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Spotlight on the 23rd Session of the Asia-Pacific Forestry Commission held in Bhutan – the Land of the Thunder Dragon

Featuring

FOREST NEWS

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FOREST NEWS

TIGERPAPER is dependent upon your free and voluntary contributions in the form of articles, news items, and announcements in the field of wildlife and nature conservation in the region. In order to better serve the needs of our readers please write to us and send in the information you have or let us know if there is any information that you need. We appreciate receiving your letters and make all efforts to respond.

Front cover: Rufous-bellied eagle (*Hieraaetus kienerii*) in nest (Photo courtesy: H. Bandula Jayaneththi)

SOME OBSERVATIONS OF NESTING BEHAVIOR OF ENDANGERED RUFOUS-BELLIED HAWK EAGLE (Hieraaetus kienerii) IN UDAGAMA-KEGALLE MOUNTAINS OF CENTRAL SRI LANKA

by H. Bandula Jayaneththi

Introduction

The rufous-bellied hawk eagle (*Hieraaetus kienerii*) is easily identified by its black upper parts, chestnut under parts and under wing-coverts and white throat and breast. The size is 21-25 in., wing is 14-16 in. and the tail is 8.5-9.5 in.

The head has a dark cape and a small crest which is not normally erect. Upper parts are normally black, slightly shaded with brown. Ear coverts are mixed white, black and rufous; cheeks, throat, and breast are pure white with a few narrow black shaft lines; the rest of the under surface, including under the wing and tail coverts, are a tawny rufous, streaked with black shaft stripes broader on the flanks. The wings are black, with some of the feathers externally brownish; the inner lining of the quills is whitish ashy with a few blackish bars on the inner webs of the primary feathers and the secondary feathers are narrowly tipped with white. The black tail is very narrowly tipped and whitish brown and with 6-7 indistinct bars of dark brown; the lower surface is ashy white with sub terminal brown bars. The feet are yellow and the bill is plumed.

The two sexes are physically alike but the female is slightly larger than the male.

The breeding season seems to be from December to March. The nest is large and made of sticks lined with green leaves, placed in a forest tree. A single egg is laid; white, speckled and blotched with various shades of brown and red and measuring about 58.7x47mm.

The range of the rufous-bellied hawk eagle's distribution covers south of the Himalayas, Java, Philippines, Borneo and Sumatra, lower Bengal, Myanmar and Sri Lanka.

It is a resident of Sri Lanka, scarce in the hills, rare elsewhere, endangered but widely distributed in the island. The eagle favors patana woods and the like in the medium elevations of the hill zone from about 1,000-4,000 feet, though it may be seen at times at other elevations.

Observations

The rufous-bellied eagle's characteristic behavior was observed at Sabaragamuwa Province in Gamthuna village in Kegalla District. Located close to Kegalle City limits, the village consists of three sub-villages. Udugama is the village at the highest point, in the middle is Medagama and at the lowest point is Pathagama. Udugama is surrounded by a scenic mountain 900 to 1,060 meters above sea level; it also includes a few astonishing waterfalls. Cloves and tea are mainly grown in this area which lies between northern latitudes 7^{o} 5' - 7^{o} 10' and eastern longitudes 80^{o} 20' - 80^{o}25'.

This eagle's nest building was observed while the author was walking halfway through the mountain passing a Dothaluya tea plantation at around 9 in the morning.

The nest was located on a dried tree top, 20 meters high. One bird was making a racket of noise. It could be identified as a female because of the body size. The male, which has a relatively smaller body size, was in a big tree at a height of 25 meters nearby. This tree had a thick trunk and grew straight (vertically) for 20 meters. The nest was built among the 3 main branches, and the male was perched on the nest. Suddenly the male took flight from the tree where the nest was and flew high in a spin, targeting another dried branch. Flying at top speed while holding onto that small

branch, the branch broke off from the force of the speed of the bird. The male then flew over to the nest and the small tree branch was laid across the nest accordingly. Once again, the male perched on top of the tree where the nest was for a few minutes in the silence. More branches were collected in the manner as observed before until the nest was completely built. The nest building was observed for 45 minutes.

Discussion

Birds of the Falconiformes Order are predators; they are at the top of the food chain. The population density or numbers of these carnivorous birds is not great. Because their numbers are low, it increases the chance of their becoming endangered.

Even though Sri Lanka contains 20 birds from this order, a high percentage are reported only rarely. Some birds, after first and second sighting reports, were not found again. According to the observations above, the rufous-bellied hawk eagle is also a rare bird in Sri Lanka. Even though in Sri Lanka their nests have been recorded, studies on their behavior are recorded only rarely. Therefore, the nest building seen is important to be documented.

Acknowledgements

The author would like to express gratitude to Mr. Jagath Gunewardene, Mr. Deepal Warakagoda & Mr. Sampath Gunathilake for giving valuable advice to complete this paper. Thanks also to Mr. Priyankara Sedawaththa, Pubudu Weerarathne, Paramee Vidyarathne, Wajira Kanth, Menaka Gunasekara, Mahesh Chathuranga, Sameera Molligoda, who gave their encouragement and participation for the field visit, and Ms. Maga Ganeshan for her help in the preparation of this report.

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EXAMINING THE EXTENT OF HUMAN-TIGER CONFLICT IN THE SUNDARBANS FOREST, BANGLADESH

by Gertrud Neumann-Denzau and Helmut Denzau

Introduction

The Sundarbans mangove forest in the Gangetic delta is the largest continuous mangrove area in the world (10,284 km²), with 4,267 km² (41.5%) in Indian territory and 6,017 km² (58.5%) in Bangladesh. It is the home of some 100 endangered Bengal tigers (*Panthera tigris tigris*), possibly one of the biggest remaining tiger populations on the globe.

Within the memory of man, Sundarbans tigers have been ill-famed as man-eaters. The earliest known written document is found in the letters of Portuguese Jesuit missionaries, among them Francis Fernandez and Melchior Fronseca, who travelled to Bengal in 1598 and 1599. For the first time they reported that tigers in the Gangetic delta are fond of human flesh (Hosten, 1925). The reason for this behavior cannot so far be understood. The term "man-eater" is used here for all tigers that attack people within the forest, regardless of the circumstances and regardless of the victim's fate, be it getting injured, killed or eaten.

People who enter the Sundarbans face several risks. The area is prone to cyclones and other natural disasters. The occurrence of pirates is another problem. Among the dangerous animals like sharks, crocodiles and snakes, the tiger is the most dreaded. Although humans are frequently attacked by tigers during their stay in the forest, the human-tiger conflict in the Sundarbans does not attain much attention. The victims are usually very poor people whose fate doesn't reach the public eye at large. Resource extractors and other intruders in this mangrove forest are nowadays mainly fishermen, woodcutters, collectors of honey and other minor forest produce, but also staff of the forest department and tourists, scientists, poachers and pirates. Most of the human activities are seasonal.

A small number of investigations regarding the man-eater problem in the Bangladesh Sundarbans have been carried out. Hendrichs (1975) undertook a 3 month field survey in Bangladesh Sundarbans in January – April 1971 and investigated tiger casualities between 1956/57 and 1970/71 in the files of the forest department. He found 392 cases for this period of 15 years. His analysis of man-eating incidents produced basic new findings. Siddiqi and Choudhury (1987) analysed forest department data on 554 human casualties for a period of 28 years from 1956-1983. JJS (2003) analysed data of 181 tiger attacks. Their information is based on forest department data, newspaper clippings, and interviews with staff at local hospitals and other people for the period January 1999 – March 2002.

So far, the total number of tiger victims in the Sundarbans has remained hidden, since too many casualties of illegal intruders have gone unreported. Blamed for their illegal entries their fate was passed over in silence, suppressing the justification of the forest staff for letting such a high degree of illegal entries happen.

Our aim (for Bangladesh) was to calculate an extrapolation of the total annual numbers of tiger victims, to determine the number of unreported cases, and to estimate the percentage of victims without permission. By raising awareness of the real extent of human-tiger conflicts, the development of solutions for reducing the loss of human lives and saving tigers shall be supported.

Total number of tiger victims

Two independent data sets with individually known names of tiger victims allowed us to apply a correlative method to extrapolate the total number

of casualties for the Bangladesh Sundarbans for the years 2003 – 2005. Furthermore, this approach allowed us to determine the percentage of permit holders, unreported cases and illegal entries respectively.

The first data set consists of cases for the period 1984 – 2005 registered by the Bangladesh Forest Department (BFD) and includes name, age, profession and home village of the victim, as well as date and place name of the incident, sometimes along with the compartment number. This listing contains only cases of people who have entered the forest with legal permission.

The second data set is formed on the basis of newspaper reports. Notes on tiger victims are irregularly scattered over various national and local newspapers and are far from complete. Many cases probably remain unreported. The following Bangladesh newspapers and news services were checked for casualties which occurred between 2003 - 2005: *The Daily Star, New Nation, The Independent, New Age, The Bangladesh Observer, The News Today, News of Bangladesh, The Financial Express, Daily Dristipat, Daily Prabartan, Daily Folafol, Daily Kafela, Gramer Kagoj, Daily Purbanchal, Vore Kagoj, Daily Janmobhumi, Loksomag, Prothom Alo, Dainik Thottho, Probambanber*, along with releases of the news agencies UNB, BSS and AFP.

We counted as tiger victims persons injured or killed by tiger attacks within the Sundarbans forest area in Bangladesh. Persons injured or killed by tigers straying into human habitations in the fringe area were not taken into account here, as it remains unknown in most of the cases whether the tiger was provoked to defend himself against uncontrolled reactions of villagers or not.

To identify individual cases we looked at date, name, age, place of origin, profession and place of incident whenever it was possible. We only counted cases where victims could be identified by names. This was an intricate procedure because the data of different sources were partly inaccurate and controversial. We took the earliest date of incident if the date information was divergent. The numbers of BFD cases were always smaller (counting only permit holders). Newspapers always reported on more cases, but contrary to all expectations they reported only a small fraction of the BFD data.

Based on this overlap of newspaper reports and BFD data we developed the following formulae for our extrapolations:

$$n = nf + nn - ovl \quad (1)$$

$$rc = ovl / nf \quad (2)$$

$$tv = nn \times nf / ovl = nn / rc \quad (3)$$

$$ill = (tv - nf) / tv \quad (4)$$

n = number of individually known tiger victims after combining BFD and newspaper data

nf = number of individually known tiger victims as listed by the BFD (only permit holders)

nn = number of individually known tiger victims as reported by newspapers (whether permit holders or not)

ovl = overlap of cases between nf and nn (ovl not equal 0)

rc = fraction of BFD cases reported by newspapers

tv = extrapolated number of tiger victims

ill = estimated fraction of persons, who enter the forest without permission

Out of 15 cases listed in 2004 by the Bangladesh Forest Department (BFD), not more than 3 were reported in the newspapers. This supports the assumption that only 20% (3 of 15) of the tiger victims became known to the public, while 80% have remained unreported. Applying this hypothesis to the number of 35 cases published in newspapers (=20%) would result in a total number of 175 casualties (=100%) for the year 2004. Table 1 shows the calculation for the period 2003 – 2005.

Table 1: Extrapolated number of tiger victims (tv) in Bangladesh Sundarbans as derived by comparison of individually reported casualties by BFD (nf) and newspapers (nn), based on the fraction of BFD cases overlapping with newspaper reports (rc). The last column contains the ascertained percentage of persons, who entered the forest without permission (ill x 100).

year	n	nf	nn	ovl	tv	rc	un-reported	ill x 100
2003	83	20	72	9	**160**	0.45	55 %	87.5 %
2004	47	15	35	3	**175**	0.20	80 %	91.4 %
2005	47	14	36	3	**168**	0.21	79 %	91.7 %
annual average for the period 2003 - 2005					**167.7**			

Monu Mullah, an ill-fated fisherman, badly injured in a first tiger attack in the Sundarbans in 1997, was killed in a second tiger attack in 2009 (Photo: Gertrud & Helmut Denzau)

The remarkable finding of Table 1 is that the extrapolated numbers of tiger victims for all three subsequent years are quite similar, ranging from 160 to 175, although the numbers of the forest department and the newspapers differ considerably for one of these years. The ascertained number of unreported cases, neither recorded by BFD nor by newspapers, and the portion of victims who entered the forest without permission are also listed in Table 1.

In 2003, the percentage of unreported cases was significantly smaller than in the other years. This is due to the fact that some newspapers gave long lists of tiger victims at the end of the year.

In our data set for 2003 to 2005 (36 months), 177 casualties were reported, out of these were 49 by the BFD (Table 1). Without knowing the names of the victims one would consider that 27.7 % of the incidents were reported by BFD. Our extrapolation, resulting in a total number of 503 victims (founded on cross-checking by name), comes to the reasonable assumption that only 9.7 % of the casualties are reported by the BFD. This is an alarmingly low portion.

Discussion

The total number of tiger victims for 2003-2005 were extrapolated in this study to an annual average of 168. Most unspecified estimations about the number of tiger victims in Bangladesh Sundarbans are far below this extrapolation. Solely, Helalsiddiqui (1998) supposed a number of 100 - 150 people killed by tigers each year. JJS (2003) found 71 tiger attacks for the year 1999 and were surprised to find only 12 cases reported by the Forest Department. They also suspected that the discrepancy could be related to the portion of victims having entered the forest illegally.

For these three years we came to the result that only 10% of the casualties are reported by the Forest Department, 90 % of the victims were illegal entries.

Hendrichs (1975) found for some years before 1971, "that about 70% of the tiger casualities reach the Khulna Divisional Headquarter files". For the Satkhira Forest Range he estimated 10% illegal entries yearly.

Illegal entries are entries without legal permission, either unseen entries or entries achieved by bribing the forest staff. The resource extractors may not always know the difference between legal and illegal entries when paying fees. For many years the system has been obviously very corrupt from top to bottom, coming finally to light when in 2007 the chief conservator of forest was arrested and imprisoned (Anonymous, 2008).

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SEASONAL DIETARY COMPOSITION OF SLOTH BEAR (*Melursus ursinus*) IN THE RESERVE FOREST OF VIJAYNAGAR, NORTH GUJARAT, INDIA

by Tana Mewada and Nisith Dharaiya

Introduction

Sloth bears are found widely in the Indian subcontinent (Sri Lanka, Nepal, India, Bangladesh and Bhutan). The bear lives in a variety of habitats such as teak forest, sal forest, lowland evergreen forest, riverside forest and tall grass areas on the floodplains of Nepal, and in the Brahmaputra valley of Assam (Cowan, 1972; Krishnan, 1972; Brander, 1982). Presently, sloth bear occurs commonly and has a wide distribution across the tropical forest of the Indian subcontinent (Yoganand, *et al*., 2006). In the past, until the early 1800s, sloth bear may have occurred in most non-arid, low-altitude forests of India. They were reported to be abundant during the mid 1800s, but declined severely due to hunting and habitat loss from the late 1800s until the 1950s (Gilbert, 1897; Dunbar-Brander, 1923; Prater, 1948; Phythia-Adams, 1950; Krishnan, 1972).

In India, sloth bear occurs frequently in moist and dry deciduous forest (42% and 33% respectively) and less frequently in wet evergreen (13%) and dry scrub (6%) types of forest (Yoganand *et al*., 2006). Sloth bears are reported to be present in 174 protected areas in India, which includes 46 national parks and 128 wildlife sanctuaries (Chauhan, 2006). However, baseline information about their distribution and present status in India is lacking.

Out of five protected areas where sloth bear occurs in Gujarat, (Shoolpaneshwar, Jambughoda, Ratanmahel, Jassore and Balaram Ambaji wildlife sanctuaries) Balaram Ambaji and Jassore wildlife sanctuaries of the North Gujarat region have reported the highest sloth bear densities anywhere in India (Garshelis *et al*., 1999). In North Gujarat Forest Division, sloth bears have created a very formidable image among the people living in and around the Balaram Ambaji Wildlife Sanctuary (BAWLS), Danta forest of Banaskantha and the Vijayanar forest of Sabarkantha districts. Currently, man-bear conflicts are on the rise and immediate attention needs to be paid, not only to resolve the conflicts, but also for the conservation of this threatened species (Shankar and Murthy, 1995; Chauhan *et al*., 1999).

Study area

The Sabarkantha district of Gujarat State, is situated between latitudes 23° 13' 15" and 24° 35' 30" north and longitudes 72° 47' and 73° 37' 30" east. The forests are mostly confined to the northern and eastern hilly regions of the district, but isolated patches are distributed over the southern and western parts of the district. Hill ridges and rivers normally constitute the boundaries with Rajasthan State in the north and east.

The total forest area in Vijaynagar taluka (sub-district) is 293.2 km^2, which is divided in two ranges. Out of this, 168.1 km^2 comprises dense forest, 100.4 km^2 are open and a small part of this is degraded, which harbors the sloth bear population. This forest is being proposed for the sanctuary, but currently comes under the reserve forest. Vijaynagar forest has two forest ranges which support the sloth bear, namely Dholwani and Vijayanagar ranges.

The Aravalli hill range extends from the northern to the eastern border and takes a southern turn along the eastern border of the tract. The continuous and detached hills of the district are the part of the Aravalli range which starts from Khedbhrahma taluka. Vijaynagar, Dholwani and parts of Bhiloda range are hillier. The hills of these

ranges are either interlinked by ravines or form a long continuous chain.

The climate of Sabarkantha district is sub-tropical with three main seasons: summer: March-June; monsoon: July-October; and winter: November-February. There is considerable variation between the different parts of the district and between the summer and winter months. Summer begins by the end of February and continues up to the end of June, with gradual rises in temperature. April and May are the hottest months. However, Vijaynagar taluka enjoys a cooler climate during summer owing to its elevation and dense vegetative cover. Winter is quite pleasant; however, extreme cold and frost are experienced in Dholwani and Vijayngar areas.

According to the revised classification of forest types by Champion and Seth (1968), parts of the forests lying in the northeast region (Vijaynagar Range, Dholwani, Poshina, Devnimori, Mudeti, Chandarni, Pal, etc.) fall under type 5A/C-1b-Dry Teak forest. These are mixed dry deciduous forests with teak usually forming the major portion of the crop. It is interesting to note that the national boundary of teak passes through these forests of Sabarkantha. Teak is absent in Poshina range and the major parts of Vadali and Dholwani ranges. The present forest crop is mostly middle-aged to mature. The top canopy, middle canopy and understorey are easily distinguishable. The ground cover is mostly open, but seasonally clothed with herbs and grasses.

Manvel bamboo (*Dendrocalamus strictus*) occurs mainly in Dholvani, Bhiloda and Vijayanagar areas. The bamboo crop was once very rich in Righad and Poshina ranges, but now it is observed to be deteriorating.

There was a time when tigers roamed the area. Polo forest, a rich biodiversity area, is the northern limit of teak forest in the country. Sloth bear, leopard, and four-horned antelope are frequently seen in the forests of Vijaynagar, especially in the forests of Polo and Vanaj. A forest guard at Vanaj claimed that he saw a group of eight bears in Vanaj forest in 1999 (Singh, 2001).

Materials and methodology

The nocturnal foraging habits of sloth bears are the primary reason for the lack of adequate data gathered based on direct observations on their feeding behavior. But in many places where there were less disturbances, bears were also seen active during the daylight hours. So data on composition and seasonal variation in bear diet were based on scat analysis.

Scats were collected from different habitats during the transect work and while surveying the forest for animal signs. During the monsoon season there was a sudden bloom of the vegetation cover. Faeces were also collected opportunistically from the feeding and resting sites and along trails. Faeces were collected in polythene bags, sun dried, and then stored for further analysis. Efforts were made to collect scats every month; however, this was difficult during the monsoon period.

Results and discussion

Variations in dietary composition in the summer, monsoon and winter seasons were estimated.

Despite their adaptations for myrmecophagy, results of past studies indicate that diets of sloth bears may vary seasonally and geographically across their range from Nepal, south through India to Sri Lanka, depending on the availability of fruit and the hardness of mounds that harbour colonies of termites (Baskaran, 1990; Davidar, 1983; Eisenberg and Lockhart, 1972; Gokula *et al*., 1995; Gopal, 1991; Laurie and Seidensticker, 1977; Schaller, 1967). Sloth bears in Royal Chitwan National Park in Nepal, moved seasonally between lowland and upland habitats (Joshi *et al.*, 1995) and it was hypothesized that changes in the availability of food prompted these shifts in home range.

In the present study we analysed 132 scats (summer (n=52), winter (n=25) and monsoon (n=57)), which were further analysed with the percent frequency of the seasonal diet. Analysis revealed 12 kinds of plant matter, and animal matter that included insects (large red ant, large black ant, honey bees and beetle). In 2-3 scat samples bird feathers and the hair of the small mammals was

found (Table 1). Other materials which were found to have been ingested with the food were stones and mud.

Table 1: Food items found in the scats of sloth bear

Plant matter	Animal matter	Non- food matter
Carrisa congesta *Cassia fistula* *Cordia dichotoma* *Cucurbita* spp *Diospyros melanoxylon* *Ficus* spp. *Madhuca indica* *Mangifera indica* *Miliusa tomentosa* *Syzygium* spp. Unidentified plant material *Zizyphus* spp.	Insects (large red ants, large black ants, termites, bees, beetles) Hair Feathers	Mud Stones

In Wilpattu National Park iin Sri Lanka, Eisenberg & Lockhart (1972) found that sloth bears fed heavily on termites and fruits when in season. Schaller (1967) examined 92 sloth bear droppings in Kanha National Park in Central India, and found that termites were the year-round staple, with fruits important primarily from April to June.

In summer, the sloth bear was found to feed more on *Ficus* spp. (35%), which is very common in this area and present in good numbers throughout the year. The vegetation survey in this area recorded *Ficus benghalensis*, *Ficus religiosa*, *Ficus racemosa*, *Ficus arnottiana* and *Ficus virens*. *Ficus* spp. also appeared in the monsoon and summer season diets (60 & 34 % respectively). Most of the *Ficus* species are fruiting throughout the year and they comprise the major source of diet for sloth bear in the monsoon and summer seasons.

In winter, *Cassia fistula* was the fruit most frequently taken (84%), along with insects (35%).

With the onset of the monsoon, the rain water softens the soil and bears have been documented digging extensively for termites and ants at this time (Schaller, 1967; Davidar, 1983; Gopal, 1991; Joshi *et al*., 1997).

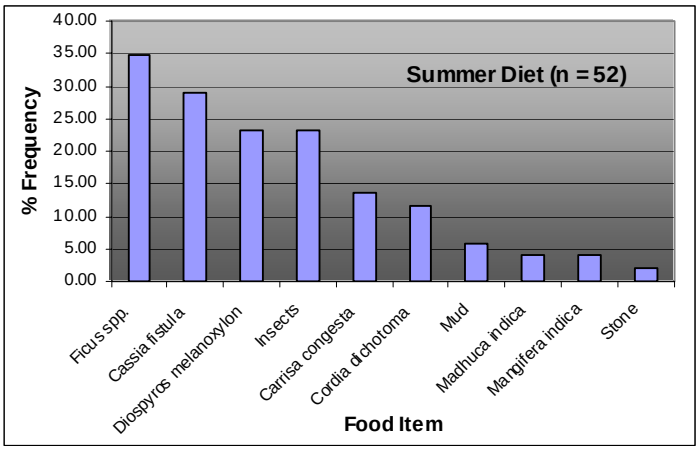


Fig. 1: Summer diet

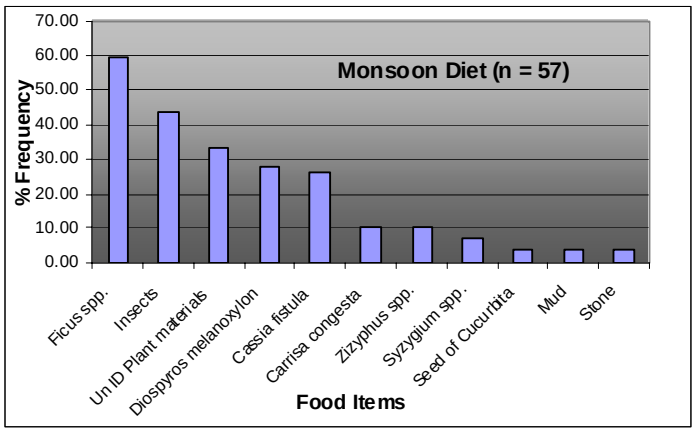


Fig. 2: Monsoon diet

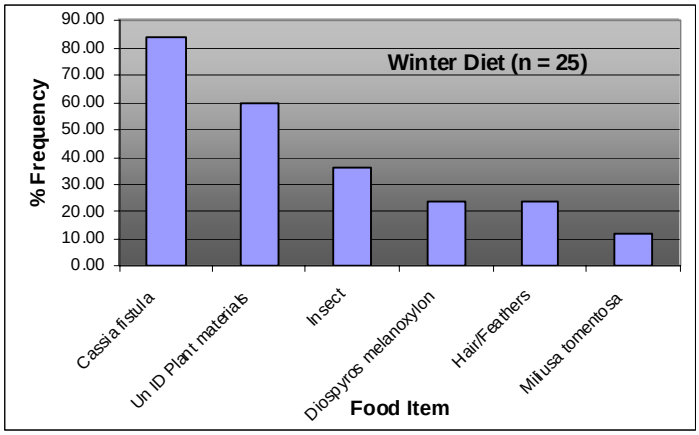
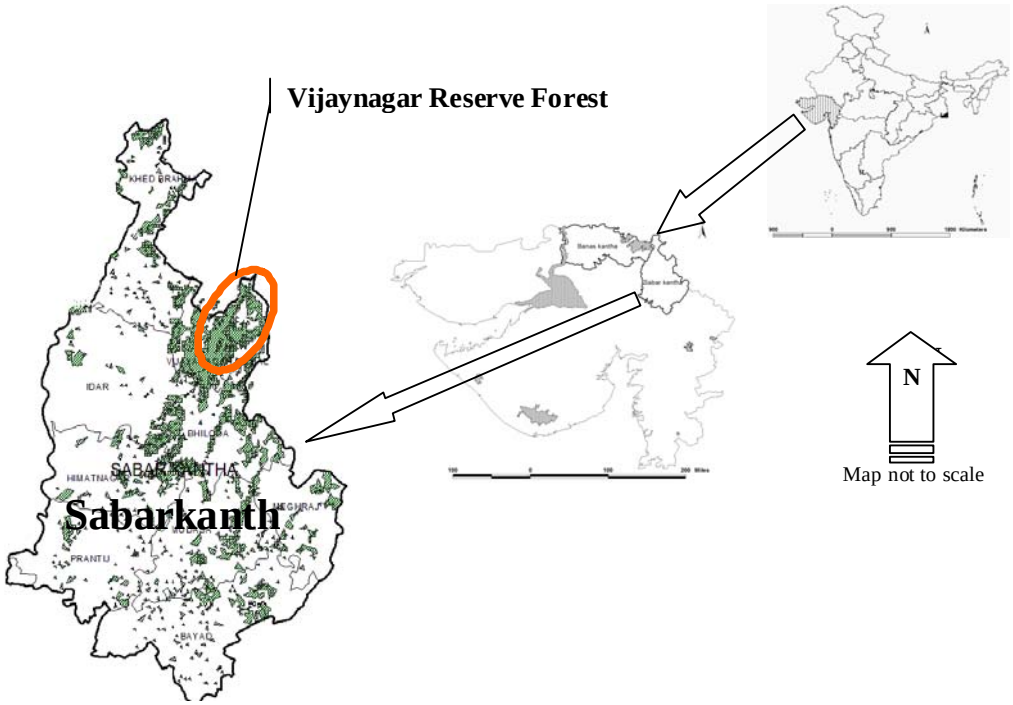


Fig. 3: Winter diet



Map showing the study area in the north Gujarat's District Sabarkantha, and the forested area of the Vijayanagar Reserve forest (source: FSI report 2003)

The sloth bear's insect diet again supports diversity in the different forms eaten like red ants, black ants, beetles and honey bees. This is clearly observed in the monsoon and winter diets. We believe that the relative importance of plant matter in bear scats during summer is due to seasonal flowering and fruiting. In contrast, hard soil during summer probably deterred bears from digging for termites and ants (Davidar, 1983; Gopal, 1991; Joshi *et al*., 1997).

In the degraded habitats of Vijayanagar, Sabarkantha district of North Gujarat, both animal and plant matter contribute to the diet of sloth bear. However, *Ficus spp*. plays an important role by providing a constant supply of food throughout the year. This is particularly important during summer when there are no crops in the fields to raid and fewer fruiting species, and bears find it difficult to dig for termites and ants.

Recommendations

We recommend that cutting and lopping of *Ficus* trees around sloth bear den sites and inside the forested area should be prohibited. To lessen conflicts, villagers should avoid the collection of minor forest product inside the forests which are preferred by bears.

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ODONATES OF BARIPADA DIVISION OF SIMILIPAL BIOSPHERE RESERVE, INCLUDING NORTH ORISSA UNIVERSITY CAMPUS, ORISSA, INDIA

by S.K. Das, H.K. Sahu and S.D. Rout

Introduction

Among the insect world Odonates occupy a vital position in ecosystems as both adult and larvae are valuable indicators of water quality and landscape disturbance (Watson *et al.*, 1982; Caastella, 1987). They are also an important and widespread component of freshwater ecosystems, being top predators (Corbet, 1962).

According to Silsby (2001), eight superfamilies, 29 families and some 58 subfamilies of dragonflies for approximately 600 genera and 6,000 named species have so far been described all over the world. Prasad and Varshney (1995) gave a checklist of Indian odonates listing three sub-orders, 17 families, 139 genera and 499 species and subspecies. Fraser (1933-36) dealt in detail with the odonate fauna of India including some species from Orissa.

Previous works on odonate fauna in the state of Orissa were undertaken by Laidlaw (1915), Fraser & Drover (1922), Srivastava & Das (1987) and Mitra (2000). As recorded earlier, 16 species of odonates were reported from Similipal Biosphere Reserve (Sethy & Siddiqi, 2007).

The study area is a semi-urban area and comes under Similipal Bisphere Reserve (SBR), Orissa.

Urban areas are highly modified and complex landscapes, within which green or open areas are seen as valuable for human well being as well as wildlife (Pickett *et al.*, 2001, 2004). The most imminent threat to odonata species persistence is the loss of suitable habitat. Diversity and extent of habitat will continue to decline as human populations increase and alter landscapes for agriculture and development. Therefore, this study was designed to get precise information about the odonata diversity of this particular area with relation to different seasons.

Study area

Baripada Division of Similipal Biosphere Reserve (SBR) is situated in Mayurbhanj in Orissa (India), lying at the extreme northern end of the Eastern Ghat (21°55' N and 86°45' E). It is just 10 km east to Similipal Biosphere Reserve (Tiger Reserve and proposed National Park) and within the biotic province Chhotanagpur Plateau. It is the representative ecosystem under the Mahanadian Biogeographic Region. The township is surrounded by large open areas comprised of barren lands, grasslands scattered with small patches of shrubs, city parks, home gardens, orchards, perennial water bodies and with some reserve forests. The study area includes North Orissa University (N.O.U) campus, located 5 km south of the district headquarters, Baripada, in the district of Mayurbhanj and comes under Similipal Biosphere Reserve. The university area encompasses 110 acres of land with varied habitat.

There are two reserve forests also present inside the study area. One is Manchabandha (under JFM), just 3 km south of the university campus. The area is sal (*Shorea robusta*) dominated and the ground vegetation is also covered by newly grown *sal* trees. The other forest is Budikhamari reserve (under JFM) forest, 7 km. south of the university campus with the same characteristics as Manchabandha.

Methodology

The survey of Odonates was carried out in three different locations for 1 year from September 2008 to August 2009 in all three seasons, viz. summer (March to June), monsoon (July to October) and winter (November to February). The direct searching method, which includes visual encounter surveys (Heyer *et al.*, 1994).) was used. Transects were randomly selected and species were collected from different locations. Collected odonates were identified with the help of Subramanian (2009).

Results and discussion

In all, 58 odonate species are known to inhabit Orissa (Srivastava and Das, 1987). This study records the distribution of 31 species of odonates in the Baripada Division of SBR under 25 genera and 6 families. A detailed systematic list of odonates is presented in Table.1. Of these odonates, family Libellulidae (19) is well represented followed by Coenagrionidae (6), Calopterygidae (2), Gomphidae (2), Lestidae (1), and Ashenidae (1). Among the collected Libelluids, *Pentala flavescens* (Fabricius) and *Orthretum sabina sabina* (Drury) were more abundant during the monsoon season. In the case of Zygopterans, *Ischnura aurora* (Brauer) was more abundant than others inside the study area. The family and species level classification follows Davies and Tobin (1984, 1985) and Prasad and Varshney (1995).The prey of the adults consists mostly of the harmful insects of crops, orchards and forests, and thus has a regulatory impact on agroforestry. Their aquatic larvae constitute a natural biological control over mosquito larvae and thus help to control several epidemic diseases like malaria, dengue, filarial, etc. (Mitra, 2002). But several developmental activities such as the construction of buildings, roads, and stone crushers in the peripheral areas have a direct impact on the population of the odonates as their habitats and food are being destroyed by such activities. In temperate regions, the greatest threat to many odonata species is the intensification of modern agriculture (Moore, 1991a). It may lead to the local extinction of sensitive species. Public awareness is required to conserve these odonates and their habitats. An extensive odonatological survey needs to be carried out to explore the rich diversity of these elegant insects.

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Table.1: Checklist of Odonates of Baripada Division, SBR

Sl NO.	Family	Name as in Fraser, 1933-36	Name as in Prasad & Varshney, 1995
I	**Coenagrionidae**		
1		*Agriocnemis pygmea*	*Agriocnemis pygmea* (Rambur,1842)
2		*Ceriagrion coromandelianum*	*Ceriagrion coromandelianum* (Fabr.,1798)
3		*Ceriagrion olivaceum*	*Ceriagrion olivaceum* Laidlaw,1914
4		*Ischnura delicata*	*Ischnura aurora* (Brauer,1865)
5		*Ischnura senegalensis*	*Ischnura senegalensis* (Ramb.,1842)
6		*Pseudagrion microcephalum*	*Pseudagrion microcephalum* (Rambur,1842)
II	**Lestidae**		
7		*Lestes viridula*	*Lestes viridulus* Rambur,1842
III	**Calopterygidae**		
8		*Neurobasis chinensis*	*Neurobasis chinensis* (Linnaeus,1758)
9		*Vestalis apicalis*	*Vestalis apicalis* Selys,1873
IV	**Gomphidae**		
10		*Ictinus rapax*	*Ictinogomphus rapax* Rambur,1842
11		*Mesogomphus lineatus*	*Paragomphus lineatus* (Selys,1850)
V	**Aeshnidae**		
12		*Anax guttatus*	*Anax guttatus* (Burmeister,1839)
VI	**Libellulidae**		
13		*Acisoma panorpoides*	*Acisoma panorpoides* Rambur,1842
14		*Aethriamanta brevipennis*)	*Aethriamanta brevipennis* (Rambur,1842)
15		*Brachythemis contaminata*	*Brachythemis contaminata* (Fabr.,1793)
16		*Bradinopyga geminata*	*Bradinopyga geminata* (Rambur,1842)
17		*Crocothemis servilia*	*Crocothemis servilia* (Drury,1770)
18		*Diplacodes trivialis*	*Diplacodes trivialis* (Rambur,1842)
19		*Neurothemis fulvia*	*Neurothemis fulvia* (Drury,1773)
20		*Neurothemis tullia*	*Neurothemis tullia* (Drury,1773)
21		*Orthetrum pruinosum*	*Orthetrum pruinosum* (Rambur,1842)
22		*Orthetrum sabina*	*Orthetrum sabina* (Drury,1770)
23		*Pantala flavescens*	*Pantala flavescens* (Fabr.,1798)
24		*Potamaracha obscura*	*Potamarcha congener* (Rambur,1842)
25		*Rhodothemis rufa*	*Rhodothemis rufa* (Rambur,1842)
26		*Rhyothemis variegata*	*Rhyothemis variegate* Linn.,1763
27		*Tholymis tillarga*	*Tholymis tillarga* (Fabr.,1798)
28		*Tramea basilaris*	*Tramea basilaris* Kirby,1889
29		*Trithemis aurora*	*Trithemis aurora* (Burmeister,1839)
30		*Trithemis festiva*	*Trithemis festiva* (Rambur,1842)
31		*Trithemis pallidinervis*	*Trithemis pallidinervis* Selys,1889

(continued on p.17)

(continued from p.16)

Learning the life: Calves with their mothers in the Rajaji National Park (Photo: Ritesh Joshi)

DOES ASIAN ELEPHANT (Elephas maximus) CO-EXIST WITH HUMAN BEINGS? A CASE STUDY FROM THE RAJAJI NATIONAL PARK, INDIA

by Ritesh Joshi

Introduction

The Shivalik forest represents a good deal of variations in altitude, topography and climatic conditions. As a consequence, this region is one of the richest in faunal diversity and a very congenial home for the Asian elephant (*Elephas maximus*). Keeping the view of conserving the elephant in its natural habitat, a few research-oriented studies have been conducted in this park. The present note is a part of a long-term study on the behavioral biology of Asian elephant in the Rajaji National Park area. The author has been conducting research activities in this area for the last eight years.

The Shivalik hills offer the most prominent geomorphic features of this tract and the river Ganges has cut across these hills at Hardwar. Rajaji's biological system provides an opportunity to study the behavioral biology of the world famous Asian elephant, due to the rich floral diversity, complexity and accessibility. However, a few of the areas under the park are fragile; mainly due to increasing anthropogenic activities. As many of the forest ranges of the national park are associated with human habitation, therefore, there are strong

reasons for depleting forest resources and to provide new land for cultivation and that is one of the major strong pressures that has caused serious man-elephant conflicts in this region. All of these findings may have wider implications for developing predictive models of human-elephant interactions.

During the last 4-5 years the wildlife in the park appears to be under constantly increasing stress. It has been mainly due to increasing anthropogenic encroachments into the deeper forest areas, either to meet the daily requirements of the rural people living on the periphery of the park or due to a number of developmental activities and park-related management works. The status of the elephant in the adjoining countries is equally poor. Nepal, which has the lowest country population, has lost over 80% of its elephant habitat on account of human settlements. Bangladesh, Myanmar, Cambodia, Vietnam, Laos, Sri Lanka, etc. are also rapidly losing their natural forest cover, especially the elephant habitats. In Thailand, in spite of the elephant having been a protected species since the 18th century, over-exploitation of the habitat and the pressure of human population has made the species highly vulnerable (Daniel, 1996).

The problem of existence is more acute for the large-sized mammals, including the elephants. The increasing number of accidents in the area is another indicator of straying outside the park of these wild animals besides the increasing instances of man-animal conflict. The most noteworthy point is that in many places the elephants of Rajaji have lost their traditional migratory routes over the last 4-5 years. Formerly, the elephants of the Rajaji followed a fixed route for entering the adjoining areas and for re-entering the forest area, but presently their traditional routes are denied to them, as they have been replaced by human habitations. This may cause changes in their inter-breeding in intra-breeding, which generally leads to changes in their genetic material.

Hardwar-Dehradun railway track, which passes through the Rajaji National Park, acts as an unnatural death trap for many wild animals, including the major species elephant. During the last decade so many accidents resulting in deaths of elephants have taken place on this part of the track. However, the most dangerous part of the railway track for animals is between Motichur to Kansrao (Hardwar-Dehradun railway section), which has caused the accidental deaths of 19 elephants since 1987 besides many other wild animals. A preliminary study has focused on the recurrence of rail accidental deaths of elephant in the Rajaji National Park and gives safety suggestive measures in relation to its conservation (Joshi & Joshi, 2000). Though not common, there are often instances of human beings attacked, thrashed and killed by elephants. The Rajaji area is no exception to this phenomenon. In the recent past a number of such direct attacks on human beings, especially when they are solitary, have occurred more frequently than in the past.

Elephant died due to collision with train in 2000 inside the Rajaji National Park (Photo: Ritesh Joshi)

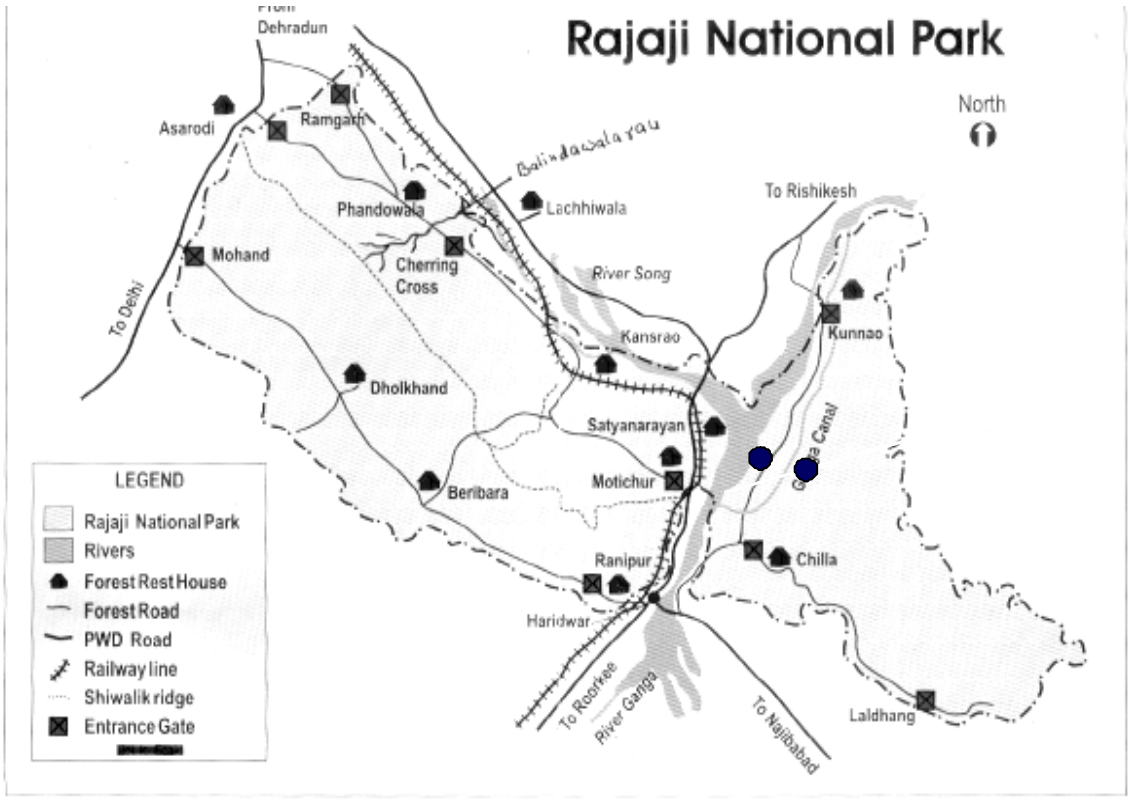

Figure 1. Map of the study area.

Methodology

Study area

Rajaji National Park (29°15' to 30°31' north latitude, 77°52' to 78°22' east longitude) is spread over an area of 820.42 km² in and around the Shivalik foothills, which lies between the lesser Himalayas and the upper Gangetic plains. Spread across Hardwar, Dehradun and Pauri districts of Uttarakhand state, Rajaji National Park has been designated as a reserved area for "Project Elephant" by the Ministry of Environment and Forests, with the sole aim of maintaining a viable population of elephants in their natural habitat. The Shivalik Hills offer the most prominent geomorphic features of this tract. The river Ganges has cut across these hills at Hardwar. The Chilla forest area of the Rajaji National Park lies to the east of the river Ganges and is attached to the Garhwal Forest Division. The study has been ongoing in Hardwar (District-Hardwar), Chilla (District-Pauri) and Motichur (District-Dehradun) forest ranges of the Rajaji National Park since 1998. The altitude lies between 302-1,000 m asl. The study site falls in the sub-tropical moist deciduous forest type.

To study the various aspects of conservation the entire area of Rajaji National Park in Uttarakhand was surveyed in depth for about seven years (1999-2006). The traditional feeding grounds and movement patterns of elephants were located and observed and plotted on maps. The causes of conflicts and the major problems were thoroughly investigated from an environmental conservation point of view. The natural behaviors of elephants were observed both during day and at night with all precautionary safety measures. Different forest blocks of the concerned forest ranges were chosen one after another sequentially and searched for elephants for about approximately 10 – 12 hours (depending upon climatic conditions) in a single day search. The observations started in the early hours of the morning, as it is the best time to search

for and observe the elephants in open areas, and for four hours in the afternoon, i.e., before sunset. Field binoculars were also used to observe the elephants' feeding behavior from an adequately safe distance without disturbing the animals.

The data collected was part of the animal monitoring activities. The daily record was based on direct sightings of animals, indirect evidence such as feeding signs, footprints (approximate time the were made), etc. The direct sightings were noted in duly prepared proformas, recording the herd composition, age and sex, whether observed in groups and also the place of sighting, time and vegetation type. Villagers of adjoining areas, Gujjars (where available), forest department staff, researchers from various scientific institutions, non-government organizations and other individuals working on this problem were interviewed.

Results and discussion

A substantial amount of work has already been done on the wildlife biology of Asian elephants (Johnsingh *et al.*, 1990, 1999; Williams *et al.*, 1998; Singh, 1987). However, no in-depth study of man-elephant conflicts with reference to socio-economic upliftment of local rural agricultural communities has been made; therefore, it was desirable to undertake work on this aspect. At the dawn of the 20th century the Gujjars of Jammu and Kashmir moved into the Shivaliks hills. Here they raised buffalo and practiced transhumance pastoralism, spending autumn (approximately October to April) in the Shivaliks and the summer and the rainy seasons (May to September) in the alpine pastures of the Himalayas. Migration between these grazing zones took up to three months. The Gujjars are totally dependant on the forests for their needs of fodder, fuelwood and timber for their dwelling huts called "Deras". Their current unsustainable life style is a major drain on the resources of the park. There was stiff competition for fodder and water between wildlife and the cattle of Gujjars. Traditionally, the Gujjars who lived in and use the Shivaliks were absent during the monsoon, the main growing season, when they migrated to the alpine pastures of the Himalayas. The diverse vegetation of Shivaliks accumulated during the rainy season, and when the Gujjars returned in the autumn their animals benefited from the fodder reserve.

As per the directions of the Hon. Supreme Court of India, most of the Gujjars families have been resettled outside the park area. But in few of the areas (some of the forest compartments/ranges) they are frequently living outside or peripheral to the park area. They have been resettled in Pathri, one of the two rehabilitation sites. Two acres of land was allotted to each family for cultivation, but unfortunately during the last four years, many of these Gujjar families are not interested to live outside the park area mainly due to of lack of proper fodder for their animals. The second rehabilitation site is at Gaindikhata. It was observed and inferred from the present investigation that after the resettlement of Gujjars outside the park area, the movement activities of the elephant continued to increase after all the natural water holes were freed from their deras and cattle. In Rajaji National Park area they still exist in few of the forest ranges, as the rehabilitation process is currently ongoing.

The Motichur area of the Rajaji lies to the west of the river Ganges, whereas the Chilla area lies to its east. There are four islands within the river in this region, which form part of the park. However, in the 1950s and 1960s a number of developments having drastic effects on the land use came up on the western bank. The BHEL set up a major plant to the west of the Ganges in the southern park of this trans-Ganga corridor for wildlife, especially elephants. Later, the IDPL set up a large factory in the northern part of the corridor, also to the west of Ganga. The Army has utilized the area in between for a large ammunition dump and subsequently some remaining land was given away for the rehabilitation of Tehri Dam oustees.

On the east bank yet another major development activity has destroyed one of the biggest ecological corridors. A hydel power project was set up in the 1970s and a barrage was constructed across the Ganga at Kunnao area just outside the park in the middle of the northern boundary. From here, a deep power channel runs parallel to the east of Ganga for about 14 km up to Chilla, where the powerhouse is located. Although there are a couple of narrow bridges over the channel, these are not

generally utilized by the animals. There have been cases of deer and even elephant mortalities in attempts to cross these bridges. In rare instances elephant bulls and identified groups are known to cross, but otherwise there is complete isolation between the western and eastern components of the ecological unit now managed as Rajaji National Park.

A military complex, including an ammunition dump, based at Raiwala in Dehradun district is situated in the center of the park and covered by park ranges on both sides. This army complex is adjacent to the famous corridor area of the park, which is commonly known as Chilla-Motichur corridor. There are reports of elephants trying to enter the fenced area of the army ammunition dump. The presence of the army camp in the elephant corridor has also adversely affected the movement of wild animals. Almost at the same place, one relocated village has 29 families, originally from Khand village of the submergence zone of the Tehri dam. The village occupies an area of 48.56 ha and 18 houses have been constructed by the villagers. Out of 29 families at present, there are 18 families located inside the park area and 11 families who have yet not constructed their houses in Johra block but who are occupying the land. The village is located in the elephant migration corridor and is an obstacle to their movement. Elephants follow this route for their seasonal movement and migration to and from the Chilla/Motichur forest. Rajaji National Park falls under the sub-tropical moist deciduous forest vegetation type, therefore, there are seasonal variations in fodder species. Elephants use the whole of the park area for their movements, but mostly they leave some areas for few months, when there is less vegetation cover, and move towards other forest ranges which are richer in fodder species. At that time a few of them (mostly solitary bulls) use the same feeding grounds.

A large mammal like the elephant could be expected to move considerable distances even within a short time period and at the same time families of a clan seemed broadly coordinated in their seasonal movements (Sukumar, 1989). In the dry months, i.e., from January to April, when no rainfalls occur, the herds seek the neighborhood of considerable streams and shady forests and from the month of June, after the first showers, they emerge to roam and feed on the young grass. By July and August this grass in the hill tracts becomes long and course. The elephants then descend and move again to the lower areas, where the grasses are not so far advanced. One of the reasons for the elephants and other animals migration is the highlands continuous and uninterrupted hilly terrain for grazing, assured food, an ideal breeding ground, thick population, etc. (Sinha, 1981).

Hardwar-Dehradun National Highway in Motichur forest range, BHEL roads in Hardwar forest range, Hardwar-Ranipur by-pass road in Hardwar forest range, Hardwar-Chilla-Rishikesh motor road, Hardwar-Laldhang-Kotdwar motor road, and Hardwar-Bijnor National Highway in Hardwar forest division are a few of the motor roadways which have too much heavy traffic passing along them. Holy temples like Goddess Mansa devi, Chandi devi, Sureshwari devi, Bilkeshwar, etc., are also situated inside this park area, as a result of which the visiting devotees and workers of the above-mentioned temples are also hindering the local movement of elephants. In a few of the areas the elephants' natural paths are also peripheral to these temples; therefore, when any elephant herd is on the move their movement is restricted by the presence of local people. In addition, some irresponsible local people also restrict the elephants' movement inside the park area with recreational activities, setting off firecrackers and throwing stones to shoo away the elephants or other wild animals. There are many instances when religious banquets on a large scale are organized in these temples. Hordes of visitors disturb the elephants that come to drink water in the afternoon. More than 600,000-700,000 people visit the Mansa devi temple every year. In other temples more than 50,000 people visit annually. The crowds are especially noticed during the Shivratri and Sawan Purnima fairs.

During the study, it was noted that the cultivators-elephant problems were quite conspicuous. Crop damage problems, along with human and elephant casualties, especially around the villages peripheral to the park area and around the railway track which passes through the park area, are too high. During the recent past, the park authority has faced several questions about the problems of this endangered

Two bull elephants walking along the Hardwar - Bijnor National Highway (Photo: Ritesh Joshi)

animal. In fact, this has emerged as a very serious problem recently.

Park officials mentioned that a few villages, due to their proximity to the park area, face more crop raiding problems, especially during the night. It is difficult to observe and force the animal back to the forest area from a safe distance, due to a lack of facilities. This may lead to casualties. During the author's period of investigation, he always contacted the villagers personally, to discuss such problems and to find possible remedial measures, which may come up as a result of long association and experiences of these rural people of the area. One day when returning back from the forest area in the evening, the author saw on the Hardwar bypass road (industrial area road) that a crowd was looking at an object towards the forest area. A few persons were making loud noises and throwing stones at the object. Upon a closer look, the author observed that a solo bull elephant was feeding on bamboo. The next day, when discussing some matter with the forest officer at Hardwar forest range office, the Range Officer told me about the casualty of a villager in the same area of the elephant disturbance the previous night.

It was inferred that most of the villagers are unaware of the rules and regulations of the national park, though their participation in the conservation of valuable forest and endangered wildlife is highly required. Many of the villagers are also ignorant as far the elephants of this area are concerned. When a villager was asked a question about what are the reasons for this serious crop raiding by elephants and what the concerned department has done to control this problem, he replied that he was not sure, but 8-10 years back perhaps the elephant population was not as big as it is today on the one hand and the vegetation cover is less, but that it was also said that the elephants are dropped by helicopter to the park area and forest officials allow them to raid the fields.

This type of answer was heard from a number of villagers. In a few of the villages the author became aware of the bad image of the concerned department due to various reasons. This is one of the most important factors which give rise to the seriousness of man-animal conflicts in this part of the globe. If occasionally an elephant injured a villager or damaged the crops, the villagers requested the author to help them to get compensation from forest officials. This shows that there is a communication gap or some sort of fear psychology among the villagers towards the concerned staff. Under such conditions, strong and well-planned conservation strategies need to be implemented by using various scientific researches for conserving the highly endangered Asian elephant; otherwise they are bound to become extinct in the near future.

Management problems

Some of the common management problems associated with elephants in the park are related to the inevitable consequences of their large body size and high intake of food. The elephant is the largest terrestrial mammal on earth and requires a great amount of food and water. In the wild, an adult male elephant will spend as many as 18 hours feeding, consuming as much as 280 kg of food and 140-200 liters of water per day (John & Subramanian, 1991). The seasonal movement of elephants in the park is also affected by the availability of food and water. A preliminary study has described the crop-raiding problem in south India along with elephant's migration during dry season (Nair, 1990). One of the reasons for raiding of crops by elephants is due to the unavailability of their natural food (Dorji, 1997).

The plantations that adjoin the park along the north-west boundary are situated on land that was once part of the elephant's home range. Therefore, the present escalation of the man-elephant conflict is unfortunate but inevitable. The present boundary wall along the foothill margin from Ranipur to the Harnol area has failed to check the elephants from straying out of the park. The electric fence from Motichur forest rest house up to Raiwala around the railway track is presently damaged due to lack of proper maintenance. During the present study it was observed that regulating the animals' movement near the railway track hinders their routine movements for range utilization for their essential biological requirements, because both sides of the track comprise park areas with plant species that elephants feed on. In a few of the villages the concerned department has also enclosed sensitive areas to restrict the elephants' movement with electric fencing, but due to lack of maintenance and unawareness of the local people, the fencing has become damaged and fails to control the movement of elephants.

In the absence of an adequate buffer zone to separate the elephants and human beings from each other (which is practically impossible), a powerful, well-constructed electric fence may have some chance of mitigating the present elephant-man conflicts. Seasonal water streams are another major problem as far the straying of animals is concerned. Broad iron pillars buried deeply in strengthened concrete bases with strong, wide horizontal iron bases at the upper side could be another way to keep the elephants from straying out of the park. They would need proper maintenance in the rainy season when floods are at their peak and rainwater carries floating refuse and debris along with raw timber pieces.

Rajaji National Park represents one of the important sub-tropical moist deciduous protected areas for elephants in India. At present, observations from this study indicate that the elephant population is below the park's carrying capacity since there are no obvious signs of any over-utilization and habitat deterioration. The long-term survival of elephants and the viability of the park itself as a self-sustaining eco-system would depend very much on wise management practices that incorporate both socio-economic as well as ecological considerations. Rajaji National Park serves as a good natural home for Asian elephants, but increasing crop depredations and the straying tendencies of elephants reveal their increasing uneasiness within their habitat, which is forcing them to move out of the park area. The situation in the park conforms to the last category in that it involves elephants inhabiting an area that is capable of maintaining them yet they still carry out crop raiding along the boundary where small scale plantations, small holdings and human settlements abound.

With the increase in the human population, the demand for cultivated land is also ever increasing. To meet the demand and supply chain more and more forests are being converted into agricultural land, which disturbs the ecological balance. This diversion of the inhabitants from traditional natural sources to new ones is primarily due to the shortage of food and water resources in the forest, which forces them to divert their search for the food towards the villages and settlements, which in turn gives rise to various accidents sometimes leading to the death of the animal. The presence of human beings in the forest areas makes the animals feel insecure and unsafe. This includes railway tracks and highways which run between the forests.

Conclusion

The Asian elephant has became a seriously endangered species and is listed as such in the *Red Data Book* of the International Union for the Conservation of Nature and Natural Resources (IUCN). On the basis of this study and available information, a large number of recommendations could be suggested. However, promoting the general awareness among the local people about the animal is most urgently required, which could be done through the media and by organizing awareness programmes in this area. It is not possible for elephants to be restricted to eating only few plant species which are left in the park area, as they need more variety of plant species to fuel their large body size. Therefore, the most effective way to deter the elephants from straying to areas outside the park would be to stop the local people/villagers from lopping and felling the fodder plant species.

Controlling the movement of human beings inside the park area and stopping the poaching of wild animals are other ways for conserving the elephants. The long-term survival of elephants in such a restricted area as the Rajaji National Park calls for the skillful management of elephants at or below the carrying capacity of the park. The future park management emphasis should not be on its declaration as a protected area, but on the proper maintenance of the elephants at a level at which benefits outweigh the costs.

Recommendations

- To control the heavy traffic between Haridwar and Raiwala, a fly-over is needed, which will help in reducing the number of accidental road deaths of wild animals and which would allow them to move freely within the Motichur – Chilla corridor. There is also need to educate the local people and tourists not to feed wild animals in the forest stretch, which also attracts elephants to feed on the remains.
- Complete the Gujjar relocation/rehabilitation from Rajaji National Park area from the few forest pockets where they still live.
- Strengthening of the Chilla –Motichur and the Rajaji – Corbett corridors.
- The army ammunition dump should be shifted elsewhere, along with their settlements.
- Islands on the river Ganges (including Dudhia forest beat of Hardwar forest range) should be restored and free from any anthropogenic disturbances.
- Traffic should be stopped along the Chilla – Rishikesh road during night hours.
- Artificial water holes must be created, spread within the park area at short distances. In Chilla forest, artificial water ponds will be constructed using the Ganga canal, which will help during hot periods.
- As the park area is mainly within the Dehradun/ Hardwar region, it is proposed that the time of the night trains be shifted approximately half an hour earlier than the present schedule time. By employing this method the train could be made to move slowly and can be easily stopped in an emergency through the park area up to Hardwar.
- A few sub-ways (elephant underpath ways) may be constructed at the places where elephants cross the railway track and the national highway.
- The foothills near the track must be widened and cleared for better and distant visibility of the train drivers as well as for the wild animals.

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FOREST VEGETATION AS THE CUSCUS FEEDING PLANTS IN UDOPI WOSI VILLAGE FOREST COMPLEX, MANOKWARI DISTRICT, PAPUA

by Obeth Nakoh, Petrus I. Bumbut and Matheus S.E. Kilmaskossu

Introduction

The native mammal fauna of the island of New Guinea is depauperate, meaning that many kinds of mammals found in adjacent regions are lacking here. New Guinea here refers to the whole large island of Irian, composed of Indonesia's Papua province and Papua New Guinea.

New Guinea's mammal fauna is made up of two kinds of monotremes (egg-laying mammals), around 60 species of marsupials (pouched mammals) and about 60 species of rodents. However, marsupials are far more diverse. The rodents are represented by just one family that includes rats and mice (Muridae). Marsupials consist of seven families and they range from tiny mouse-sized carnivores to large herbivorous kangaroos. Belonging to this group are the cuscus, which New Guinea can claim as a native.

Going west from New Guinea through Indonesia, one can also find other kinds of mammals. In the island of Sulawesi, for example, are found native monkeys, buffaloes and various wild pigs, rodents like the porcupine and squirrels, as well as two kinds of cuscuses.

Petocz (1987) mentioned that of the 11 cuscus species found in New Guinea, 5 of them are now protected by the Government of Indonesia through a decree issued by the Ministry of Agriculture (SK Menteri Pertanian Nomor 247/KPTS/UM/11/1979). The five protected species are: *Phalanger orientalis, P. gymnotis, P. rufoniger, P. vestitus* and *Spilocuscus maculatus*. However, the livelihoods of the people in Papua are linked with the natural environment; which is why cuscuses are still being hunted as food. As the hunting activities are still increasing, management steps must be taken to prevent their extinction in the future.

For this purpose, information about the cuscus feeding plants is very important, related to the efforts in their conservation *ex situ*, as their current condition in nature is threatened due to frequent hunting. Menzies (1990) noted that the cuscus is hunted not only for its meat, but also for its beautiful fur, which is utilized for several decorations and handicrafts like bags, purses, hats or ornaments, in addition to being kept as pets.

Based on the conditions mentioned above, the efforts for *ex situ* conservation of cuscus are necessary. Preliminary information required to support the effort concerns the forest plants which are used by the cuscus as feeding plants.

Materials and methods

The study was conducted in Udopi Wosi Village Forest Complex, Manokwari District, Papua, Indonesia, from May 27– June 22 2006. The method used was a descriptive method with observation technique. The variables in this study consist of plant species and the parts of plants eaten by cuscus. The data was analyzed using the tabulation method and presented in the form of tables, graphics and photos.

Results and discussion

The results of identification based on morphological characteristics according to Menzies (1991) show that there are two cuscus species in Udopi Wosi Village Forest Complex, i.e., *Spilocuscus maculatus* and *Phalanger orientalis.* Based on color, *Spilocuscus* sp. is a bright brown color and spotted, while *Phalanger* sp. is brown to dark brown and has a black line (stripe) at the dorsal.

The feeding plant species of cuscus

Based on the field observations, the forest plants that are consumed by cuscus consist of 21 species from 16 families. The food plants of cuscus at Udopi Wosi Village Forest Complex are shown in Table 1.

According to Table 1 the highest number of forest plants that the cuscus consume belong to Family Moraceae (5 species), Family Meliaceae (2 species) and the other 14 families are represented by one species each.

Parts of plant consumed by cuscus

Field observations also revealed which parts of the plants the cuscus feed on, as shown in Table 2.

From Table 2 it is seen that cuscus consume the fruits of 18 forest plant species and the leaves from only five plant species.

The cuscus consume the fruits because they contain water and are more fibrous, which is good for the digestion. The parts of leaves consumed are mostly young leaves or shoots.

Table 1: Food plant species of cuscus

No.	Family	Species
1.	Anacardiaceae	1. *Spondias dulcis* Forst
2.	Araceae	2. *Scindapsus* sp.
3.	Caesalpinaceae	3. *Intsia bijuga* OK
4.	Casuarinaceae	4. *Casuarina rumphiana* Miq
5.	Elaeocarpaceae	5. *Elaeocarpus sphericus*
6.	Euphorbiaceae	6. *Macaranga mappa* M.A
7.	Fabaceae	7. *Cynometra rhamiflora* L
8.	Meliaceae	8. *Chisocheton* sp.
		9. *Aglaia* sp.
9.	Mimosaceae	10. *Paraserianthes falcataria* Nielsen. Berg.
10.	Moraceae	11. *Ficus glomerata* Roxb
		12. *Ficus grandis* BL
		13. *Ficus variegata* BL
		14. *Ficus septica* Burm.f
		15. *Ficus* sp.
11.	Musaceae	16. *Musa achisocarpa* Ness
12.	Myristicaceae	17. *Knema* sp.
13.	Piperaceae	18. *Piper aduncum* L
14.	Rubiaceae	19. *Nauclea orientalis* L
15.	Sapindaceae	20. *Pometia coreacea* Radlk
16.	Verbenaceae	21. *Premna corymbosa* L

Table 2: Parts of plants consumed by cuscus

No	Scientific name		The parts of forest plants that are consumed	
	Family	Species	Leaf	Fruit
1.	Anacardiaceae	1. *Spondias dulcis* Forst	?	?
2.	Araceae	2. *Scindapsus* sp.	*	?
3.	Caesalpinaceae	3. *Intsia bijuga* OK	?	*
4.	Casuarinaceae	4. *Casuarina rumphiana* Miq	*	?
5.	Elaeocarpaceae	5. *Elaeocarpus sphericus*	*	?
6.	Euphorbiaceae	6. *Macaranga mappa* M.A	*	?
7.	Fabaceae	7. *Cynometra rhamiflora* L	?	*
8.	Meliaceae	8. *Chisocheton* sp.	*	?
		9. *Aglaia* sp.	*	?
9.	Mimosaceae	10. *Paraserianthes falcataria* Nielsen. Berg.	?	*
10.	Moraceae	11. *Ficus glomerata* Roxb	*	?
		12. *Ficus grandis* BL	*	?
		13. *Ficus variegata* BL	*	?
		14. *Ficus septica* Burm.f	*	?
		15. *Ficus* sp.	*	?
11.	Musaceae	16. *Musa achisocarpa* Ness	*	?
12.	Myristicaceae	17. *Knema* sp.	*	?
13.	Piperaceae	18. *Piper aduncum* L	*	?
14.	Rubiaceae	19. *Nauclea orientalis* L	*	?
15.	Sapindaceae	20. *Pometia coreacea* Radlk	?	?
16.	Verbenaceae	21. *Premna corymbosa* L	*	?
	Total		**5**	**18**

? = consumed
* = not consumed

Conclusion

The species of cuscus found in Udopi Wosi Village Forest Complex are *Spilocuscus maculatus* and *Phalanger orientalis*. Forest plants identified as cuscus feeding plants consist of 21 species from 16 families. The parts of plant consumed by cuscus are the fruits from 18 species and leaves or shoots from five species.

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FIRST HAND OBSERVATION AND STUDY OF A PALLAS'S GULL (Larus ichthyaetus Pallas 1775) OFF THE COAST OF GANJAM, ORISSA

by Pranjalendu Ray, Siba Prasad Parida and Manaswini Parida

Introduction

The existing records of the distribution of Pallas's gull or Great black-headed gull list it as a winter visitor to coasts and large rivers of the Indian subcontinent (Baker, 1929; Ali, 1996; Grimmet *et al.*, 1998), India and Pakistan (Ali and Ripley, 1981) and India (Alfred *et al.*, 2001). Also, recent publications (Dev, 1997; Kumar *et al.*, 2005) mentioned its occurrence as a winter migrant to the Orissa Coast. The present paper puts on record the first hand observation and study of a Pallas's gull (*Larus ichthyaetus* Pallas 1775) recovered off the coast of Ganjam, Orissa.

Collection

A seagull was recovered on 8th January 2006 at 9:30 hrs., while floating in sea-water approximately ten nautical miles off the coast of the Rushikulya river mouth in Ganjam District, Orissa. Initially, the bird was handled with care for its recovery and release into nature, but in vain! It could not fly on its own and subsequently it was brought to the museum for further observation and study.

Field behavior

Interestingly, during field observations, some gulls were seen snatching away fishes about to be swallowed by little cormorants just on water surface near the shoreline. The calls of these gulls were much similar to the call 'kraa-a' mentioned by Ali (1996). The Great black-headed gull is solitary while feeding and gregarious during roosting. (pers. com. Dr S.S. Saha)

Observation in captivity

In captivity the rescued gull survived for seven days and showed no external injuries. Its post-mortem x-ray examination negated any skeletal injury to the bird. Although the gull appeared healthy it showed little interest in eating any artificial marine fish food and regurgitated whole fish at times. It could not stand or fly for long on its own and died on 14th January 2006. The reasons for such behavior are not known.

The specimen took considerable time for specific identification, as there are variations within populations at different stages of the life cycle in consonance with continental migration. With the available literature and on the basis of morphometric details, it was identified as a Great black-headed gull.

Morphometric details:

Wing	:	494 mm
Culmen	:	70 mm
Tarsus	:	74 mm
Tail	:	185 mm
Total wing span	:	740 mm
Total body length	:	706 mm
Sex	:	Male
Shape of testis	:	Oval
Approx. size of testis:		Right = 7 mm; Left = 3 mm

(after 7 days preservation in 70 % alcohol)

The Great black-headed gull is bigger in size than a domestic duck; a wingspan exceeding 450 mm (Baker, 1929) extending beyond the tail is peculiar to the species. The specimen was a male. The head had a long slender yellow bill suffused with crimson red, concentrating more in the base of lower beak at an angle and a black band on the side. The bill has a distinctive sub-terminal black band stretching across the beak. The eyes are dark, marked with distinctive white upper and lower

crescents and a red circumorbital ring. The head and upper neck feathers are grey with a slight brownish tinge and greyish white bases varying from its true winter plumage. In winter, the black on the head is lost and the head and neck becomes white liberally streaked with black (Baker, 1929) or brown (Ali, 1996), which turns black again by February (Ali, 1996). The present description thus clearly suggests a plumage in the state of transition from its true winter to true summer plumage. While its back and wing feathers were ashy grey, the rest was snowy white. Although Baker (1929) described the presence of eleven primaries as the key to family character, the present specimen bore ten primaries in both the wings. The first primary was black on the outer edge up to 240 mm from base with a narrow black sub-tip; its inner edge has a broad black band of 90 mm. The outer six primaries had sub-terminal black bands tipped with white, the first two having mirrors (right wing - Ist primary mirror = 41 mm; IInd primary mirror = 21mm; left wing - Ist primary mirror = 40 mm; IInd primary mirror = 27 mm). The rest of the primaries and secondaries were tipped grey and white. The second primary is the longest of all, measuring 330 mm in length when the wings are in a folded condition. There are twelve tail feathers; the 4th, 9th and 10th feathers bear dark black oval spots on the upper side near the tips, with a lighter shade on underside when viewed from right to left. The middle six tail feathers are shorter than the outer ones such that when fanned out, all tail feathers are aligned along the outer margins. The gull's legs and feet are a greenish-yellow color, fully webbed, bearing three toes and a small hind toe at the back and all terminating with black claw. The tarsus is scutellated in front.

Bird on display

The taxidermy preparation of the gull along with its complete skeleton is presently on display in the museum in a small exhibition corner titled "Body's Hardware" with the skeletons of reptiles, birds and mammals, giving valuable clues to the animals' habits and habitats and for a better and comparative understanding of the arrangement of different bones of the animals and their functions.

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Fig. 1 Pallas's gull released on the ground, unable to fly

Fig.2 Close-up view of head, eye and bill with sub-terminal black band on tip

Fig.3 Mirror mark on primaries

Fig.4 Appearance of oval black patches on tail feathers

CONSERVATION FOR DEVELOPMENT: ANNAPURNA CONSERVATION AREA PROJECT (ACAP) NEPAL

by Neeru Thapa

Launched in 1986, the Annapurna Conservation Area Project (ACAP) is the first and largest conservation area in Nepal. In 1992, ACAP was officially gazetted and given the authority to manage the conservation area. ACAP aims at "Achieving sustained balance between nature conservation and socio-economic improvement of the people living within in the Annapurna Conservation Area (ACA)".

Located in north-central Nepal, ACA enjoys a world renowned reputation as a premier trekking destination. The Annapurna Range comprises the world's well-known tallest peaks, Annapurna I (8,091m) and the scared mountain of Machhapuchhhre (6,993m). The world's deepest valley, the Kali Gandaki River Basin, numerous impressive waterfalls, glaciers, one of the highest passes, namely Thorang- La, and the fabulous Trans-Himalayas zone fall under the ACA. An extremely diverse flora ranging from subtropical to alpine grasslands exist in ACA. The ACA harbors 1,226 species of plants, 9 species of mammals, 474 species of birds and 39 species of amphibians. The area also harbors rare and endangered wildlife species such as the Snow leopard (*Uncia uncial*), Himalayan musk deer (*Moschus chrysogaster - Syn. Moschus muschiferous*), Tibetan argali (*Pantholops hodgsonii*), Impeyan pheasant (*Lophophorus impejanus*) and Crimson-horned pheasant (*Tragopan satyra*). The ACA provides a habitat gradient from subtropical to temperate forests and perennial snow, which maintain the biodiversity and integrity of the central Himalayas.

ACAP has adopted people's participation, the catalytic role of ACAP and sustainability of the program as three guiding philosophies towards the achievements of its goals. The underlying principle of the ACAP is to strengthen the linkage between ethics and environment by making local communities both the principal actors and beneficiaries of the conservation undertakings. Recognizing that local participation is a fundamental aspect of environmental conservation, ACAP integrates local communities in all stages of development, from planning to execution and evaluation phases. Since 1986, ACAP has evolved an experimental Integrated Conservation and Development Program (ICDP) model to become the largest protected area in Nepal. For management of the ACA, the area has been divided into 7 Unit Conservation Offices (UCOs) and these UCOs have 57 Village Development Committees.

More than 10 ethnic groups inhabit the region. After agriculture, livestock farming is the secondary occupation. ACAP allows local residents their traditional rights and access to the use of natural resources.

The tourism business has been a source of cash income for the people living in the ACA for a decade. It ensures sustainability by encouraging the local inhabitants to invest in cash or kind in the conservation and development activities. In every initiative, communities are motivated to contribute in kind to program implementation to guarantee continuation of optimal management of the schemes. The Nepal government has allowed ACAP to collect an ACA conservation entry fee.

ACAP has launched various programmes for nature conservation; alternative energy; conservation education and extension; sustainable community development; agriculture, livestock and gender development; sustainable tourism management; heritage conservation; and health programmes all designed and based on the needs and demands of the local people. This is an exemplary achievement of the ACAP to manage the country's largest conservation area for development.

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FOREST NEWS

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Twenty-third session of the Asia-Pacific Forestry Commission held in the Land of the Thunder Dragon

Introduction

At the invitation of the Government of Bhutan, the twenty-third session of the Asia-Pacific Forestry Commission (APFC) was held in Thimphu, Bhutan, 9 - 11 June 2010. Delegates from 28 member countries and 4 United Nations organizations participated in the session, along with observers and representatives from 17 regional and international inter-governmental and non-governmental organizations.

Mr. Eduardo Rojas-Briales, FAO Assistant Director-General, Forestry Department, welcomed participants on behalf of FAO. He thanked the Government of Bhutan, and especially the Department of Forest and Park Services, for the preparatory work and arrangements for the twenty-third session of APFC. Mr. Rojas-Briales noted a range of opportunities and challenges confronting forestry in Asia and the Pacific; vast plantation programmes are being implemented in some countries, while deforestation, loss of biodiversity, and weak forest law enforcement and governance occurs in other countries. He stressed that, while carbon financing may assist in addressing these issues, such financing also will come tagged with its own expectations and requirements.

His Excellency, Lyonpo Yeshey Zimba, Minister of Works and Human Settlement, provided the

keynote address. He outlined the concept of Gross National Happiness, and noted the importance of environmental conservation, including community forestry, in the country's development paradigm and policies. The Minister enumerated a variety of roles played by forests and noted that deforestation remains a challenge for many countries. He expressed concern over negative impacts of climate change and noted potential roles for forests in climate change mitigation.

State of forestry in the Asia-Pacific region: forestry in transition

The Commission considered the state of forestry in the region. Delegates provided informative summaries of recent developments and issues in their countries.

Significant achievements were noted in afforestation, reforestation and forest rehabilitation, with several countries reporting ambitious planted forest establishment programmes and tree-planting targets. Delegates noted efforts to provide support and incentives for small-scale and community tree-growing. The Commission was apprised of efforts to prevent and mitigate the impacts of forest fires, pests and diseases.

Delegates highlighted the increased emphasis being given to ecosystem services of forests. The importance of biodiversity conservation and forest protection were underscored by many delegates. The Commission was informed of efforts to promote ecotourism, improve watershed protection and ensure clean and reliable water supplies. Delegates emphasized the growing potential for ecosystem services to contribute to financing sustainable forest management.

The Commission noted regional trends towards community forestry, devolution of forest user rights and participatory forestry. Opportunities for revitalizing forest sectors to contribute to poverty alleviation, economic recovery, employment and rural development, including through public-private partnerships, were also highlighted.

The Commission noted ongoing efforts to review and reformulate forest policies and revise or enact new legislation. The importance of national forest programmes in improving forest governance, including within FLEG frameworks, was highlighted. The Commission highlighted the benefits of ongoing international collaboration and provision of technical support. The contributions of forest certification and forest codes of practice as tools for achieving sustainable forest management were noted.

Delegates highlighted the importance of national forest inventories and the need to strengthen related capacity for this work, including in support of emerging programmes related to climate change mitigation. The Commission was apprised of several recently conducted or proposed national forest inventories, as well as programmes to delineate and demarcate forest lands.

The Commission expressed concern over the potential negative impacts of climate change on forests. Delegates reported on national forestry responses to climate change including enhanced carbon sequestration capacities, efforts to reduce carbon emissions, development of "climate compatible" strategies, and development of REDD-plus strategies and readiness. The Commission requested FAO to take a leading role in supporting technical aspects of REDD-plus in collaboration with UNEP and UNDP.

Global Forest Resources Assessment 2010

The Commission noted with satisfaction the release of preliminary findings of the *Global Forest Resources Assessment (FRA) 2010* and looked forward to the publication of a comprehensive FRA 2010 report. Delegates reiterated the importance of reliable data and information on forest resources in achieving progress towards sustainable forest management in the region.

A special in-session seminar highlighted newly released findings from the *Global Forest Resources Assessment 2010* of relevance for the Asia-Pacific region

The Commission acknowledged the need for continuous improvement in forest monitoring, assessment and reporting to improve the accuracy and comprehensiveness of collated FRA data. The Commission noted that the quality of FRA is largely

dependent on national forest information systems and reporting, although an FAO remote sensing survey will provide new and additional global and regional forest data.

Delegates noted that the complexity of national reporting under the FRA process creates significant challenges for countries. The Commission acknowledged that society's increasing demands on forests and requirements for more comprehensive information will likely increase the complexity of FRA reporting in the future.

The Commission requested FAO to assist countries in developing and implementing efficient and practical forest monitoring and assessment mechanisms, to assist in accessing available technologies, and to help build capacities for utilizing such systems. The Commission requested that FAO develop methodologies to include evaluation of environmental services into national forest resources assessments for countries that might wish to include these in their national assessments.

Asia-Pacific Forestry Sector Outlook Study

The Commission congratulated FAO and member countries on the publication and release of the Regional Report of the Asia-Pacific Forestry Sector Outlook Study (APFSOS) and encouraged FAO to complete and publish planned country reports, thematic studies, policy briefs and sub-regional outlook study reports.

Delegates emphasized the importance of ongoing forward-looking analysis of issues, challenges and opportunities affecting forests and forestry. The Commission urged FAO and member countries to make full use of the wealth of information and analysis that has been generated by the APFSOS, by integrating it into national strategic planning, national forest programme processes, and forest policy formulation.

Recognizing the wide range of challenges and conditions across the region and the consequent need for specific analyses and responses, the Commission requested FAO and partner organizations to support sub-regional workshops on strategic planning in forestry and further scenario development.

Considering the critical relationships between forests and indigenous peoples, the Commission emphasized the importance of free, prior and informed consent with respect to all forestry-related policies, programmes and activities that might impact indigenous peoples.

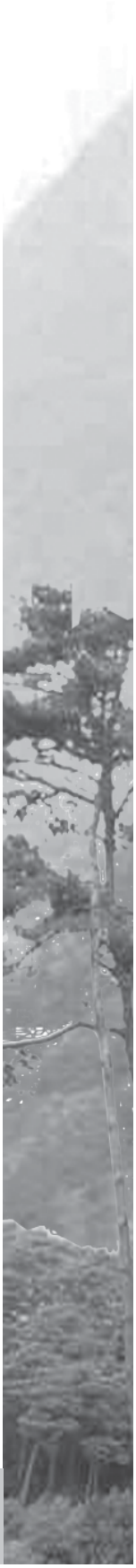
Forests and biodiversity: conservation and sustainable use of our forest treasures

The Commission considered the conservation and sustainable use of forests and biodiversity and noted significant achievements in expanding protected area networks and efforts to enhance biodiversity. The Commission was informed of efforts to enlist local communities in biodiversity conservation activities and noted the need for conservation efforts to protect the rights of indigenous peoples.

The Commission noted strong synergies between REDD and biodiversity conservation, with significant potential for joint implementation of biodiversity conservation and REDD initiatives. The Commission expressed satisfaction at the development of tools[1] to assess areas of high carbon and high biodiversity values.

The Commission noted that plantations provide many ecosystem services including biodiversity functions, but these functions are not a substitute for the biodiversity functions of natural forests. The Commission emphasized that planning for, and management of, planted forests should encompass provisions for biodiversity enhancement and other ecosystem services.

The Commission recognized the importance of incorporating biodiversity dimensions within national forest programmes as a way of mainstreaming biodiversity conservation within central government policies. The Commission noted broad support for biodiversity conservation within international arrangements, national legislative and policy frameworks, and specific national biodiversity action plans. The



[1]www.carbon-biodiversity.net

Commission urged member countries to enhance participation of foresters in multilateral biodiversity dialogues and to strengthen international arrangements, including due attention to financing and international assistance, as a means of facilitating action at national levels.

The Commission requested FAO, in collaboration with other international partners, to assist countries in identifying and studying key problems of regional significance related to biodiversity conservation, determine strategic priorities and to support implementation of recommendations. The Commission recommended that countries share experiences and advice on efforts to enhance biodiversity conservation, including opportunities to capitalise on bioprospecting.

The Commission requested FAO, the Secretariat of the Convention on Biological Diversity and other partners to provide advice and tools to assess forest degradation, forest fragmentation and related biodiversity loss and to further address the harmonizing of forest-related definitions through the Collaborative Partnership on Forests.

Progress in improving forest law enforcement and governance in the region

The Commission considered progress in improving forest law enforcement and governance (FLEG) in the region and noted its satisfaction at the publication of the APFC stocktaking exercise *Forest law enforcement and governance: Progress in Asia and the Pacific*.

The Commission noted recent important changes to national laws and policies governing imports of illegal timber including the European Union's impending due diligence regulations, amendments to the United States' Lacey Act, "green" procurement policies in Japan, and New Zealand's new illegal logging policy reflecting increasing market sensitivities to illegal timber. The Commission acknowledged that while such regulations can provide a positive incentive for improving forest law enforcement, they may also be perceived as barriers to trade. The Commission noted the importance of establishing bilateral dialogues between timber exporting countries and importing countries to express views and share concerns. The Commission was apprised of the establishment of bilateral memoranda of understanding in this regard.

The Commission welcomed the emergence of various multilateral initiatives including the Asia Forest Partnership, the Responsible Asia Forestry and Trade (RAFT) programme, Asia FLEG, FLEGT and ITTO initiatives, and the development of various certification and verification systems. The Commission noted that harmonization of various FLEG-related processes may be desirable.

The Commission noted that domestic forest law enforcement issues require significant attention; these may relate to small-scale illegal felling, agricultural, industrial and fisheries encroachment and urbanization. Delegates acknowledged the importance of involving local governments and reinforcing intersectoral linkages. The Commission noted the need to ensure that sustainable community forestry practices are enabled.

The Commission acknowledged that weaknesses in the adjudication of environmental laws may result in failures to enforce forest laws. Training and capacity building for the environmental judiciary can enhance enforcement and prosecution. Delegates noted that wider issues of corruption, including collusion between illegal loggers and elite segments of society, constitute obstacles to forest law enforcement in some countries.

The Commission urged FAO to collaborate with other international organizations and partners to facilitate additional regional dialogue on FLEG to discuss shared concerns, identify best practices in FLEG implementation, and establish mechanisms for cooperation. Delegates proposed topics for discussion including defining forest legality and legality verification systems. The Commission emphasized that other stakeholders, including the private sector and civil society, should be included in such dialogue. The Commission requested FAO and other international organizations and partners to provide assistance to build capacities to fight illegal logging and other forest crimes, and to help countries secure financial resources for effective FLEG implementation.

Heads of forestry dialogue

A special Heads of Forestry dialogue provided an opportunity for direct exchange of views among delegates on *Forests, climate change and REDD: beyond Copenhagen* and *Harnessing new opportunities for financing sustainable forest management*

Forests, climate change and REDD: beyond Copenhagen

Delegates noted that the global economic crisis had created a hiatus, which has temporarily dampened interest and slowed progress in developing carbon markets. However, delegates highlighted that the outcome of the UNFCCC COP 15 was promising for forestry, including significant progress in LULUCF negotiations and recognition of carbon storage in wood products.

The Commission noted that engagement of all stakeholders is critical if environmental, economic, and social benefits potentially achievable through REDD and REDD-plus are to be sustainable. Delegates highlighted that while achieving "REDD readiness" is important, investment in the fundamentals of improved forest governance and management must continue.

The Commission urged adherence to the true spirit of the Bali Action Plan by inclusion of the role of conservation, sustainable management of forests and enhancement of carbon stocks in REDD-plus mechanisms.

The Commission acknowledged that carbon market mechanisms are highly complex. While this may present significant challenges for implementation, it may also be a signal that the market is maturing. Delegates noted that high carbon market transaction costs threaten benefits received on the ground, thus, innovative solutions to create workable mechanisms are needed.

Delegates noted accessing carbon markets was a particular challenge for rural communities and stressed the need for fully engaging local communities. In this respect, lessons learned from efforts to access funding for forestry-related activities under the Clean Development Mechanism of the Kyoto Protocol may be applied.

The Commission emphasized FAO's strategic role in providing continued support for fundamental issues surrounding climate change and sustainable forest management, including capacity building, sharing of information and experience, partnership building, and facilitating the exchange of technologies and best practices.

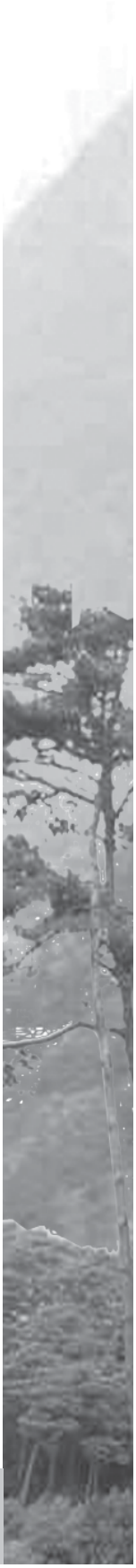
Harnessing new opportunities for financing sustainable forest management

Delegates observed that, despite an increase in interest and funding for forestry as a result of concerns over climate change, huge funding gaps exist in many countries. The Commission noted that key challenges for developing countries include: a) inadequate financial resources; b) inadequate capacities; and c) inadequate access to technologies.

The Commission emphasized that sustainable forest management requires funding from a diverse range of sources, including both public and private entities, and from traditional as well as new and innovative approaches. Delegates acknowledged that investment was likely to flow most rapidly to countries that have addressed key areas of concern such as resource tenure, corruption, and excessive bureaucratic regulation; but, that this may not help those countries most in need.

The Commission recognized the importance of a conducive enabling environment to attract and retain investment in the forestry sector. Common constraints across the region included unclear tenure rights, weak judiciaries, excessive regulation, and lack of political will.

The usefulness of formulating national strategic plans for forest financing that address constraints, establish priorities, and facilitate the involvement of other related sectors, was considered very important. The Commission urged FAO to assist member countries in developing viable strategies for attracting investments.



APFC and FAO-supported activities in the region

The Commission reviewed APFC and FAO-supported activities carried out during the past two years, including follow-up to the recommendations of the twenty-second session of the Commission, and priorities for future work. The Commission noted its satisfaction with the work programme that had been implemented and commended FAO on the number and quality of initiatives being undertaken in the region.

The Secretariat clarified that many regional activities supported by FAO were carried out within the framework of APFC. Activities generally had been concentrated in three areas: (a) economics, policies and institutions; (b) improvement in forest management for multiple benefits; and (c) involvement of people in forestry.

Delegates expressed particular appreciation for the Asia-Pacific Forestry Sector Outlook Study, regional policy studies, and the forest policy short course. The Commission requested FAO to continue support for policy-related work under the APFC-initiated Asia-Pacific Forest Policy Think Tank.

Delegates applauded the work of the Asia-Pacific Forest Invasive Species Network (APFISN), established by the Commission at its twentieth session in 2004, and noted with appreciation that it was viewed as a model for effective regional cooperation on invasive species throughout the world. The Commission encouraged FAO and member countries to maintain the strong level of activity and collaboration of APFISN.

The Commission noted the importance of sound management of coastal ecosystems and urged FAO to continue active engagement as a partner of the Mangroves for the Future Initiative and to provide targeted project support for mangrove and coastal resources management.

The Commission highlighted the importance of capacity building on a wide range of topics, and emphasized the potential for member countries to provide quality resource persons and infrastructure for hosting regional and sub-regional workshops and other training activities. The Commission requested FAO to facilitate and support capacity-building in priority technical, management and policy-related areas needed to make further progress towards sustainable forest management.

Delegates emphasized the need for increased support for forestry education at various levels. The Commission encouraged FAO and member countries to continue efforts to establish a regional support network for forestry education, and to support forestry-related education of youth, university students and forestry practitioners.

The Commission requested FAO to continue assisting forestry agencies in reviewing structures, policies and functions to better align with the new demands and expectations being placed on forests and forestry.

The Commission urged FAO to carefully monitor and evaluate activities to ensure effectiveness and increase efficiency of future delivery. The Commission noted that activities in the region should support FAO's broader strategic plans. The Commission requested FAO to report more extensively on APFC and FAO-supported activities in the Pacific at future sessions.

International Year of Forests – 2011

The Commission was informed of preparations for celebrating and supporting the International Year of Forests (IYF), which has been designated for 2011. The Commission was informed that national activities would constitute the foundation of IYF and delegates were encouraged to identify opportunities for national events and activities.

Regional issues identified by the commission for the attention of the committee on forestry

Recognizing COFO's stated desire to see FAO's regional forestry commissions strengthened, the Commission wished to bring to the attention of COFO the vibrancy and vitality of APFC, as demonstrated by the large number of inter-sessional activities implemented during the past two years, including completion of the second Asia-Pacific Forestry Sector Outlook Study, regional forest policy studies, the third forest policy short

course, FLEG stock-taking exercise, numerous activities of the Asia-Pacific Forest Invasive Species Network, and others.

- The Commission wished to highlight to COFO the completion of the analytical phase of the Asia-Pacific Forestry Sector Outlook Study and publication of the main report. Considering that several regions have now completed forestry sector outlook studies, COFO may wish to consider how FAO can best support member countries in making effective use of the wealth of information and analysis produced by the outlook studies in national strategic planning, national forest programme processes and forest policy formulation.
- The Commission wished to bring to the attention of COFO the need for increased support for forestry education, particularly in light of the rapidly changing demands and expectations being placed on forests and forestry by society. COFO may wish to consider how FAO can best provide support through regional networks of educators and direct support for forestry-related education of youth, university students and forestry practitioners.
- Noting the increasing demands for data and information on a wide range of forest characteristics and values, in relation to growing recognition of forest-related ecosystem services, the Commission wished to bring to the attention of COFO the need for FAO to develop methodologies for including evaluation of environmental services into national forest resources assessments.
- The Commission wished to bring to COFO's attention its request to FAO to take a leading role in supporting technical aspects of REDD-plus in collaboration with UNEP and UNDP.
- Recognizing that people-centred development is increasingly the focus of forestry policies, the Commission wished to highlight to COFO the need to continue efforts to enhance social forestry, including community-based forest management. COFO may wish to reflect on evolving relationships between people and forests, societies' perceptions of forests, and the need for the forestry sector's communications to reflect this evolution.
- The Commission wished to bring to the attention of COFO the need to strengthen monitoring, reporting and assessment of statistics relating to community forestry, including within the Global Forest Resources Assessment process.
- The Commission wished to highlight to COFO the need to develop greater appreciation of the full range of benefits that society derives from forests. In this regard, COFO may wish to consider how broader measures, such as the concept of Gross National Happiness pioneered by Bhutan, may be utilized to better reflect forestry contributions to society.

Date and place of the next session

The Commission noted with appreciation the offer of the delegation from China to host its twenty-fourth session and the second Asia-Pacific Forestry Week.

Summary of recommendations

For the attention of Governments and FAO

The Commission recommended:

- assisting in developing and implementing efficient and practical forest monitoring and assessment mechanisms, assisting in accessing available technologies, and building capacities for utilizing such systems;
- making full use of the wealth of information and analysis that has been generated by the APFSOS, by integrating it into national strategic planning, national forest programme processes, and forest policy formulation;

- enhancing participation of foresters in multilateral biodiversity dialogues and strengthening international arrangements, including due attention to financing and international assistance, as a means of facilitating action at national levels;
- collaborating with other international partners, to assist countries in identifying and studying key problems of regional significance related to biodiversity conservation, determine strategic priorities and supporting implementation of recommendations;
- sharing experiences and advising on efforts to enhance biodiversity conservation, including opportunities to capitalise on bioprospecting;
- in collaboration with other international organizations and partners, providing assistance to build capacities to fight illegal logging and other forest crimes, and helping countries secure financial resources for effective FLEG implementation;
- adherence to the true spirit of the Bali Action Plan by inclusion of the role of conservation, sustainable management of forests and enhancement of carbon stocks in REDD-plus mechanisms;
- assisting member countries in developing viable strategies for attracting increased investment in forestry, including formulating national strategic plans for financing that address constraints, establish priorities, and facilitate the involvement of other related sectors;
- maintaining the strong level of activity and collaboration of the Asia-Pacific Forest Invasive Species Network (APFISN);
- continuing efforts in establish a regional support network for forestry education, and supporting forestry-related education of youth, university students and forestry practitioners.

For the attention of FAO

The Commission recommended:

- taking a leading role in supporting technical aspects of REDD-plus in collaboration with UNEP and UNDP;
- developing methodologies to include evaluation of environmental services into national forest resources assessments for countries that might wish to include these in their national assessments;
- completing and publishing planned country reports, thematic studies, policy briefs and sub-regional outlook study reports;
- in collaboration with partner organizations, supporting sub-regional workshops on strategic planning in forestry and further scenario development;
- in collaboration with the Secretariat of the Convention on Biological Diversity and other partners, providing advice and tools to assess forest degradation, forest fragmentation and related biodiversity loss and further addressing the harmonizing of forest-related definitions through the Collaborative Partnership on Forests;
- collaborating with other international organizations and partners to facilitate additional regional dialogue on FLEG to discuss shared concerns, identifying best practices in FLEG implementation, and establishing mechanisms for cooperation;
- providing continued support for fundamental issues surrounding climate change and sustainable forest management, including capacity building, sharing of information and experience, partnership building, and facilitating the exchange of technologies and best practices;
- continuing support for policy-related work under the APFC-initiated Asia-Pacific Forest Policy Think Tank.;
- continuing active engagement as a partner of the Mangroves for the Future Initiative and providing targeted project support for mangrove and coastal resources management;

- facilitating and supporting capacity-building in priority technical, management and policy-related areas needed to make further progress towards sustainable forest management;
- assisting forestry agencies in reviewing structures, policies and functions to better align with the new demands and expectations being placed on forests and forestry;
- carefully monitoring and evaluating activities to ensure effectiveness and increase efficiency of future delivery;
- reporting more extensively on APFC and FAO-supported activities in the Pacific at future sessions;
- in collaboration with member organizations of the Collaborative Partnership on Forests, developing joint communication materials to convey key messages relating to forests during the International Year of Forests.

Welcome Addresses

Excerpts from the Welcome Address by His Excellency Lyonpo Yeshey Zimba, Minister of Works and Human Settlement

Today, as we gather here on this auspicious day, I want to take the privilege of welcoming you all to Bhutan.

Bhutan is undergoing profound changes and has witnessed significant historical events in the last few years. Most profoundly, we celebrated the enthronement of a young, dynamic and compassionate monarch as the 5th King of Bhutan in December 2008. And we have successfully transitioned into a constitutional monarchy.

As a young democracy, we have every intention of wanting to bring vibrancy and transparency to this new system of governance for ensuring a just, vibrant and healthy Bhutanese society. Nevertheless, our development paradigm is still inspired and guided by the philosophy of Gross National Happiness championed by His Majesty the 4th King of Bhutan.

One of the four pillars for achieving and ensuring Gross National Happiness is environmental conservation. Today, Bhutan has over70% of its land area under forest cover. And our constitution mandates that 60% of our land area remain forested for all times to come. Forests therefore are central to the discourse of environmental conservation in Bhutan.

Bhutan has long championed conservation and the Bhutanese with their inherent respect for nature have been exemplary stewards of the forests and environment. With enlightened leadership under the 4th King, Bhutan is now regarded as a model for conservation across the world. Today, we have more than 50% of our land under protected areas and wildlife corridors. And scientific principles are the cornerstone on which management of landscapes for timber and other resources extraction are based.

Recognizing environmental conservation as one key factor for the well being of all, all infrastructure development in the country ensures environmental-friendly construction. One of the Vision elements in the construction sector therefore is that, “the physical infrastructure will not pose any threat to the pristine environment by its existence and during its construction. It shall draw upon the natural resources in an eco-friendly and sustainable basis from the environment”.

We are also increasingly cognizant of the fact that people and communities must partner and bear in the management of our forests and water. Through conscious interventions and efforts, we have over 230

community forests. This has been achieved in less than 5 years. We also acknowledge that our communities are not only guardians of our forests, but that they also possess an incredible wealth of knowledge about our forests. We must make every effort to document and treasure such traditional knowledge. In this age of synthetics, the forests still hold the promise of the organic and natural.

This movement of engaging communities has come of age. In our region, where poverty is endemic and widespread, the practice of forestry cannot be discussed in isolation of its possible benefits to our rural poor. I believe that forests have the power to not only heal in a spiritual sense, but also to provide for the needy in terms of tangible material outputs. We must, therefore, manage and nuture our forests to ensure the health of both humans and wild species.

A concern close to my heart is one associated with a warming planet. Bhutan being in the Himalayas is especially prone to bearing the brunt of the negative impacts of climate change. While the science may be debated, there is no doubt that climate change is happening. It is immensely disturbing that we neither have the data nor the knowledge to predict the rate of change and the severity of possible impacts. At both local and global scales, within the immediate and the long term, forests appear to offer a possible solution to halt the rate of climate change by acting as carbon sinks and offering a renewable source of energy. While humanity has lived and thrived off forests, never has there been a time when the worth of a forest has been consciously appreciated.

This great coming together here in Bhutan today should be geared toward ensuring that forests remain forever in our Asia-Pacific region. I believe that forests should continue to provide basic requirements of food, wood and energy for all those in need. I believe our forests should be conserved, protected and managed to provide for the greater ecological services of maintaining our water catchments and regulating our weather cycles while it serves as a carbon sink. Furthermore, I believe that our forests should continue to inspire us and provide the much needed space for contemplation and enlightenment. As we all know, there are many wonders in the forest. And we must keep the forest alive – for ourselves and our children.

I wish you all a successful conference.

Excerpts from the Opening Address by Eduardo Rojas-Briales, Assistant Director-General, Forestry Department, Food and Agriculture Organization of the United Nations

It is my honour and great pleasure to convey the warm welcome, greetings and best wishes of FAO Director-General Jacques Diouf and the FAO Forestry Department at the opening of this 23rd session of the Asia-Pacific Forestry Commission.

I also extend FAO's gratitude to the Government and the people of Bhutan for having graciously offered to host our meeting and for the excellent preparations and facilities placed at our disposal for this event. I particularly wish to offer appreciation at the outstanding efforts of Mr. Karma Dukpa and his staff from the Department of Forests and Parks in bringing together the many strands involved in organization of an event of this magnitude. The enthusiasm, dedication and competence they have brought to this task reflect great credit on the Department of Forests and Parks.

Ladies and Gentlemen, it seems fitting that we are holding the 23rd session of APFC in Bhutan, given that our meeting coincides – in 2010 – with the International Year of Biodiversity and as a precursor to the 2011 Year of Forests. Bhutan is rightly famous for its efforts in balancing economic growth and modernization with its traditional culture and environmental values. This has enabled the country to avoid much of the ecological damage – including deforestation, forest degradation and loss of biodiversity – inherent in much of the rest of Asia and the Pacific, and indeed the rest of the world.

These trends in forest loss, degradation and decreasing biodiversity have once again been brought to the forefront of our attention, with the publication of the preliminary findings of the Global Forest Resources Assessment 2010. Across the Asia-Pacific region, the findings of the FRA 2010 are mixed. In some countries, afforestation efforts have led to an enormous turnaround in forest cover, to the extent that in the region as a whole the area of forests increased by 14 million hectares in the past decade. However, in many countries the rate of deforestation, especially the loss of natural forests, remains deeply concerning. The region has lost 3.5 million hectares of primary forests and 7 million hectares of naturally-regenerated forest area. Colleagues – we must find ways to do better, and I am pleased that we have several agenda items that give the Commission opportunity to consider these trends.

We can hope to draw much guidance from the Asia-Pacific Forestry Sector Outlook Study. This enormous effort by APFC and the member countries is coming to fruition with the release of the Main Report of the study scheduled during an in-session seminar this afternoon. The wealth of information and analysis gathered in the various country reports, thematic studies and regional and subregional reports should help to prepare us to confidently face the challenges of the future.

And we should make no mistake – the challenges to the forestry sector in this region will be extremely demanding. It goes without saying that climate change has topped the international environmental agenda over the past year and forests featured prominently in the negotiations. Important decisions in the Copenhagen Accord, crafted in December 2009, produced significant new financing commitments through Reducing Emissions from Deforestation and Degradation (REDD-plus) activities. This is, of course, extraordinarily good news for the forestry sector since most countries struggle to secure adequate financing to enable the sort of progress towards sustainable forest management that society is demanding.

However, we should be under no illusions – with the money will come great expectations – and forestry needs to be ready to deliver on its potential and its promises. We need to be preparing for that future now. In this respect, the Heads of Forestry Dialogue – being organized for the first time during this APFC session – offers a great opportunity to share experiences and discuss effective approaches in the areas of *Forests, climate change and REDD*; and *Harnessing new opportunities for financing sustainable forest management*.

Some of these approaches will be found in better policies, better legislation, stronger institutions and better governance. An agenda item on *Progress in improving forest law enforcement and governance in the region* will enable us to consider some of these issues.

A variety of other sessions and events – including some organized by, or in collaboration with partner organizations – will enable us to holistically address the overall theme of this APFC session – *Forests: Our Heritage, Our Future*. At the same time, I remind you that the Committee of Forestry (COFO) will have its 20th session in October this year. COFO will need to define the program for FAO Forestry for the coming biennium, and in doing so, it will consider developments in other major processes and the best ways to provide inputs to them.

Regional Forestry Commissions have a golden opportunity now to make a great impact on global negotiations and at the same time, strengthen the linkages between policy and implementation. In this spirit I invite you to be bold and visionary in identifying issues to be brought to the attention of COFO and provide your input to help shape the global dialogue on forests.

Ladies and Gentlemen, we have an extremely rich program in the coming three days that will provide an excellent opportunity to consider major challenges and appropriate responses. Using the best information and drawing on the wide knowledge of participants here this week, I am optimistic that practical responses can be developed to take forestry into a successful future.

Side events held at the APFC

During the 23rd Session of the Asia-Pacific Forestry Commission, numerous side events were also held, including:

- *Workshop: "Forests: Moving Beyond GDP Contributions to Gross National Happiness Considerations"*
  Organized by APFC, Government of Bhutan, FAO, and The Center for People and Forests (RECOFTC)
- *Partners' event: "Sustaining Forest Biodiversity"*
  Organized by the International Tropical Timber Organization (ITTO) and the Convention on Biological Diversity (CBD)
- *Workshop: "Pathways of biological invasions into forests"*
  Organized by the Asia-Pacific Forest Invasive Species Network (APFISN)
- *"Roundtable for Climate Change Mitigation in the Himalayan Region"*
  Organized by the IUCN Regional Office, Bangkok and the Environment and Health Foundation (India)
- *Partners' Meeting: "Forest Inventory and Monitoring in Montane Ecosystems"*
  Organized by the USDA Forest Service
- *Side event: "Small Island Developing States (SIDS)"*
- *Networking Event: "Open Forum"*

Following are reports on three of the events.

Finding happiness in the forest?

Introduction

The pre-session workshop on *Forests: Moving beyond GDP Contributions to Gross National Happiness* was jointly organized by FAO, The Center for People and Forests (RECOFTC) and the Ministry of Agriculture and Forests (Bhutan). Sixty-four representatives from 26 countries participated. The background to the workshop owes to the fact that Gross Domestic Product (GDP) and other similar quantitative economic metrics do not capture effectively the contributions from forestry, especially the goods and ecological services which are important for the wellbeing of societies. As a result, the forestry sector's contribution to sustainable development remains under-reported, and consequently the sector receives less development funds. The workshop was organized to review economic metrics systems which can help address the reporting of the true values of forests' benefits to society.

The objectives of the workshop were to:

- enhance awareness of the broader issues of societal well being encapsulated under Gross National Happiness (GNH) and other related concepts; and
- discuss adequacy of existing measures/ indicators in providing an indication of forestry's contribution to societal wellbeing.

The introduction to the workshop was made by Mr. S. Appanah (FAO/RAP), who provided the background and objectives. Mr. B. Debroy (Center for Policy Studies, New Delhi) reviewed the gamut of existing metrics available for measuring economic development of countries. All these indicators which use quantitative data have their

limitations. Simple metrics like GDP can only quantify the total value of goods and services produced over a designated time. However, notions of economic development have evolved over time, and measures of poverty, education, health, child mortality, etc. are being captured through more complex metrics such as the Human Development Index. Nevertheless, subjective elements such as "happiness" raise difficulties in measurement, sample designs, sample sizes, and even the questionnaires to be used. As such, metrics like Gross National Happiness (GNH) are unlikely to find acceptance easily. Until reliable survey systems are developed, it would be difficult to take them forward.

Dasho Karma Ura (Center for Bhutan Studies, Thimphu) provided the background and history of the development of the concept of GNH, and the technical tools being used for making "happiness" surveys. According to Dasho Ura, GNH is not against change, it propounds development which balances economic development, preservation of the environment and religious-cultural heritage. The underlying message is that people should not give up elements which are important for their happiness to gain material benefits. Under this approach, the GNH survey takes into account not only the flow of money, but also other less quantifiable and subjective elements such as time spent with family, conservation of nature, and other non-economic sources which human beings depend on. The guiding principles in the formulation of GNH are sustainable and equitable socio-economic development, conservation of the environment, preservation and promotion of culture, and good governance. This novel approach, while still regarded as work in progress, has already been encapsulated in Bhutan's constitution and is given strong emphasis in the policies of the natural resource sector.

Mr. T. Enters (RECOFTC, Bangkok) explored the various contributions of forestry to societal wellbeing, the recognized sustainability and wellbeing indices, and what they measure. He pointed out that these indices are too simple to be meaningful, too aggregated to be realistic, and are suffering from a questionable mix of weighting and valuation techniques. In the case of forestry, there are many difficulties arising from measurement problems, unavailability of data, subjectivity and comprehensibility. Mr. Enters argued for a simpler system to relay the forestry case.

The panelists presented different perspectives, ranging from concerns of the private sector, how people value forest services, education for sustainable development, and how rural societies value their spiritual aspects *vis-à-vis* that of their environment.

Conclusions

The discussions did not arrive at specific recommendations considering the issues are new to the group. Nevertheless, some conclusions were enunciated. Some held the view that existing economic metrics that work on quantitative measures cannot be spliced together with those that are subjective in nature, as the concept of "happiness" is a very subjective matter. On the other hand, there was argument that the subject of "happiness and wellbeing" are too critical to be left out, which argues for using both the quantitative and non-quantitative models for evaluating the contributions of natural resources to society's wellbeing. While not arriving at a general agreement, the group expressed the view that this area should be further explored, so future policy formulations can benefit from such developments. It was also pointed out that as urbanization increases, the role and value of forests is likely to shift, which would need to fuse both subjective and objective valuations for ensuring the greatest goods from forests for the greatest number of people.

Threats to the forest: pathways of biological invasions

The Asia-Pacific Forest Invasive Species Network (APFISN) workshop was organized as a partners' event during the 23rd session of the APFC held at Thimphu, Bhutan. A total of 35 delegates representing 13 countries attended the workshop. The workshop aimed to:

- take stock of current and potential invasive species transport pathways both within and across countries;
- identify agencies at national and international levels that need to be sensitized in biological invasions.
- plan awareness programs targeting governments, media and business establishments; and
- identify linkages within APFISN and multi-agency systems within member countries for a targeted campaign at regional levels.

Country reports on pathways of biological invasions into forests were presented by representatives from Bangladesh, Cambodia, China, India, Indonesia, Japan, Malaysia, Maldives, Nepal, Philippines and Sri Lanka. Zhao Wenxia of the Research Institute of Forestry (Chinese Acadamy of Forestry), made a special presentation on the pest risk analysis protocol for non-crop plants in China. There also were presentations on detecting target pests and risk analysis by Ross Wylie of the Biosecurity Queensland Control Centre, and on pathways of plant invasions and mechanisms and factors contributing to success of invasion by Inderjith Singh of CEMDE, Delhi University.

The workshop continued with the following presentations: Forest surveillance and pathway analysis (by Ross Wylie); Global invasive species program by Tim Christophersen of the Secretariat of the Convention on Biological Diversity; Phytosanitary standards in forestry by Jose Antonio Prado (FAO, Rome); Country report on invasive species from Bhutan by Tandin Wangdi of the National Biodiversity Centre of Bhutan; and Interventions at pathways – problems and prospects by T.V. Sajeev of the Kerala Forest Research Institute. Each of the presentations was followed by discussions on the topic. In the concluding session, the participants deliberated on topics such as: target pests of the region; major pathways; action plans for forest surveillance and risk analysis; institutional mechanism for intervention at transport phase; listing of stakeholders; and awareness literature for the region and decided on action points for the future.

The workshop made the following recommendations:

- Neighbouring countries showing similar invasive species problems should work together to facilitate training based on common needs. Five regional groups were identified for this as follows:
  - India, Sri Lanka, Bhutan, Nepal, Maldives, Pakistan, Myanmar, Bangladesh
  - Lao PDR, Thailand, Vietnam, Cambodia
  - China, Korea, Japan, Mongolia
  - Malaysia, Indonesia, Philippines, Timor Leste
  - Fiji, Samoa, PNG, Solomon Islands, Vanuatu, Australia, New Zealand, U.S.A.;
- APFISN has drawn up excellent action plans but has inadequate resources to support these activities, therefore, it is hoped that international organizations may earmark funds for the network activities;
- There is a lack of communication among scientists, foresters, policy makers and quarantine personnel in most member countries. The APFC may recommend member countries to promote such communications so as to enable them to fight invasive species issues better.

Forest inventory and monitoring in montane ecosystems

Exerpts from a report by Elizabeth Lebow, USDA Forest Service

Increasing concerns for accurate carbon accounting, determining baseline forest conditions in changing climates, biodiversity conservation, and ecosystem services have led to a greater emphasis on timely forest inventory throughout the Asia-Pacific region. Countries are at various stages in the planning, execution, and reporting of forest inventory information, with some countries requiring capacity building and other countries serving as forest inventory role models.

The main objectives for the session were: 1) to provide a forum for exchanging technical information on forest inventory and monitoring systems in montane ecosystems; 2) to share information on managing data and using the information from forest inventories for multiple uses related to climate change; and 3) to provide a summary of regional needs and recommendations related to forest inventory.

This session was sponsored by the USDA Forest Service, Bhutan's Ministry of Agriculture and Forests and FAO with presentations by Bhutan, India, Nepal, the USFS Forest Inventory and Analysis (FIA) and FAO.

Forest inventory status in the Eastern Himalayas

The Eastern Himalayan mountains span multiple countries and a regional approach to managing the landscape is becoming increasingly desirable as the countries experience similar and related impacts from climate change. India, Nepal, and Bhutan are interested in exchanging technical information on their forest inventory methods and information use.

Forest inventories are important for both national needs and international reporting. They are necessary for establishing baseline information for REDD+ purposes, as well as establishing a baseline against which future climate change impacts on forests can be measured. Approaches to forest inventories in the region vary widely depending on national circumstances, population needs, legislative mandates and natural resource management policies.

Bhutan

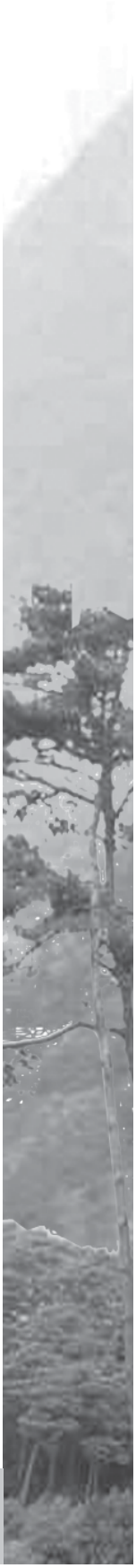
Bhutan's population is highly dependent on forests and vulnerable to climate change impacts, and they have a constitutional mandate to maintain 60% forest cover, making accurate data on forests essential. Bhutan has been working with Yale University to design and field test a new "national forest inventory and ecosystem health monitoring system". The inventory design takes a holistic ecosystem management approach and includes data collection on timber, biodiversity, non-timber forest products (NTFPs), soil, and social factors.

India

One-tenth of the forest area in India is sampled biennially, focusing on timber, meaning that a total forest inventory is completed in 20 years. India has its own satellites that capture forest cover on a two-year cycle, producing forest cover maps within two years of data acquisition. Remote sensing is heavily relied upon in some areas. India's NFI does not collect data on smaller trees, shrubs, litter, dead wood, bark, or below ground roots. In potential REDD+ areas the NFI will need to be revised to include this information in order to get a total forest biomass and carbon estimate.

Nepal

A five-year Forest Resource Assessment (FRA) in Nepal began in 2010, supported by the Embassy of Finland. While the previous inventory of 1986-1997 was focused on timber, the 2010 inventory work will provide data and maps of forests, biodiversity, and NTFPs. The inventory will provide a national and limited sub-national estimate of forest resources. Provincial mapping is possible



and maps will be used on the ground to examine changes in forest extent and to inform REDD+. Additional work will be needed in some areas to provide accurate biomass and carbon estimation for markets.

Regional needs

Technical
- Biomass equations;
- Biomass equations for trees < 10 cm dbh (diameter at breast height);
- Remote sensing technologies, including LiDAR;
- Modifying inventory design/analysis for comprehensive carbon assessments;
- General capacity building.

Communications
- Software sharing;
- Sharing of methodologies and technical information

Financial
- Forest inventories are labor intensive and expensive. Bhutan is seeking funds from international donors for its planned four-year inventory. Modifying design and data collection for climate change purposes, or intensifying sampling in certain areas for REDD+ purposes, will likely require additional resources and/or capacity building.

Recommendation

To continue the dialogue on forest inventory and monitoring, participants of this partner's session recommended creating a forest inventory network under APFC for exchange of forest inventory methodologies, technology, software, and potentially data.

FAO ASIA-PACIFIC FORESTRY CALENDAR

14-17 September 2010. ***Regional workshop on Development of Forest Information System.*** Patum Thani, Thailand. Contact: Masahiro Otsuka, Forestry Officer, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; E-mail: Masahiro.Otsuka@fao.org

20-22 September 2010. ***Regional workshop on linking communities to forestry-related voluntary carbon markets.*** Chiang Mai, Thailand. Contact: Marija Spirovska-Kono, Forestry Consultant, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; E-mail: Marija.SpirovskaKono@fao.org

27 September - 1 October 2010. **30th *FAO Conference for Asia and the Pacific***. Gyeongju, Korea. Contact: Purushottam Mudbhary, APRC Secretary, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; E-mail: Purushottam.Mudbhary@fao.org

4-8 October 2010. ***20th Session of the Committee on Forestry (COFO)***. Rome, Italy. Contact: COFO-2010@fao.org

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