconia	White stork		II
Ciconia nigra	Black stork		II
Grus grus	Common crane		
Houbaropsis bengalensis	Bengal florican	E	I
Lophophorus impejanus	Impeyan pheasant		I
Sypheotides indica	Lesser florican		II
Tragopan satyra	Crimson-horned pheasant		III
Reptiles			
Gavialis gangeticus	Gharial	E	I
Python molurus	Asiatic rock python	V	I
Varanus flavescens	Golden monitor lizard	I	I

CONSERVATION OF ANIMALS IN HANOI ZOO

by Nguyen The Chan

Hanoi Zoological Gardens is one of the two largest zoos of Vietnam (Hanoi Zoo and Saigon Zoo). Founded in 1976, the zoo is located in the western part of Hanoi, 6 km from the city center, with an area of 21 ha.

Nowadays, Hanoi Zoo is managing and raising over 800 animals, belonging to 93 species including: 36 mammal species, 50 bird species, 7 reptile/amphibian species. The responsibility of the zoo is the conservation, breeding and display of some of the rare animals of Vietnam.

Hanoi Zoo has been an official member of SEAZA since 1993 and is affiliated with 30 zoos and world conservation organizations.

Some of animals successfully bred and raised in Hanoi Zoo are listed below:

Aves

- Red jungle fowl (*Gallus g. gallus*)
- True silver pheasant (*Lophura n. nycthemera*)
- Vietnam pheasant (*Lophura hatinhensis*)
- Edward's pheasant (*Lophura edwardsi*)
- Siamese fireback pheasant (*Lophura diardi*)
- Indochinese green peafowl (*Pavo muticus imperator*)
- Ostrich (*Struthio camelus*)
- Rhea (*Rhea americana*)

Mammalia

- Slow loris (*Nycticebus pygmaeus*)
- Rhesus macaque (*Macaca mulatta*)
- Pig-tailed macaque (*Macaca nemestrina leonina*)
- Stump-tailed macaque (*Macaca artoides*)
- Hatinh langur (*Presbytis phayrei crepusculus*)
- White-cheeked gibbon (*Hylobates concolor lencogennis*)
- Vietnam sika deer (*Cervus nippon pseudaxis*)
- Sambar deer (*Cervus unicolor*)
- Przewalski's wild horse (*Equus przewalskii*)
- Owston's palm civet (*Chrotogale owstoni*)
- Masked palm civet (*Paguma larvata*)
- Common palm civet (*Paradoxurus hemaphroditus*)
- Binturong (*Arctictis binturong*)

In the near future, Hanoi Zoo also hopes to also breed Indochinese tiger (*Panthera tigris corbetti*), Clouded leopard (*Neofelis nebulosa*), Golden cat (*Felis temmincki*), Asiatic black bear (*Selenarctos thibetanus*) and Phayre's langur (*Trachypithecus phayrei*).

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▲ VƯỜN THÚ HÀ NỘI - MỘT KHÔNG GIAN THIÊN NHIÊN TƯƠI ĐẸP

▲ **NIỆC MỎ VẰN**
(Aceros undulatus)
Wreathed Hornbill

▲ **HẠC ĐEN**
(Ciconia nigra)
Black Stork

● **CẦY VẰN**
(Chrotogale owstoni)
Owston's Palm Civet

2 HỔ CON ▶
(Panthera tigris corbertti)
Indo - Chinese Tiger

VOỌC VÁ ▶
(Pygathrix nemaeus)
Douc langur

NGỰA VẰN ▶
(Equus burchelli bohmi)
Zebra

ĐÀ ĐIỂU PHI ▶
(Struthio camelus)
Ostrich

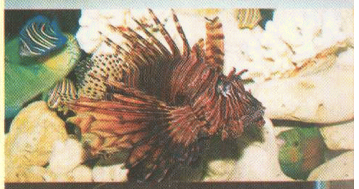
ĐÀ ĐIỂU MỸ
(Rhea americana)
Rheas

▼ **VOI CHÂU Á**
(Elephas maximus)
Elephant

▶ **CẦY MỰC**
(Arctictis binturong)
Binturong

▶ **CÁ CÓC TAM ĐẢO**
(Paramesotriton deloustali)
Tam Dao Newt

▶ **CÁ BƯỚM TIÊN**
(Dendrochirus brachyptenus)
Bwarf Lionfish



▶ **ĐỒI MỒI**
(Lepidocholys olivacea)
Olive Loggehead

FOREST NEWS

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INTERNATIONAL YEAR OF MOUNTAINS IN ASIA-PACIFIC

Mountain areas in the Asia-Pacific region are important sources of water, energy and biological diversity, while also providing resources such as agricultural and forestry products, minerals, and recreational sites. Mountain environments are, however, immensely fragile. Their steep slopes, and vertical dimensions make them susceptible to soil erosion, landslides, and loss of habitats and biodiversity. Mountains also pose significant challenges to those who live among them. Poverty is endemic among mountain-dwellers because of the harsh physical environment, isolation, relative failure to transfer knowledge and technology to mountain communities, and the marginalisation of ethnic minorities.

The United Nations has proclaimed 2002 as the International Year of Mountains (IYM) to increase awareness of the global importance of mountain ecosystems. FAO has been assigned the role of lead agency in collaboration with governments, NGOs and other UN organizations.

International events

IYM in Asia and the Pacific will be celebrated through a number of international events. The first major event in Asia was a symposium on *The Conservation of Mountain Ecosystems* held at the United Nations University's Tokyo headquarters on 1 February. The UNU events brought together 400 environmentalists, researchers and UN staff from around the world in an effort to further understand the status of mountain systems amid global change, the pressures facing mountains and the responses of indigenous groups and mountain societies.

Representatives of the Himalayan region will meet in Yuksam, India, in April to establish direct links between the populations of the various Himalayan regions and facilitate sharing experiences in socio-economic development. This meeting will be in preparation for the Second World Meeting of Mountain Populations, to be held later in the year, in Quito, Ecuador. Other up-coming events include:

- *High Summit 2002*, an international conference linking events from the highest mountain in each of seven continental regions, will be convened 6-10 May. This major global event will feature an interactive video conference broadcast simultaneously from locations situated near some of the world's highest peaks. In the Asia-Pacific region, broadcasts will be made from Mt. Everest in Nepal and Mt. Cook in New Zealand.
- An *International Conference of Mountain Children* will be held in Uttaranchal, India, 15 - 23 May. This conference will bring together children from more than 50 mountain countries to help contribute to a global agenda for IYM.
- *Celebrating Mountain Women* will be held in October 2002 in Thimphu, Bhutan. This conference will bring together indigenous women, donor agencies, policymakers and planners, entrepreneurs, and researchers to share insights related to the problems and progress of mountain women. An action programme will be developed to help overcome neglect and poverty that plague many mountain areas of the world.
- Sustainable mountain development will be a key agenda item at the *Twenty-Sixth FAO Regional Conference for Asia and the Pacific* to be held in Kathmandu, 13-17 May 2002.

National initiatives

A range of national activities are also being held throughout the Asia-Pacific region, including the

following:

- In Hong Kong, IYM was launched in early January with an opening ceremony and associated hiking festival at Cheung Sheung - a hill village in the West Sai Kung Country Park. A series of Country Park Exploring Hikes were held every Sunday in January and February, with participants awarded International Year of Mountain badges.
- A Snowy Mountains Biodiversity Blitz was held in Jindabyne, Australia, 12-13 January. The Blitz gathered experts from all fields of biological sciences to make an inventory of all the different types of organisms in a target area encompassing the variety of ecosystems between the Thredbo Valley Floor and the summit of Mt. Kosciuszko.
- In the Philippines, the Makiling Center for Mountain Ecosystems and collaborative partners launched national activities on the slopes of Mt Makiling. A *National Mountains Clean-Up Campaign* and *MountaiNet Philippines* (a website on Philippine mountains) were initiated.
- A month-long course in *Community-based Tourism for Conservation and Development*, was held in Thailand, in February.
- A *Nomad Festival* was held in Pakistan, 7-8 April, to celebrate and encourage interaction with nomadic people from the high mountains of Kashmir and from Northern Areas of Pakistan. The Festival arranged product displays, as well as discussions of problems related to education, health care and livestock.
- A *Summer Adventure Camp* is planned in Bhutan in mid-May. Forty Indian schoolchildren (winners of a quiz competition) will be taken to the mountains to experience trekking, camping and study of the varied flora and fauna of the Himalayas.
- The *Mount Everest Golden Jubilee*, in Nepal, will commence 12 months of activities to celebrate the 50th anniversary of the first ascent of Everest.
- In Yunnan, China, a Mountain Festival to promote cultural diversity and showcase mountain activities and mountain environments will be held in late-August.

To date, 12 countries in the Asia-Pacific region have established national committees for the IYM or are in the process of doing so. Countries with IYM national committees are: Bangladesh, Bhutan, India, Indonesia, Japan, Republic of Korea, Laos, Nepal, Pakistan, Philippines, Sri Lanka and Viet Nam.

Related activities

A variety of IYM-linked conferences are also planned in Asia. These include:

- *International Seminar on Mountains*. Kathmandu, Nepal. 6-8 March;
- *Quaternary Climate, Tectonics and Environment of the Himalaya: Comparison with other Regions*. Nainital, India. 11-15 March;
- *Benefits Beyond Boundaries in East Asia*, Yangminshan National Park, Taiwan Province of China. 18-24 March;
- *National Seminar on Conservation of Eastern Ghats*. Hyderabad, India. 24-26 March;
- *Symposium on Mountain Geography*. Tokyo, Japan. 29 March;
- *The Changing Face of Pastoralism in the Hindu Kush Himalayas-Tibetan Plateau Highlands Regional Strategy Workshop*. Lhasa, China. 12-19 May;
- *Risk Management and Sustainable Development in the Mountains of Central Asia: An International Symposium*. Gilgit, Pakistan. 5-7 June;
- *III MMSEA Conference: Mountain Indigenous Knowledge, Sustainable Livelihoods, and Creative Means of Resources Governance*. Lijiang, China. 25-28 August;
- *Mountain Infrastructure and Technology Conference.* How can mountain communities access technology and infrastructure to improve their livelihoods? Pakistan. 26-30 August; and
- *NGOs as Key Players in the Sustainable Development of Mountains in the Hindu-Kush Himalaya Region*. Rawalakot, Pakistan. 10-11 September.

Further details of events and activities are available at the International Year of Mountains website: http://www.mountains2002.org/

EFFECTIVENESS OF DIRECT INCENTIVES FOR FOREST PLANTATION DEVELOPMENT QUESTIONED

The Asia-Pacific Forestry Commission (APFC) is currently undertaking a comprehensive multi-country study on the "Impact of incentives on the development of forest plantation resources in the Asia-Pacific region." The study is covering nine countries (Australia, China, India, Indonesia, Malaysia, New Zealand, Philippines, Thailand, U.S.A.). The results will be presented to the 19th Session of the Asia-Pacific Forestry Commission, scheduled to meet in Mongolia in August 2002.

From 19 to 21 March 2002, FAO organized a workshop in Manila, Philippines, bringing together the main authors of the country studies to discuss the progress of the work and to provide guidance for the completion of the studies. The Forest Management Bureau of the Philippines Department of Environment and Natural Resources (FMB/DENR) provided logistical support.

Although it is early to offer firm conclusions, several issues have emerged from the preliminary findings. The general context and socio-economic environment explain to a considerable extent the effectiveness of direct and indirect incentives and investors' interest in plantation establishment. High interest rates, low wood prices, lack of suitable planting areas and the financial attractiveness of alternative land uses (e.g., oil palm plantations) discourage investments in forest plantations by the private sector. This emphasizes the importance of the enabling environment, including solid and timely research. Good governance, clear land tenure, national security and market development are all major aspects that investors (small- and large-scale) consider before making decisions, and often have a greater influence than direct incentives such as free seedlings or inexpensive credit.

The example of New Zealand highlights the importance of mindsets and attitudes. As long as people view forests as a barrier to development or do not foresee significant financial opportunities, it remains difficult to attract investors to forest plantations. In a similar vein, it is essential to follow up plantation-friendly policies with strategies and action plans. In too many countries, it can be observed that policies—with frequently ambitious targets—are in place but little is done in terms of translating them into action. Furthermore, is was observed that some disincentives or barriers to tree planting are so dominant that even—at first glance—attractive looking incentives remain ineffective.

In some countries, actual or perceived negative social impacts also have turned investors away from growing trees. Conflicts with local people increases risks and jeopardizes returns to investments. In extreme cases, plantations have been burned by those people who were promised employment but instead lost access to land they considered their own.

Analyzing the impacts of direct and indirect incentives on forest plantation development is very challenging. The effects of particular incentives change over time and they are often masked by developments outside the control of investors (e.g., the financial crisis that hit many Asian countries during the second half of 1997). The task of impact assessment is particularly difficult because effective monitoring mechanisms are lacking in most countries. Some plantations that were heavily subsidized exist only on paper. Due to poor monitoring, the extent to which incentives have been abused is often unknown, further complicating the task of assessing cost-effectiveness of incentives.

LACK OF ACCURATE AND RELEVANT INFORMATION LIMITS FOREST POLICY REVIEWS

Senior forestry officials from Bhutan, Cambodia, India, Indonesia, Laos, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka and Thailand came together with FAO experts and a representative of the European Commission (EC) for the second workshop of the EC-FAO Partnership Programme on Information and Analysis for Sustainable Forest Management during the second EC-FAO Partnership Programme workshop held from 22 to 24 January, Kuala Lumpur, Malaysia. The meeting reviewed the progress of the Programme, which is implemented in 13 South and Southeast Asian countries, discussed future activities to improve forestry statistics, and agreed on a common approach for new forest policy studies.

The EC-FAO project is promoting sustainable forest management in South and Southeast Asia through policies that integrate the economic, environmental and social aspects of forestry. The immediate objective is to improve national capacities to collect, compile and disseminate reliable and up-to-date forestry information in these countries.

The first part of the workshop dealt with the progress of the EC-FAO Partnership Programme while the remaining two days were reserved for forest policy related issues. In general, the participants were satisfied with the EC-FAO Partnership Programme's progress. By the end of 2001, more than 50 activities, most of them pilot studies had been initiated. Most studies are still ongoing and expected to be completed during the second quarter of 2002.

Participants recommended that the EC-FAO Partnership Programme focus in 2002 on training activities. The first training course will be organized by the Forest Survey of India (FSI) from 22 to 26 April 2002 in Dehra Dun, India. The training, for which FSI has recently developed a training manual, will focus on cost-effective methods for assessing trees outside forests (TOF).

An important output of the Programme is the establishment of a network of national statistical correspondents. Participants agreed to set up the network to strengthen national and regional statistics and promote sharing of information among South and Southeast Asian countries and to facilitate communication between FAO and individual countries. Selected correspondents will be invited to a forestry statistics training course to be held in Bangkok from 20 to 24 May 2002.

During the course of the workshop, the 11 representatives of the participating countries presented overviews on forest policies and recent policy reviews in their respective countries. Albeit the considerable differences among countries in Asia with regard to the importance of forestry to the national economy and environmental and socio-economic indicators, some common trends in forest policies can be observed. Over the last two decades, forest policies have been shaped by the problems of deforestation, the widening gap between timber supply and demand, the recognition that forests are a source of diverse goods and services besides timber, and the trend towards decentralization, devolution and privatization of forest management. A common problem is that the lack of accurate, relevant and up-to-date information, critical for assessing the impact of previous forest policies. The country presentations provided sufficient food for thought and first inputs to major forest policy studies that will be supported by the EC-FAO Partnership Programme.

For more information about the EC-FAO Partnership Programme or for obtaining a copy of the workshop proceedings please contact Thomas Enters, Forestry Sector Analysis Specialist, at Thomas.Enters@fao.org.

WOOD ENERGY - LESSONS LEARNED

Contributed by Auke Koopmans[1]

The FAO - Regional Wood Energy Development Programme (RWEDP) was operational for over 16 years, assisting its member countries with various wood energy-related issues ranging from planning, utilization of resources, conservation, the promotion of wood as a modern source of energy for power generation, etc. The programme terminated at the end of 2001, so at this point in time it may be worthwhile to take a step back and reflect upon the lessons learned with regard to wood energy, in particular during the last phase of the programme (1995-2001).

RWEDP confirmed and systematically documented the important ongoing roles of wood fuels, which serve the daily needs of more than one billion people in the region (i.e. about 40 percent of the regional population). In all countries, wood energy is the largest single supplier of energy. Most of the users are from relatively poor rural households, though a great many users also live in urban areas and are included in relatively well-to-do income groups. The consumption patterns are complicated and closely linked with local socio-economic, environmental and institutional patterns. In many ways wood energy plays a key role in rural livelihoods in general and in food security in particular. RWEDP has also confirmed (but this is still not widely appreciated) that wood energy businesses make a substantial contribution to income generation for a considerable number of people living in rural as well as urban areas.

Unfortunately, although the situation has improved over time, a number of constraints related to wood and other biomass energy sources persist, for example within the legal, infrastructural and institutional framework. Authorities in the sectors concerned have been slow to acknowledge the important social and economic characteristics of wood energy. On one hand energy departments exhibit a tendency to focus only on electricity and fossil fuels, neglecting what they consider the "traditional fuels", and many energy staff ignore the not-so-glamourous woodfuels, which they hardly recognize as a form of renewable energy. Forestry departments, on the other hand, often look at woodfuel as simply a marginal by-product. Forestry staff still have limited knowledge of the latest climate and greenhouse gas issues related to tree growth and woodfuel use. Unfortunately, agriculture departments take no interest in woodfuel whatsoever, even though most woodfuels originate from agricultural land. And regrettably, many NGOs are ill informed about the roles and implications of wood energy, though some do excellent work. This overall institutional neglect, combined with numerous misconceptions, has tended to result in governments tolerating wood energy at best rather than developing it to its full potential. Besides the constraints mentioned earlier, the most pressing social problems associated with wood energy are undoubtedly the potential severe adverse health impacts for users, in particular women, children, etc., who spend considerable time around cooking fires in poorly ventilated surroundings.

A number of relatively new and important findings have also been documented by RWEDP. These include, but are not limited to the fact that, contrary to common belief, woodfuel consumption will remain at a high level for the foreseeable future. This prospect alone should justify

[1] *Auke Koopmans served as Wood Energy Conservation Specialist with RWEDP from 1995 to 2000, and as Chief Technical Adviser for the program from 2000 to 2001.*

increased attention from policy makers. It has also been further substantiated that generally speaking, no direct correlation exists between wood energy consumption and income per capita, since for most people the supply of new forms of energy like electricity and gas complements rather than substitutes for wood/biomass fuels. Nor is there any compelling evidence of a direct link between woodfuel use and deforestation in most places[2]. In fact, evidence points to the importance of non-forest areas like agricultural land, common land, trees around houses, along roads, etc. as key sources of woodfuel supplies. In many cases over 50 percent of the woodfuel supplies are derived from these non-forest areas. RWEDP has further documented that the economic value of wood energy is much higher than generally assumed (i.e. equivalent to about US$ 30 billion per year in the region). Unfortunately, as woodfuel is not associated with powerful stakeholders or concentrated cash flows, government decision makers and private sector organizations have accorded it a low priority, despite its considerable value[3].

Of a more qualitative nature are the following findings. Woodfuel supply practices can very well support local environmental management. It has become obvious that wood and other biomass energy issues should be addressed simultaneously because of their many inter-linkages in terms of socio-economics, substitutability, and technologies for processing and use. At present, most households, commercial establishments and industries still use inefficient or inappropriate wood/biomass energy technologies. The majority of household stoves currently in use generate emissions which cause serious health hazards and also contribute unnecessarily to greenhouse gases. Fortunately, cost-effective stove technologies with reduced emission characteristics that simultaneously mitigate health hazards and climate risks are being designed. The same applies to institutional stoves, which are still very much underdeveloped even in terms of cost-effectiveness. Space heating requirements (e.g. in winter and at higher altitudes) need specialist attention, which is as yet rarely available. Furthermore, loose biomass residues, which are piling up at processing sites, can be developed much further as a source of energy. Cost-effective improvements in wood fuel use are possible in small-scale industries and some progress is already being made, but extensive efforts to disseminate such improvements are required. Improvements in charcoal production are also possible, but the constraints are very much determined by the local social and economic factors and by restrictive legislation. At the same time, activities to introduce improved conversion devices and technologies represent a powerful and cost-effective option for mitigating the emission of greenhouse gases, something becoming increasingly important considering global concerns regarding the detrimental effects these emissions may have on climate.

The abundance of information generated and compiled by RWEDP has important conceptual implications. By now it should be well understood that there is no general link between fuel wood use and deforestation, and the so-called "fuel wood gap theory" is false. Furthermore, woodfuel is not a marginal product and its use is not phasing out[4]. Woodfuel is not just a traditional commodity serving poor people, and it does not "trap people in poverty", as was ventured so dramatically by the World Bank some time ago. Although economic development is advancing in the region, woodfuel is not currently being replaced by modern energy forms, but is rather being complemented by these. The majority of wood and other biomass fuels are being sustainably grown and their fuel cycle does not make a net contribution to the world's greenhouse gases when

[2] It is now being more widely acknowledged that deforestation is mainly due to the conversion of forest land into agricultural land, in addition to logging practices.

[3] Woodfuel is generally collected and traded in small quantities in most of the region's countries, which makes the value of this commodity less visible than the more concentrated cashflows associated with timber.

[4] A cause of this misconception may be that energy experts usually represent the trends of wood energy consumption as a share of total energy consumption, which only shows that other forms of energy use are increasing at a faster rate, **not** that wood fuels are phasing out!

proper combustion technologies are applied. The problem is not the wood/biomass fuel as such, but rather the poor technologies being used in the region. In fact, the choice of technology is not simply either traditional or modern, as a continuous range exists from more traditional to more modern applications of woodfuels. The solution is not to leap-frog from one type of application to another but rather to develop the whole spectrum of traditional and modern applications.

The above conceptual understanding has led to a change in the paradigms underlying the work in wood energy development. In the context of sustainable development, the change has been from "wood energy as a suspect" to "wood energy as an ally". In the social context it has become clear that rather than a general focus on poverty alleviation, there needs to be a specific focus on alleviating the adverse health effects of current woodfuel technologies throughout South Asia, and especially in mountainous regions. In the context of national economies, wood/biomass energy is now changing from a neglected sub-sector to a sector offering numerous economic opportunities.

Some further important conceptual issues originated from RWEDP's collaboration with its member countries. For instance, woodfuel flow studies have proved to be essential for understanding local situations and for formulating adequate policies. The supply aspects of woodfuels are as crucial as the consumption aspects in terms of the rural socio-economy (viz. the income earning from woodfuel businesses). Woodfuel should be looked upon as a legitimate crop, though with a much longer gestation period than common agricultural crops. On the consumption side, it has been found that for the majority of households, fuel saving is not a sufficient argument to invest in an improved stove. This fact has been poorly understood by numerous well-intentioned rural development programmes in the past decades. Moreover, RWEDP has found that many of the so-called "improved stoves" constitute no improvement at all in terms of health risks and sometimes not even in terms of fuel savings. The former is largely owing to a lack of knowledge amongst stove designers, and the latter to limited skills amongst stove builders for securing the fuel-saving features of the stove design. Quality control of the production and dissemination of improved stoves requires extensive efforts.

Policy development is supported by information and skill development. Short-term training sessions provide a useful instrument for raising awareness and enhancing skills for wood energy development. However, it was found that few, if any, regular training institutes exist in Asia that can offer comprehensive training that integrates the multi-disciplinary aspects of wood energy. Fortunately, many high-level specialists are available in the region and these specialists have been invited to provide inputs into training programmes which were conceptualised and integrated by RWEDP experts. This approach appears to be a workable formula. For the dissemination of information on wood energy, the internet has become a powerful medium, in addition to periodic newsletters and other publications.

In all its training activities, RWEDP has had to strike a balance between enhancing skills by means of a "cookbook approach" and pushing to stimulate critical and independent thinking. Interestingly, with respect to the gender aspects of wood energy, RWEDP found it possible and effective to conduct training sessions without taking sides in frantic gender debates.

With regard to its 16 member countries, RWEDP has experienced excellent co-operation with the national focal points and departments concerned. Obviously, national institutions do not easily change their prevailing bureaucratic practices because of a time-bound project with exhaustible resources. It is, therefore, not surprising that important inter-sectoral linkages between wood energy and forestry, energy, agriculture, environment, rural development, industry, science and technology, public health and others, in practice could not be institutionalized at the national level. Inter-sectoral national committees can make useful comments, but they are hardly

suited to take up responsibility or even play a sound advisory role. Institutional realities further dictate that chief executives and senior government staff frequently change to other positions, which jeopardises the institutional continuity for co-operation with a long-term project. The risks are less when a firm lead role is allocated to one single sector (e.g. one department).

It has been RWEDP's experience that the strength of a regional project lies in a specific phase of its development (e.g. a phase during which basic information is acquired and spread, policies are adjusted, and/or technology and skills are transferred throughout the entire region). In such situations, the cooperation of neighboring countries supported by an international agency can generate the necessary momentum and transfer information, technology and skills in a cost-effective manner. Building on such a foundation, further assistance can focus on sub-regional common issues or even national problems. However, in order to instigate a policy change regarding wood energy development by national or sub-national governments, intensive advice and support to the department in charge is required, and this is something that a large regional project like RWEDP may not always be able to provide.

As stated above, the agriculture sector is lagging in giving attention to woodfuels produced on agricultural land. However, more studies are needed on the potential of biomass crop processing residues as useful energy sources. Furthermore, the potential of logging waste and wood industry residues as a source of energy needs more attention, and the role of "scrap wood" as a common source of woodfuel must be measured. In some areas, agro-forestry practices have proven to be instrumental in the supply of wood and other biomass fuels. Such production systems seem to have great benefits far beyond crops and fuels, although a lot is yet to be studied and tested in agro-forestry (this quest may have its parallel in Western countries where agro-forestry is being rediscovered as a tool for environmental management). Though wood energy use can be reasonably well planned even with limited firm data, more information is needed to support area-based wood energy planning and policy making. The LEAP model provides a useful tool for area-based studies as well as macro-level energy planning. A recent update enables the model to accommodate environmental aspects of the fuel cycles. On the wood/biomass energy consumption side, extensive efforts to transfer and disseminate a variety of improved technologies are very much needed. Again, it must be stated that mitigating the adverse health impacts of wood combustion is the prime social priority. In several countries, government policies towards wood/biomass energy need to be consolidated and the skills for their implementation further strengthened.

Post-RWEDP

After the closure of RWEDP on 31 December 2001, wood energy information including the RWEDP wood energy database, will remain available on the RWEDP website, which will remain operational for at least another two years. RWEDP studies, reports, training materials and manuals have been widely disseminated and are being kept at numerous documentation centers in the region. They can also be downloaded from the RWEDP website (http://www.rwedp.org) and documents and reports still in print can be obtained as hard copies. In addition, the information contained on the RWEDP website is also available on CD-ROM. For further information, please contact Mr. Patrick Durst (Patrick.Durst@fao.org) at the FAO Regional Office for Asia and the Pacific in Bangkok, Thailand.

SETTING RESEARCH PRIORITIES FOR VIETNAM'S FIVE MILLION HECTARE REFORESTATION PROGRAM

Contributed by S. Appanah[1]

The Forest Research Support Programme for Asia and the Pacific (FORSPA) recently joined the Center for International Forestry Research (CIFOR), Swedish International Development Cooperation Agency (Sida) and Vietnam's Ministry of Agriculture and Rural Development to organize a workshop on setting research priorities for Vietnam's Five Million Hectare Reforestation Program. The workshop was organized 20-22 November 2001 in Dalat in response to Vietnam's call to the donor community to support the massive reforestation program. It was recognized that success of the program would require appropriate research support, but priority research areas would first have to be identified before the donors could take suitable action.

Around 40 participants from various government agencies, international donor and technical agencies and NGOs attended the workshop. Three papers were presented. The first ("Background on Forest Research," by Dr. Do Dinh Sam) provided an overview of forest research in Vietnam, including a historical perspective, present capacity, funding, focus and past achievements. The second paper ("Issues Related to Forest Research," by P. Guizol and J. Blakeney) reviewed current research needs in Vietnam and highlighted the main issues, including: 1) the need to broaden research beyond the biophysical and include policy and socio-economic topics; and 2) alternative approaches to conducting and funding research. The third paper ("External Links & Experience in Prioritizing Forest Research," by S. Appanah) provided information on relevant research results available in the region, the regional agencies that can support initiatives in Vietnam, and the prioritization procedures to be employed for the workshop exercise.

Group work identified the relevant research topics and the prioritization methodology. The workshop then identified criteria for prioritizing research, which included the urgency of the research, its impact on the reforestation program and its technical feasibility. Following this, the research approaches and suitable collaborators were identified. The results of the exercise were produced in the form of a matrix of research topics, priority, approach and collaborators.

The workshop built on a two-year Forest Sector Support Program process which produced the knowledge gaps and needs as the starting point. Vietnamese researchers and research users followed a process that first required them to identify the research needs and prioritize them. This collaborative, demand-driven approach to identifying research topics differed from the traditional process of "defining research, requesting funds and receiving funds." The workshop further balanced the inputs of Vietnamese researchers and research users, with inputs from international researchers, forestry sector donors and NGOs. The results of the workshop will be further reviewed by experts and submitted to the donor community for consideration. The details of the discussions and prioritization exercise will be published in March 2002.

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[1] *S. Appanah is Senior Programme Adviser for the Forestry Research Support Programme for Asia and the Pacific (FORSPA).*

IMPLEMENTING A CODE OF PRACTICE FOR FOREST HARVESTING IN MYANMAR

By Clynt Wells[1]

In 2000, the Forest Department of Myanmar (FD) and Myanmar Timber Enterprises (MTE) developed a National Code of Forest Harvesting Practices (CoHP) in Myanmar modeled on the Code of Practice for Forest Harvesting in the Asia-Pacific. In October 2001, at the request of the FD, the Regional Model Forest Project (RMFP) provided the services of Mr. Clynt Wells to assist in the planning and implementation of a pilot CoHP demonstration. To introduce the Code, it was decided to undertake a trial implementation at the Paukkhaung model forest in Pyay District.

Logging in Myanmar is somewhat unusual in that the majority of the annual harvest of some 3.5 million cubic meters of teak and other hardwoods is carried out using elephants. Typically, trees are marked and teak is girdled two years prior to logging. Most trees are felled by ax and crosscut saw before extraction to a landing by elephant. Logs are either loaded onto trucks for transport or floated down streams. This approach to harvesting poses quite different issues relative to the largely heavy machinery-based logging of the Asia-Pacific Code. Myanmar, through the FD and MTE, has a long-standing tradition of forest management and over 100 years of expertise in elephant logging.

The following strategy was adopted for the demonstration:

- field assessment of implementation needs and development of implementation guidelines;
- preparation of implementation material such as field guides;
- conducting a training course for officers involved in the pilot implementation;
- pilot implementation at Paukkhaung forest; and
- an implementation review and development of revised guidelines for general Code implementation.

In October 2001, Mr. Clynt Wells (FAO consultant), U Kyaw Htun of the FD and U Khin Zaw of MTE, along with other FD and MTE staff conducted a field assessment of present practices and code implementation needs in the proposed demonstration area.

A Code-check was prepared as a checklist of required standards, and current practices were assessed and conformance to the code standards noted. Where differences or problems existed, the matter was discussed and solutions proposed. The assessment indicated that:

- Myanmar has a well developed institutional framework with well trained professional staff.
- The relationship between the FD (forest custodian) and MTE (timber harvesting agency) is professionally cooperative and focused towards improvement.
- In areas controlled by the FD, current practices are well documented and generally sound.
- The initial Code of Practice is basically sound, but minor adjustments are needed to enhance its relevance.

The assessment highlighted the advantages of elephant extraction. In comparison to tractor logging, elephant extraction has very low impact in moving logs to the landing. Elephants were observed dragging logs uphill on a low angle to the contour along a trail that was less than 1 meter

[1] *Clynt Wells is a forest harvesting Consultant, based in Australia.*

in width. This narrow track, unless used many times, suffers very limited disturbance and is unlikely to be a source of soil erosion.

Overall, given the inherently low impact of elephant extraction, it was recommended that Myanmar adopt a full Reduced Impact Logging approach to harvesting. This would include all aspects including inventory, yield calculation and regeneration. Such guidelines will have to be adapted to the Myanmar situation. With this in place, Myanmar harvesting has the potential to be low impact, and not just reduced impact.

Since the assessment, pocket field guides have been prepared to combine both the Code standards and the recommended implementation guidelines in a simple and convenient field book. These, together with operator pocket guides, will be used as the basis for a training program and the pilot implementation. To initiate implementation, an initial training exercise on the use of the field guides was carried out in January 2002.

FAO SUPPORTS DEVELOPMENT OF NEW FORESTRY LAW FOR VANUATU

The Vanuatu Parliament passed new forestry legislation in November 2001. The New Forestry Act was drafted with technical and financial assistance from FAO under the Technical Cooperation Programme. The new act was developed through wide consultations with stakeholders including chiefs, landowners and women's representatives, NGO groups, the national government, provincial governments and forest industry representatives.

The new act covers a wider range of issues than the previous act, including:

- a new forestry lease arrangement, which aims to encourage plantation development;
- enhanced mechanisms for increasing government revenue;
- establishment of a new Forestry Board to oversee all development within the forestry sector; and
- provision for a Forestry Sector Plan, which will institutionalize a clear system for planning of the forestry sector.

The act sets out a transparent structure for identifying land and forest resource owners for particular concession areas, designed to reduce the frequency and severity of land disputes. It also covers controls on export of live or dead plant material.

For further information, please contact the Director of Forests, PMB 064, Port Vila, Vanuatu; forestry@vanuatu.gov.vu

WORKSHOP ON STRATEGIC PLANNING ON FORESTRY
Nanning, Guangxi, China PR, 26-29 March 2002

A workshop on strategic planning on forestry was held in Nanning, Guangxi, on 26-29 March 2002, jointly organized by FAO, the State Forestry Administration of China, and the Department of Forest of Guangxi, with support from the Governments of Germany, Sweden and the Republic of Korea. Fifty-seven persons from China, DPR Korea, Mongolia and the Republic of Korea participated in the workshop.

The main objective of the workshop was to facilitate a better understanding and to publicize and disseminate the contents of the Commission on Sustainable Development/Intergovernmental Panel on Forests Proposals for Action (CSD/IPF), including forestry strategic planning, and to discuss mobilisation of partners for the implementation of the national forest programme (NFP) approach. The aims of the workshop were as follows:

- to discuss several aspects of forestry planning, including strategic planning, information, research, regional co-operation, and the importance of non-wood forest products for sustainable forest management;
- to publicize the CSD/IPF Proposals for Action, to share the experience of the Six-Country Initiative in putting the CSD/IPF Proposals for Action into practice;
- to discuss mobilisation of partners in NFP implementation;
- to inform the workshop participants concerning the recent international initiatives on forests and forestry, including the National Forest Programme Facility (NFPF) and to discuss how the new initiatives can be adopted at national levels;
- to discuss the political process - involving partners and stakeholders, consensus building, utilization of information and monitoring; and
- to share information on the status and progress of forestry planning in China, DPR Korea, Mongolia and the Republic of Korea.

Conclusions and recommendations

The experiences of China, DPR Korea, Mongolia and the Republic of Korea shared at the workshop provided valuable lessons of practical and conceptual nature to the participants and to the resource persons.

Strategic forestry planning, within the NFP framework or other similar systems is an important means of addressing the problems of the forestry sector. The vital components of strategic planning, covering both strategy of planning and planning of strategies, include among others: reliable and comprehensive information; involvement of all relevant stakeholders (or as many stakeholders as possible); analysis of the past trends and present situation; policy reforms to address inadequacies and weaknesses; outlook analysis and scenario setting on the basis of policy imperatives and assumptions; establishing objectives/goals; research and technology development; structuring of programs and activities (projects); intensive articulation; institutional strengthening or reforms/ reorientation as required; resource mobilization efforts; measures for inter-sectoral co-ordination/ collaboration; participatory monitoring and evaluation and above all ensuring political commitment.

There are no universally applicable guidelines or prescriptions for NFP processes. It is situation/ context specific. However, adopting certain principles to be followed in the process would be useful. These, among others, would include:

- national sovereignty and the need for national

NFP initiatives;

- informed and organized participation of stakeholders, and intensive articulation and deliberation;
- in the absence of an absolute consensus the aim should be for effective conflict management, which requires distinguishing the practical from the emotional, and understanding the limits and thresholds of practical effectiveness;
- paradigm shifts from timber-oriented management to ecosystem management, and from top down to participatory approaches need to be clearly understood; and
- while the NFP process is an important tool to achieve forest policy objectives, one should not be too enamored by it, to the extent of disregarding the quality and timeliness of product and its relevance to achieving established objectives.

The need to control deforestation and forest degradation is a key rationale and prime objective of NFPs and the achievement of that objective, along with sustainable forest management and utilization, is both a criteria and an indicator of the success of NFPs.

Resources for forestry development are scarce. Official development assistance (ODA) and foreign investment in forestry has been unstable and falling. Against this background, innovations for resource mobilization, efficiency in management and ensuring an enabling environment to attract investment assume paramount importance.

The following recommendations/ suggestions emerged from the workshop discussions:

- establish an effective mechanism and related institutional arrangements for Northeast Asia regional co-operation in forest and forestry, with the participation of China, DPR Korea, Japan, Mongolia and the Republic of Korea;
- formulate and implement regional projects covering the developing countries of Northeast Asia on capacity building, technology transfer, forest conservation and institutional strengthening;
- provide opportunities to representatives of the proposed Northeast Asia regional co-operation initiative to study the development of similar co-operative arrangements in other parts of the world through study tours, fellowships and other arrangements;
- request support of the National Forest Programme Facility to organize a regional training workshop on preparation of project proposals for the benefit of countries of the Northeast Asia Region;
- provide support for conducting a workshop on strategic planning in forestry in the DPR Korea in May 2002, which may be attended by representatives of the other countries of Northeast Asia;
- invite DPR Korea, which currently is not a member of the Asia-Pacific Forestry Commission, to attend the forthcoming session in August 2002 in Ulaanbaatar, Mongolia, as an observer;
- the workshop strongly urged that FAO take necessary action on the above recommendations, particularly those relating to a Northeast Asia regional co-operation in the field of forestry; and
- it was further suggested that China, as the host country of the workshop, should report the outcome and recommendations to the forthcoming session of the APFC, in Ulaanbaatar, Mongolia. Mongolia may also suitably include this information in its country report to the APFC session.

"If you want to plant for a year, plant a cereal.
If you want to plant for a decade, plant a fruit tree.
If you want to plant for a century, plant a forest."
– Chinese proverb –

ASIA-PACIFIC FORESTRY CHIPS AND CLIPS

MAJOR NEW WORLD BANK FORESTRY PROJECT FOR PAPUA NEW GUINEA

The World Bank recently approved US$34 million (US$17.36 million in loan and US$17 million in grant) for the Papua New Guinea Forestry and Conservation Project. The project has four components: Landowner Forest Decision-Making; Conservation Trust Fund; Sustainable Forest Management; and Environmental Assess-ment and Monitoring. The project will improve management and conservation of important forest ecosystems in one of the world's most biodiversity-rich regions, and increase the well-being of forest owners. It will also assist the Government to establish strict mechanisms to stop illegal and non-authorized timber harvesting, and ensure greater transparency in timber licensing.
– Inter Press Service –

DONORS COMMIT TO SUPPORT VIETNAM'S REFORESTATION PROGRAM

Eighteen international donors pledged to support Vietnam's Five Million Hectare Reforestation Program over the next 10 years. In January, donors signed an agreement committing to work cooperatively with the Government of Vietnam in reforestation, protection of the natural environment, and efforts to reduce rural poverty.
– Vietnam News Brief Service –

GOLD MEDAL FOR CONSERVATIONIST

Dr. Suwanna Gauntlett, an American conservationist working in Cambodia, has been awarded a Gold Medal for National Reconstruction and Rehabilitation by Cambodia's Prime Minister. Dr Gauntlett has worked with the Cambodian Department of Forestry to create a special Mobile Unit to combat poaching and the illegal trade in wildlife throughout the country. In a six-month period the mobile unit rescued more than 5,000 live animals from wildlife traders and released 95 percent of these into the wild. In the past 12 months the mobile unit has also detained more than 200 poachers and illegal loggers, and confiscated 74 chainsaws and over 8,000 snare traps. The Gold Medal is the highest award that can be bestowed on an individual in Cambodia.
– Environment News Service –

DUTCH BANKS COMMIT TO FOREST CONSERVATION

Three of the Netherlands' top banks – ABN AMRO Bank, Rabobank, and Fortis Bank – have decided to stop or substantially restrict the financing of the development of oil palm plantations for which existing tropical forests are cleared.
– Focus on Finance News –

THAILAND REJECTS DEBT-FOR-NATURE SWAP

The Government of Thailand opted not to sign up to a Tropical Forest Conservation Fund, proposed by the United States. The United States offered to reduce outstanding loans to Thailand, if the Thai Government would establish the Fund, along with a Tropical Forest Conservation Board. It was proposed that around US$10 million would be allocated to the fund over a 28-year period. Discussions between the two countries foundered over requirements that the US have two representatives on the TFC Board. Thailand also expressed concern over the carbon credit implications of the deal.
–The Nation –

REDUCED SARAWAK TIMBER HARVEST

Sarawak has been reducing the amount of timber harvested in its forests for the past several years. Chief Minister Tan Sri Abdul Taib Mahmud told an environmental awards ceremony that Sarawak was harvesting not more than 9.25 million cubic

metres per annum. The decline in natural forest production is expected to be offset by the establishment of forest plantations.
–RECOFTC E-letter –

PAPUA NEW GUINEA LOG EXPORTS AT A LOW

Log exports from Papua New Guinea were at a 10-year low in 2000, according to latest official data. Log volumes declined by around 22 percent of the previous year, to 1.56 million cubic metres. Export earnings from log exports declined by even more, falling from US$144 million to US$89 million, on the back of soft international log prices. Declining log export volumes are linked to World Bank structural adjustment loan requirements that placed a moratorium on new logging projects and promoted high export taxes.
– National/PINA Nuis Online –

THAILAND'S COMMUNITY FORESTRY BILL

Thailand's Senate has voted to approve the long-awaited community forest bill, but added a crucial clause prohibiting community forests in protected forests including national parks, wildlife sanctuaries and watershed areas. The community forest bill, if passed into law, will allow communities to participate more fully in the management of forests for their own benefit while helping to conserve forests for the country's overall welfare. The prohibition on community forests in protected forests is, however, a major change in the philosophy of the bill, since it implies that communities should not be entrusted with forest management responsibilities for conservation purposes.
– Bangkok Post –

AFPA OPPOSES ILLEGAL LOGGING

The American Forest and Paper Association (AFPA) has approved a declaration committing to efforts to stamp out illegal logging worldwide. AFPA says that, as well as being bad for the world's forests, illegal harvesting undermines consumer confidence that the forest products are made from trees harvested in an environmentally responsible manner.
– Environment News Service –

JAPAN'S IMPORTS OF TROPICAL LOGS

Reflecting declining tropical log production in several countries, Japan's imports of tropical logs were markedly lower in 2001. The country's tropical log imports in 2001 totalled a fraction less than 2 million cubic metres, 34 percent less than in 2000. Imports declined from Sabah (down 33 percent), Papua New Guinea (down 46 percent), Solomon Islands (down 22 percent) and Sarawak (down 88 percent).
– ITTO Tropical Timber Market Report –

TIMBER PRODUCTION IN CHINA

Domestic timber production in China totalled around 51 million cubic metres in 2001, a continuation of a trend of declining production in response to the Natural Forest Protection Programme. Production from forest plantations, however, increased by 8 percent, to 31.5 million cubic metres, or 62 percent of the national planned production of timber. China also imported almost 17 million cubic metres of logs.
– ITTO Tropical Timber Market Report –

SHAWL SEIZURE REVEALS ILLEGAL WILDLIFE TRADE

New Delhi police recently seized 80 shahtoosh shawls in a raid that nabbed some of the biggest shahtoosh traders in Delhi. The shawls are made from the underwool of the rare Tibetan antelope, found in the remote mountain plateaus of Tibet and Western China. The Tibetan antelope is listed in Appendix I of CITES; however, the illegal trade in the prized shawls constitutes a major threat to its survival. An estimated 240 antelopes would have been killed to provide sufficient wool to manufacture the confiscated shawls, which are valued at approximately US$5,000 each.
– Terragreen –

FAO ASIA-PACIFIC FORESTRY CALENDAR

13-17 May 2002. Kathmandu Nepal. ***FAO Regional Conference for Asia and the Pacific.*** Contact: T.C. Ti, Senior Food Systems Economist, FAO/RAP, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand; Tel: (66-2) 697-4195; Fax: (66-2) 6974445; E-mail: TC.Ti@fao.org

20-24 May 2002, Bangkok, Thailand. ***Workshop on Forest Products Statistics.*** Organized by the EC-FAO Partnership Programme. Contact: Thomas Enters, Forestry Sector Analysis Specialist, FAO/RAP/ Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand; Tel: (66-2) 679-4328; Fax: (66-2) 697-4445; E-mail: Thaomas.Enters@fao.org

31 May - 12 June 2002. Lin'an, China. ***Lin'an Best Practices Workshop.*** Organized by the Regional Model Forest Project and the Lin'an Secretariat. Contact: Tang Hon Tat, Chief Technical Officer, Regional Model Forest Project, FAO Regional Office for Asia and the Pacific; Maliwan Mansion, Bangkok 10200, Thailand; Tel: (66-2) 697-4220; Fax: (66-2) 697-4432; E-mail: hontat.tang@fao.org

May/June 2002. Tacloban, Philippines. ***Policy Review Synthesis Workshop.*** Contact: Tang Hon Tat, Chief Technical Officer, Regional Model Forest Project, FAO Regional Office for Asia and the Pacific; Maliwan Mansion, Bangkok 10200, Thailand; Tel: (66-2) 697-4220; Fax: (66-2) 697-4432; E-mail: hontat.tang@fao.org

June 2002 (provisional). Tacloban, Philippines. ***Terminal PSC and Regional Model Forest Workshop.*** Contact: Tang Hon Tat, Chief Technical Officer, Regional Model Forest Project, FAO Regional Office for Asia and the Pacific; Maliwan Mansion, Bangkok 10200, Thailand; Tel: (66-2) 697-4220; Fax: (66-2) 697-4432; E-mail: hontat.tang@fao.org

10-13 June 2002. Rome, Italy. ***World Food Summit: five years later.*** More information is available at the following website: www.fao.org/worldfoodsummit/

8-12 July 2002. Fujian, China. ***Field Training Course on Designing Local Auditing Systems for Sustainable Forest Management in China.*** Contact: S. Appanah, Senior Programme Adviser, Forestry Research Support Programme for Asia and the Pacific, FAO Regional Office for Asia and the Pacific; Maliwan Mansion, Bangkok 10200, Thailand; Tel: (66-2) 697-4136; Fax: (66-2) 697-4411; E-mail: Simmathiri.Appanah@fao.org

26-30 August 2002. Ulaanbaatar, Mongolia. ***19th Session of the Asia-Pacific Forestry Commission.*** Contact: Patrick Durst, Senior Forestry Officer, FAO/RAP, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand; Tel: (66-2) 697-4139; Fax: (66-2) 697-4445; E-mail: Patrick.Durst@fao.org

2-11 September 2002. Johannesburg, South Africa. ***World Summit on Sustainable Development ("Rio+10").*** More information is available at the following website: www.johannesburgsummit.org

7-10 October 2002. ***Bringing Back the Forests: Policies and Practices for Degraded Lands and Forests.*** Kuala Lumpur, Malaysia. Organized by APAFRI, FAO, FORSPA, FRIM and IUFRO. Contact: Dr. Sim Heok Choh, Forest Research Institute Malaysia, Kepong, 52109, Kuala Lumpur, Malaysia; Tel: 6003-62722516; Fax: 603-62773249; E-mail: foreconf@apafri.upm.edu.my; Website: apafri.upm.edu.my

21-28 September 2003. ***XII World Forestry Congress.*** Québec City, Canada. Contact: Secretariat General, XII World Forestry Congress 2003, P.O. Box 7275, Québec City, Canada G1G 5E5; E-mail: sec-gen@wfc2003.org

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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)
7. Asia-Pacific Agroforestry Profiles: Second Edition (APAN Field Doc. No.4/RAP Publication 1996/20)
8. The Khao Kho Story: Reclaiming the Barren Hills of Thailand's Central Highlands (RAP Publication 1996/27)
9. Reports Submitted to the Regional Expert Consultation on Eucalyptus - Vol.II (RAP Publication 1996/44)
10. Forests and Forest Management in Mongolia (RAP Publication 1997/4)
11. Non-wood Forest Products: Tropical Palms (RAP Publication 1997/10)
12. Gone Astray: The Care and Management of the Asian Elephant in Domesticity (RAP Publication 1997/16)
13. Directory of Selected Tropical Forestry Journals and Newsletters (2nd Edition) RAP Publication 1997/17 - FORSPA Publication No.19/1997.
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17. Leasing Degraded Forest Land: An Innovative Way to Integrate Forest and Livestock Development in Nepal (RAP Publication 1998/4)
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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
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
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