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Featuring

FOREST NEWS

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FOREST NEWS

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Cover: Silver pheasant (*Lophura nycthemera*) camera trapped in Phu Khieo Wildlife Sanctuary, Thailand
Photo: L. Grassman, Jr., Feline Research Program, CKWRI, Texas A&M University Kingsville

ACTIVITY PERIODS OF BIRDS IN THAILAND AS DETERMINED BY CAMERA TRAPPING

by Lon I. Grassman, Jr., Aaron M. Haines, Jan E. Janecka, Michael E. Tewes and Kitti Kreetiyutanont

Introduction

Activity patterns are part of basic natural history information. Most activity data on avifauna come from diurnal observations, resulting in a lack of nocturnal sampling. Previous camera trapping studies have allowed researchers to assess the activity periods of elusive tropical mammals (Griffiths and van Schaik, 1993; van Schaik and Griffiths, 1996; Lynam *et al.*, 2001; Jácomo *et al.*, 2004; Grassman *et al.*, 2005); however, due to the intrinsic difficulties involved with camera trapping birds, there is a paucity of such data for birds. We conducted a 1-year camera trapping survey study in Phu Khieo Wildlife Sanctuary (PKWS), Thailand. The objective of our study was to gather information on activity periods of forest mammals and birds residing within PKWS.

Study site

Phu Khieo Wildlife Sanctuary is situated in Chayaphum Province (lat. 16°5'–16°35' N, long. 101°20'–101°55' E) in north central Thailand. Established in 1979, PKWS encompasses 1,560 km^2 of forests within the larger 4,550 km^2 Phetchabun Forest Complex (Kumsuk *et al.*, 1999). The sanctuary is dominated by a mixed-evergreen forested plateau at 800–1,100 m elevation. The subtropical forest is composed of dry and hill evergreen (82%), mixed deciduous (14%), and dry dipterocarp (4%) species (Kumsuk *et al.*, 1999). The study area is located in the central portion of the sanctuary. Encompassing approximately 110 km^2, the area includes forested hills of 700–1,100 m, 3 permanent reservoirs, and 5 km^2 of grasslands.

Methods

We surveyed the study area using 5 active-infrared Trailmaster® (Lenexa, KS, USA) and 20 passive-infrared Camtrakker® (Winder, GA, USA) camera traps. The units were placed on animal trails and roads and positioned for photographic captures of terrestrial birds. Slide 400 ISO film was used for greater range at night with the camera flash. The units were configured to operate continuously to take photographs during diurnal and nocturnal periods. Each indicated the date and time a capture event occurred. We used a grid system for camera placement where each 1 km^2 grid of the study area contained 2 camera traps (Grassman *et al.*, 2002). Camera traps at each location were operated for 1 month, with an *ad hoc* maintenance regime to change film and batteries. We sampled intermittently from January 2002–May 2003.

We classified activity patterns of photo-captured birds based on the methods of van Schaik and Griffiths (1996). For species with >10 captures, we defined diurnal activity as species with <10% of captures during the nocturnal period, and nocturnal activity for species that had >90% of nocturnal captures. Species with capture times between 10% and 90% were defined as arrhythmic. We tested whether the deviations from the 10% or 90% were significant (2-tailed at $P < 0.05$) based on binomial distribution probability tests with the probability set at either $P = 0.1$ or $P = 0.9$, depending on which was closest to the observed percentage of the nocturnal period (van Schaik and Griffiths, 1996).

Results

We sampled 1,224 trap-nights with 281 photographs of 28 faunal species, consisting of 22 mammals, 6 birds and 1 reptile. Camera trapped birds were: blue magpie (*Urocissa erythrorhyncha*), Chinese pond heron (*Ardeola bacchus*), jungle fowl (*Gallus gallus*), Siamese fireback pheasant (*Lophura diardi*), Silver pheasant (*L. nycthemera*) and coral-billed ground-cuckoo (*Carpococcyx renauldi*) (Table 1). Jungle fowl and Siamese fireback pheasant were captured most often (17 and 34 photographs, respectively), and were determined to be significantly diurnal (Table 1). Sampling was insufficient to determine activity patterns for blue magpie, Chinese pond heron, silver pheasant and coral-billed ground-cuckoo.

The significantly diurnal activity patterns of jungle fowl and Siamese fireback pheasant was not unexpected given the frequency of diurnal observations for these species recorded by birders (L. Grassman, pers. obs.). However, through the application of 24-hour sampling we confirmed the absence of nocturnal activity by jungle fowl, and low degree of nocturnal activity by Siamese fireback pheasant (1 photo-capture). Although most camera trapping studies have focused on terrestrial mammals, camera trapping appears to be a valid tool for recording terrestrial bird activity patterns; however, careful planning must be considered. Unlike mammalian camera tracking studies that place camera traps along terrestrial animal trails where mammalian activity may be greatest, avian camera tracking studies should instead focus on areas with concentrated avian activity. These areas may include wetland areas, lakes, open meadows, and habitat edges. Camera traps also may be situated near nest sites to record activity to and from the nest by adult birds.

Acknowledgments

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Table 1. Activity periods of captured birds as recorded by camera traps in Phu Khieo Wildlife Sanctuary, Thailand, from February 2001—July 2002.

Species	Scientific Name	n	%Nocturnal	%Diurnal (n)	Activity
Blue Magpie	*Urocissa*	1	0	100 (1)	NA
	erythrorhyncha	1	0	100 (1)	NA
Chinese Pond Heron	*Ardeola Bacchus*	17	0	100 (17)	D*
Jungle Fowl	*Gallus gallus*	34	3 (1)	97 (33)	D*
Siamese Fireback Pheasant	*Lophura diardi*	1	0	100 (1)	NA
Silver Pheasant	*Lophura nycthemera*	1	0	100 (1)	NA
Coral-billed Ground Cuckoo	*Carpococcyx renauldi*				

Note: n=number of captures, D=diurnal, and NA=insufficient sample size.
* Indicates significant designations of activity periods.

THE EXTIRPATION OF BALI AND JAVAN TIGER: LESSONS FROM THE PAST

by Mohammed A. Ashraf

Introduction

Its beauty, grace and power make the tiger (*Panthera tigris*) one of the world's most loved animals, yet it is precisely these qualities that have been its downfall (Seidensticker, 1999). More than a quarter of a century has passed since the tiger was first internationally recognized as being endangered and soon to be extinct in the wild if the forces resulting in its decline continued unabated. Over the ensuing years, considerable resources have been invested in saving the tiger with mixed results. Many small tiger populations are completely isolated, critically endangered and facing a bleak future. Entire subspecies from Bali, Java and areas in or around the Caspian Sea have not survived and have perished from the wild (Jackson & Kemf, 1999). This paper focuses on identifying the critical factors, both from ecological and socio-economical points of view, which led to the extirpation of Bali tiger (*Panthera tigris balica*) and Javan tiger (*Panthera tigris sondaica*) in the Indonesian islands of Bali and Java, and to utilize this knowledge to help conserve the Bengal tiger subspecies in Sundarbans mangrove forest in Bangladesh. The process

(stochastic and deterministic) that led to the extirpation of Bali and Javan tigers might be the same could lead the tigers of the Sundarbans to the brink of extinction. This report attempts to gauge ecological perspectives at the genetic level for tiger conservation management in the Sundarbans, based on the science of wildlife biology and conservation genetics against the backdrop of the historical extirpation of island tigers of Indonesia – commonly known as Sunda Island tigers.

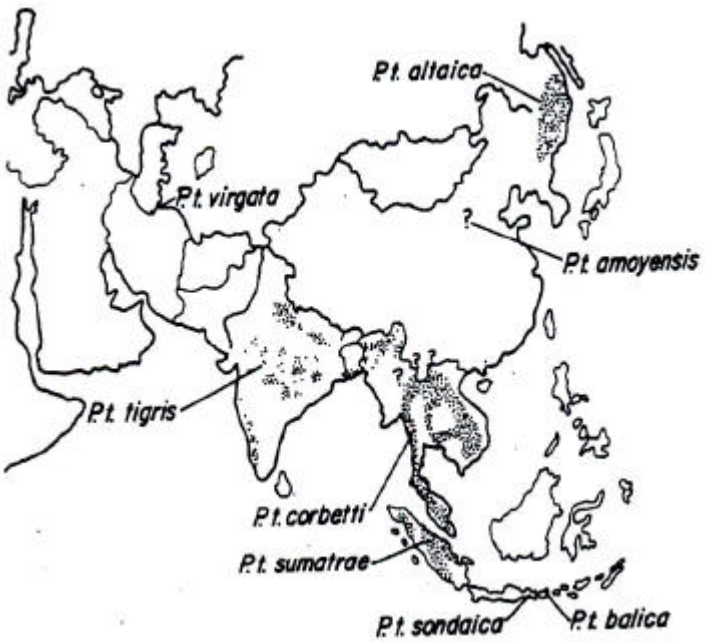
Conservation and population status

Concern for the tiger's survival in India and throughout its range was roundly expressed at the 1969 New Delhi meeting of the IUCN by a consensus of senior conservationists (S. Ali, Z. Futehally, J. C. Daniel, G. Mountfort, S.D. Ripley). Subsequently, in 1972, IUCN and its sister organization, the World Wildlife Fund, initiated "Operation Tiger" or "Save the Tiger" to raise funds, generate international public support and encourage national governments within the tiger's range countries to undertake their own action programs. By 1979, when representatives from most of the tiger range countries met in New Delhi at the first International Symposium on the tiger, wild populations of four subspecies, i.e. Bengal tiger, Indochinese tiger (*Panthera tigris corbetti*), Amur Tiger (*Panthera tigris altaica*) and Sumatran tiger (*Panthera tigris sumatrae*) – were declared relatively secure as long as the newly established conservation measures were maintained (Jackson, 1979). Populations of four subspecies – Caspian tiger (*Panthera tigris virgata*), South China tiger (*Panthera tigris amoyensis*), Javan tiger and Bali tiger – were either depleted or extinct.

Geographical distribution

Less than a century ago, tigers occupied a range extending from Turkey and the southern fringes of the Caspian Sea, eastward across Central Asia as far south through eastern China to the Indian sub-continent, and the whole of Southeast Asia as far as the Indonesian islands of Sumatra, Java and Bali. This former range has now contracted and been fragmented dramatically in recent decades (Jackson & Kemf, 1999). Tigers now occur only in scattered populations in parts of South Asia, Southeast Asia, Sumatra and the Russian Far East, with a small number possibly still surviving in China. The map delineates the geographic distribution of all the extant and extinct subspecies.

Fig.1: Geographical distribution of all the subspecies of tigers across its range countries



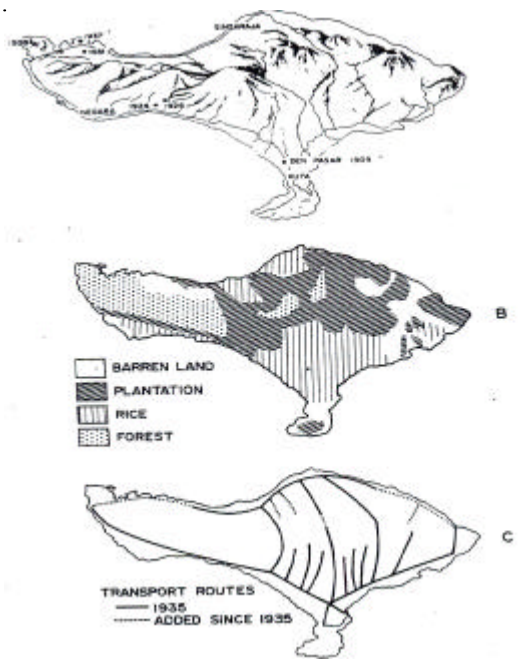


Fig. 2 Island of Bali, Indonesia: A: Shown are landforms and major cities where Dutch used to collect specimens of Bali tiger. B: Land use on Bali 1900s. C: The major roads already been developed in 1935

The extirpation of Bali tiger

The extirpation of the Bali tiger was largely attributed to the colonial development by the Dutch settlers in the Indonesian islands (Geertz, 1963). When the Dutch colonized Bali during the 1920-1930s, they pursued the indiscriminate hunting of the Bali tigers as part of their sports recreation pursuits (Ditdjen, 1971). Agricultural and road infrastructure development during the late 1800s and early 1900s also contributed to altering the land use and ecosystem fabric of Bali, thereby causing the tiger population decline.

The rich volcanic slopes, with their superb drainage and climate, made irrigation both technically possible and seasonally stable in Bali. The island's transportation network was strongly influenced by the grain of major gorges and spurs; east-west communications were difficult, hence road transportation developed in a north-south direction through the Bali terrain (Fig 2, C) (Sody, 1933; Ditdjen, 1971). All these agricultural and transportation developments, on top of the unrestrained hunting of Bali tigers, dramatically fragmented the large blocks of forested land that was the home of tigers in the island (Harper, 1945). The breeding territory of female tigers started to shrink, along with the prey population size. A single, continuous breeding population of tigers was soon restricted to a small isolated population amidst the booming development of agricultural and Dutch colonial landscapes (Seidensticker, 1978). By the end of the 1940s, the Bali tiger was gone from the wild forever. Later observations suggested that intense agricultural pressure massively altered the Bali landscape, thereby forcing the tigers to live in an isolated small population. Intense colonial hunting regimes by the Dutch, and no consensus for wildlife conservation by the public despite the stringent wildlife legislation, were also attributed as major factors that diminished the small but magnificent subspecies of tiger that once used to live in almost all parts of Bali Island.

The extirpation of Javan Tiger

The extinction of Javan tiger from the tropical lush Javan island was also largely attributed to the Dutch agricultural revolution from the late 1800s in the Island of Java (Seidensticker, 1978). From that time on, the Netherlands East Indies Company efficiently and systematically brought all remaining cultivated lands in Java under production (Greetz, 1963). Tigers and other wildlife declined, as forested areas, alluvial plains, and river basins were converted for use in agriculture.

In 1850, tigers were still widespread, although Harper (1945) reported that they were considered a nuisance. By 1940, tigers had disappeared from all but the most inaccessible island reaches. Much of the extensive monsoon forest areas where tigers had lived in east Java had been converted to teak plantations. This monoculture cash-crop cultivation significantly reduced the prey biomass contribution to the tiger's diet and hence the adult breeding tigers faced starvation. Prey depletion also brought humans into closer conflict with tigers. In the 1920s and 1930s a system of reserves was established in Java, but by the mid-1960s tigers survived in only three of these reserves. By 1970, tigers could only be found on the southeast coast known as Meru-Betiri. In 1976, there were at least three tigers living in Meru-Betri (Seidensticker and Suyono, 1980), but sadly, by the 1980s, competent observers failed to find any sign that the tiger had survived. From then on, Javan tiger was officially enlisted as an extinct species (Jackson, 1999).

Lessons from Indonesian tiger for conserving the Bengal tiger in the Sundarbans

The Bali and Javan tigers were protected by law and reserves to protect them had been established in the 1930s and early 1940s. So what went wrong that led to the complete extirpation of these two subspecies and what lessons we can learn from it to avoid the fate of the Bali and Javan tigers in the future? How does this account relate to the Bengal tiger population in the Sundarbans mangrove forest in Bangladesh and what conservation measures need to be adopted to safeguard the remaining sub-population of tigers in the Sundarbans? The author addresses these questions against the backdrop of the Sunda Island incident.

Like the islands of Bali and Java, the Sundarbans has long been isolated from any adjoining forest tracts or corridors (Seidensticker, 1986). Its tiger population is also an insular one, hence the factors (stochastic and anthropogenic) that led to the extinction of the Bali and Javan tigers are similar for the tigers of the Sundarbans mangrove ecosystem (Seidensticker, 1978). Widespread habitat fragmentation in Bali and Java isolated the tiger populations. In most cases, insular populations develop an inbreeding depression that can have a drastic impact on animal population viability in the long run (Ballou, 2004), commonly referred to as the population bottle-neck scenario. There is a great risk that tigers will eventually disappear from any small, isolated reserves through the effects of inbreeding depression, but the genetic diversity of the remaining subspecies of tigers in the wild is little known (Seidensticker, 1986). Connecting the small, isolated habitats through wildlife corridors is an effective sub-population (meta population) management strategy for sympatric large carnivores such as the tiger. It reduces the chances of inbreeding and increase the chances of outbreeding, hence strengthening the allelic diversity. Allelic diversity in turn ensures that species can better adapt to stochastic environmental changes that can lead to population decline or ultimate extinction. For example, the reserves where the last Javan tigers were found are small (<500 km^2) and insular, but in the 1930s when most where established, they were connected and thereby the population could disperse and inbreeding was avoided. The insular habitat (<500 km^2) in Java had no dispersal potential for transient Javan tigers and probably caused serious inbreeding, hence extinction was inevitable (Seidensticker, 1986).

Genetic diversity of tiger population in Sundarbans Forest in Bangladesh

The Sundarbans is the largest contiguous mangrove forest in the world. It is also the only mangrove ecosystem in the world that harbors a wild tiger population (Ashraf, 2005). An area covering approximately 10,000 km^2, encompassing

areas in both Bangladesh (6,017 km^2) and India (4,000 km^2), it is a unique tiger habitat in terms of its habitat integrity, low poaching pressure and the current demographic status of tigers (Wikramanayake, 1999)). The Sundarbans is considered as a top priority Tiger Conservation Unit (TCU) according to the World Wildlife Fund (WWF) and Wildlife Conservation Society (WCS), USA (Wikramanayake, 1998). Since the genetic study of tigers in the wild is still in its infancy, the results of research to measure the allelic diversity, effective population size (Ne), and outbreeding rate of wild tigers in the Sundarbans are not yet known. Considering the deleterious impact of inbreeding on Bali and Javan tigers in the Sunda Islands (Sumatra, Java, Bali and Borneo) that resemble the Sundarbans, conducting basic ecological studies of tigers that at least address the distributional status of tigers in the protected areas of the Sundarbans is a central conservation concern (Ashraf, 2005). More advanced scientific studies that attempt to estimate the relative and absolute abundance of tigers need to be conducted in Sundarbans in order to determine the effective population size (Ne). The effective population size (Ne) is generally much less than the sample estimation size (N) of an unmanaged population – often only one-tenth (Ballou, 2004). A population study by the Bangladesh Forest Department and its associates reported an average tiger population size of 388. This is the average number of tigers in the Bangladesh Sundarbans, based on the infrequent demographic studies for over a quarter of a century (1971-2004). This gives us an average density of approximately 6 tigers per 100 km^2 in the Sundarbans. However, this is more likely to be an empirical density estimate with little or no scientific validation of the population survey design for meeting regular monitoring goals. Using the empirical census data of 388 tigers, we can theoretically calculate the effective population size (Ne) for the Sundarbans tigers. With our average 388 tigers, the effective population size (Ne) will be 38.80 (1/10th of the N) in Sundarbans. Ballou (2004) stated, "effective population size much greater than 50 is required to avoid inbreeding depression." Based on the average population size of tigers in the Sundarbans, we can conclude that the tiger population in Bangladesh is under grave threat at the very least from the deleterious impact of inbreeding in future. Therefore, more advanced studies that underpin the statistical framework to estimate ecological and genetic parameters of tigers (Karanth & Nichols, 2002) are an essential first step to safeguard the isolated population of tigers in the Bangladesh Sundarbans.

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Author's background: Mohammed Ashraf is a wildlife biologist with a keen interest in wild tiger populations and other endangered sympatric carnivore felids in tropical ecosystems. He is interested to form a tiger conservation forum with like-minded conservationists and biologists and can be contacted at the following email address: bengal_tiger010@yahoo.com

CURRENT STATUS OF OTTERS (MAMMALIA: LUTRINAE) IN VIETNAM WITH CONSERVATION IMPLICATIONS

by Nguyen Xuan Dang

Four species of otter have been recorded from Vietnam: the Asian small-clawed otter (*Aonyx cinerea*); smooth-coated otter (*Lutra perspicillata*); Eurasian otter (*L. lutra*); and the hairy-nosed otter (L. *sumatrana*). All four species were listed in 2004 in IUCN's **Red List of Threatened Species** (http://www.redlist.org) as follows: *Aonyx cinerea* – Nearly threatened (NT), *Lutra perspicillata* – Vulnerable (VU), *Lutra lutra* – Nearly threatened (NT), and *Lutra sumatrana* – Data Deficient (DD). In Vietnam, all otter species have declined and are facing the threat of extinction. Otters are protected by law in Vietnam; however, the lack of up-to-date scientific information on their status impedes the country's efforts to develop appropriate conservation strategies. This paper presents the status of four otter species in Vietnam based on the author's own study from 1998 to 2005, and also in the context of otter studies by other authors.

Vietnam has a land area of 330,541 km^2, extending for 3,360 km along the southeastern coastline of Asia, from 8º30'N to 23º00'N. About three-

quarters of the country consists of hills and mountains rising over 3,000 m above sea level. There are two wide deltas: the Mekong River Delta in the south and the Red River Delta in the north. Although Vietnam lies in the monsoon tropical climate belt, the climate varies with the latitude, with a mean temperature of 27ºC in the south and 21ºC in the north. The mean annual rainfall over most of the country is around 2,000 mm, but can reach over 3,000 mm in some areas. The country has large areas of wetlands and complex networks of water bodies (rivers, lakes, streams, reservoirs, etc.), with a wide range of natural vegetation types (mangrove forests, *Melaleuca* forests, fresh-water swamp forests, lowland evergreen/ semi-evergreen broadleaf forests) that provide good habitat for otters.

Methods

Semi-structured interview with key informants
Interviews with selected key informants such as forest guards, local hunters, forest users, wildlife traders, etc. were carried out to obtain general information about the otter fauna in the survey area and human impacts (e.g. hunting, trading, habitat disturbance) on the otter population.

Transect survey for direct observation of otters and their signs
During the survey periods, rivers, streams and other water bodies were extensively searched for direct sightings of otters or signs of their activities. In large wetland habitats such as mangrove forests and *Melaleuca* forest, various transects were made to cover all habitat types in the area as much as possible. Direct observation of otter is ideal, but the thick vegetation cover and low density of otters made direct sightings very low. So signs of otters such as tracks, droppings (spraints), dens, etc. became the main focus of the transect surveys.

Species identification by examining the specimens and their remains
Otters are often kept by Vietnamese in captivity as pets or for catching fish. Otter skins are usually prepared for sale or for some kinds of traditional medicine. The remains of captive otters provide valuable materials for exact species identification.

Camera-trapping
Camera-traps (Trailmaster TM1000/TM 1500, produced by Goodson and Associates, INC) were used in the survey. The camera-traps were set at 24 hour active; number of pulses to miss (-P) = 5, and camera delay CD = 2 minutes.

Current status of otters in Vietnam

Otters have not been well studied in Vietnam. The lack of systematic surveys has resulted in a scarcity of precise information on the distribution and abundance of the species. Localities of confirmed records (observations and specimens) are shown in Table 1 and Fig. 1. Historically, all four species had a wide distribution range in Vietnam; however, these have greatly shrunk over recent decades due to habitat destruction and over-hunting.

Table 1: Localities of confirmed otter records in Vietnam

Locality (Province)	Coordinates (Approx.)	*Aonyx cinerea*	*Lutra perspicillata*	*L. lutra*	*L. sumatrana*
Lai Chau	22º10'N; 103º15'E			+	
Lao Cai	22º21'N; 103º50'E	+		+	
Yen Bai	21º50'N; 104º30'E	+		+	
Bac Kan	22º23'N; 105º35'E			+	
Thai Nguyen	21º50'N; 104º30'E	+			
Son La	20º55'N; 103º40'E				
Hoa Binh	20º30'N; 105º40'E			+	
Quang Ninh	20º50'N; 107º10'E	+	+	+	
Hanoi	21º18'N; 105º50'E			+	

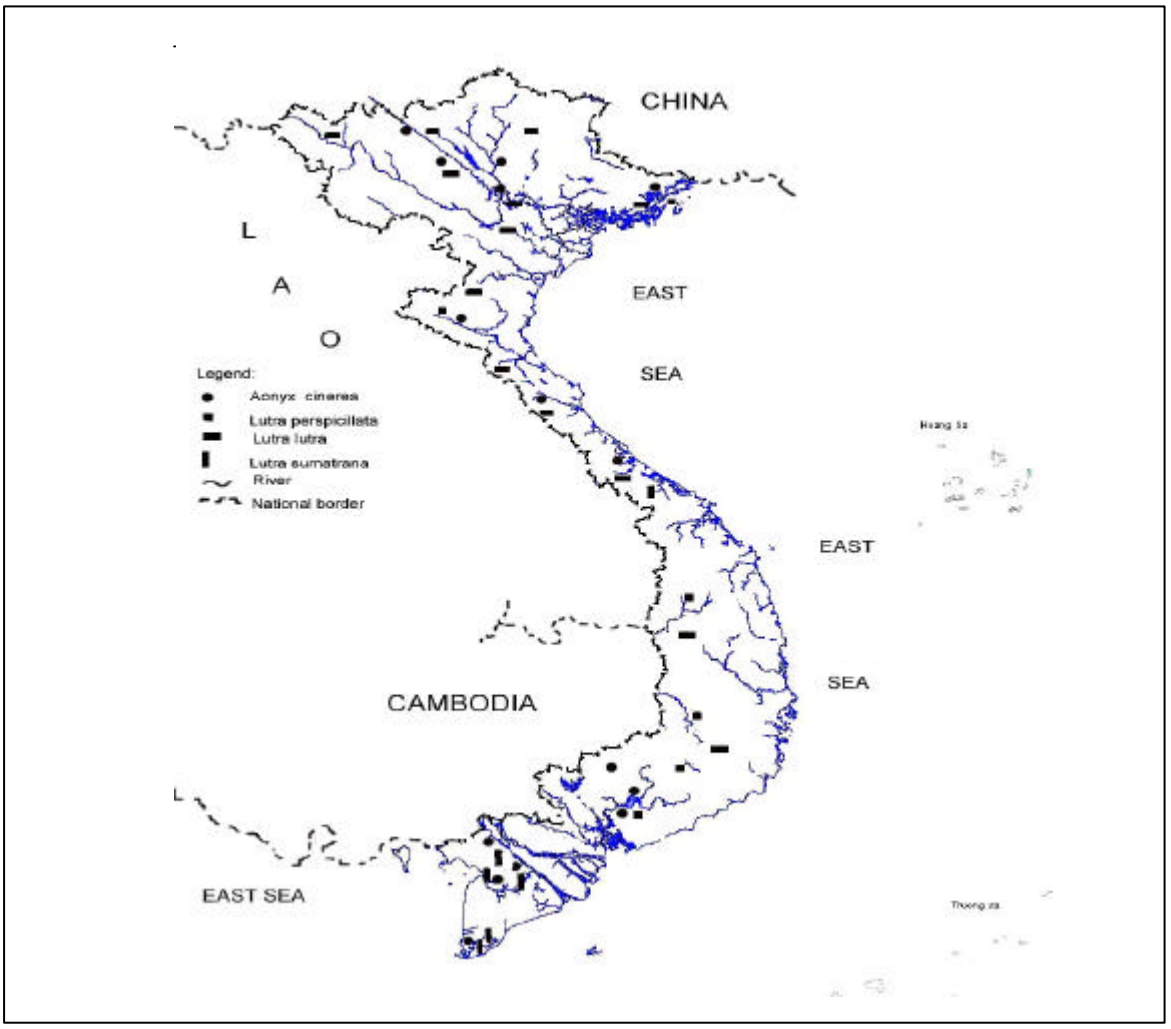

Figure 1: Localities of otter records in Vietnam

Asian small-clawed otter (*Aonyx cinerea*)

The Asian small-clawed otter is the most common otter species in Vietman, being widely distributed throughout the country (Fig.1). It has been seen, or specimens have been recorded from the provinces of Lao Cai, Yen Bai, Thai Nguyen, Quang Tri (Dang Huy Huynh *et al.*, 1994), Nghe An (SFNC, 2001), Quang Ninh, Vinh Phuc, Quang Binh, Binh Phuoc, Lam Dong, Dong Nai, An Giang, Can Tho, Kien Giang and Ca Mau. It has also been found on coastal islands such as Ha Long Bay of Quang Ninh Province (Nguyen Xuan Dang *et al.*, 1998). This species inhabits both freshwater and marine habitats, such as forest streams, rivers, lakes, inundated grasslands and rice fields. The otters were often hunted in large groups of up to 20+ individuals. It is their habit to deposit their spraints in one place for many days or months. In some caves in Ha Long Bay (Quang Ninh Province) large amounts of spraints have been collected over for several years. Crab particles always dominate the spraints.

Otters are still abundant in some mangroves and *Nypa* and *Melaleuca* forests of Kien Giang and Ca Mau Provinces (South Vietnam). This species has also been successfully bred in captivity in some of Vietnam's zoos.

Smooth-coated otter (*Lutra perspicillata*)

The smooth-coated otters have been recorded in the North and Central Vietnam provinces of Kon Tum (Dang Huy Huynh *et al*, 1994), Nghe An (SFNC, 2001), Quang Ninh, Dak Lak, Dong Nai

and Lam Dong (Fig. 1). At present, the species remains in scattered small groups within this range. These animals live in both freshwater and marine habitats. They forage in small groups of seven to ten individuals, feeding on fishes, amphibians, molluscs, crabs, etc. Some captive otters have successfully bred in Saigon Zoo (Ho Chi Minh City).

Eurasian otter (*Lutra lutra*)

The Eurasian otter has been recorded from North Vietnam to the southernmost provinces of Central Vietnam: Lai Chau,Yen Bai, Bac Kan, Hoa Binh, Quang Ninh, Hanoi, Nghe An, Ha Tinh, Quang Binh, Quang Tri (Dang Huy Huynh *et al.*, 1994), Lao Cai, Gia Lai and Lam Dong (Fig. 1). The species has not been reported from South Vietnam. At present, the numbers of Eurasian otters in the country have been seriously reduced due to hunting and habitat destruction, and survive only in small scattered groups. The species lives in both freshwater and marine habitats, feeding mainly on fish, as well as crabs, molluscs and some other small animals. This species is not found in any of Vietnam's zoos.

Hairy-nosed otter (*Lutra sumatrana*)

The hairy-nosed otter is identified by the IUCN/ SSC Otter Specialist Group (Foster-Turley *et al.*, 1990) as one of five otter species of top global conservation concern. However, its actual status and range remain unclear. At present, its existence has been confirmed from a few localities in Thailand (Budsabong, 2000), Cambodia (Poole, 2003) and Vietnam (Dang *et al.*, 2001). In Vietnam, investigations of hairy-nosed otters can be dated back to 1925. However, very few records of the animal's presence have been reported (Tables 1, 2; Fig. 1), indicating the rarity of the species in the country. Historical distribution of hairy-nosed otter ranges from Central to Southern Vietnam (south of 16th latitude); however, its present distribution may be restricted only to the Mekong Delta.

Table 2: Specimens of Hairy-nosed otter collected in Vietnam

No	Collectors	Collecting locality	Latitude/ Longitude	Collecting date	Where specimens are kept
1	Osgood	Annam	?	1932	?
2	Pocock	Thua Thien-Hue Province (Hue City)	ca. 16º28'N, 107º36'E	1941	British Museum ?
3	Pocock	An Giang Province (Long Xuyen District)	ca.10º23N, 105º25'E	1941	British Museum?
4	Truong Minh Hoat	Ca Mau Province (Ngoc Hien District)	ca. 8º33'N, 105º15'E	14 Apr. 1977	Institute of Ecology and Biological Resources, Hanoi (IEBR)
5	Truong Minh Hoat	Can Tho Province Phung Hiep District)	ca. 9º49'N, 105º50'E	22 Apr. 1977	IEBR
6	N. X. Dang, P. T. Anh, L. H. Tuyen	Kien Giang Province (U Minh Thuong NP)	9º36'50"N 105º03'15"E	4 Mar. 2000	IEBR
7	N. X. Dang, P. T. Anh, L. H. Tuyen	Kien Giang Province (U Minh Thuong NP)	9º37'49"N 105º07'29"E	7 Mar. 2000	IEBR
8	N. X. Dang, P. T. Anh, L. H. Tuyen	Kien Giang Province (U Minh Thuong NP)	9º31'58"N 105º05'57"E	8 Mar. 2000	IEBR
9	N. X. Dang, P. T. Anh, L. H. Tuyen	Kien Giang Province (U Minh Thuong NP)	9º31'45"N 105º05'30"E	20 Mar. 2000	IEBR
10	N. X. Dang, P. T. Anh.	Ca Mau Province (Vo Doi NR)	9º11'53"N, 104º58'06"E	12 Mar. 2002	IEBR

In 1932, Osgood published the first record of the hairy-nosed otter in Vietnam from an uncertain locality (Annam), based on an analysis of mammal collections made during 1925-1929. In 1941, Pocock published two further records from Long Xuyen District, An Giang Province and Hue City, of Thua-Thien-Hue Province. After that, no further records of hairy-nosed otters were made for 36 years. After the end of the war in 1975, Vietnamese scientists started wildlife studies in Southern Vietnam, and in 1977, two specimens of hairy-nosed otter were collected: one in Ngoc Hien District of Ca Mau Province, and another in Phung Hiep District of Can Tho Province. After that there were no new records of the species for a further 24 years until our present record.

During 2000-2002, surveys in the wetlands of Kien Giang and Ca Mau Province (South Vietnam) recorded the existence of the species in U Minh Thuong National Park (Kien Giang Province) and Vo Doi Nature Reserve and its vicinity (Ca Mau Province). In U Minh Thuong National Park (9º29'- 9º42'N; 105º01'- 105º09'E), the dried skins of three adult and one juvenile hairy-nosed otters were found. Local farmers are reported to catch these otters in areas adjacent to the Park's core zone. Measurements of the skins are shown in Table 3. A live sub-adult hairy-nosed otter was caught by a local farmer on 28 September 2000 in the Park's buffer zone. Three sets of camera-traps set in the Park from March to December 2000 obtained five pictures of hairy-nosed otters on 20 March 2000, 20 June 2000 and 24 June 2000. Two groups of the otter were observed in the Park and a number of fresh tracks and spraints were often seen during surveys in 2000, 2001 and 2002.

Table 3: Measurements of hairy-nosed otters

Specimen	Locality & date	Sex	Head-Body (mm)	Tail (mm)	Ear (mm)	Weight (kg)
Animal	Ca Mau, 1977	female	520	297	18	3.5
Animal	Can Tho, 1977	female	625	345	20	3.7
Skin 1*	Kien Giang, 2000	unknown	910	455	?	~6
Skin 2*	Kien Giang, 2000	unknown	940	580	?	~7
Skin 3*	Kien Giang, 2000	unknown	940	400	?	~5
Skin 4* (juvenile)	Kien Giang, 2000	unknown	430	230	?	~1.2
Skin*	Ca Mau, 2002	unknown	780	440	?	?

Note: (*) – Measurements are taken from dry skin, weight is as reported by hunters

In Vo Doi Nature Reserve (NR) and its adjacent state forestry enterprises (9º11'-14'N; 105º43'-55'E), surveys were conducted in November 2000 and March 2002. During these surveys, the skin of an adult hairy-nosed otter, confiscated by Vo Do NR staff from a local hunter who had killed the otter near the Reserve (9º11'53"N, 104º58'06"E) in August 2001, was examined. Local farmers reported that at least three other individuals were killed during 2001-2002 when they got stuck in fishing nets. One observation of a live adult hairy-nosed otter was made on 7 March 2002 in a canal within the Reserve. Fresh tracks and spraints of hairy-nosed otter were also regularly found both inside Vo Doi NR and in adjacent enterprises.

In 2003, we conducted a census of hairy-nosed otter in U Minh Thuong NP based on direct observation. The results indicated that the hairy-nosed otter population in U Minh Thuong NP consisted of 180-230 individuals (Dang *et al.*, 2003). This is possibly the largest population of this species in Vietnam.

U Minh Thuong NP, Vo Doi NR and the surrounding vicinity are large wetland habitats, consisting of small areas of mature natural peat swamp *Melaleuca* forests, surrounded by large replanted *Melaleuca* forests, inundated *Phragmites* grasslands, *Eleocharis* meadows and open swamp with floating aquatic plants. Mature natural *Melaleuca* forest occurs only in Vo Doi

Nature Reserve (about 3,195 ha) and U Minh Thuong NP (about 2,000 ha). The forest consists predominately of *Melaleuca cajuputi*, 10-15 m high and other trees, such as *Ilex cymosa, Alstonia spathulata*, at much lower densities. The trees are usually covered by dense lianas: *Stenochlaena palustris, Flagellaria indica, Scleria sumatrensis*, etc. Replanted *Melaleuca* forests are *Melaleuca* plantations of various ages are found throughout the area. The forests are usually clear with a developed ground grass layer. The inundated meadows are dominanted by *Eleocharis dulcis*, followed by *Cyperus halpan, Cyperus polystachyos, Phragmites vallatoria*, etc. *Phragmites* grasslands occur on the higher land and are dominated by *Phragmites vallatoria*, and other common species such as *Cayratia trofolia, Vigna luteola, Panicum repens*, etc. Canals and swamps are common in the area and usually covered by dense floating aquatic plants such as *Eichhornia crassipes, Pistia stratiotes, Salvinia cucullata* and, *Ipomoea aquatica*. In the buffer zone there are rice fields and other crop fields. Hairy-nosed otters live and forage in all these habitat types, but are more active in the young replanted *Melaleuca* forests interspersed with grasslands and meadows. Canals and swamps are their important foraging grounds.

Hairy-nosed otters often forage in small groups of two to five individuals and move from one area to another. They do not accumulate their spraint in one place for many days or months; defecation possibly occurs while foraging. The spraints contain mainly scales and bones of fishes. No hairy-nosed otter dens were found during the surveys, although some individuals were observed to stay in the same small area for many months.

Conservation of otters in Vietman

The numbers and distribution of all four species of otters in Vietnam has been seriously reduced due to severe habitat destruction and over-hunting over the past several decades. At present, all species are listed in the **Red Data Book of Vietnam** (MOSTE, 2000) and face the following threats:

- illegal hunting for meat and for skin export;
- destruction of wetland habitats by deforestation, clearance of dense vegetation along water bodies, drainage of lakes, streams, wetland, etc. and human disturbance;
- over-exploitation of otter prey sources (fishes, crabs, and molluscs, etc.); and
- pollution of water bodies and wetlands by pesticides, herbicides, mineral fertilizers and other wastes.

In Vietnam, there is no tradition of using otter skins, and the local people have no preference for otter meat over other mammals. Otters are hunted mostly for illegal national and transborder wildlife trade, and to a lesser extent for meat and medical use. During the 1990s. there was an illegal nation-wide campaign to catch otters for the illegal export of their skins to China. The hunters used large numbers of strong metal leg-hold traps and snares to catch the animals. This campaign greatly reduced the otter numbers in the country. Otter hunting is much reduced now due to the low number of animals in the wild and better enforcement of wildlife management laws and regulations. However, hunting still remains a significant threat to otters, especially in Vietnam's Mekong Delta where the wildlife trade is still out of control.

Many of the otter habitats were destroyed by bombing and defoliation agents during the war (Anh *et al.*, 1995) and the country's development after the war. At present, wetlands continue to be destroyed and degraded by several socioeconomic development programmes, as well as by the use of pesticides and chemical fertilizers for agricultural production.

In Vietnam, all four species of otter are protected by legislation. Government Decree No. 32/2006/ ND-CP, dated 30 March 2006, lists the precious and endangered species and the regulations for their protection, and includes all four species of otter in Group IB – animals with a strict ban on their hunting and use. Vietnam has established a network of 126 protected areas which covers 2,541,675 ha (Vietnam SR, 2003). All otter species occur in one or more protected areas. These protected areas, however, are facing significant pressures on their biological resources. These include illegal exploitation of woods, forest

products and wildlife encroachment of agricultural lands and increase of local human population.

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POPULATION DYNAMICS OF BATS IN AND AROUND JODHPUR OF GREAT INDIAN DESERT

by Ashok Purohit, K.B. Vyas and K.R. Senacha

A colony of Indian Flying Fox, Pteropus giganteus giganteus roosting on the tree of Pithecellobium dulce (Vilaiti Imaly) at Rail Sadan, Jodhpur.

Introduction

Worldwide, bats play an essential role in keeping populations of night-flying insects in balance. Just one bat can catch hundreds of insects in an hour, and large colonies catch tons of insects nightly, including beetle and moth species that cost farmers and foresters billions of rupees annually, not to mention the mosquitoes in our backyards. Throughout the tropics the seed dispersal and pollination activities of fruit- and nectar-eating bats are vital to the survival of rain forests, with some bats acting as "keystone" species in the lives of plants crucial to entire ecosystems. Many plants bloom at night, using unique odors and special flower shapes to attract bats. The famous baobab tree of the eastern African savannas is a good example. Bats approach the tree from below, in a manner likely to come in contact with the flower's reproductive organs and achieve pollination. They do so because the plant rewards them handsomely with nectar. This tree is so important to the survival of other kinds of wildlife that it is often referred to as the "Tree of Life." Wild varieties of many of the world's most economically valuable crop plants also rely on bats for survival. Some of the better-known products with commercial value are fruits such as bananas, breadfruit, avocados, dates, figs, peaches, and mangoes. Others include cloves, cashews, carob, balsa wood, kapok (filler for life preservers), and even tequila. Most of the plants from which these products come are now commercially cultivated, but the maintenance of wild ancestral stocks is critically important. They are the only source of genetic material for developing disease-resistant strains, rejuvenating commercial varieties, and for producing new, more productive plants in the future. The value of tropical bats in reforestation alone is enormous. Seeds dropped by bats can account for up to 95% of forest re-growth on cleared land. Performing this essential role puts these bats among the most important seed-dispersing animals of both the Old

and New World tropics. Studies of bats have contributed to the development of navigational aids for the blind, birth control and artificial insemination techniques, vaccine production, and drug testing, as well as to a better understanding of low-temperature surgical procedures (Tuttle, 1988).

There are 1,001 species of bats throughout the world. Bats belongs to the order Chiroptera, which is divided into two suborders i.e the Megachiroptera (often known as Old World fruit bats) with 167 species and the Microchiroptera with 834 species (Mickleburgh *et al.*, 1992; Hutson *et al.*, 2001). These show extensive adaptive radiation as to size, habit and diet and are recorded from all areas of the world except the Arctic, Antarctic, a few isolated oceanic islands and some extreme deserts. Bats make up more than 20% of the mammal species of the world. In many countries bats are major contributors to mammalian biodiversity, and in some places, particularly small oceanic islands, they may be the only indigenous mammals and play a vital role as "keystone" species in ecosystem (Cox *et al.*, 1992). The majority of bat species, including most of those in the suborder Michrochiroptera, are insectivorous, although some are carnivorous, a few are piscivorous, and three species of vampire bats are sanguivorous. Bats of the Old World suborder Megachiroptera are predominantly frugivorous, but also consume nectar, flowers, leaves and occasionally insects. Bats in the New World family Phyllostomidae have a similar plant diet, but some species may incorporate a greater proportion of insects than the Megachiroptera. Bats are the only mammals with the capacity for powered flight (Altringham, 1996) and the Michrochiroptera, together with the Megachiropteran genus *Rousettus*, have evolved a system of echolocation, by means of which they orient themselves and locate their food, and which also enables them to roost in situations where light intensity is low. In addition, those species living in temperate latitudes are heterothermic and able to adapt to food shortages during winter by hibernating; their reproductive cycles have become modified as a result. The most notable reproductive adaptation is a delay in fertilization: mating generally takes place in autumn and spermatozoa are stored in the female's reproductive tract until ovulation occurs in the following spring (Racey, 1999).

Out of 114 species of bats reported from India, the Thar Desert -– one of the smallest deserts of the world – has been home to 11 Microchiropteran (*Rhinopoma microphyllum kinneari, Rhinopoma hardwickii, Taphozous perforatus perforatus, Taphozous katchensis* (*T. nudiventris*), *Rhinolophus lepidus, Scotophilus heathii, Pipistrellus mimus* (*tenuis*), *Pipistrellus dormeri, Megaderma lyra lyra, Hipposideros fulvus* and *Tadarida aegiptiaca*) and three Megachiropteran (*Pteropus giganteus giganteus, Cynopterus sphinx* and *Rosettus leschnaulti*) species (Prakash, 1963; Sinha, 1979; Gaur, 1981; Bates and Harrison, 1997). The entrance of the Thar Desert in Jodhpur (26°17'59" N and 73°02'02" E) is one of the dynamic centers for biodiversity studies in India. In last two decades, this semi-arid region has seen tremendous changes in its eco-biogeography. Rapid increases in the human population, the introduction of Indira Gandhi Nahar at Jaisalmer, the implementation of advanced technology to enhance agricultural productivity, massive growth in construction of new buildings, renovation of historical monuments and urbanization are key factors that have led to the inhospitable changes affecting the distribution and availability of the bat species in this area.

Environment of the study site

Climatically, Jodhpur is a typical hot desert type. During the summer the temperature ranges between 20°C to 45°C, and in May can rise up to 49°C. The average annual rainfall is 300 mm, distributed over twenty rainy days. This wide range of climatic conditions has formed different types of habitat for the Chiropterans in and around Jodhpur city. The vegetation of the area is a typical desertic shrub forest type represented by *Acacia senegal, Euphorbia caducifolia, Ziziphus nummularia, Grewia tenesc, Salvadora persica, Capparis separaia, Anogeissus pendula, Maytenus emarginatus and Commiphora wightii.* The main wild fauna of this area includes Hyaena (*Hyaena hyaena),* Indian wolf (*Canis lupus*), Jackal (*Canis aureus*), Hanuman langurs (*Semnopithecus entellus*), Porcupine (*Hystric indica indica*), Blue bull (*Boselaphus*

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tragocamelus), Jungle cat (*Felis chaus*), etc. (Chhangani, 2002).

Materials & methods

An intensive survey of the study site was undertaken from November 2001 to August 2003 to locate the Chiropteran roosting sites in and around Jodhpur within a radius of 20 km. Information about various roosts was collected from the available literature and through inquiries with the local people, and a bat detector was used to locate minute roosts. Specimens were collected from the different roosting sites and the identification of specimens was done on the basis of the key used by Bates and Harrison (1997). A Global Positioning System (GPS) was used to assess the global position of the roosting sites, and a Digital Minimum-Maximum Thermo-hygrometer and a Digital Lux Meter were used to record the microclimatic parameters of the bat roosts. The population dynamics of bat roosts were studied by Visual Emergence Count (Easterla and Watkins, 1970; Humphrey and Cope, 1976; Swift, 1980) and the Capture-Mark-Recapture method (Kunz, 1988). Photographic Count (Thomas and LaVal, 1998), Surface Area Estimate (Dwyer, 1966) and Direct Roost Count methods (Thomas *et al.*, 1979) were also used in some cases.

Observations and discussion

An extensive survey conducted by the authors (November 2001 to August 2003) to explore the Chiropteran roosts in and around Jodhpur revealed that the number of Microchiroptera species at the study site has been drastically reduced from eleven to seven, and among the Megachiroptera from three to one. A comparative study shows that there has been a conspicuous change in the Chiropteran roosting sites of the region. *Rhinopoma kinneari*, *Rhinopoma hardwickii* and *Taphozous perforatus* that were reported in the early 1960s from the Kaga, Udaimandir, and Jain temple of the city have vanished totally from these sites due to the effects of urbanization (Prakash, 1963). Meanwhile, Deval of Maharaja Shri Gaj Singh, Deval of Maharaja Shri Ajit Singh, palm tree plantation of the Mandore garden, Mehalado of Soorsagar, a dark interwoven cave of Daijar Mata Temple, an unattended bungalow of Krishna Nagar Colony, Sagi kee Bhakari of Jhalamand and the Open Convocation Pandal of J. N. V. University are the new roosting sites for the Microchropterans and Rail Sadan is the new site of the Megachiropterans of this region. Detailed accounts of every roosting site of Chiropterans in and around Jodhpur as mentioned follows. Out of these sites we have selected four sites, two for Megachiropterans viz., Rail Sadan and Balsamand, and two for Microchiropterans viz., Mandore tunnel and Open Convocation Centre, for more detailed studies of their population dynamics.

Megachiropteran roosting sites

Balsamand garden: One of the big gardens of the city covering a 200 acre area and situated about five miles north of Jodhpur. Balsamand Lake, a big water reservoir, is a major topographical feature of the garden. During the early 1960s Prakash (1963) reported the roosting of *Pteropus giganteus giganteus* on *Ficus* trees and a few *Rhinopoma hardwickii hardwickii* roosting in a deserted palace in the garden. During the present survey we saw a huge colony of *Pteropus giganteus giganteus* roosting on the association of four giant *Ficus* trees growing inside the garden, fifteen meters away from the lake, but did not see any *Rhinopoma hardwickii hardwickii* anywhere in the garden.

The population of *Pteropus giganteus giganteus* roosting on the trees of *Ficus bengalensis* in Balsamand Garden ranges between 23-445 individuals as per the counting done during the different months of the study period. The maximum population was observed in February 2002 (445 ± 21.36), whereas the minimum numbers were recorded in March 2002 (23 ± 2.36). A comparative analysis of the population data obtained for various months of the study period reveals that the population of *Pteropus giganteus giganteus* at this roost used to be high in the winter season (November to February), while falling in the summer season (March to June).

Rail Sadan: This is the residential bungalow of the Divisional Railway Manager (DRM), Jodhpur, situated close to the main railway station of the city. It has a well-maintained kitchen garden, which

has almost a hundred trees of various species. For the first time from this site, we reported a huge colony of Indian flying fox *(Pteropus giganteus giganteus)* inhabiting almost twenty trees such as *Pithecellobium dulce, Azadirachta indica, Albizia lebeck, Saraca asoca, ficus religiosa* and *Syzygium cumini.* Their numbers vary according to the season.

The population of *Pteropus g. giganteus* roosting on the trees in Rail Sadan ranges between 115-1,491 individuals as per the counting done during the different months of the study period. The maximum population was observed January 2002 (1491 ± 104.1), whereas the minimum numbers were recorded in May 2003 (115 ± 8.17). A comparative analysis of the population data obtained for various months of the study period reveals that the population of *Pteropus giganteus giganteus* at this roost used to be high in the winter season (November to February) while falling in summer season (March to June).

The reduction in numbers seems to be a result of the seasonal migration of this species, which has already been reported in various parts of India and abroad (Sinha, 1980). The comparison of the population count in the different months of two successive years of the study period suggests that the abundance of Indian flying fox, *Pteropus g. giganteus* at both these roosts dropped considerably in 2002-2003 compared to 2001-2002. This decline in the number of the individuals of this species seems to be a result of the severe drought that prevailed over the entire western part Rajasthan which reduced the availability of food for *Pteropus g. giganteus,* which prefers fruits and foliage of trees such as *Ficus religiosa, Ficus bengalensis, Azadirachta indica* and others.

Microchiropteran Roosting Sites

Meharangarh fort: This is one of the historical monuments of Jodhpur, situated on a hillock about 1,000 ft. high to the north of the city. Today it is almost unattended. In the early 1960s Prakash (1963) reported a large number of *Rhinopoma hardwickii hardwickii, Rhinopoma kinneari, Megaderma lyra lyra* and *Rhinopoma kinneari* roosting at various spots in the fort. During the late 1970s Gaur (1979) studied the site and reported that *Megaderma lyra lyra* had disappeared from the site. Presently it is inhabited by an association of *Rhinopoma microphyllum kinneari* and *Rhinopoma hardwickii* at the dark underground portion and staircase of the Palace, and *Rhinopoma microphyllum kinneari* in the Chakelaw well.

Mandore garden: Situated 9 km north of Jodhpur railway station it is the largest public garden of the Jodhpur city and contains various species of flora and fauna. In the early 1960s, for the first time Prakash (1963) reported three Microchiropteran species namely, *Rhinopoma kinneari, Taphozous perforatus* and *Megaderma lyra lyra* from the tunnel of the Mandore *nullah*. In addition, three new roosting sites of Microchiropterans *viz.*, Deval of Maharaja Shri Gaj Singh, Deval of Maharaja Shri Ajit Singh and Palm Tree Plantation were explored from this garden during the study period. Crevices of various old ruined buildings of garden and fissures of the surrounding hillocks were presumed to be the roosting sites for the Indian Pygmy bat, *Pipistrellus tenuis* (*P. mimus*), because many individuals of this species were observed at night in this garden while foraging, and a few have also been mist netted.

Mandore Tunnel: A 600 feet long, 4-18 feet high and 20 feet wide covered passway for the overflow water of a small dam in Mandore. Prakash (1963) reported three Microchiropteran species namely, *Rhinopoma kinneari, Taphozous perforatus* and *Megaderma lyra lyra* in the early 1960s. Later on Gaur (1981) did work at this site and reported the vanishing of *Megaderma lyra lyra* and the addition of *Hipposideros fulvus* to the michrochiropterans of the tunnel. Since the early 1980s no one has studied the ecology of the bats at this site. We had reported an association of *Rhinopoma microphyllum kinneari, R. hardwickii, Taphozous perforatus* and *Rhinolophus lepidus* at this roost (Purohit and Senacha, 2002).

A great fluctuation in population density of all four microchiropteran species of this roost was observed. In general, Greater Mouse-tailed bat, *(Rhinopoma microphyllum kinneari)* dominates the other three throughout the year, except in May

and June. Maximum numbers were observed in August 2003 (2895 ± 186.18) and minimum numbers were recorded in June 2002 (44 ± 4.78). Interestingly, no *Rhinopoma m. kinneari* were observed here in May. Egyptian Tomb bat *(Taphozous perforatus)* stands second in terms of population density with the maximum number observed in May 2003 (896 ± 21.03) and minimum number in February 2002 (385 ± 15.14). Lesser Mouse-tailed bat *(Rhinopoma hardwickii)* stands third with the maximum number observed in August 2003 (117 ± 4.45) and minimum in March 2002 (47 ± 2.23). Blyth's Horseshoe bat *(Rhinolophus lepidus)* was found in the lowest numbers among all four species at this roosting site with the maximum in observed in June and July 2003 (14 ± 0.64) and the minimum in January and March 2002 (4 ± 0.19).

Deval of Maharaja Shri Gaj Singh: One of the historical monuments in the garden, built in memory of Maharaja Shri Gaj Singh, former ruler of Jodhpur State. The interior *Goombed* portion of the monument is occupied by a solitary colony of Naked-rumped Tomb bats *(Taphozous nudiventris) or* (*T. kachhensis*).

Deval of Maharaja Shri Ajit Singh: A two-story monument built by the royal family of Jodhpur State in the memory of the former ruler Maharaja Shri Ajit Singh. The *Goombed* of this Deval was found to be inhabited by a mixed colony of two bat species belonging to Family Emballonuridae *viz., Taphozous nudiventris* and *T. perforatus*.

Palm Tree Plantation: There is a colony of almost 65 palm trees situated in a block adjoining the eastern gate of Mandore tunnel. The long, dried leaves of these tall trees hang down with gravity and have formed deep hollow spaces. Individuals of Asiatic Greater Yellow House bat *(Scotophilus heathii)* were found roosting deep in these hollow spaces. During the day time they were not visible, but they could be seen roosting at the opening end of these hollows when it was time for them to forage.

Bheembhadak, Kayalana: A hilly area about 1,200-1,500 ft. high, seven miles west of Jodhpur. Prakash (1963) reported for the first time *Rhinopoma m. kinneari* and *R. hardwickii* from a natural cave and *Taphozous katchensis katchensis* (*T. nudiventris*) from the fissures and crevices of the rocks outside the cave. Our present study at the site reveals that out of these three Michrochiropteran species, *Taphozous nudiventris* has disappeared over the course of time, while the other two still roost there in the natural cave.

Open Convocation Center, New campus, J. N. V. University: An unattended building situated near the University Press at the new campus of J. N. V. University, Jodhpur. During September 1999 for the first time we reported *Rhinopoma micropyllum kinneari* (Purohit and Kaluram, 2001) from the four low laying dark rooms of the elevated portion of this open convocation center. Recently this roost has added *R. hardwickii* as a new species at the site.

A great fluctuation was found in the population density of *Rhinopoma microphyllum kinneari* as compared to *Rhinopoma hardwickii*, which inhabits this roosting site. It was observed that sometimes Greater Mouse-tailed bat *(Rhinopoma microphyllum kinneari)* was dominant, while at other times Lesser Mouse-tailed bat *(Rhinopoma hardwickii)* dominated this roost. The maximum number of *Rhinopoma microphyllum kinneari* was observed in July 2003 (3500 ± 175.12) and the minimum in November 2002 (4 ± 1.62). Interestingly no specimens of *R. m. kinneari* were observed here in May and June. However, the maximum number of *Rhinopoma hardwickii* was observed in July 2003 (35 ± 2.1), and the minimum in June 2003 (7 ± 1.3).

Shrinathji kee Haveli, Mahamandir: In the early 1980s, Gaur (1981) reported for the first time the presence of *Rhinopoma microphyllum kinneari* from the staircase and low lying dark chambers of an old building, Shrinathji kee Haveli, situated about 2 km north of the Jodhpur railway station. Presently, there is a drastic decline in the population, which has declined from numbering in the thousands to below one hundred. An increase in the resident families and disturbance by the children are the key factors behind this decline. Interestingly, we

have also observed a few individuals of *Rhinopoma hardwickii* at this site.

Mehalado, Soor Sagar: It is an old, unattended building located near the electric sub-station of Soor Sagar. For the first time in March 2002 we reported the presence of *Rhinopoma microphyllum kinneari*. About 150 individuals of this species were found roosting in the corners and ceilings of the various compartments of this ruined building.

Krishna Nagar: One of the newly developed residential colonies of the city situated along Pali road in front of the new campus of J. N. V. University, Jodhpur. The staircase and a dark underground room of an unattended partially constructed bungalow (B-63) are occupied by about 500 individuals of *Rhinopoma microphyllum kinneari*. We reported this site for the first time in March 2002.

Sagi kee Bhakari, Jhhalamand: A small hillock lying 15 km away in the east of Jodhpur. It is surrounded by the farming fields and a variety of flora and fauna inhabits the region. Deep and narrow caves, and fissures in the rocks are serving as the roosting sites for two Microchirpterans species, namely *Rhinopoma microphyllum kinneari* and *Taphozous nudiventris*. We reported this site for the first time in March 2002. It is quite difficult to approach each and every interior roosting site of the bats of this locality, but from the analysis of repeated video graphic counts at the time of emergence, we have estimated that around three thousand bats inhabit the site.

Interwoven cave of Daijar Mata Mandir: A long interwoven dark tunnel of Daijar Mata Temple (near to Daijar village), which is inhabited by two microchiropteran species. Around 200 individuals of *Rhinolophus lepidus* were seen to roost at the interior-most part of the tunnel in March 2002, while around 300 individuals of *Rhinopoma hardwickii* were seen roosting at both entrances of the tunnel in May 2002. We were the first to report this Microchiropteran roost.

The overall study of this survey reveals that *Pteropus giganteus giganteus* is the only species of Megachiroptera in Jodhpur reported presently from Balsamand garden and Rail Sadan. Among the Microchiropterans, *Rhinopoma microphullum kinneari* is widely distributed at seven sites, namely Mandore tunnel, Mandore garden; Mehrangarh fort; Open Convocation Center, J. N. V. University; Bhimbhadak, Kayalana; Krishna Nagar, Basani first phase; Mehalado, Soor Sagar; Sagi kee bhakari, Jhalamand village and Shrinathji kee haveli, Mahamandir. *Rhinopoma hardwickii* roosts at Mandore tunnel, Mandore garden; Mehrangarh fort; Bhimbhadak, Kayalana; Shrinathji kee haveli, Mahamandir; Open Convocation Center, J. N. V. University, Jodhpur and Daijar Mata temple cave, Daijar village. *Taphozous perforatus* was reported from Mandore tunnel in close association with *Rhinopoma microphyllum kinneari*, and *R. hardwickii* roosted in association with *Taphozous nudiventris* at the Deval of Maharaja Shri Ajit Singh, Mandore garden. The Deval of Maharaja Shri Gaj Singh is the solitary roost for *Taphozous nudiventris* and *Scotophilus heathii* inhabits the dry foliage of palm tree plantations at Mandore garden. A long and highly interwoven cave of Daijar Mata temple is the only big site for *Rhinolopus lepidus* in this region, but a few are also reported from Mandore tunnel. We didn't locate any permanent roosts for *Pipestrellus tenuis* (*mimus*), but we have netted them from the open areas of the study site.

Conclusion

From the above-mentioned study we can conclude that the tremendous increase in human population, urbanization and construction of new buildings, as well as the renovation of old heritage buildings during last two decades, has altered the scenario of the Chiropteran status in and around Jodhpur city. The Microchiropteran species *Megaderma lyra lyra, Hipposideros fulvus, Pipestrellus dormeri* and *Tadarida aegyptiaca* reported earlier have probably vanished from this region over the course of time, while the remaining species have seen tremendous changes in their roosting sites. Similarly, in the case of the Megachiroptera, *Pteropus giganteus giganteus* was the only species found in the study area; we couldn't find the remaining two viz., *Cynopterus sphinx* and *Rosettus leschnaulti*.

The study revealed that the populations of both Mega and Microchiropterans of the study area have been found to fluctuate throughout the different months of the year. Comparative analysis of the data collected during this study suggests that the population of *Pteropus giganteus giganteus* has declined drastically at both the sites in the year 2002-2003 as compared to year 2001-2002. Comparative analysis of population of Microchiropterans also reveals the same results regarding *Pteropus giganteus giganteus*. The severe drought in the study area may be another one of the reasons behind this drastic decline in the population of both types of bats because vegetation and agricultural practices, which have been enormously impacted by this drought, are the main sources for their feeding, whether directly or indirectly.

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A colony of Greater Mouse-tailed bat, Rhinopoma microphyllum kinneari roosting on the ceiling and walls of a chamber in Mandore tunnel, Mandore Garden, Jodhpur.

Some individuals of Greater Mouse-tailed bat, Rhinopoma microphyllum kinneari roosting on the walls and ceiling of low-lying unattended portion of Open Convocation Center, J. N. V. University, Jodhpur.

HABITAT STRUCTURE OF ROYAL SUKLAPHANTA WILDLIFE RESERVE, NEPAL

by Ram Thapa and Naveen Kumar Mahato

Introduction

Nepal has established a network of 16 protected areas covering a total area of 28,585.67 km^2, occupying 19.42% of the country's total area (DNPWC, 2005). Beginning in 1973, when the country's first national park – Royal Chitwan National Park – was established, a total of 9 national parks, 3 wildlife reserves, 3 conservation areas and 1 hunting reserve, including 9 buffer zones around the parks/reserves, have been established representing all 5 of the physiographic zones – lowlands, terai and Siwalik hills, mid-hills, high mountains, and high Himalayas (DNPWC, 2005). Besides these protected areas, a total area of 4,666.67 km^2 has been declared as buffer zones around as many as 9 of these protected areas to implement a community-based management system aimed at reducing human-protected area interaction. Out of 118 ecosystems described by Dobremez (1970) in Nepal, 80 ecosystems are covered by the current protected area system (BPP, 1995; HMGN/MFSC, 2002)

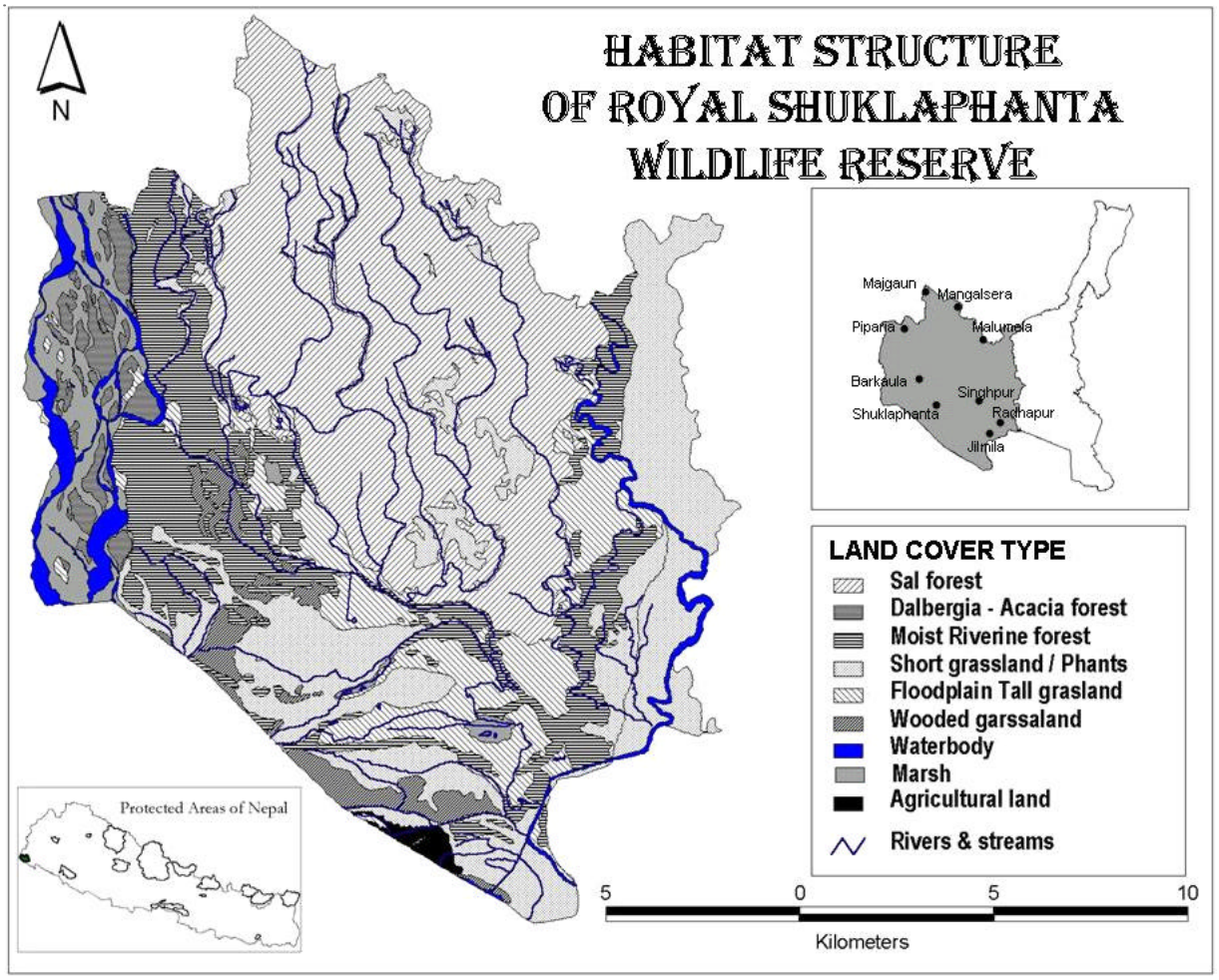
Royal Shuklaphanta Wildlife Reserve (RSWR), situated between latitudes 28°45'16"N and 28°57'23" and longitudes 80°06'04" and 80°21'40", was initially established as a Royal Hunting Reserve with an area of 131 km^2 (Yadav *et al.*, 2000), which later was gazetted as the Royal Shuklaphanta Wildlife Reserve in 1976 increasing the area first to 155 km^2 and later to the present area of 305 km^2 in 1980 (DNPWC & PPP, 2000). The reserve lies in the extreme southwest of the Terai in Kangchanpur district. It is bounded by the Mahakali River in the west, the Indo-Nepal border in the south, the Syali River in the east and the Siwalik hills in the north and east. The altitude ranges from 90-270 m above sea level. The reserve lies on the Gangetic flood plains and the common soil types are loamy soil, sandy loam, silty loan, and clay loam (Manik *et al.*, 1969; Bhatta & Shrestha, 1997). The climate is predominantly sub-tropical and monsoonal with more than 90% of the annual precipitation (1,500-2,000 mm) falling between June-September. The temperatures range from 10°-12°C (during Feb/March) to 30°-32°C (during May/June) (Department of Meteorology/HMG-N, 2003). This paper presents part of the study of Thapa (2003) which yields ecologically important information on vegetation of the core area of RSWR.

Materials and methods

The habitat structure of the reserve (excluding the extended area) was studied through direct field surveys and mapping was done with the help of GIS, based on various map sources produced by the Department of Survey of the His Majesty's Government of Nepal. Thematic information was created from a topographic map (scale: 1:25,000) (Department of Survey/HMGN, 1992) and aerial photographs taken in 1996 (Dept. of Survey/HMGN, 1996). Field verification was done during April-June 2003, using a GPS unit (12 XL Personal Navigator, Garmin). Thematic information was created with the help of Cartalinx Version 1.1 (with maximum RMS of 0.00008) and they were exported into Arc View GIS 3.1 for spatial analysis. All the works related to spatial analysis and mapping were done using Arc View 3.1 and associated extensions developed by ESRI Inc.

Results and discussions

The habitat structure was studied in the 215.62 km^2 study area of Royal Shuklaphanta Wildlife Reserve. Seven major habitat types were identified and their distribution, composition and physiognomy are discussed below.



Sal forest (*Shorea robusta*)

Sal forest occupies the largest continuous area in the northern part of the study area (RSWR) around the reserve headquarters (Majgaun), Mangalsera post, Malumela post and north of Barkaula post. A total of 75.73 km^2, covering approximately 35% of the study area, is covered by this forest type.

The tree species associated with this forest type are *Terminalia tomentosa, T. chebula, T. belerica, Lagerstromia parviflora, Garuga pinnata, Cassia fistula, Adina cordifolia, Phyllanthus emblica* etc., with *Colebrookea oppositifolia, Grewia tilifolia, Asparagus racemosus,*and *Phoenix humilis* in its understorey. This forest type had very little ground cover – *Imperata cylindrica, Narenga porphycocoma*, and *Eulalopsis binnata* being the prominent species in places with widely spaced trees. Sal dominance is broken along the streams and rivers by riverine forest species such as *Mallotus philipensis, Syzygium cumini, Trewia nudiflora, Ficus glomerate, Mitragyna parviflora,* etc. Sal is an extremely gregarious species and rarely found as a component of any other forest types (Stainton, 1972). Sal forest is the climax vegetation of the lowland (Dinerstien, 1979) and establishes itself in well-drained and more developed soil (Stainton, 1972). Sal forest accommodates suitable habitat for spotted deer (*Axis axis*), hog deer (*Axis procinus*), swamp deer (*Cervus duvauceli duvauceli*), barking deer (*Muntiacus muntjak*), wild elephant (*Elephas maximus*), etc.

Moist riverine forest

Moist riverine forest is distributed in moist areas near the floodplain with more stable and boggy soil, and represents a serial stage in succession.

Moist riverine forest is characterized by the presence of tree species such as *Syzygum cumini, Trewia nudiflora, Mallotus philippensis, Ehertia laevis, Butea monosperma, Bombax ceiba, Ficus glomerata, Albezia procera, Holarrhena antidysenterica, Careya arborea, Cedrala toona* and *Lagerstroemia parviflora*. The understorey is composed primarily of *Murraya koenigii, Cannabis sativa, Clerodendron viscosum, Dryopteris cochleata, Pteris* spp., *Calamus tenuis, Colebrookea oppositifolia*, and *Callicarpa macrophylla*. The ground cover is provided by grasses like *Imperata cylindrica, Saccharum spontaneum, Narenga porphyrocoma, Vetiveria zizanoides*, and broadleaved plants like *Ageratum conyzoides* and *Cirsium wallichii*.This forest type appears as a distinct strip along the continuum of Khair Sissoo forest and Sal forest. It closely resembles what Stainton (1972) has called 'tropical deciduous riverine forest.' The forest is denser and more mixed in composition than Sal forest. Buttressing is common among several of the tree species such as *Bombax ceiba, Syzygium cumini, Adina cardifolia* and *Ficus glomerata* in response to the boggy soil in the forest (Dinerstein, 1979).

These moist riverine vegetations are harbored mostly in the area south of the Sal forest. The riverine forest of the western flank in the vicinity of Pipariya post consists of different riverine forms, with *Syzygium* as the dominant tree species. This habitat type covers an area of 36.19 km^2 (approximately 17% of the reserve area) and provides refuge to spotted deer, swamp deer, hog deer and nilgai (*Boselaphus tragocamelus*). Signs of elephants were also observed in this habitat type. Dinerstein (1979) suggests that tigers prefer early riverine forests during the hot season because of the availability of water in this habitat and also because its prey – spotted deer – is in abundance in this forest.

Dalbergia sissoo-Acacia catechu association

Dalbergia-Acacia association dominates the banks and gravel bars of the Mahakali River on the western edge of the Reserve. Stands of *Dalbergia sissoo* and *Acacia catechu* occur either separately or together in combinations of varying proportions in this Reserve. *Dalbergia sissoo* is limited almost exclusively to riverine sites and forms pure stands on the banks and gravel bars of the Mahakali River, whereas *Acacia catechu* is also found as a component of deciduous riverine forest. *Dalbergia* and *Acacia,* being pioneer species, are restricted to major watercourses, floodplains islands and unstable riverine sites (Champion & Seth, 1968; Dinerstein, 1979). Only 5.53 km^2 are covered by the *Dalbergia-Acacia* association, which is approximately 2.5% of the reserve area.

This habitat type is characterized by *Bombax ceiba, Trewia nudiflora, Aegle marmelos, Mallotus philippensis* and *Syzygium cumini* mixed with *Dalbergia sissoo* and *Acacia catechu.* In the understory, Clerodendr*um viscosum, Colebrookea oppositifolia, Zizyphus mauritiana, Cannavis sativa* and *Artemisia vulgaris* were found to be dominant, along with other shrubs and herbs species. The ground cover vegetation was less diverse with *Imperata cylindrica, Saccharum spontaneum, Narenga porphyrocoma, Desmostachya bipinnata* and *Cynodon dactylon* being dominant. At some places this forest has *S. spontaneum* extensions on the sandy banks at the river edge. The occurrence of *Zizyphus mauritiana* was evidence of heavy grazing by domestic stock in the area (Dinerstein, 1979).

Pellets of spotted deer, hog deer and damages caused by wild elephants were recorded in this forest type. *Dalbergia-Acacia* forests with an abundant understory of *Murraya koenigiim* and *Callicarpa macrophylla* provide shelter to the greater one-horned rhinoceros (*Rhinoceros unicornis*), the latter species being a preferred food plant of the animal during the winter (Gyawali, 1986).

Short grasslands or phantas

Short grasslands, or phantas, are open areas consisting of tussock-forming, short perennial grasses (less than 2 m tall) occurring on more or less stabilized soils. These grasslands are distributed in Central Suklaphanta proper, Surya phanta, north of Barkaula phanta, Radhapur phanta and parts of Kariya phanta. A total of 48.92 km^2 covering approximately 23% of the

study area is covered by short grasslands or the phants.

These grasslands are dominated by *Imperata cylindrica, Narenga porphyrocoma, Saccharum spontaneum, S. bengalensis, Desmostachya bipinnata, Vetiveria zizanoides, Cymbopogan* spp, *Cyperus* spp and *Cynodon dactylon*. An assemblage of *Imperata cylindrica* and *Imperata cylindrica-Narenga porphyrocoma* in these short grasslands were identified by Peet (1997). Lehmkuhl (1989) suggests that these grasslands have originated due to human interventions such as forest clearing, burning, livestock grazing, cultivation and abandoned villages. On the previously cultivated sites, *I. cylindrica*-dominated swards succeed to *N. porphyrocoma*-dominated swards, which in turn give rise to a mosaic of tall and short grassland. The dominance of *Vetiveria zizanoides* is the result of livestock grazing in addition to burning (Lehmkuhl, 1989).

The occurrence of *I. cylindrica* assemblages and the associated phases, which support a number of threatened wildlife species, has made the reserve of greater conservation significance (Peet, 1998; Dinerstein, 1979). These phantas are very important habitat for swamp deer, hog deer, hispid hare (*Caprolagus hispidus*) and spotted deer. This habitat was also utilized by the endangered greater one-horned rhinoceros for grazing. The *I. cylindrica* assemblage is habitat to spotted deer and nilgai (Peet, 1998) and is also utilized by swamp deer (Schaaf, 1978) and the globally threatened Bengal florican (*Houbaropsis bengalensis*) (Inskipp & Inskipp 1983).

Floodplain tall grassland

Tall grasslands are distributed in the lower elevation floodplain of the Bahuni River, Chaudhar River and monsoon rain areas in Hariya phanta, Sundari phanta, north-east of Shukla phanta, Barkaula phanta and some portions of Kariaya phanta. An estimated area of approximately 22.43 km^2, covering 10% of the study area, is covered by the floodplain tall grassland.

Tall grasslands represent an early successional stage (Peet, 1998) and are maintained as a result of disturbances in fluvial action, principally as a result of inundation during the monsoon, under which conditions grassland can be a stable, pre-climax community. The tall grasslands consist of tall and perennial grasses such as *Saccharum spontaneum, S. bengalensis, Phragmites karka* and *Typha elephantine*, which occur on permanently wet or seasonally inundated sites. *Narenga porphyrocoma, Themeda* spp and *Imperata cylindrica* are found on better developed non-inundated soils. Shorter grasses such as *Apluda mutica* are common, along with a few herbaceous plants which are present in varying densities, including *Cirsium wallichii*. The successional pattern of the floodplain grassland under natural conditions is through intermediate stages of riparian *Sissoo* and *Khair* forest to more or less stable semi-evergreen riverine forest (Dinerstein, 1979). *Phragmites karka, Phragmities karka-Saccharum spontaneum-Saccharum arundinaceum* and *Narenga porphyrocoma* assemblages have been identified in the tall grasslands communities of RSWR (Peet, 1998).

Droppings and footmarks of wild elephants and greater one-horned rhinoceros were common in this grassland habitat. Droppings of hispid hare and pellets of hog deer and spotted deer were also found in the grassland. The hog deer and greater one-horned rhinoceros are associated with the early successional assemblage dominated by *Phragmites karka* and *S. spontaneum* (Peet, 1997), while spotted deer, swamp deer and nilgai utilize the *N. porpyrocoma* assemblage only (Dinerstein, 1979; Peet, 1998).

Wooded grassland

Wooded grasslands are of the savannah type, often dotted with tree species such as silk cotton tree *Bombax ceiba* and *Dalbergia sissoo*. During the field verification, grassland with 20-30% woody vegetation as measured based on ocular estimation was considered as wooded grassland. This habitat represents previously disturbed and cultivated sites (Dinerstein, 1979) and has a characteristically high water table, which facilitates extensive grass growth and gives graminoids a competitive advantage over shrubs and trees under conditions of more or less uninterrupted isolation.

The predominant tree species include *Dalbergia sissoo, Bombax ceiba, Butea monosperma, Sterculia villosa, Acacia catechu, Garuga pinnata* and *Mallotus philippensis* in higher densities and *Syzygium cumini, Trewia nudiflora, Ficus religiosa, Cedrela toona* and *Mitragyna parviflora* in lower densities. The grass species in this habitat are *Imperata cylindrica, Saccharaum spontaneum, S. bengalensis, Cymbopogan flexosus, Narenga porphyrocoma, Desmostachya bipinnata, Eulaliopsis binata, Cyperus* spp. and *Cynodon datylon*.

The wooded grassland in the south of Suklaphanta has mainly *Bombax ceiba, Butea monsoperma* and *Dalbergia sissoo* dispersed in the grasslands, while the region west of Barkaula phanta possesses other tree species. A 7.12 km^2 area covering about 3.5% of the total study area is covered by the wooded grassland, which provides habitat to swamp deer, spotted deer, hog deer, blue bull and wild boar (Dinerstein, 1979).

Wetlands and marshes

The wetlands in the study area include the three main river systems Mahakali, Chaudhar and Bahuni, and several shallow rivers and streams in the reserve. Other stagnant wetland types include several lakes or tals, floodplains and swamp lakes with marshes in their fringe. Some important lentic wetlands in the study area are Rani Tal, Sal gaudi Tal, Patero Tal, Shikari Tal and Kalikich Tal with permanent water throughout most of the year and luxuriant growth of aquatic vegetation. Marshes are marked by the presence of water and the soils remain saturated with water long after the monsoon. The dominant vegetation includes *Phragmities karka, Saccharum spontaneum, Narenga porphyrocoma* and *Typha elephantina*. These wetlands cover approximately 9% of the study area, comprising an area of 18.62 km^2.

Wetlands have been recognized as one of the important ecosystems and harbor about 25% of the biodiversity of Nepal (HMGN/MFSC 2002). These wetlands in the reserve support a diverse wildlife.

Conclusions

The study identified seven major types of habitat within the 215.62 km^2 study area of Royal Suklaphanta Wildlife Reserve. Sal forest occupies the largest area followed by the *Imperata cylindrica*-dominated short grassland, while the *Dalbergia sissoo-Acacia catechu* association covered the least area in the unstable riverine sites and floodplain islands of the Mahakali River in the western flank of the reserve. The highest similarity (as calculated using Sorensen's Index of Similarity 1948) was observed between the floodplain tall grassland and short grassland, while the least was between the moist riverine forest and tall grassland.

Imperata cylindrica-dominated phantas, important habitats of the threatened swamp deer (Schaaf, 1978), are shrinking as a result of succession to tall grassland and forest. Active management in the form of burning, cutting and ploughing is imperative for its continued survival. The opening of the trees to arrest the encroachment of wooded grassland by trees and shrubs should be done every 2-3 years, which further ensures the local people's active participation in conservation endeavors by supplementing their forest product needs.

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PREY AVAILABILITY GOVERNING THE DIET OF LEOPARD (*Panthera pardus fusca*)

by Ravindra D. Chaudhari, Ashokkumar N. Khadse and Umesh I Hiremath

Introduction

The leopard (*Panthera pardus fusca*) is a majestic carnivore that was once widely distributed in many parts of India. Now it is restricted to a few wildlife sanctuaries and national parks and some non-protected areas of Maharashtra.

For centuries, hunters pitted their strength against this cat. In recent years international efforts by IUCN and WWF resulted in the restriction, and later on the total prohibition, on the hunting of leopard. Even up to 1962, leopards were treated as big game and permission was freely granted for hunting at a nominal fee of Rs.15 per month or Rs.30 per year. This practice continued until 1976-77 (Srivastav, 1999) when the first ban on shooting of leopards was imposed. At present, leopards are included in Schedule I of the Wildlife (protection) Act, 1972.

With only a few research works available (Kadambi, 1953; Schaller, 1967; Muckehirn & Eisenberg, 1973; Sunquist, 1981; Tikader, 1983; Robbins, 1983 & 1993; Pond *et al.*, 1995; Shukla, 2002) on the food and feeding habits of Indian leopards, it was necessary to focus attention on all aspects of the leopard's life history, particularly on those having direct relevance to predator-prey relationships.

Even though predation has a major influence on the dynamics of animal populations, it must be judged on the basis of its effect on populations and not on individuals. The cattle killing by big cats associated with other livestock depredation by leopards is common news today from all parts of the country (Sawarkar, 1986). The predation on domestic livestock was formerly considered to be an aberrant form of behavior (Finn, 1929). Whereas Chaudhari (1979) held cattle killing to be aberrant when it becomes regular. Tewari (1995) stated that most carnivores are facing the problem of habitat shrinkage, resulting in the problem of non-availability of favored prey species in sufficient numbers. Guggisberg (1975) stated that the predation on domestic livestock by large carnivores is an ancient conflict; but according to Latham (1969), a predator transfers its pressure to other species when the primary prey species becomes relatively or totally unavailable.

There are increasing cases of cattle and other livestock predation by leopards in this region. Similar observations are reported regarding the lion (*Panthera leo persica*) and the leopard preying mainly on livestock in Gir National Park (Barbaria, 1982). However, Joslin (1973) reported that an analysis of 480 lion scats revealed that 75-83% of their diet was comprised of domestic livestock. According to Guggisberg (1975), the depletion of prey species in India has forced the larger cats to feed on cattle because they can be secured as food with far less effort than that needed to bring down a wild prey. Moreover, leopards have little stamina – a fast run of a few hundred meters leaves them panting – and they are unable to pursue animals rapidly over long distances. This has also been reported in lions by Schaller (1972). Here the question arises – is decimation of prey the only reason for larger carnivores taking to feeding on cattle, or are there other reasons too?

In order to assess the factors governing the predator-prey relationship, we must estimate the daily food requirement of different carnivores and the number of available prey species. In the wild, it is very difficult to estimate the food intake of

leopards as they are diversely adapted for various habitats and may not remain more than a few days in a given locality. Also, it is very agile and can travel up to 50 km a day in search of food (Maan & Chaudhary, 2000). Trying to follow an individual leopard continuously for many days presents other problems. Observations over only a few days may give misleading results. Schaller (1972) reported that a lion was able to consume enough meat for at least 5 days in one meal and able to fast for more than a week without obvious discomfort. Therefore, data on leopards in captivity from Katraj Zoo (Pune, Maharashtra), Borivili National Park & Temporary Rescue Center for rehabilitation of leopards at Manikdoh (Junnar, Pune) under the Ghod Project Forest Division, Junnar, was used to calculate the minimum daily food requirements of leopards. The population numbers of predators (leopard, jackal, Indian fox, hyena, wolf, common palm civet or toddy cat) and prey (herbivore) species were obtained from the Ghod Project Forest Division, Junnar 1997 and 2001 census reports.

The main purpose of this paper is to present the facts about the large predators, mainly the leopard, in the jurisdiction of Ghod Project Forest Division, Junnar, in an attempt to provide information to help understand how the leopard can be preserved, maintained and managed in the near future.

In the wild, leopards and lions are opportunistic feeders, generally feeding on any species that is available and vulnerable (Soni *et al.*, 1992). The minimum average amount of food consumed by a male and female leopard pair in captivity at Mankidoh was 4 kg and 2.5 kg respectively; at Katraj Zoo, the average was 2.5 kg for males and 2.25 for females; and at Borivili National Park the average was 5 kg for both sexes. Mitchel *et al.* (1965) reported that 7 kg of meat is the daily requirement of a wild panther, but Crandall's (1964) captive food consumption data indicated 1.2 kg per day. Prabhu *et al.* (2001) stated that 4 kg of buffalo meat + 2 eggs are the dietary requirements of leopards at Kanpur Zoo. Schaller (1967) and Muckehirn & Eisenberg (1973) stated that the annual prey requirement of the leopard appears to be about 1,000 kg/year in the wild. At Manikdoh (Junnar), the rescued leopards are only held temporarily and are released back into the wild as early as possible. Using the captive food consumption data for the minimum average daily requirement, a male leopard would need 1,460 kg and a female 913 kg of meat per year. However, an arbitrary average of 25% of the weight of small prey and 40% of large prey is inedible (Schaller, 1972). So, in order to obtain the necessary amount of meat, each male and female has to kill 1,855 kg and 1,210 kg of prey per year respectively.

Taking into consideration the leopard census in April 2001 and May 2002, the total estimated leopard population of males, females and cubs in April 2001 was 41, 46 and 23 respectively, and in May 2002 it was 40, 36 and 12. Based on our estimation, a total of 131,715 kg of meat is required per year for the male and female leopards (excluding cubs) in the Ghod Project Forest Division, Junnar. These figures presume that leopards eat all edible portions of a carcass, but in actual fact, kills are often abandoned, portions of a carcass are wasted, and hyenas, jackals, foxes, wolves and wild pigs appropriate some remains, which are all factors that tend to raise the number of animals that the leopards have to kill.

Schaller (1972) and Sunquist (1981) estimated that predators annually remove about 10% of the standing biomass. In addition, during the 1997 and 2001 censuses, a total of 20/15 hyenas, 16/9 Indian foxes, 47/21 jackals, 47 wolves and 23 leopard cubs were respectively recorded. They also are mainly dependent on the herbivore population for food and require a considerably large quantity of meat per year. Eisenberg (1980) and Santiapillai *et al.* (1982) reported high densities of 17.20 leopards/100 km^2 from habitats in Sri Lanka, where competing predators such as tiger and dhole are entirely absent. But in the Ghod Project Forest Division, Junnar, there is a much higher average density of 20.95 leopards/km^2, and as many as 25 leopard cubs and 92 other competing predators.

The biomass of herbivores is 15,527 kg in Ghod Project Forest Division, Junnar. This would not seem to be sufficient to support the leopards in this area, even without taking into consideration the cubs and other predators in the area. Hence, depletion of the prey species could be the major cause that has driven the leopards to feed on cattle and other livestock from the villages adjoining the

forest. It is important to note though that leopards are widely adapted for their diet, which includes lizards, snakes, crabs and insects (Rice, 1986), earthworms (Akhtar & Narang, 1998), scorpions (Shukla, 2002), etc.

Living in habitats that have insufficient wildlife prey species leads to conflicts with man when the leopard takes to feeding on domestic stock (Daniel, 1996). Leopard attacks on cattle and other livestock and even humans are frequently reported in the jurisdiction of this Division Office. Predation on cattle and other livestock cannot be eliminated completely, but it can be minimized if the protected forest areas are intensively managed for wildlife by increasing the population of herbivores – and therefore the prey base of leopards. Hence, the only solution to minimizing this major problem is to take serious steps to improve the prey population; otherwise the leopard-human conflict will continue. A detailed, intensive study of the problem is needed, and in fact, the leopard is a singular species of which there is a remarkable absence of data (Daniel, 1996).

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Table 1: Wild animal census reports of Ghod Project Forest Division, Junnar

Name	Population 1997 Census	Population 2001 Census
Hyena	20	15
Jackal	47	21
Wolf	5	47
Indian Fox	16	9
Jungle Cat	17	8
Common Palm Civet or Toddy Cat	5	0
Hare	0	29
Wild Pig	0	62
Monkey	370	21
Barking Deer	14	7
Sambar	0	2
Porcupine	22	0
Giant Squirrel	10	0
Varanus sp.	21	0
Peacock	114	67

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FINANCING SUSTAINABLE FOREST MANAGEMENT: WHO IS RESPONSIBLE?

This article has been adapted from a Secretariat Note that was prepared for the 21st Asia-Pacific Forestry Commission Session held 17-21 April 2006, Dehra Dun, India. Delegates at the APFC session recommended that the Secretariat Note be more widely distributed to foster debate and understanding of issues related to financing of forest management.

Securing adequate financing: a continuing challenge

Financing sustainable forest management continues to be an important element of the national and international dialogue on forests. Adequate financing is crucial for implementing sound forest management and, more broadly, for achieving sustainable development and the Millennium Development Goals. With government budgets for forest administrations falling in many countries and prices for many products in decline, current financial resources for forest management are considered insufficient in many areas.

There is broad agreement at national and international levels that society has a moral obligation to manage forests in a manner that provides vital goods and services to both current and future generations. Disagreement persists, however, over the precise definition of sustainable forest management, whether sustainable forest management needs to be achieved at all costs – considering that it is competing with other sectors for scarce funds – and who should bear the costs for managing a resource that simultaneously provides local, national, regional and global values. In particular, what are the roles and what are the relative responsibilities of governments, the private sector and the donor community in financing activities that contribute to sustainable forest management?

The issues related to financing sustainable forest management are highly complex. Financing refers not only to funding the management of existing forest resources, but also to the establishment of new resources and facilities for the production and marketing of forest products. It encompasses forest resource development (e.g. plantations, silvicultural operations, natural forest management) as well as the needs of the forest products processing industry. It includes the maintenance of environmental services that forests provide. Of critical importance to developing countries, financing is also required for national forestry institution-building (e.g. administration, policy formulation and implementation, law enforcement, planning, national and local capacity strengthening), research, education and extension and market development.

Ideally, in the long run, sustainable forest management, especially of production forests, should be self-financing through the sale of forest goods and services. Currently, in most instances, it is not. Consequently, financial resources are often insufficient to properly manage vast areas of forests. In light of the substantial financial resources required, effective mobilization of funds needs to involve a wide range of mechanisms and sources, both traditional and innovative, and domestic as well as foreign.

With few exceptions, traditional funding mechanisms are well recognized and understood, and member countries are making regular use of them. Governments allocate budgets to forest administrations. Donors (including bilateral aid agencies, multilateral organizations and development banks) provide funds for projects and programs. The private sector provides financing for targeted investments. Non-governmental organizations – sometimes playing roles very similar to donors and implementing agencies – provide support, especially at grass-roots levels. Millions of rural people donate time and effort to plant and tend trees, and to manage existing forest resources for goods and services.

Although a dizzying array of financing arrangements exists[1], it remains a significant challenge for the forestry sector to identify and secure adequate funding for all forest management needs. The roles, responsibilities, priorities and requirements of the various funding entities remain unclear to many individuals. As a result, expectations are sometimes unrealistic and efforts to ensure adequate funding are occasionally misguided.

What can realistically be expected from donors?

All countries have come under increasing pressure in recent years to enhance forest protection and improve management. Developing countries have often contended that such insistence be accompanied with tangible financial support for forest conservation, management and capacity building in the form of higher levels of official development aid, increased market access, and innovative new financing schemes such as conservation concessions, debt-for-nature-swaps, etc.

An important question, however, relates to the extent that developing countries can or should rely on grants and loans provided by the donor community for financing sustainable forest management. There appears to be considerable "donor fatigue" on one hand, as various donors have become disillusioned at the slow pace of progress in the forestry sector, and donor priorities have shifted to support rural livelihoods and poverty reduction. On the other hand, many forest-related projects have been criticized for being donor-driven or for infringing on national sovereignties. Hence, some degree of fatigue is also apparent at the recipient end.

International financing is indispensable for activities that protect the global environment and provide benefits beyond local boundaries and national borders. It is therefore unlikely that financing mechanisms such as the Global Environment Facility (GEF) will become obsolete in the foreseeable future. Since 1991, the GEF has provided US$4.5 billion in grants and generated US$14.5 billion in co-financing from other partners for projects in developing countries and countries with economies in transition. It has contributed significantly to biodiversity conservation in forest areas.

But what should be the role of other – more traditional – donors when global environmental values are not at stake and/or where direct beneficiaries can be easily identified? In such situations, support from these donors can still serve an important catalytic role in supporting change and the adoption of new practices and processes, such as national forest programmes. But at some point donor support may reduce opportunities for the private sector to become more actively involved. For example, donor support for the establishment of forest plantations or forest product processing could well undermine the motivation of the private sector to invest in such ventures.

Creating space for the private sector

Experience has demonstrated that if a favourable business climate exists, the private sector will make

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[1] *The Collaborative Partnership on Forests (CPF) maintains an online "Sourcebook on Funding for Sustainable Forest Management" to provide information on a wide array of funding opportunities. The Sourcebook can be accessed at:*

http://www.fao.org/forestry/foris/webview/cpf/index.jsp?siteId=2225&sitetreeId=6117&langId=1&geoId=0

investments in the forestry sector if expected rates of return are sufficiently attractive. For example, there was great interest in financing forest plantation expansion when wood product prices were rising sharply in the early 1990s. Forest product processing is another domain largely financed by the private sector. The public sector and donors might be ill-advised to compete with the private sector in these areas. To encourage the private sector to invest with full confidence and commitment in sustainable forest management requires the creation of a stable enabling environment. Using donor funds to support public-sector involvement in these areas could easily serve as a disincentive to private-sector financing.

Historically, the private sector has been quick to invest in the production and processing of forest goods, timber and non-wood forest products when the opportunity has been granted and when prospects for profits are apparent. This pattern continues throughout the region and, as the Sustainable Forest Management Licence Agreement approach in Sabah, Malaysia indicates, innovative ways are being developed to encourage long-term investments in forest management by profit-seeking enterprises.

For the most part, the private sector has paid relatively little attention to the environmental services that forests, if properly managed, can provide. However, a number of innovative market-based solutions have recently emerged, some of which suggest that the private sector can play a dual role. On one hand, private companies can benefit from "green" funds (e.g. through carbon offset arrangements). Several carbon sequestration payment schemes are being explored internationally, especially within the framework of the Clean Development Mechanism. Although the process is very complex, countries are slowly beginning to capture more afforestation funds from carbon emitters.

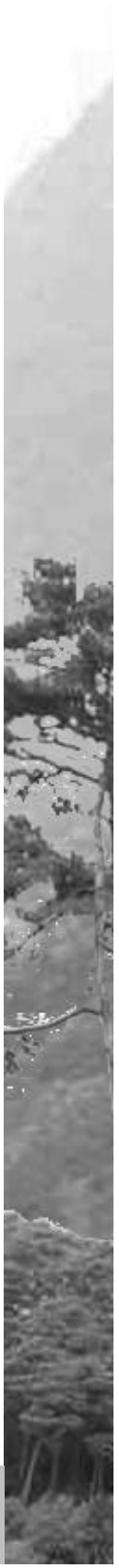
The private sector can also make compensatory payments to forest users and land owners who forgo direct benefits in the process of providing recognized and valued environmental services. Ecotourism, amenity values and watershed protection may serve as examples. For instance, healthy watersheds can provide improved water quality, local flood protection, soil erosion control and soil fertility maintenance – all of which can be of enough interest to the business community that it may be willing to pay for the maintenance or enhancement of the services.

Redefining the role of the public sector

However, the local and domestic benefits that environmental protection and sustainable forest management provide are not only valued by the private sector. Benefits also accrue simultaneously to society more broadly. This explains why historically the protection and management of critical forest areas, such as watersheds and biodiversity reserves has been the preserve of government. In serving the public interests, governments will be fully justified in continuing efforts to safeguard the environmental services that forests can provide. But increasingly – and particularly as public sector budgets shrink – governments should seek to embrace the roles that others can play and encourage investments by the private sector and market-based approaches that support the provision of environmental services.

An increasing number of examples demonstrate that the private sector can take on responsibilities that historically have been shouldered by public-sector forest administrations and financed through government budgetary allocations. Further experience is needed, however, to determine those functions and modalities that can be most effectively assumed by the private sector and those which require continued involvement of forest agencies. While the private sector has made limited forays into research, extension and capacity building, these are probably areas that will continue to rely extensively on government support.

To some extent, public funding allocations are also determined by how government agencies view themselves and to what extent they are willing and able to "reinvent" themselves to demonstrate relevance in times of change, such as shifts in forest management objectives and the decentralization of management authorities. Rather than asking who should finance what, policy makers and forest administrations might



better assess who can perform desired functions most effectively and efficiently, and subsequently work to enhance their contributions through appropriate financing.

Finally, the attention given to attracting funds and searching for new financing mechanisms has, to some extent, distracted from the need to focus on what can be achieved with the funds currently available and how to improve cost-effectiveness through the establishment of strategic partnerships among stakeholders. An increasing number of countries and organizations have found that greater emphasis on effective partnerships and more careful use of existing budget resources can yield significant results without the need for additional budget allocations. Cost savings can be made especially in the area of law enforcement, where the requirement for detailed prescriptions and complex regulations lead to high (public) cost of enforcement and high (private) cost of compliance for commercial operators, small farmers and communities alike.

TAKING STOCK ASSESSING PROGRESS IN DEVELOPING AND IMPLEMENTING CODES OF PRACTICE FOR FOREST HARVESTING IN ASEAN MEMBER COUNTRIES

Implementing sustainable forest management continues to be one of the most critical challenges facing wood-producing countries in the Asia-Pacific region. Responding to this challenge, many countries have developed and are implementing codes of practice for forest harvesting or similar guidelines for improved harvesting practices in natural forests. To reflect the region's commitment to sustainable forest management, the Asia-Pacific Forestry Commission (APFC) published the *Code of Practice for Forest Harvesting in Asia-Pacific* in 1999. The Association of Southeast Asian Nations (ASEAN) Senior Officials on Forestry endorsed the regional code in 2001, as a guide to develop specific national codes and/or guidelines.

With regard to improving forest harvesting practices in general, and implementing national codes of practice for forest harvesting in particular, a comprehensive and current picture of the progress among ASEAN member countries was needed. Therefore, the 7th Meeting of ASEAN Senior Officials on Forestry, held in May 2004, called on the ASEAN Secretariat to take stock, in collaboration with FAO, of the development and implementation of codes of practice for forest harvesting in ASEAN member countries. The review was to answer whether the development of the regional code and subsequent national codes has made a tangible difference in the way forest harvesting is conducted in ASEAN member countries.

The findings of the review are mixed. On one hand, the development and implementation of national codes of practice for forest harvesting and promotion of reduced impact logging (RIL) has contributed to the improvement of forest harvesting practices and standards of natural forest management. On the other hand, progress

remains slow. In fact, there is little room for complacency.

The progress made is due partly to enabling legislation, improved regulations, and increased interest in forest certification by forestry enterprises. The area of certified forests in Indonesia, Malaysia and Lao PDR has significantly increased. Some countries (e.g. Malaysia, Indonesia, Vietnam) have published RIL guidelines in national languages.

Research, primarily conducted in Malaysia and Indonesia, indicates that the application of RIL practices can reduce damage to the residual stand by about 50 percent and logging waste by 10-30 percent. Some innovative RIL techniques and technologies have been developed, but have been applied at a small scale only in a limited number of locations. Although the body of knowledge on better forest management and RIL has expanded, dissemination of such knowledge in the field remains unsatisfactory, especially across the borders of ASEAN member countries.

Knowledge on the economics of different logging systems is particularly limited. Thus, the debate on the financial implications of reduced impact logging continues, often based more on perceptions than scientific information. Increased extension and cross-border exchanges of information and experiences, facilitated by regional and sub-regional entities, could help address these knowledge gaps and accelerate adoption.

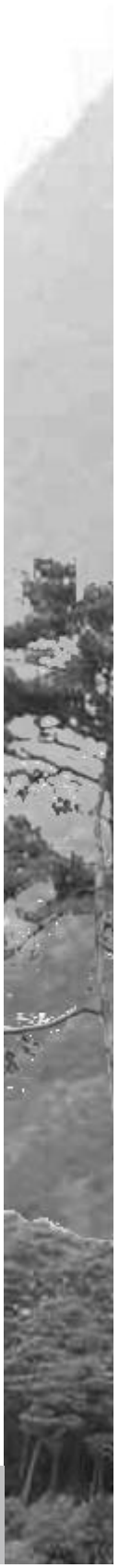
Training has received considerable attention throughout the region, although a shortage of qualified trainers means that the number of trainees remains low. In most countries, there is also an absence of regular monitoring and evaluation of training activities. With few exceptions, training tends to be sporadic rather than systematically organized as part of a broader and strategic approach to increasing knowledge, upgrading skills and changing attitudes in the industry. A more coherent approach to training is emerging in some countries, however, often in collaboration with international organizations.

Currently, in some countries (e.g. Cambodia, Lao PDR, Myanmar, the Philippines, Vietnam, and partly in Indonesia), forest harvesting in some natural forests and plantations is shifting from capital-intensive mechanized to semi-mechanized systems. Awareness among communities and foresters about small-scale forest management operations is growing. This has both positive environmental and socio-economic impacts, through enhanced employment and income generation at local levels. This is also good for sustainable forest management. It is therefore important to include aspects of manual and semi-mechanized forest harvesting systems in national codes of forest harvesting, and also to consider the issue of labor-intensive low-impact forest harvesting and forest management in any guidelines.

The acceptance of national codes remains problematic, as most codes were formulated without wide stakeholder consultations. Many key stakeholders do not feel ownership of the national codes. Many codes also do not leave sufficient flexibility to account for local differences in topography, soils, forest types, forest harvesting systems or socio-economic conditions.

Most of the national codes, with the exception of the Cambodian Code of Practice for Forest Harvesting, are not legally binding. In several countries, national codes have been prepared and published, but not formally adopted and disseminated widely, which results in enforcement problems. In addition, the implementation of national codes is not systematically monitored and evaluated in any of the four countries visited as part of the review (Indonesia, Lao PDR, Malaysia, Myanmar).

Illegal logging has emerged as a serious threat to the effective implementation of codes of practice for forest harvesting, the application of RIL, and sustainable forest management in general. Illegal operations depress market prices for forest products, reduce the comparative profitability of products produced under more sustainable regimes, and provide a competitive advantage to illegal operators. As they witness profit margins shrink, legitimate operators can hardly be expected to invest in the training, equipment,



improved supervision, and incentives that are needed to support the adoption and implementation of codes for improved forest harvesting. Consequently, forest law enforcement has become one of the most debated topics among responsible forest operators.

Discussions with forestry officials revealed several concerns and requests for the ASEAN Secretariat, the FAO Regional Office, APFC, and other regional institutions to consider. They include encouraging and facilitating the exchange of information among ASEAN member countries, especially on illegal logging, illegal timber trade, international and domestic timber market prices, growth and yield data of forest stands and forest certification schemes. Other recommendations include:

- establishing a common understanding on code and RIL development and implementation;
- promoting labor-intensive and small-scale forest harvesting practices;
- strengthening capacities in developing and implementing codes and applying RIL;
- establishing a monitoring and evaluating system for the implementation of national codes of practice and RIL in ASEAN member countries; and
- establishing a permanent forestry unit at the ASEAN Secretariat to coordinate the development and implementation of codes of practice and RIL in ASEAN member countries.

FAO and ASEAN have jointly published the results of the stock-taking exercise in both book and CD-ROM formats. For copies of the publication, please contact the ASEAN Secretariat at public@aseansec.org or Patrick Durst of FAO at Patrick.Durst@fao.org

NEW PROJECT ON STRENGTHENING MONITORING, ASSESSMENT AND REPORTING ON SUSTAINABLE FOREST MANAGEMENT IN ASIA GETS STARTED!

Contributed by Masahiro Otsuka, Forestry Officer, Monitoring Assessment and Reporting, FAO-RAP & Kailash Govil, Senior Forestry Officer, Monitoring Assessment and Reporting, FAO, Rome

FAO initiated the project "Strengthening Monitoring, Assessment and Reporting on Sustainable Forest Management in Asia" (MAR-SFM) (GCP/INT/988/JPN) in January 2006. The 5-year project is funded by the Government of Japan.

The main objective of the project is to develop a globally harmonized, forest-related national monitoring, assessment and reporting (MAR) system to contribute directly to the improvement of sustainable forest management (SFM) regimes in the Asia-Pacific region. An allied objective of the project is to enhance the use of the MAR information in national decision-making, formulation of effective forest policies, and sustainable forest management and planning.

The project aims to accomplish its objectives in two phases. During the first two-year development phase, the project will focus on:

- international activities such as the establishment of linkages with forest-related processes;
- development of a globally harmonized framework, guidelines and database structure, including pilot testing in some countries;
- use of MAR information in forest planning and development of forest policies at the national level;
- establishment of a country-level network of national focal points to various forest-related processes; and
- initiating a set of national activities that facilitates the implementation of the harmonized MAR.

The implementation phase will spread over the remaining three years of the project period and focus on the implementation of the harmonized MAR, including facilitating the establishment of databases at national levels in selected project countries through studies, reviews, training, workshops and expert consultations. The detailed design of this phase will be finalized on the basis of a review of the activities and the outputs of the first phase.

All countries in the Asia-Pacific region are welcome to participate in the project, although the actual level and intensity of each country's involvement may vary. Forestry departments in respective countries have been requested to express their willingness to participate in the project and to nominate national focal points.

A project Inception Workshop was organized in Sapporo, Japan, 24-28 July 2006, by FAO, in collaboration with Japanese Forest Agency, International Tropical Timber Organization (ITTO), International Network for Bamboo and Rattan (INBAR) and the FAO-Norwegian project. The workshop explored the current status of MAR in the project countries, briefed the national focal points about the project, and deliberated on the work plan for project activities for the first year of operations.

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DEVELOPING SYSTEMS FOR MONITORING COMPLIANCE WITH HARVESTING CODES

Contributed by Patrick C. Dugan, Project Coordinator, "Enhancing Sustainable Forest Harvesting in Asia" Project (GCP/RAS/192/JPN)

With assistance from FAO and other donors, countries throughout the Asia-Pacific region have developed codes of forest harvesting practices. Reduced impact logging (RIL) methods are clearly described in the codes in simple texts and illustrations. Producing a good code comprises an important first step in promoting good harvesting methods. But it is also crucial to determine whether principles and practices set forth in a code are being applied.

To help forest administrators assess the results of code implementation, FAO conducted a workshop 17-21 July 2006, in Bangkok, involving key personnel from Lao PDR, Myanmar and Vietnam. The workshop was organized to assist in developing protocols, systems, and methods for evaluating outcomes of harvesting practices. The three participating countries are currently implementing the *"Enhancing Sustainable Forest Harvesting in Asia"* Project (GCP/RAS/192/JPN). Codes are already in place in these three countries, and training on application of sound harvesting principles and practices has been carried out over the last two years. The countries are now challenged to monitor and evaluate if forest harvesting is being implemented consistent with their respective codes. The workshop focused on this challenge.

Workshop participants built on experience in their countries and a model from Tasmania, Australia, where development, refinement, and improvement of codes and monitoring systems started in the 1980s and has been continually updated since then. Graham Wilkinson, Chief Forest Practices Officer of Tasmania, facilitated the workshop. He guided participants through the processes of identifying what to monitor, defining monitoring standards, systematic data collection, analyzing results and preparation of monitoring reports. "Keep it simple, but don't miss anything important," was a theme emphasized throughout the workshop. Wilkinson also stressed that monitoring and evaluation (M&E) are not "fault-finding" exercises; they are tools that identify options for doing a better job. At the same time, M&E results provide a basis for rewarding good performance and taking corrective disciplinary action as needed.

Each country has unique features relative to forest management and socio-economic or cultural conditions that influence harvesting practices. The participants took these factors into consideration in developing their monitoring protocols. They returned to their countries with drafts they will test in the field during the next logging season, starting November or December. Meantime, each country will conduct workshops and seminars with concerned stakeholders to explain the protocols and solicit suggestions for improvement. Concurrently, they will begin organizing and training teams competent to conduct monitoring and evaluation effectively. This isn't a job that anyone can do well. So, in addition to crafting systems, the workshop participants also formulated criteria for selecting people who will be trained for this important task.

Building the institutional framework for implementation of M&E systems is another challenge. Assurances of support for this need were given by FAO/RAP, and country focal points continue to exchange ideas and experiences via e-mail to collectively work toward enhancing M&E capabilities.

HOW EFFECTIVE ARE TREES AND FORESTS IN PROTECTING COASTAL ASSETS?

The workshop "Coastal protection in the aftermath of the Indian Ocean tsunami: What role for forests and trees?" was held 28-31 August 2000 in Khao Lak, Thailand, under the auspices of the FAO Forestry Programme for Early Rehabilitation in Asian Tsunami Affected Countries and funded by the Government of Finland. The workshop aimed at contributing to improved coastal area planning, coastal forest management and disaster mitigation by increasing the knowledge and understanding of the role of trees and forests in protecting populations and assets from the most common and destructive natural hazards affecting coastal areas of Asia, namely cyclones, erosion, tsunamis, wind and salt spray.

In the aftermath of the Indian Ocean tsunami that wreaked havoc and destruction on 26 December 2004, the protective role of mangroves and other forests and trees received considerable attention, both in the press and in academic circles. Numerous forest rehabilitation efforts were subsequently launched, citing coastal protection as the rationale. However, contrasting views on the effectiveness of forests in coastal protection arose; many eyewitnesses reported that coastal forests had saved lives and villages from destruction, but some people claimed that forests could not provide significant protection from hazards of a certain magnitude. Several experts asserted that land elevation and distance of assets from the coast were more significant determinants of protection than forest cover. It became clear that a better understanding of the degree to which forests and trees could provide protection from different types of coastal hazards was needed to provide an improved basis for formulation of coastal management plans and disaster mitigation strategies.

The Khao Lak workshop provided a rare opportunity for multi-disciplinary analysis of this issue. Coastal engineers and oceanographers, forest ecologists and managers, disaster management specialists, coastal planners and social scientists brought together their combined experience regarding the role of coastal forests against cyclones, erosion, tsunamis, wind and salt spray. The 63 participants included government representatives from eight tsunami-affected countries (Bangladesh, India, Indonesia, Malaysia, the Maldives, Myanmar, Sri Lanka and Thailand), other experts from 15 different countries and from national, regional and international organizations.

The workshop confirmed that forests and trees can act as bioshields to protect people and other assets against tsunamis and other coastal hazards, but care must be taken to avoid generalizations and to create a false sense of security. Coastal forests, in fact, are not able to provide effective protection against all hazards. In cases where bioshields are not a feasible option or sufficiently effective, provisions must be made for other forms of protection, including hard engineering solutions and a hybrid of "hard" and "soft" solutions, and – in extreme events – evacuation must be relied upon.

Detailed information on the workshop itinerary, conclusions and recommendations may be found at: www.fao.org/forestry/tsunami/coastalprotection

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NATIONAL FOREST PROGRAMMES -- AN UPDATE

Contributed by S. Appanah, NFP Advisor for Asia and the Pacific, FAO-RAP

After three years of implementation, the National Forest Programme Facility underwent a mid-term review earlier this year. The findings, which were released in October 2006, Concluded that the governance of the Facility has been innovative and exceptionally good. In most cases, funding levels were considered adequate by countries and recipient organizations. One criticism, however, was that the Facility allocated the same amount of funding to all countries, irrespective of their size and individual needs.

The Facility's management received high marks, and likewise the quality of technical support. Nevertheless, there were some criticisms of some of the regional advisers in terms of promptness of action, suggesting the need for additional staff. The review was also critical of the lengthy "Letter of Agreement" negotiation process, slow clearance of reports and delayed disbursement of funds. Related to proposal selection, the reviewers suggested the Facility should somewhat soften its "demand-driven" approach in partner countries where a more strategic approach is warranted. Also cited by the reviewers were implementation constraints and difficulties linked to partner countries' forestry situations including: inter-sectoral coordination, conflict between some NGOs and forest departments, low status of the forest sector in national policies, and lack of mechanisms to involve rural people.

The reviewers identified other factors that have chronically confused partner countries. Chief among them was the institutional relationship of the Facility with FAO. Partner organizations (and countries) generally equate the Facility with FAO, although the Facility Team has continually emphasized that the Facility is an autonomous entity, with its secretariat hosted by FAO.

With respect to the critical aspect of Facility operations – both the country support and information services components – the reviewers identified some clear directions, while acknowledging the difficulty of drawing firm conclusions based on limited experience. In many of the partnership countries, Facility support has been instrumental in opening up and broadening non-state stakeholder participation in the nfp process. The Facility has provided concrete incentives and encouragement for civil society organizations and forest departments to come together in nfp-related dialogues. Likewise, the reviewers found concrete examples of the Facility having an impact in removing barriers to successful nfp implementation (e.g., raising awareness of community rights, initiating dialogue between community forest users and government departments, engaging municipal organizations, etc.).

The reviewers found the potential sustainability of the processes and activities initiated with Facility support to be good. They attributed this to the fact that: i) the grants are small, and so do not require much additional external assistance thereafter; and ii) the grants are allocated through a nationally or locally driven process, which gives the work much impetus. However, the reviewers considered the duration of the grants, usually one year, to be too short for the work to take root. Encouragingly, Facility support has played a catalytic role in attracting additional funds from other donors in some instances and has generally catalyzed national policy debates and policy processes in numerous cases.

The review made several recommendations to the Steering Committee, the Facility Team and FAO. These included the following:

- Country support should be specifically targeted to support well-focused actions that facilitate or remove barriers from integrating nfps into national strategies for sustainable development, and establishing multi-stakeholder partnerships and programmes.
- Partner countries should be provided with stronger and clearer guidance on priority themes to be supported, along with a checklist that defines the activities that qualify for Facility support.
- Training events should be organized that address understanding of nfp concepts, and proposal writing.
- Efforts should be increased to organize and facilitate workshops and seminars at regional and subregional levels on lessons learned and exchange of experiences.
- Whenever possible, the number of disbursements under each Letter of Agreement should be reduced.
- More staff time of the regional nfp advisers should be allocated to Facility-related work, so as to improve the promptness in feedback to partnership countries.

Asia-Pacific update

As of September 2006, Facility-related work is ongoing in China, Indonesia, the Philippines, Palau, Pakistan, Vanuatu and the South Pacific countries. Although Thailand is part of the partnership, and the Launching Workshop was held in July 2005, no substantial activities have been initiated, mainly because the various forestry agencies under the Ministry of Natural Resources and Environment are being revamped and the Ministry has yet to decide which agency will be responsible for nfp-related activities. A partnership between Vietnam and the Facility has also been finalized, and the activity areas have been identified, but no activities have been initiated to date because of difficulties in agreeing on the modalities for implementation and funding.

In Indonesia, the "NFPs for All – Enhancing the National Forest Programme Process" was organized in June 2006. Presentations were made on: i) *Sustainable Development and International Forest Processes*; ii) the *International Forest Regime and its relevance to the national forest programme*; iii) the *Concept of Conservation District*: *NFP Facility's operational and funding arrangements*; and iv) *Priority issues for implementation of the nfp in Indonesia*. The group work sessions dealt with the *Concept of Conservation District* and *Evaluation of the nfp process in Indonesia as a tool for sustainable forest management.*

A number of lessons were derived from the Indonesia exercise. First of all, the "NFPs for All" workshops require country specific adjustments, and there is a need to involve as many country partners as possible for delivering the presentations and for facilitation. There is still the notion that nfps are FAO/Facility-led rather than country-driven processes. Finally, the nfp processes can be enhanced further by joining forces with international and regional agencies that are active in the country (e.g., in the case of Indonesia, it would be valuable to work with ASEAN/ReFOP).

In July 2006, the NFP Facility sent out a call for new country partnerships. Countries not already receiving Facility support are requested to make use of this opportunity. The partnership provides up to US$300,000 over a 3-year period. The deadline for submitting Concept Notes is **30 September 2006**.

For more information on nfps in the Asia–Pacific region and/or the National Forest Programme Facility, please contact:
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FAO Regional Office for Asia and the Pacific
Bangkok, Thailand
Tel: 66-2-697-4136
Fax: (66-2) 697-4445
E-mail: simmathiri.appanah@fao.org

RAP FORESTRY STAFF MOVEMENT

Mr. Kenichi Shono, a national of Japan, joined RAPO as an Associate Professional Officer in December 2005. Mr. Shono provides assistance on issues related to promoting sustainable forest management in the region. He has conducted a study on the forest revenue system in Cambodia and is involved with FAO's work related to forest restoration and the national forest programme. He oversees the publication of *APANews* (a biannual agroforestry newsletter) and maintains and updates the Asia-Pacific Forestry Commission (APFC) website.

Mr. Shono obtained a Master's degree in Forest Science and Management from the Yale School of Forestry and Environmental Studies in 2002.

Prior to joining FAO, Mr. Shono worked for the Center for Tropical Forest Science – Arnold Arboretum, where he conducted research on forest restoration and tropical forest dynamics in Singapore.

Mr. Masahiro Otsuka, a national of Japan, has joined RAP as Forestry Officer for the project on Strengthening, Monitoring, Assessment and Reporting (MAR) on Sustainable Forest Management (SFM) in Asia on 15 May 2006. Mr. Otsuka is developing collaborative programmes of the project with participating countries to strengthen the harmonization of forest-related MAR activities for SFM, including the development of national networks.

Mr. Otsuka started his career with FAO in 1991 as an Associate Professional Officer (Communications) in Bogor, Indonesia, after graduating from the Master's Program in Environmental Sciences at University of Tsukuba, Japan. After two years of service with FAO, he worked with ICRAF for two years and JICA for ten years, conducting field research and providing technical assistance on forestry and environment in Indonesia and Madagascar.

Ms. Susan Braatz, a U.S. national, joined RAP as Programme Coordinator for the Regional Forestry Programme for Tsunami Rehabilitation on transfer from Headquarters in September 2005. The programme is implementing field activities in Indonesia, the Maldives and Sri Lanka, as well as supporting a regional component to strengthen information exchange and coordination.

Ms. Braatz has a Bachelor's degree in Ecology from Smith College and a Master of Forest Science degree from Yale University's School of Forestry and Environmental Studies. She has worked with FAO since 1991, first as Land Use and Agroforestry Officer, then as Policy Officer preparing the State of the World's Forests report, and most recently as Senior Officer for international forestry arrangements. From 2001-2004 she was seconded from FAO to the UN Secretariat in New York as part of the Secretariat of the United Nations Forum on Forests, the main international forest policy forum. Since January 2005, Ms Braatz has been the FAO Forestry Department's focal point for tsunami rehabilitation.

Mr Jeremy Broadhead, a national of the United Kingdom, was appointed Assistant Coordinator to the Finnish-funded Regional Forestry Programme for Early Rehabilitation in Asian Tsunami Affected Countries (OSRO-GLO-502-FIN) in December 2005.

Prior to joining FAO/RAP, Mr Broadhead worked on forestry project preparation and coordination for the World Bank and Asian Development Bank in Laos and Cambodia. He has also worked in Myanmar, Kenya, Indonesia and at FAO head-quarters in Rome.

Ms. Chalinee Vamarupa has been appointed a secretary for the project Regional Forestry Programme for Early Rehabilitation in Asian Tsunami Affected Countries."

Ms. Valeeporn Sinsawasdi has been appointed a secretary for the project Enhancing Sustainable Forest management in Asia project (GCP/RAS/192/JPN).

Mr. Philip McKenzie, a national of the Netherlands, completed his 3-year Associate Professional Officer assignment in April 2006. As an APO, his work focused mainly on forest policy related issues. Philip now resides in Australia. His contact address is: tikoesch@gmail.com

Ms. Miyuki Ishikawa, a national of Japan, completed her 2-year assignment as an Associate Professional Officer (Forest Economics and Policy) with FAO/RAPO in October 2005. She subsequently joined the Japan International Cooperation Agency (JICA) in Tokyo as an associate expert (natural resource management and community development) in January 2006. At JICA, she continues to work on forestry issues in Asia and the Pacific, specifically socio-economic and livelihood aspects, which entails frequent traveling to Southeast Asia. Her contact address is: Ishikawa.Miyuki@jica.go.jp

Mr. Conrado Heruela, a national of the Philippines, former Project Coordinator for the Reducing Greenhouse Gas Emissions by Promoting Bioenergy Technologies for Heat Applications Project (EP/RAS/106/GEF), began work as Chief Technical Adviser of the UNDP-DPRK Sustainable Rural Energy Development Programme in August. His contact address is: Conrado.Heruela@undp.org

Ms. Sini Jaakkola, a national of Sweden and Finland, completed a six-month internship with RAPO in June 2006. She was supported by the West Swedish Fellowship Programme for Young Academics. The programme provides young academics with an opportunity to work for international organizations as trainees and to receive on-the-job experience. Ms. Jaakkola graduated with a M.Sc in environmental science from Göteborg University, Sweden, in 2005. She has now returned to Sweden to pursue a career in environmental management.

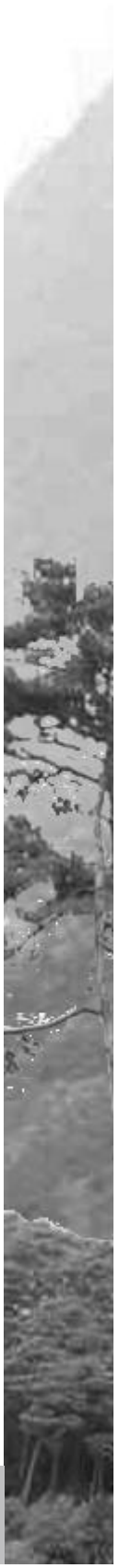
Mr. Thomas Enters, a German national, joined FAO in July 2000 as a Forestry Sector Analysis Specialist for the EC-FAO Partnership Programme: Information Analysis for Sustainable Forest Management. After the completion of the program in February 2003 Mr. Enters served as the National Forest Programme Facilitator for countries in the Asia-Pacific region until August 2006. He will continue to work with FAO on various projects as an international forestry consultant and can be contacted at Thomas.Enters@fao.org

Ms. Pernille Lausen Hansen, a national of Denmark, joined RAPO as an intern in July 2006 for a 6-month stay under the internship program of the International Development Studies, Roskilde University (Denmark). She is currently involved in helping to organize the International Conference on Managing Forests for Poverty Reduction, to be held in Ho Chi Minh City, Vietnam, in October 2006.

Ms. Hansen has a B.A. in International Development from Roskilde University, Denmark, and is currently studying for the M.Sc. at the same institution, focusing on environmental management in development countries.

Ms. Meng Linlin, a national of China, joined RAPO in September 2006 for a 2-month internship under the M.Sc program at the Technical University Munich (Germany). She is currently preparing an Asia-Pacific Forestry Sector Outlook Study Working Paper: *The relevance and impact of gender issues on the outlook for forestry to 2020 in North Asia*.

Ms. Meng has a B.A in Water and Soil Conservancy and Desertification Prevention Control from Beijing Forestry University, China, and has finished the theoretical courses for the M.Sc at Technical University Munich, Germany with a major in sustainable resource management.



ASIA-PACIFIC FORESTRY CHIPS AND CLIPS

WORLD'S SMALLEST FISH FOUND IN INDONESIA

The world's smallest fish on record was recently discovered in an acidic peat swamp in Indonesia. The peculiar fish is a member of the carp family and measures less than 8 mm at maturity. It has a transparent body and a head that is unprotected by a skeleton. Peat swamps were once thought to harbor very few animals, but recent research has discovered that they support many species that occur nowhere else. Such swamps are under threat in Indonesia from fires lit by plantation owners and farmers.

– Associated Press –

LOGGING ACTIVITIES TO RESUME IN ACEH

The Indonesian government has licensed five forest concession holders to resume harvesting in Aceh in order to meet demand of around 200,000 cubic meters of wood for post-tsunami reconstruction. The government and the Aceh and Nias Rehabilitation and Reconstruction Agency will monitor the activities of the concessionaries to ensure compliance with existing forest regulations.

– ITTO Tropical Timber Market Report –

INDONESIA CANCELS PLANS FOR LARGE OIL PLANTATION

Indonesia announced that it would end plans to establish a 1.8 million hectare oil palm plantation in Borneo, which was backed by Chinese investors. The decision was made as part of the "Heart of Borneo" initiative by the governments of Indonesia, Brunei and Malaysia to protect key areas of biodiversity in Borneo. The initiative aims to protect 220,000 square km of tropical rainforest.

– ITTO Tropical Timber Market Report –

THE RUSSIAN FEDERATION JOINS FAO

The Russian Federation has taken up membership of FAO more than 60 years after FAO's foundation. Russia is a major agricultural economy and contains vast areas of forests. The decision increases FAO membership to 189 member countries and one member organization, the European Community. Russia has also applied for membership in the Asia-Pacific Forestry Commission (APFC).

– FAO –

MORE CONTROLS ON LOGGING

The Autonomous Region in Muslim Mindanao in the Philippines imposed a total logging ban in late March to protect the region's remaining forests. The logging ban came after the army seized a sizable cargo of illegally harvested forest products.

– ITTO Tropical Timber Market Report –

INDIA FACES RECORD DEFICIT IN TIMBER SUPPLY

According to a recent World Bank study, India is facing a serious shortage in the supply of timber and fuelwood and has stirred timber markets in Indonesia, Malaysia, Myanmar and Nigeria in recent months. Shortfall in timber supply is projected at 39 million cubic meters in 2006. Fuelwood demand is estimated at 139 million tons, far above the supply from regulated and sustainable sources. The government of India encourages the import of round wood, and around 95 percent by volume of India's timber imports consist of industrial roundwood.

– ITTO Tropical Timber Market Report –

FSC LAUNCHES CHINA INITIATIVE

The Forest Stewardship Council (FSC), a non-governmental organization aimed at promoting responsible forest management, has launched an initiative in China that marks the first formal steps toward the development of a forest certification scheme in China. Given China's massive role in the world's timber market, the FSC initiative in China is expected to play a critical role in mitigating the negative environmental impacts of poor forest management.

– WWF –

FIRST FSC CERTIFIED FOREST IN VIETNAM

Responsible forestry in Vietnam took a major step forward when the Quy Nhon Plantation Forest

Company of Vietnam Ltd. became the first company to earn Forest Stewardship Council (FSC) certification in the country. There is significant potential to build sustainable forestry within Vietnam using certification as a key tool. Exports of wood products have tripled since the mid-1990s. More than 1,200 companies are involved in timber processing, requiring approximately 2 million cubic meters of wood per year.

– www.forestandtradeasia.org –

ASEAN LAUNCHES ENVIRONMENT YEAR 2006 AT BOGOR

The Association of Southeast Asian Nations (ASEAN) has designated 2006 as ASEAN Environment Year (AEY) with the theme, "Biodiversity: Our Life, Our Future" at an official launch held in Bogor, Indonesia on May 18. AEY is celebrated every three years with the aim of promoting environmental awareness at all levels of society. It highlights ASEAN's environmental achievements, strengthens partnerships among ASEAN member countries as well as the private sector, civil society and non-governmental organizations, and addresses environmental challenges in the ASEAN region.

– Viet Nam News –

PINE RESIN MAKES INROADS IN LUCRATIVE U.S. MARKET

Vietnam recently exported its first consignment of processed pine resin to the United States, which local enterprises described as a breakthrough for the nation's fledgling pine resin industry. American demand for high-quality pine resin – used to produce many products including ink, glue and paint – is substantial, given that the nation is a center for the printing and chemical industries.

– Viet Nam News –

ANNOUNCING "INVASIVES"

The Asia-Pacific Forest Invasive Species Network (APFISN) was established in response to the immense costs and dangers posed by invasive species to the sustainable management of forests in the Asia-Pacific region. APFISN is a cooperative alliance of the 32 member countries of the Asia-Pacific Forestry Commission (APFC). The network focuses on inter-country cooperation that helps to detect, prevent, monitor, eradicate and/or control forest invasive species in the Asia-Pacific region.

INVASIVES is the new monthly newsletter of APFISN. Each issue includes information about new threats, available methods of control, ideas on precautionary measures, and news about meetings and publications on forest invasive species.

If you would like to subscribe to ***INVASIVES*** or contribute news items, please contact Dr. K.V. Sankaran, APFISN Coordinator, at the following address: sankaran@kfri.org.


INVASIVES

Newsletter of the Asia-Pacific Forest Invasive Species Network (APFISN)

Vol. 3 September 2006

FROM THE EDITOR'S DESK

THREATS

NEW PUBLICATIONS

RECENT BOOKS

FORTHCOMING SEMINARS/SYMPOSIA/ WORKSHOPS

THREATS

Fall webworm

FAO ASIA-PACIFIC FORESTRY CALENDAR

3-6 September 2006. Yogyakarta, Indonesia. ***Regional Workshop on Forest Governance and Decentralization in Asia.*** Organized in collaboration with the Center for International Forestry Research (CIFOR), the Regional Community Forestry Training Center (RECOFTC), Swiss Intercooperation and the Governments of Indonesia and the Philippines. Contact: P. Durst, Senior Forestry Officer, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand; Tel.(662) 697-4139; Fax: (662) 697-4445; E-mail: Patrick.Durst@fao.org

26-29 September 2006. Bangkok, Thailand. ***Workshop on post-tsunami forest rehabilitation and coastal forestry policies in Asian tsunami affected countries*** and ***Workshop on coastal area planning and management in Asian tsunami affected countries.*** Contact: Susan Braatz, Regional Coordinator, Forestry Programme for Early Rehabilitation in Asian Tsunami Affected Countries, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand; Tel.(662) 697-4112; Fax: (662) 697-4445; E-mail: Susan.Braatz@fao.org

3-6 October 2006. Ho Chi Minh City, Vietnam. ***International Conference on Managing Forests for Poverty Reduction: Capturing Opportunities in Forest Harvesting and Wood Processing for the Benefit of the Poor.*** Organized in collaboration with the Netherlands Development Organisation (SNV), the International Tropical Timber Organization (ITTO), the Asia-Pacific Forestry Commission (APFC), the Tropical Forest Trust (TTT), the Regional Community Forestry Training Center (RECOFTC) and the Department of Forestry in Vietnam. Contact: P. Durst, Senior Forestry Officer, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand; Tel.(662) 697-4139; Fax: (662) 697-4445; E-mail: Patrick.Durst@fao.org

18-20 October 2006. Bangkok, Thailand. ***Meeting of the Asia-Pacific Forestry Sector Outlook Study Scientific Committee.*** Contact: P. Durst, Senior Forestry Officer, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand; Tel.(662) 697-4139; Fax: (662) 697-4445; E-mail: Patrick.Durst@fao.org

31 October - 2 November 2006. Chiang Mai, Thailand. ***Regional Workshop on Development of Regional Umbrella Annual Plan of Activities Under the MAR on SFM Project (GCP/INT/988/JPN)***. Contact: Masahiro Otsuka, Forestry Officer (Forest Monitoring Assessment and Reporting) for Project GCP/INT/988/JPN, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand; Tel.(662) 697-4112; Fax: (662) 697-4130; E-mail: Masahiro.Otsuka@fao.org

20-22 November 2006. Chiang Mai, Thailand. ***Financial Mechanisms for Sustainable Forest Management: Sharing Experiences from Latin America and Asia-Pacific.*** Contact. S. Appanah, National Forest Programme Adviser, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand; Tel.(662) 697-4136; Fax: (662) 697-4445; E-mail: Simmathiri.Appanah@fao.org

12-16 March 2007. Rome, Italy. ***18th Session of the Committee on Forestry (COFO).*** Contact: Doug Kneeland, Secretary COFO, FAO Forestry Department, Via delle Terme di Caracalla, 00100, Rome, Italy; E-mail: Douglas.Kneeland@fao.org

April 2007. Bangkok, Thailand. ***Forest Policy Short Course***. Contact: P. Durst, Senior Forestry Officer, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand; Tel.(662) 697-4139; Fax: (662) 697-4445; E-mail: Patrick.Durst@fao.org

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