



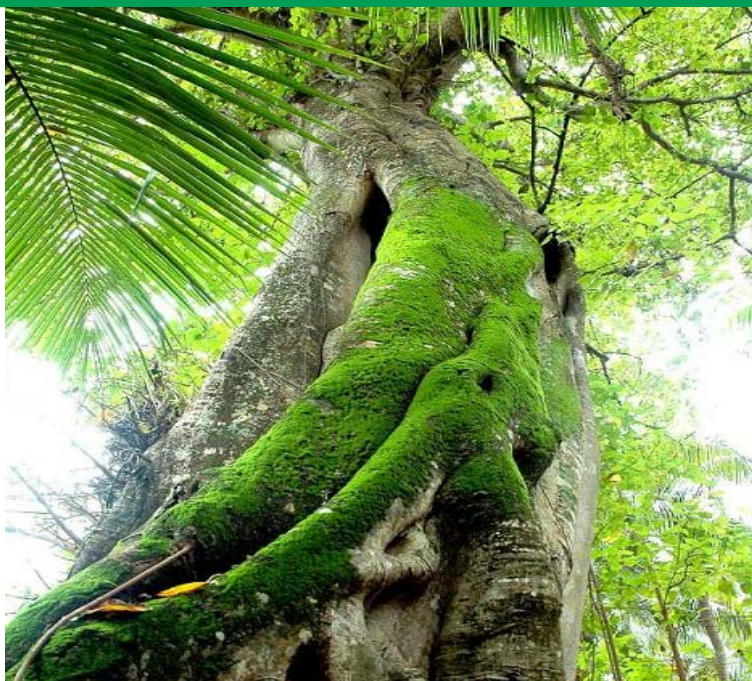
REGIONAL OFFICE FOR ASIA AND THE PACIFIC (RAP), BANGKOK
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

July-September 2008

TIGER PAPER

Regional Quarterly Bulletin on Wildlife and National Parks Management

Vol. XXXV : No. 3



Featuring

FOREST NEWS

Vol. XXII : No. 3



TIGERPAPER



**REGIONAL OFFICE
FOR ASIA AND THE PACIFIC**

TIGERPAPER is a quarterly news bulletin
dedicated to the exchange of information
relating to wildlife and national parks
management for the
Asia-Pacific Region.
ISSN 1014 - 2789

Address

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regional/rap/tigerpaper/tigerpaper.htm](http://www.fao.org/world/regional/rap/tigerpaper/tigerpaper.htm)

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Front cover: Right photo: Winning photo of the Asia-Pacific Forestry Week Photo Contest - by Eko Bambang Subiyantoro; Top left: Photo contest entry by Mohamed Naiph; Bottom left: Photo contest entry by Sugiyanto Krisdianto **Back cover:** Photo contest entry by Tidarach Toktang

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DIVERSITY AND ABUNDANCE OF BEETLES IN SILVIPASTURELANDS OF THAR DESERT

by G. Tripathi, R. Deora and B.M. Sharma

Introduction

Coleoptera is the largest order in the animal kingdom and includes about 350,000 named species (Chandler & Lutz, 1946) of beetles in the world and many more unnamed species. India has 4.37% of the world's beetle fauna (Ghosh, 1996). They exhibit a great degree of diversity and adaptability and are found in extremely varied habitats. In addition to being associated with all kinds of plants, they are found in logs, fungi, decaying plant and animal matter, mud, water, stored food, as well as in termite, bird and mammal nests. About 98% of beetles are inhabitants of soil or decaying matter. Distribution of beetles is dependent on many factors such as soil texture, soil chemistry, litter quality, litter composition, and litter amount (Finch, 2005; Kiikila *et al.*, 2005; Ducarme, 2004). Beetles can be herbivorous, carnivorous or omnivorous. Most beetles are either plant feeding or predaceous. Some species feed as scavengers on dead plants and animals. Other species feed on fungi or mold, and a few are parasitic on other insects or vertebrate animals. Beetles will prey on both active and inactive stages, such as eggs and pupae, of a wide range of insects and other prey. Many beetles that live in decaying leaves on the ground, or leaf litter, prey on mites. Hammond *et al.* (2001) studied the early colonization of newly coarse woody material by saproxylic beetles and found the high turn over rate of the Coleopteran taxa. They suggested that the management of coarse woody material may facilitate the conservation of saproxylic beetles.

Many beetles are quite beneficial. Carrion beetles feed on dead and decaying materials and help in the decomposition cycle (Schroeder, *et al.* 2002). Ladybird beetles and other predators prey on aphids, scale insects, and other pests that damage crops. Beetles perform several important functions for the grassland ecosystem such as aiding in

decomposition and distribution of organic matter (Kirkwood, *et al.*, 2000). It has been found that 3-33 % of the decomposed wood of fallen trunks at the natural forest is due to the activity of *Passalidae interstitialis* (Rodriguez, 1985; Rodriguez and Zorrilla, 1986).

Edwards (1974) emphasized beetles as important decomposers because they convert plant remains into humic substances and their movements cause a mixing effect in the upper soil layers. Beetles are very useful to the pasture ecosystems. They benefit the pasturelands by feeding on decaying plant matter and animal residues including dung, and thus accelerate the return of elements to the food chain. They also prevent the use of decaying materials by other pest insects. As the beetles or their larvae feed on animal dung, the survival of eggs or larvae of dung breeding flies, tapeworms, roundworms, etc. is highly reduced.

A serious problem of cattle dung disposal in grazing land in Australia was overcome by using South African species of beetles (Waterhouse, 1974). Silvopasture land of Indian Thar desert is the lifeline for the rural poor. Therefore, a systematic study on species diversity and abundance of beetles in silvipasture lands of the Indian Thar desert was carried out for future perspectives and accomplishments. The relative tree effects of silvipasture trees on beetles was also analyzed to elucidate their interactions.

There is no scope for extra organic inputs to improve silvipasture systems and make them sustainable. Beetles, however, are widely adapted to live in desert regions and contribute to the sustainability of silvipasture systems. A study on the biodiversity of beetles inhabiting arid silvipasture land was needed to gather baseline

information for their conservation in desert habitats.

Materials and methods

Study area

A survey of beetles was made in the silvipasture lands of Jodhpur district (26° 45' N latitude and 72° 03' E longitude) of the Indian Thar desert. The climate of the Indian Thar desert is dry tropical, characterized by extremes of temperature, fitful and uncertain rainfall, high potential evapotranspiration and strong winds. The three prominent seasons in the year are summer, monsoon and winter. Summer is the most dominant season characterized by high temperatures from March to mid-July. The period from mid-July to September is the monsoon season, when most (75%) of the rainfall is received. The winter season is from November to February. Maximum and minimum temperatures during the year range between 44°C-2°C. Mean annual rainfall in the region varies from 100-450 mm with 40-50% coefficient of variation and an average of 15-21 rainy days per year. Daily potential evapotranspiration is 7-13 mm in summer, 5.3-6.4 mm during the monsoon season and 1.8-2.9 mm in winter, whereas mean annual pan evaporation reaches 2,700 mm. Average wind speed is 14 to 18 km h⁻¹, which may occasionally reach 60-70 km h⁻¹ in summer.

Prosopis cineraria, *Zizyphus rotundifolia*, *Tecomella undulata*, *Belanitic aegyptiaca*, *Acacia senegal*, *Hardwickia binata* and *Colophospermum mopane* are the dominant trees and *Cenchrus ciliaris*, *Lasiurus indicus* and *Aristida funiculata* are the dominant grasses growing naturally in the pastureland. The most common combinations of trees and grasses are *P. cineraria* with *C. ciliaris*, *L. indicus* and *A. funiculata*, *Zizyphus rotundifolia* with *C. ciliaris*, *L. indicus* and *A. funiculata*, *Tecomella undulata* with *C. ciliaris*, *L. indicus* and *A. funiculata*, *Belanitic aegyptiaca*, with *C. ciliaris*, *L. indicus* and *A. funiculata*, *A. senegal* with *C. ciliaris*, *L. indicus* and *A. funiculata*, *H. binata* with *L. indicus* and *A. funiculata* and *C. mopane* with *L. indicus* and *A. funiculata*. These combinations of trees and grasses were chosen as study systems. In addition, pure grass blocks were randomly marked as control plots at a distance of 20 m from the isolated tree for study of relative

tree effect (RTE). Sampling was done using 25x25 quadrats under the canopy of each selected tree as well as in the control plots (outside canopy) for observations.

Soil samples were processed by Tullgren funnels employed for the extraction of small beetles. Larger sized beetles could be picked up by hand. Collected specimens were preserved in 70% alcohol. Specimens were kept in different vials and sent for identification by the Zoological Survey of India, Jodhpur, Rajasthan (India).

Assessment of faunal diversity and tree facilitation

Qualitative composition of species, percent composition of families, species habitat relationship, species diversity index (H') both with respect to and irrespective of silvipasture systems and the relative tree effect on beetle species were studied.

Species diversity (H') was estimated according to the method of Shannon and Weiner (1963). The effects of trees on populations of beetles were assessed through the relative tree effect (RTE). RTE was calculated according to the method of Markham and Chanway (1996) for relative neighbor effect.

$$RTE = (X_t - X_c)/x$$

Where *X* was the population of target species in the absence (t) and presence (c) of the tree and *x* was the higher of *X_t* or *X_c*. Negative values of RTE indicated the beneficial and positive values reflected the negative effects of tree presence on the beetle population in desert.

Results

Species diversity

A total 24 species belonging to 7 families of coleopteran were recorded from various pedoecosystems of the arid environment. These families were the Scarabaeidae, Carabidae, Rhysodidae, Elateridae, Tenebrionidae, Curculionidae and Meloidae. Among them, 6

species from Scarabaeidae, 4 species from Carabidae, 1 from Rhysodidae, 1 from Elateridae, 9 from Tenebrionidae, 2 from Curculionidae and 1 from Meloidae were recorded. Scarabaeidae beetles are popularly known as dung beetles. *Adoritus lobiceps*, *Onthophagus bonasus*, *Onthophagus difficilis*, *Onthophagus kuluensis*, *Onthophagus troglodyta*, and *Onthophagus fuscopunctatus* were observed from the Scarabaeidae family.

Carabidae beetles are commonly known as ground beetles. This is a very large and widely distributed family. *Bembidion luniferum*, *Asaphidion triste*, *Leitus indus*, and *Scaritus* species were recorded from Carabidae in our study area. Rhysodidae are small black beetles easily recognized by the neck bearer head. Only one *Rhysodes* species was recorded from the Rhysodidae family. Elateridae beetles are known as click beetles. They are easily recognized by their head sunk in the large prothorax. Only one *Adelocera* species was found from the Elateridae family. Tenebrionidae are popularly known as darkling beetles. *Pimelia inexpunctata*, *Pseudoblaps erenata*, *Spiratus indus*, *Rhytinota impoliata*, *Oxycara tharansis*, *Hyperopus unicolor*, *Scleron orientalis*, and *Mesomorpha* species were recorded from this family.

Curculionidae beetles are widely known as weevil beetles characterized by the rostrum that is produced by the prolongation of the head. *Crinorhinus surtus* and *Myloccerus* species were observed from the Curculionidae family. Meloidae beetles are commonly known as blister beetles or oil beetles. Only one *Meloe* species was observed from the Meloidae family.

Qualitative composition

Populations of *Adoritus lobiceps*, *Onthophagus bonasus*, *Onthophagus fuscopunctatus*, *Bembidion luniferum*, and *Leitus indus* were moderate in the *P. cineraria*-based soil system. Whereas populations of *Onthophagus difficilis*, *Adelocera* sp., *Pseudoblaps erenata*, *Spiratus indus*, *Rhytinota impoliata*, *Oxycara tharansis*, *Setinus semiopaca* and *Mesomorpha* sp. were poor. Densities of *Onthophagus bonasus* and *Leitus indus* were moderate in *Z. rotundifolia*-based

pedoecosystems. While *Adoritus lobiceps*, *Onthophagus troglodyta*, *Pimelia inexpunctata*, *Spiratus indus*, *Rhytinota impoliata*, *Oxycara tharansis*, *Mesomorpha* sp. *Crinorhinus surtus*, *Myloccerus* and *Meloe* sp. showed poor presence in this system. Populations of *Adoritus lobiceps*, *Leitus indus* and *Hyperopus unicolor* were moderate in *T. undulate*-based systems. However, populations of *Rhytinota impoliata*, *Oxycara tharansis*, *Scleron orientalis* and *Myloccerus* sp. were poor. Similarly, in *B. aegyptiaca* silvipasture system *Adoritus lobiceps*, *Onthophagus kuluensis*, *Bembidion luniferum*, *Pimelia inexpunctata*, *Spiratus indus*, *Rhytinota impoliata*, and *Oxycara tharansis* species exhibited poor populations. *Setinus semiopaca* was moderately present.

In *A. Senegal*-based fields *Asaphidion triste* species were poor in composition, whereas *Adoritus lobiceps*, *Onthophagus bonasus*, *Onthophagus kuluensis*, *Scaritus* sp., *Leitus indus*, *Rhysodidae* sp., *Pimelia inexpunctata*, *Spiratus indus*, *Rhytinota impoliata*, *Oxycara tharansis*, *Setinus semiopaca*, *Mesomorpha*, *Myloccerus* and *Meloe* sp. were recorded as moderate. In the *Hardwickia binata* system, the density of *Bembidion luniferum* was moderate, while *Adoritus lobiceps*, *Onthophagus difficilis*, *Adelocera* sp. *Rhytinota impoliata*, *Oxycara tharansis*, and *Hyperopus unicolor* exhibited poor populations. Only *Onthophagus fuscopunctatus* was present abundantly in the *C. mopane*-based pedoecosystem, whereas the populations of *Adoritus lobiceps*, *Asaphidion triste*, *Rhytinota impoliata*, and *Setinus semiopaca* were poor.

Species habitat relationship

A total of 13 species (*Adoritus lobiceps*, *Onthophagus bonasus*, *Onthophagus difficilis*, *Onthophagus fuscopunctatus*, *Bembidion luniferum*, *Leitus indus*, *Adelocera* sp., *Pseudoblaps erenata*, *Spiratus indus*, *Rhytinota impoliata*, *Oxycara tharansis*, *Setinus semiopaca*, *Mesomorpha* sp.) were recorded in the *Prosopis cineraria* system. They belonged to four families, i.e., Scarabaeidae, Carabidae, Elateridae and Tenebrionidae. In the *Z. rotundifolia*-based soil system, 12 species (*Adoritus lobiceps*, *Onthophagus bonasus*, *Onthophagus troglodyta*, *Leitus Indus*, *Meloe* sp., *Crinorhinus surtus*,

Mylocerus sp., *Pimelia inexpunctata*, *Spiratus indus*, *Rhytinota impoliata*, *Oxycara tharansis*, and *Mesomorpha* sp.) related to 5 families were observed. Only 7 species (*Adoretus lobiceps*, *Leistus Indus*, *Meloe* sp., *Rhytinota impoliata*, *Oxycara tharansis*, *Hyperopus unicolor*, *Scleron orientalis* sp.) of beetles belonging to four families (Scarabaeidae, Carabidae, meloidae, Tenebrionidae) were recorded from the *Tecomella undulata* system.

Eight species (*Adoritus lobiceps*, *Onthophagus bonasus*, *Bembidion luniferum*, *Pimelia inexpunctata*, *Spiratus indus*, *Rhytinota impoliata*, *Oxycara tharansis* and *Setinus semiopaca* sp.) belonging to three families (Scarabaeidae, Carabidae, Tenebrionidae) inhabited *Belanitic aegyptiaca*-based silvipasture land. Unlike *B. aegyptiaca*, in the *A. senegal*-based field, 15 species (*Adoritus lobiceps*, *Onthophagus bonasus*, *Onthophagus kuluensis*, *Asaphidion triste*, *Scaritus* species, *Leitus indus*, *Rhysodes* sp., *Mylocerus* sp., *Meloi* sp., *Pimelia inexpunctata*, *Spiratus indus*, *Rhytinota impoliata*, *Oxycara tharansis*, *Setinus semiopaca*, *Mesomorpha* sp.) related to six families (Scarabaeidae, Carabidae, rhysodidae, Curculionidae, Meloidae, Tenebrionidae) were present.

Seven species (*Adoritus lobiceps*, *Onthophagus difficilis*, *Bembidion luniferum*, *Adelocera* sp., *Rhytinota impoliata*, *Oxycara tharansis*, *Hyperopus unicolor*) related to the Scarabaeidae, Carabidae, Elateridae, Tenebrionidae families inhabited the *Hardwickia binata* system. In the *C. mopane*-based silvipasture system, 5 species (*Adoretus lobiceps*, *Onthophagus fuscopunctatus*, *Asaphidion triste*, *Rhytinota impoliata* and *Setinus semiopaca* sp.) belonging to the Scarabaeidae, Carabidae and Tenebrionidae families were present. *Adoritus lobiceps*, *Rhytinota impoliata* and *Oxycara tharansis* were recorded from all systems.

Percent composition of species

A total of 24 species belonging to seven families (Scarabaeidae, Carabidae, Rhysodidae, Elateridae, Tenebrionidae, Curculionidae and Meloidae) were

found to be associated with various silvipasture systems in the Indian desert. Six species of Scarabaeidae represented 32.77% of the total beetle fauna; Carabidae - with four species - contributed 23.4%; and Rhysodidae, represented by only one species, made up 0.74 % of the composition. Similarly, Elateridae, also represented by only one species, contributed 1.49%. Tenebrionidae, with 9 species, contributed 37.23 %. Curculionidae, consisting of only two species, contributed 2.87% of the total Coleoptera, whereas Meloidae, with only one species, represented 1.49% of the composition.

Species diversity indices

A higher value of diversity index predicts a higher diversification among the relative proportion of species population. In *P. cineraria*-based fields, the highest species diversity index (0.27) was shown by *Bembidion luniferum* and the lowest (0.11) by *Adelocera* sp. In the *Z. rotundifolia*-based pedoecosystem, the highest species diversity index (0.32) was presented by *Leitus indus* and the lowest (0.09) by *Mylocerus* sp. Similarly, in the *T. undulata*-based silvipasture system, the highest species diversity index (0.34) was demonstrated by *Leitus indus* and *Hyperopus unicolor* and the lowest (0.20) by *Oxycara tharansis*.

In the *B. aegyptiaca*-based system the highest species diversity index (0.36) was shown by *Setinus semiopaca* and the lowest (0.17) by *Spiratus indus*. In the *A. Senegal*-based field the highest (0.30) and lowest (0.12) species diversity indexes were represented by *Asaphidion triste* and *Pimelia inexpunctata* respectively. *Scleron orientalis* was recorded in *P. cineraria* and *T. undulata*-based soil systems respectively. This shows the habitat specific occurrence of beetles, which may be due to food preferences, etc. The maximum six out of seven families of beetles recorded from *A. senegal* means that the *A. senegal*-based soil system was highly conducive to the survival of beetles. The family Tenebrionidae was represented by the maximum number of species (9). Environmental parameters regulate the distribution of Tenebrionidae beetles (Clolombini *et al.*, 2005). The representatives of Tenebrionidae presented the maximum diversity of species and contributed to

the highest (37.23%) faunastic composition, followed by Scarabaeidae (32.77%). Similar results have been shown by Parihar, (1996). Quintero and Roslin (2005) described Scarabaeidae as a functionally important group of insects of tropical ecosystems. Scarabaeidae are most useful in consuming and dispersing the excrement of large mammals. The burrowing and burrowing habits of these beetles help in building soil in several ways. Ecologists have regarded such activities as beneficial in that the nutrients are recycled more efficiently and quickly (Mittal, 1993). The beneficial effects of the activity of the Scarabaeidae beetle on plant life and pasture ecosystems has been highlighted by various workers (Bornemissza and Willams, 1970; Mc Kinnney and Morley, 1975; Fincher *et al.*, 1981).

The beetles *A. lobiceps*, *R. impoliata* and *O. tharansis* were present in almost all silvipasture systems. The highest species diversity index (0.36) with respect to the systems was represented by *O. fuscopunctatus*, *B. luniferum*, and *S. semiopaca* in *C. mopane*-, *H. binata*- and *T. undulata*-based soil systems respectively. This reflects the maximum diversification among the relative proportions of these species. *A. lobiceps* showed the highest diversity index (0.26) irrespective of the system. This shows that *A. lobiceps* was the most adapted species in all pedoecosystems compared to other species.

The results indicate that most of the beetle species have their preferences for a particular habitat. Invertebrate species tend to choose their habitat on the basis of structural composition and makeup of leaves (Finch, 2005). A wide variation in the distribution of beetles may be due to the availability of food sources and food preferences. Beetles exhibited preferences not only in the type of tree, but also in the part of tree that is eaten (Harmon *et al.*, 1986). Different habitats presented a remarkable similarity in species qualitative composition, while species differed in their relative abundance. Similar results were also found for tenebrionid beetles in desert habitat (Parihar, 1996). The changes in values of RTE among populations of beetle species in different silvipasture systems suggest that the population of various species depends upon a favorable environment, including high quality food resources, in the silvipastoral

system (Seastedt *et al.*, 1988). The higher population density in silvipastoral systems compared to the control plots suggests that trees have a beneficial effect on beetle populations. The system-specific differences in the diversity and relative abundance of beetles showed a rich faunal diversity but poor populations in the harsh desert climate. The present studies may help in conservation of beetles and their habitats in desert regions.

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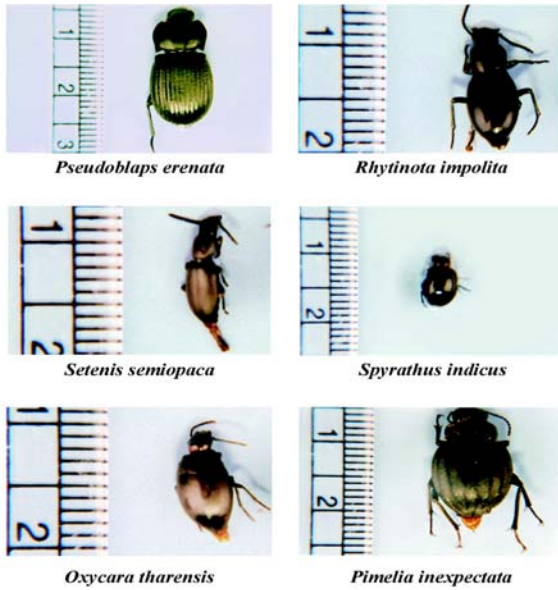


Plate. 1 . Species of Tenebrionidae family of beetles collected from silvipasture system.

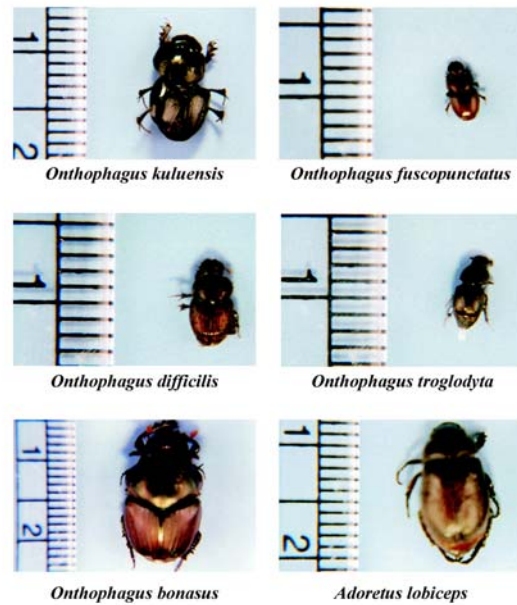


Plate. 2 Species of Scarabaeida family of beetles collected from silvipasture system.

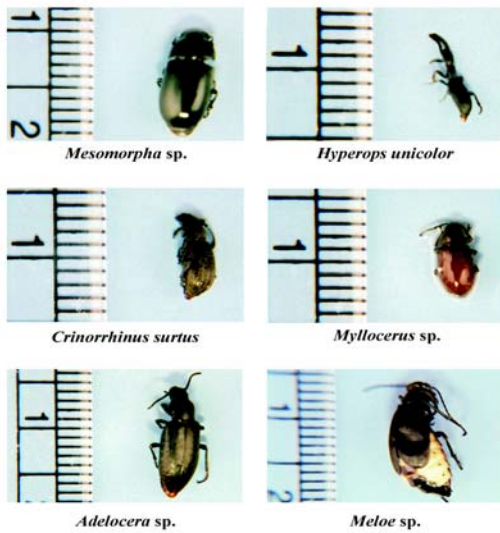


Plate 3. Species of Tenebrionidae, Curculionidae, Elateridae and Meloidae families of beetles collected from silvipasture system.

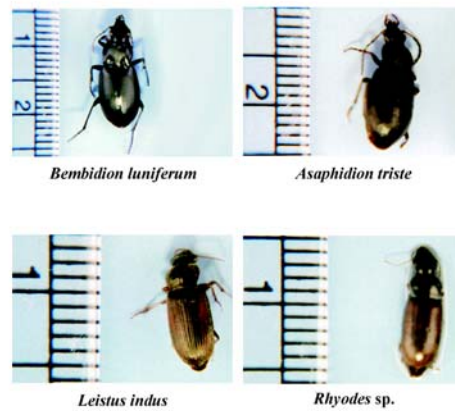


Plate 4. Species of Carabidae and Rhysodidae families of beetles collected from silvipasture system.

STATUS, DISTRIBUTION AND HABITAT USE OF HISPID HARE (*Caprolagus hispidus*) IN ROYAL SUKLAPHANTA WILDLIFE RESERVE, NEPAL

by Bhupendra Prasad Yadav, S. Sathyakumar, Raj K. Koirala and Chiranjibi Pokharel

Introduction

The hispid hare is one of the world's rarest mammals. It is included in the protected animal species list under the National Parks and Wildlife Conservation Act, 1973. CITES has included it in Appendix-1, and IUCN lists it in the endangered category. Historically, it has been recorded from tracts along the southern Himalayan foothills from Uttar Pradesh (India) through Nepal and West Bengal to Assam (India), extending southwards as far as Dacca in Bangladesh (Blandford, 1888; Dawson, 1971). In the present day it occurs in India and Nepal, but may be extinct in Bangladesh (IUCN, 2004). It still exists in a few isolated pockets across the former range of its tall grassland habitat in northern India and southern Nepal. Evidence of the occurrence of hispid hare was found in three protected areas, i.e. Royal Chitwan National Park, Royal Bardia National Park, and Royal Suklaphanta Wildlife Reserve by Oliver in 1984.

Study area

Royal Suklaphanta Wildlife Reserve is located in the far western Terai, at the southwestern edge of Nepal and is the second smallest of Nepal's protected areas (305 km² including extension areas). It was established as a wildlife reserve in July 1975.

The objectives of the study were as follows:

- To determine the status of hispid hare.
- To prepare a distribution map of hispid hare.
- To map the habitat use of hispid hare.
- To identify the existing threats to hispid hare.

Methods

Hispid hare habitats were identified through discussions with park wardens, park staff, KMTNC/SCP staffs, concerned and knowledgeable people and from literature. Study sites were selected after field verification. Actual field work was conducted in November and December 2005 (before burning of grassland in RSWR).

Status through pellet estimation

A direct count of rabbits is not a suitable method to determine rabbit distribution on a fine grained scale (Burnham *et al.*, 1980, Buckland *et al.*, 1993). Many factors restricted the selection of transects and the indirect count method. All grasslands were inhabited by a variety of potential dangerous mammals such as tiger, rhino and wild boar. Consequently, working in the grasslands on foot involved a significant risk from animal attack. Taking into consideration the size of the hispid hare and its habitat of tall grassland, these factors make it almost impossible to even see them. Therefore, the pellet count method was chosen for the research study.

Two study sites (Barkaula study area-1 and Suklaphanta study area-2) were selected for the study. Four major different types of habitats (tall grassland, short grassland, riverine forest and broadleaved forest) were selected to search for the presence or absence of hispid hare pellets for this survey.

Strip transects were randomly laid out in the hispid hare's distribution area. Each strip transect was

20 m long and 2 m wide on either side of the transect line that was taken into consideration for counting pellet groups. Forty-four plots were used for the calculation of pellet density. It was calculated on the basis of second time count method after a ten day interval. Sixteen fresh groups of pellets were found. All pellets (182 pellet groups

including fresh and old) that were found in the first time survey were counted and cleared from the plots for the second time count.

Population density was estimated with the help of pellet density and defecation rate (9) by following formula:

$$\text{Pellet density (N)} = \frac{\text{Total pellet groups}}{\text{Transect area} \times \text{Transect number}}$$

$$\text{Population density} = \frac{\text{Observed pellet density in a specific time period}}{\text{Estimated defaecation rate for same time period for a single animal}}$$

The reference of the mean defaecation rate for the population density was taken from the Central Zoo of Kathmandu and Green Pastureland rabbit farm, Pokhara. Two mature (one male and one female) rabbits were selected for a three-day intensive study and the mean defaecation rate was calculated and used to estimate population density.

Distribution

The distribution pattern was identified on the basis of direct observation, the presence and absence of pellets and tracks, and from interviews with key informants (park staff, etc).

GPS points of the hispid hare distribution area were used in digitizing a Topo-map (1996) of the study area and the hispid hare distribution map was prepared using GIS software Arc View version 3.2.

Habitat use

The layout of transects and plots were the same as in the vegetation study except for the plot shape and size. The sample plot size for plants used was as suggested by Schemnitz (1980), which is 10m x 10m (r=5.64m) for tree layer, and 4m x 4m (r=2.6 m) for all woody undergrowth to 3m in height. Circular sample plots (10m², r=1.78m) were used for grass species in each plot (Gyawali, 2003). Altogether, 58 plots were laid out (tall grassland-44, short grassland-7, riverine forest-4 and broad leaved forest-3) for the study and the collected data was used for calculating the frequency, relative frequency, density, and relative density by using following formulae:

Habitat preference: Habitat preference was calculated by using the formula (Pokharel, 1996).

$$\text{HP} = \frac{\text{PPE}}{\text{TPP}} \times 100$$

Where, HP= Habitat preference, PPE= Pellet present (%) in each habitat, TPP = Total pellet present (%) of the all habitat types.

Difference in pellets of both hispid hare and Indian hare

The faecal pellets of both hispid hare and Indian hare can be readily distinguished on the basis of their relative size & shape, i.e., Hispid hare: larger, flattened and rounded in shape; Indian hare: smaller, often darker, elliptical one pointed end.

Results and discussions

The present population density of hispid hare in the study area is 1.01 animals/ha, whereas the Diana Bell study (1987) results indicated that the overall mean density was 6.10/ha. The previous study (Bell, 1987) and the present study show that the population density is decreasing. The reason behind the declining population is uncontrolled grass burning and cutting. The grassland of the RSWR is burned each year in December-January. The literature shows that the hare's breeding season exactly coincides with the grass burning season. Therefore, the burning practice has been playing a crucial role in the decline of the hispid hare in the RSWR. The park authority has only been

concerned with the mega fauna and Swamp deer. There is no system for managing small mammals, including hispid hares, in a proper way.

Other threats that may be contributing to the declining populations of hispid hares in RSWR include grazing, thatch collection, habitat loss, floods and predation.

Apart from hispid hare, pellets of spotted deer, hog deer, sambar deer, and dung of rhinoceros, wild elephant, cattle and signs of wild boar diggings were also recorded in the study site habitat.

Distribution of hispid hare

Hispid hare pellets were found in the following grasslands: Suklaphanta, Barkaula and Piparia (especially in Shital phanta and the southern part of Machan of Piparia). Pellets were not found in the following places: Haraiya phanta north-east of Ranital and Radhapur phanta. Except for Singhpur (potential grassland area), all potential habitats were searched for the absence and presence of the pellets. The two study areas chosen - Barkaula study area-1 (2.6 km²) and Suklaphanta study area-2 (14.8 km²) - were selected for the study of hispid hare based on the recording of pellets in the site. Areas were calculated by plotting them with the help of GIS.

Evidence of pellets was also found in the southern part of Suklaphanta grassland along the Indian border. The grassland area of the Indian side was joined with the Nepal grassland. The grassland area of the Indian side may also be potential habitat for hispid hare.

The author did not find any evidence of hispid hare in the Haraiya phanta, whereas the Bell (1987) study found old dried and sparse pellets in this phanta.

Habitat use

Food

In the study, it was found that the main food species consumed by the hispid hare is *Narenga porphyrocoma* species. The hare consumes the inner core of the stem after removing the outer

bark. The hare also consumes the leaves of *Cymbopogon* sp., *Imperata cylindrica* and the inner core of *Saccharum spontaneum*.

Hares mostly prefer to stay in a certain area and eat the grass species present in that area instead of bringing food from different areas.

Hispid hare nests were found to be made by laying out *Narenga* grass leaves in circular shapes.

According to Oliver (1980) the hispid hare's diet consists mainly of thatch shoots and roots which are bitten off at the base and stripped of the outer sheaths prior to consumption, but the above diet may vary according to season, availability of food and locality.

Water

In the field observation there was no evidence of any pellets near the water sources. The hispid hare stays far from water sources in winter because the water content of some plants is above 60% in early winter. But in summer, hispid hares were mostly seen resting under the shade of tall grass clumps, which were in some instances far from the water body (Sabnis, 1981).

In winter, the movement of hares is confined only to the highland areas where grasses are not that tall, but are dense. As summer approaches more and more fresh pellets were noticed in the tall grass patches close to the streams and waterlogged areas, indicating that the hispid hare obtains water from the green grasses.

Ground cover

In addition to feeding grounds, rabbits need cover to protect them against predators and places for breeding in order to successfully thrive (Roger, 1981; Wheeler *et al.*, 1981; Kolb, 1991; Palomares & Delibes, 1997).

The pellet deposition rate generally increases when the density of ground cover increases from moderate to dense. Pellet deposition was approximately 90% when the ground cover was dense (75-100%). It was clearly realized from the study of the area that the hispid hare generally

prefers to live in dry soil, and mostly near *Narenga* sp. with clumps of grasses more than 1m tall where they can easily move, see and play around.

Ground condition

Most of the pellets were found in the dry places rather than wetlands. But it is also depends on the season, as during the study period most of the grasses were green and provided a sufficient amount of water to the hispid hares, but in the dry season the amount of water contained in grass is very low, so the hares may move to the wetland areas.

Grass species preferred by hispid hare

Altogether, there were 14 grass species found in hispid hare habitat in Barkaula and Suklaphanta. *Narenga* sp. (relative frequency (RF)-26%) was most preferred species of hispid hare, followed by Paniu (RF-13%), Barni, Shiv bagan, Siru, Dubo, Lemon grass, Pharsa, Dhaddi, Kuro, etc. in the Barkaula site, whereas at the Suklaphanta site the most preferred species were Siru (RF-42.6%) and *Narenga* (RF-27.5%), followed by Kans, Shiv bagan, Paniu, Barni, etc. Pellet densities were high at the Barkaula site where the relative density (RD) of *Narenga* grass was high (26%), followed by Paniu. At the Suklaphanta site the relative density of Siru grass was high (42.66), followed by Kans.

The botanical information collected at these two study sites also showed the high relative frequency and density of *Narenga* (RF=23.45; RD=26.79) followed by Siru (RF=14.24; RD=25.67) and Kans (RF=13.17; RD=15.86). The evidence of grass species eaten by the hispid hares was found frequently in the nests and where pellets were observed.

Narenga porphyrocoma and *Saccharum spontaneum* had the highest coverage (46.15% and 19.65%), whereas *Narenga porphyrocoma* and *Imperata cylindrica* had highest frequency (100% and 83.33%) (Gyawali, 2003). A higher number of hispid hare pellets were recorded in *Narenga* (21.5% of pellets found) followed by Kans (17.71%), Siru (16.35%), Paniu (11.19%) and others, which confirms tall grasslands (dominated by *Narenga*, Kans, and Siru) as its habitat.

Relationship between average grass height and pellet deposition

Grass height above 1m was specified as tall grassland for this study. The average height of *Narenga*, Kans, Siru, Munj and Dhaddi were 2m, 1.7m, 1.2m, 3.4m and 4.3m respectively. Hispid hare also showed a preference for certain tall grass species over other tall grass species. The height of grasses preferred by hispid hare differs according to the season.

Hispid hare pellets were also found in a *Phragmites-Arundo* marshland community at Royal Suklaphanta Wildlife Reserve. This was the only instance where the species was found to utilize this type of habitat and was thought to be due to the displacement of individuals from the surrounding *Saccharum munj-Narenga* grassland which had recently been burned (Oliver, 1984).

Habitat preference

Hispid hare showed zero preference for short grassland, riverine forest and broadleaved forest. Grass species composition was similar in short grassland (average height below 1 m) and tall grassland, but no pellets were found in the short grassland during the study period (November-December). This suggests that the hispid hares selects habitat that provides both shelter and food.

Existing threats

Fire

Generally the Reserve authority carries out controlled burning during December-January in order to manage the grassland. Unfortunately, this coincides with the main breeding season of the hispid hare. Thus, there is high possibility of casualties of leverets (young hares) during the controlled fires. Greater care needs to be taken during the controlled burning, especially in the drier tall grasslands with *Narenga*, Siru and Kans. The fires not only destroy habitat, but also reduces the regeneration of the grass species. This may be the major factor for the declining the hispid hare population in Royal Suklaphanta.

If the annual controlled burning is not done carefully it is likely to alter the species composition, and what the effects of this would be is still poorly understood. This may also cause changes in the succession stages.

Invasion of grass species by trees (Broadleaved)

The invasion of grasslands by trees is playing a large role in habitat loss. Large patches of grassland become invaded by trees like *Bombax ceiba* and shrubs. It is becoming a major issue in Suklaphanta. If management practices are not carried out in time, these broadleaved species will replace the grassland area.

Grazing

The park also faces grazing pressure from the surrounding villages, mainly towards the peripheral areas, forcing the wild animals to congregate more at the core area of Suklaphanta Grassland.

Flood

The flood that resulted from the heavy rainfall during July-August 2005 completely destroyed the grasses in some parts of Suklaphanta, and as a result the conditions became unsuitable for hare movement and nesting. This may be the reason for the absence of pellets in some parts of Suklaphanta during this study. In Suklaphanta, the Mahakali River has had a major effect on the habitat of hispid hares.

Predation

Bell (1987) suggested that the following were predators of hispid hare: Indian fox, jackal, jungle cat, leopard, large and small Indian civet cats, tiger and crested serpent eagle. The author observed eagles in the sky over the habitat of hispid hare (possibly crested serpent eagle) and tracks of jackals and pug marks of tigers in the hispid hare habitat. However, there was no evidence of predation on hispid hare during the study period.

Thatch collection

Every year during the winter season, the local people are allowed to collect grass for thatch from

the reserve area, which puts huge pressure on the park grassland area. Such a high pressure from human activity creates great disturbances to the hispid hare and may drive them away from this area.

Conclusions

- The pellet density of hispid hare was 90.90/ha, and the population density was 1.01/ha. This is a significant decrease from the 6.10/ha population density recorded in the previous study (Bell, 1987).
- Distribution of hispid hare was restricted to only tall grassland such as found in Suklaphanta, Barkaula, Piparia, and possibly the Singhapur area.
- Hispid hares consumed the inner part of the stems of Narenga and Kans, the leaves of Siru and the fruits of Panu and others.
- Most of the pellets were found at an average distance of 600m from the water sources. No pellets were found closer than 290m to the water source.
- Hispid hare habitat had dense ground cover (75-100%) and dry ground conditions.
- Fourteen grass species were found in hispid hare habitat in the study area. *Narenga* sp, (RF-39.75%) was the most preferred species of hispid hare, followed by Siru (RF-13.84%), and Kans (RF13.17%).
- Habitat preference calculation determined that the hispid hare preferred only tall grassland.
- Existing threats include fire, invasion of grassland areas by broadleaved trees, grazing, floods, predation and thatch collection.

Recommendations

- An Action Plan should be developed for the hispid hare.
- An ecological study covering aspects such as defecation rate, gestation period and the impact of current habitat management practices is needed.
- A check dam should be constructed at the point where the Mahakali River enters into RSWR. This is a most dangerous situation for Suklaphanta and for the phanta's animals, including the endangered swamp deer and

- globally threatened birds like Hodgson's bushchat, Bengal florican and others.
- Some patches of tall grassland should be left unburned/uncut for the hispid hare.
- The illegal entry of domestic animals into the reserve for grazing should be controlled.
- Much attention should be paid during grass burning, especially when it takes place near hispid hare habitat.
- Improved management of grasslands in the buffer zone will help decrease the pressure on the reserve grassland and forest.
- The invasion of grassland by broadleaved species should be controlled by digging out whole roots of these trees.
- Permanent monitoring plots should be established in the potential hispid hare habitats to study the impact of management techniques.

Acknowledgements

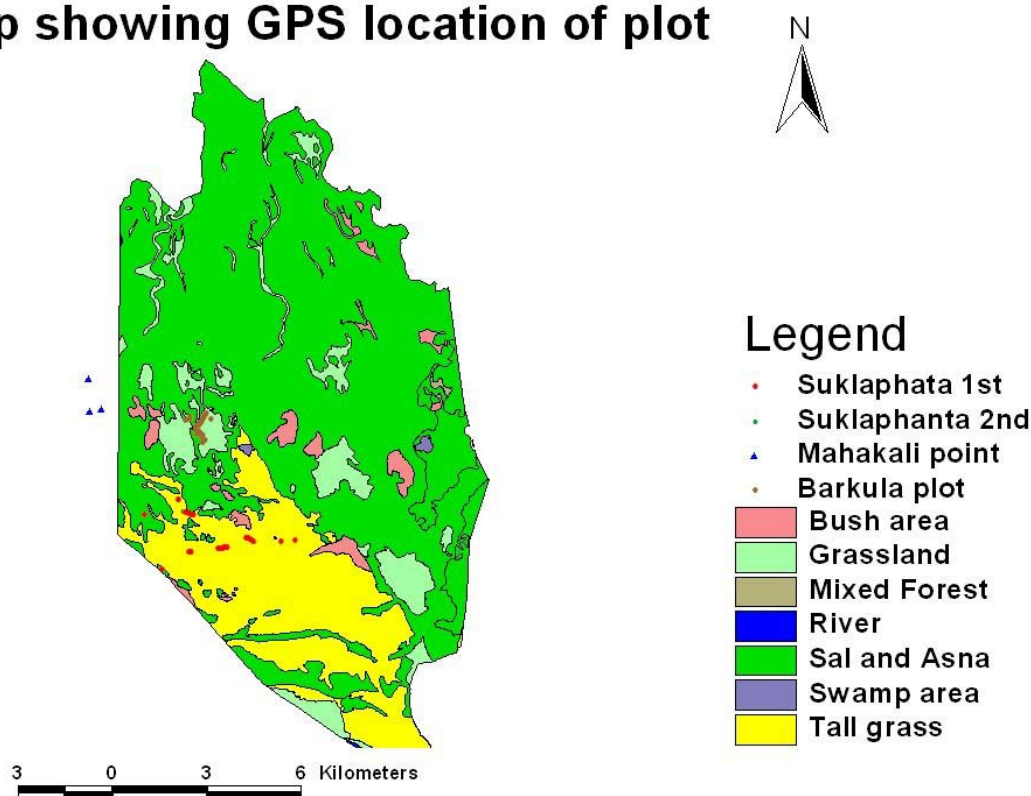
The author is deeply indebted to the National Trust for Nature Conservation/SCP and would like to extend his thanks to Mr. Jhamak Bd. Karki, Tika Ram Adhikari (DNPWC, Nepal), for their constructive comments and suggestions. Special thanks also go to Achyut Aryal (The Biodiversity Research and Training Forum (BRTF), Pokhara, Nepal www.brtf.org.np) for his support on data analysis, suggestions and necessary help in research and paper designing, and to Pradeep Saud for GIS map preparation, and finally to the staff of Suklaphanta Wildlife Reserve for their valuable support.

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Map showing GPS location of plot



DISTRIBUTION AND POPULATION ABUNDANCE OF SLOTH BEAR (*Melursus ursinus*) IN DISTURBED AND UNPROTECTED HABITAT OF NORTH BILASPUR FOREST DIVISION, CHHATTISGARH

by Naim Akhtar, Harendra Singh Bargali and N.P.S. Chauhan

| Distribution and population abundance of Sloth Bear in North Bilaspur Forest Division, Chhattisgarh |

Introduction

The sloth bear is a Schedule 1 species in the Indian Wildlife Protection Act, 1972, and has been listed as “threatened” by IUCN (Anon, 2006). The sloth bear (*Melursus ursinus*) inhabits India, Sri Lanka, Nepal, Bhutan and Bangladesh. In India, it ranges from the foothills of the Himalayas to the southern tip of the Western Ghats. The desert regions of Rajasthan and Gujarat limit its westernmost distribution. It is found in low-altitudinal, and non-arid areas. The Central Indian highlands (Madhya Pradesh, Chhattisgarh, Orissa and northern Maharashtra) harbor a major part of the sloth bear population of India. However, Western Ghats also holds a good population. Estimating the population and distribution of sloth bear is becoming more important in areas where the animal lives in conflict situations, like in North Bilaspur forest division. Human-sloth bear conflicts are on the rise in this area and the situation has become alarming. According to Forest Department records and village surveys, there were 395 human casualties attributed to bears between 1991 and 2000. Out of the 178 villages, 122 were affected by sloth bears raiding agriculture crops (Bargali, 2003).

No systematic information is available on sloth bear distribution and population either in or outside the protected areas in India. This study was designed to get precise information on the status and distribution of the sloth bear population so that North Bilaspur Forest Division can develop mitigatory strategies to combat human-bear conflicts on a long-term basis.

Study area

The study was carried out in the Pendra and Marwahi ranges of the North Bilaspur Forest Division, Chhattisgarh, covering an area of 1,395 km². The study area lies between 220° 40' N and 230° 06' N and 810° 44' E and 820° 13' E. The forest cover is patchy and scattered, covering an area of 337 km². Forest blocks in the area range from 11 to 97 ha. The human population exceeds 200,000 and the livestock population is over 150,000, thus inflicting severe biotic pressure on the forest.

The study area lies in one of the oldest mountain chains of India. Ecologically, this area is a part of the Eastern Deccan Biogeographical Zone (Rodgers and Panwar, 1988). The topography is undulating, interspersed with chains of hillocks and rocks, ranging in elevation from 450 m-1,050 m. It is known as the Vindhya or Maikal range. Champion and Seth (1968) have classified the forest types of the area as dry deciduous peninsular Sal forest, northern tropical dry mixed deciduous forest and northern tropical secondary moist mixed deciduous forest. Besides sloth bears, other large mammals found in this area include leopard (*Panthera pardus*), spotted deer (*Axis axis*), hyena (*Hyena hyena*), jackal (*Canis aureus*), Indian fox (*Vulpes bengalensis*), four-horned antelope (*Tetracerus quadricornis*), wild pig (*Sus scrofa*), common langur (*Semnopithecus entellus*), and rhesus macaque (*Macaca mulatta*).

Methods

Data was collected during an ongoing study on human-sloth bear conflicts in North Bilaspur Forest Division. Bear den sites were located and identified as to whether they were active sites or temporary ones during intensive surveys. Villagers were contacted to help in finding the location of den sites in their areas during the fieldwork. Dens with single or multiple openings in a small hillock were considered as one den site. Distinct tunnels in a large hillock with multiple openings were considered as separate den sites. All the den sites were marked on the toposheets and then transferred into GIS domain to exhibit distribution. The distance to the nearest water body and village from each den site was recorded.

To estimate the bear population, 78 linear transects of one km² were laid in representative areas covering various habitat types and land use categories in the study area. Each of the transects was inspected four times over a period of one year in different seasons. While walking the transects, all sightings of bear were recorded. Indirect evidences of bear presence such as scats and signs of digging at termite mounds or ant nests were recorded from a 10 m circular plot at intervals of 250 m. Bear abundance indices were calculated on the basis of the findings of scats and diggings per hectare.

Six den sites (i.e., Pundi dongri (Tauli), Jhandi dongri (Masurikhar), Amlu dongri (Chuabakra), Lamra dongri (Ghusariya), Ladara dongri (Jhirna Pauri) and Niranjana kharil (Jhirna Pauri)) were selected in different areas of Pendra and Marwahi ranges. These den sites were considered representative of the active den sites in the study area and were monitored at dusk during May and June of 1999 & 2000 to count bears. The occurrence of bears was also verified during the winter and monsoon seasons. Bears were counted between 16:00-20:00 hrs, when they generally came out from their dens. The counting continued for 6-8 consecutive days at each den site. On the basis of body size and grouping behavior, individuals could be identified and counted without any duplication. Assuming that the bears did not change their den sites frequently, the mean number of bears in six den sites was extrapolated at 95%

confidence limit with the number of active den sites.

Results

Distribution of sloth bear denning sites

In the study area, 109 bear den sites were identified, with 44 and 65 in the Pendra and Marwahi ranges, respectively. Among these, 56 den sites were actively used and 53 were used occasionally. There were 18 active dens in Pendra range and 38 in Marwahi range. Most of the den sites were located in the forest areas, but a few were found in the revenue land. More than 96% of the den sites were located within 1,250 m of human habitations. Generally, the number and size of dens (caves) corresponded to the size of the hillock. Most den sites were located in large hillocks (150-300 m long and 50-80 m wide). The large boulders of hillocks also provided shelter to other animals. One den site near the village of Tauli was shared by leopards, hyenas, jackals and sloth bears, with no apparent competition. In Pendra and Marwahi ranges, people gather rainwater using traditional methods by digging ponds and constructing check dams, hence, many ponds and water bodies are scattered across the area. Therefore, water availability for bears was plentiful and about 77% of the den sites had accessible water within 500 m.

Population abundance

During 312 transect walks made, only 4 bears (2 males, 1 female and 1 cub) were seen in 3 sightings in the study area. Indirect evidence pointed to the use of a diverse range of habitat types and land use categories by sloth bear. The average density of diggings per hectare was highest in Sal forest (36.0), followed by land near water bodies (18.4), Sal mixed forest (17.4), mixed forest (17.1) and scrubland (9.9). Scat density per hectare was highest in open land (3.4), followed by mixed forest (3.6), Sal forest (3.2), and land near water bodies (2.12). Average density of diggings and scats in various habitat types was 16.7/ha and 2.3/ha respectively, whereas the average number of diggings and scats per transect was 20.4 and 9.9 respectively. It was observed that there was more evidence of diggings in forest patches close to the bear den sites. The occurrence of digging varied from plot to plot (0 to 22). A high degree of

(continued on p.17)

(continued from p.16)

variability from the mean was observed in estimating bear abundance based on indirect evidence (scats and diggings), due to the patchiness of habitat and the occurrence of termite mounds. There were many plots without bear signs; consequently the variability increased.

Five to nine bears were counted at the six den sites. In total, there were 10 males, 9 females, 6 cubs and 10 unidentified bears in the vicinity of these den sites. The bear population of the 6 den sites was extrapolated at 95% confidence limit with the number of active (56) den sites. Based on this, the bear population was estimated to be 326 ± 90 bears in the study area. There were approximately 93 ± 29 males, 100 ± 53 females, 84 ± 45 cubs, and 140 ± 78 unidentified individuals in the North Bilaspur Forest Division. As the Marwahi range showed more active den sites, the bear population was found to be high in this range in comparison to the number of bears in Pendra range. Furthermore, since the North Bilaspur Forest Division encompasses an area of $1,395.72 \text{ km}^2$, the bear population could be projected as one bear per 4.28 km^2 .

Discussion

In Pendra and Marwahi ranges of NBFD, active and temporary dens of sloth bear were located in the boulder-strewn hillocks throughout the study area. Pendra range along the Amarkantak chain of hillocks showed contiguous forests, but the number of den sites was low in the area. In both Pendra and Marwahi ranges, most of the den sites and available habitats of sloth bears were interspersed with human settlements and agricultural areas. The dens sites were close to each other in the Marwahi range, whereas they were farther apart in the Pendra range. This indicates the bear distribution pattern in the NBFD. Bears occupied almost 73% of NBFD, and there were no bears in the vicinity of Basantpur, Pendra, Semra, Gaurela and Murmur towns in Pendra range, and Kudri, Kotmi, Kurkai and Patgawa towns of Marwahi range, which covered 27% of the total area (Akhtar, 2002). The location of >96% of the den sites revealed that the bears were largely dependent on villages for obtaining food. Thus, the availability of food may be major reason behind the proximity of den sites to villages. However, water was not a limiting factor

in the location of den sites, as water was plentiful across the study area.

Bears were found to take rest in dens during the daytime and rarely came out during this period due to the activities of people and livestock. Therefore, the direct sightings of 4 bears along the transects did not reflect the meaningful abundance of sloth bear. The bear encounter rate was unrealistic insofar as actual population density was concerned. Estimates of sloth bear abundance in protected areas based on indirect evidences have been generated, and the difficulty of finding correlation of signs or sightings with estimates of abundance is recognized (Wesley, 1977 and Saharia, 1980). In NBFD, a scat density of 2.3/ha or $230/\text{km}^2$ shows a very high bear abundance compared to Mudumalai Wildlife Sanctuary, which showed a scat density of $1.11/\text{km}^2$ (Desai *et al.*, 1997). While walking along the transects, the sighting of bears and indirect evidence did not reflect the meaningful abundance of sloth bear in NBFD. Hence, an alternative approach of counting bears at 6 specific den sites, representing the whole range of habitats, was used. The bear population is estimated to be 326 ± 90 bears in the $1,395.72 \text{ km}^2$ area. The population abundance is found to be $0.23 \text{ bears}/\text{km}^2$ or one bear per 4.28 km^2 . As in the Marwahi range, active den sites of similar nature were more in comparison to the Pendra range; thus, the bear population was high in the Marwahi areas.

Presently in NBFD, although the forests are highly disturbed and degraded, they still support a substantial number of sloth bears that can be compared with bear populations in other protected areas of India, Nepal and Sri Lanka. Using the sighting data, a crude density of 5 bears/ 100 km^2 was estimated in Wilpattu National Park (Eisenberg and Lockhard, 1972). Iswariah (1984) estimated a density of 12 sloth bears/ 100 km^2 outside the protected area in Ramnagaram Taluk, Karnataka. The density of sloth bear in Chitwan National Park has been estimated at $0.1 \text{ bear}/\text{km}^2$ (Laurie and Seidensticker, 1977) and $0.27 \text{ bear}/\text{km}^2$ (Garshelis *et al.*, 1999); in Mudumalai it was $0.17 \text{ bears}/\text{km}^2$ (Desai *et al.*, 1997); and in Ruhena Wilpattu National Park the density was $0.05 \text{ bears}/\text{km}^2$ (Santiapillai, and Santiapillai, 1990). In North

Bilaspur Forest Division, a density of 0.23 bears/km² was found to be comparatively high.

There are many isolated den sites in the Pendra range, viz. Barbasan, Tauli, Surungtola and in Marwahi range, viz. Katra, Karhaniya, Karsiwa, which are surrounded by human settlements and agriculture fields. During the evening hours the bears come out from their dens and raid agriculture crops such as maize (*Zea mays*), ground nut (*Arachis hypogea*), and fruiting trees such as *Ziziphus mauritiana* and *Mangifera indica*. In such situations many encounters between bears and humans also take place, sometimes resulting in maulings, and in some cases death. Sloth bears using these den sites do not have a bright future for survival and the chances of encounters with humans are always there. There is a need to translocate the bears from these sites to other suitable areas and develop a strategy to control increases in the bear population to mitigate human-bear conflicts on a long term basis.

Acknowledgements

The authors are grateful to the Director, Wildlife Institute of India, Dehradun, for his guidance in executing this study. Thanks are also extended to Chhattisgarh Forest Department for granting permission to carry out the research and providing logistical support. Finally, this work could not have been completed without the active involvement of our field assistant, the late Shri Kamlesh Singh Kashyap, and Phul Singh.

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Table 1: Abundance of bear digging signs and scats in North Bilaspur Forest Division, Chhattisgarh, India

Habitat type	No. of plots	No. of plots with digging & scats	No. of diggings/ha $\pm$ SD	No. of scats/ha $\pm$ SD
Mix forest	114	55	17.1 $\pm$ 32.4	3.6 $\pm$ 11.3
Sal forest	54	38	35.9 $\pm$ 43.5	3.2 $\pm$ 10.8
Sal mix	55	28	17.4 $\pm$ 22.0	0.6 $\pm$ 2.4
Crop field	25	7	7.2 $\pm$ 14.3	1.7 $\pm$ 8.5
Scrub land	88	28	9.9 $\pm$ 25.1	1.3 $\pm$ 4.8
Open land	25	7	7.6 $\pm$ 18.3	3.4 $\pm$ 17.0
Land near water bodies	15	9	18.4 $\pm$ 21.8	2.1 $\pm$ 8.2
Plantation	14	8	9.8 $\pm$ 10.6	
Total	390	180		

Table 2: Number and sex class of bears observed at selected den sites

Den sites	Males	Females	Cubs	Unidentified	Total count
Pundi dongri, Tauli	2	1	2		5
Jhandi dongri, Masurikhar	1	3	1		5
Amli dongri, Chuabakra	1	2		3	6
Lamra dongri, Ghusariya	2	2	2	3	9
Ladara dongri, Jhirma Pauri	2	1	1	1	5
Niranjan Kharil, Jhirma Pauri	2			3	5
Total	10	9	6	10	35

Table 3: Projection of bear population in NBFD based on bear count at den sites

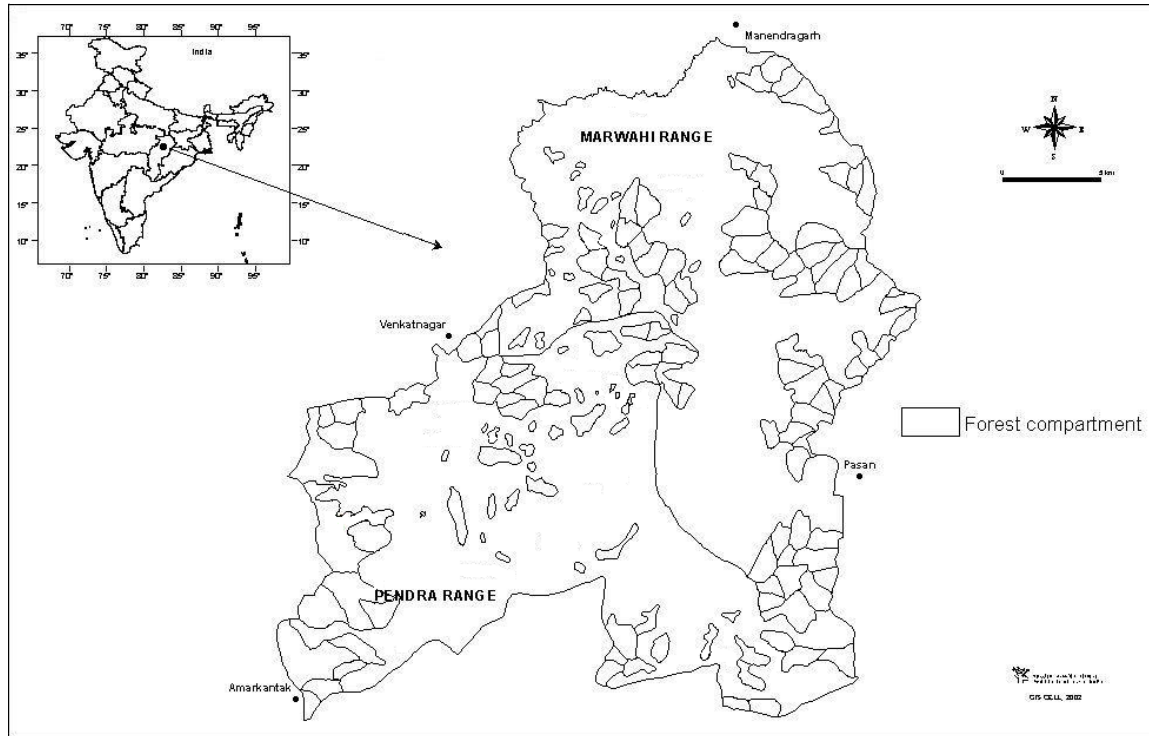
	Population		Test of significance		Population estimate
	Mean	Standard error (SE)	T-value (p>0.05)	Confidence limit (L)	
All bears	5.83	0.65	2.45	1.60	326 $\pm$ 90
Male	1.67	0.21	2.45	0.52	93 $\pm$ 29
Female	1.80	0.37	2.57	0.96	100 $\pm$ 53
Cubs	1.50	0.29	2.78	0.80	84 $\pm$ 45
Unidentified	2.5	0.5	2.78	1.39	140 $\pm$ 78

Table 4: Location of bear den sites

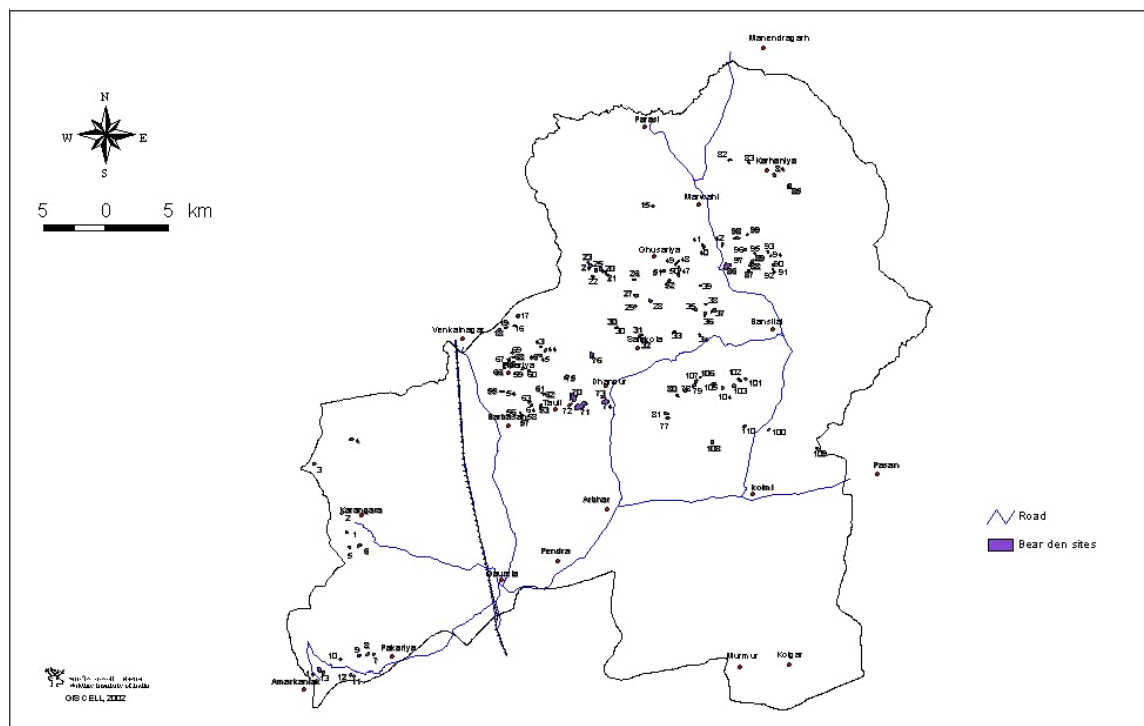
Forest compartment No.	Den ID	Name of den sites	Nearest village
UN	76	Latkeni dongri	Latkeni
UN	77	Tendu choti dongri	Silpahri
RL	34	Panika dongri	Ratga
UN	30	Baniga dongri	Karsiwa
RL	42	Bhaluwali dongri	Pandripani
RL	82	Chana dongri	Chanadongri
RL	83	Dhadhol mara	Rajarani
1243	13, 14, 15	Pakariya dongri, Thar pathra dongri, Baghmarhia dongri	Pakariya
1255	3	Bharhi dongri	Saleghore
1264	84, 85	Karhanhia dongri, Baghmara dongri	Karhaniya, Katra
1266	98	Papiyara dongri,	Marakot
1268	86, 87, 88, 89, 97	Davakol dongri, Mahra bahra dongri, Mahra bahra dongri, Litya sarai dongri, Mendra murhi dongri, Marakot dongri	Litya sarai
1269	94, 95	Janta pani dongri, Jhandi dongri	Marakot, Chilhan
1270	90, 91	Bhasbhiri dongri, Gazal dongri	Litya sarai
1279	100	Barghorka dongri	Matiadand
1328	73	Dhanpur dongri,	Dhanpur
1329	70, 71	Jhandi dongri, Chandeli dongri	Mashurikhar
1330	61,	Golpitta dongri	Tauli
1331	53, 56	Pundi dongri, Khanta dongri	Tauli
1332	54, 55	Jhandi dongri, Bhuthi dongri	Barbasan
1335	67	Bhalu wali dongri,	Parkhuri
1340	16	Thuha dongri	Dharmohli
1351	20, 22, 23	Lachi dongri, Amli dongri, Rekhi dongri	Khurpa, Dharhar
1353	28	Amli dongri	Chuabahra
1358	43, 44	Ladara dongri, Niranjana kharil,	Jharnapanri
1361	32	Ghundi dongri	Salekota
1362	33	Jaldi dongri	Ratga
1368	78, 79,	Tendu badi dongri, Baijarah dongri	Silpahri
1369	103, 105, 106, 107	Aura dongri, Kolbira dongri, Jhandi dongri, Kolbira dongri	Bhagarra
1371	38, 39	Gidhlai dongri, Chitwahi dongri	Sachratola
1372	35, 36	Jogi dongri, Talwa dongri	Ratga
1375	47	Kural dongri	Ghusariya
1376	48, 50, 52	Lamra dongri, Ghusariya dongri, Madwahi dongri	Ghusariya

UN= Unknown, RL= Revenue land

Map 1: Status of existing forest cover in the form of forest compartments in North Bilaspur Forest Division, Chhattisgarh, India



Map 2: Distribution of bear den sites and ID in North Bilaspur Forest Division, Chhattisgarh.



ANTHROPOGENIC THREATS AND BIODIVERSITY CONSERVATION IN SIMILIPAL BIOSPHERE RESERVE, ORISSA, INDIA

by S.D. Rout

According to the Convention on the Biological Diversity, biodiversity is the variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

To conserve the representative ecosystems, a Biosphere Reserve program is being implemented. Ten biodiversity rich areas of the country have been designated as Biosphere Reserves applying the UNESCO/MAB criteria. These reserves aim at conserving the biological diversity and genetic integrity of plants, animals and microorganisms in their totality as part of the natural ecosystems, so as to ensure their self-perpetuation and unhindered evolution of the living resources.

India has a vast protected area network, which also includes the Biosphere Reserves. These Biosphere Reserves have been set up by expanding/merging the isolated, pre-existing national park/sanctuaries under the control of Forest and Wildlife Departments, to meet the objectives of biodiversity conservation and management (Envis, 2000). In view of the importance of the scientific management of the Biosphere Reserve, a large number of scientists have taken up research and monitoring works in the designated Biosphere Reserves. It is considered appropriate to carry out detailed scientific studies on the potential sites for additional Biosphere Reserves for evaluation and to prepare management action plans (Sharma *et al.*, 2002).

Similipal Biosphere Reserve (SBR)

Similipal Biosphere Reserve (SBR) comprises the entire Similipal sanctuary and the proposed national

park, Nato and Satkosha reserved forests, and a 10 km belt from the boundaries of Similipal. The state is covered with 57,183 km² of forest area, out of which about 12.65% fall under a network of two national parks and 18 sanctuaries. Similipal contributes 38% of the total area of the Protected Area (PA) network in Orissa (Singh, 1997).

Lying between 20°17' to 22° 34' N latitude and 85°40' to 87°10' E longitude, the Similipal hill range forms a part of the northern plateau and occupies the central part of Mayurbhanj district in Orissa. It covers a total area of 5,569 km². The Similipal Biosphere Reserve has a well demarcated core area, as well as buffer zones. The core zone has seven ranges, namely: Upper Barha Kamda (UBK), Chahala, Jenabil, Nawana (South), Nawana (North), Pithabata and National Park. The buffer zone has twelve ranges falling into three forest divisions, namely: Baripada, Karanjia and Rairangpur.

The landscape of Similipal is comprised of numerous rolling hills covered with thick forest vegetation. It is the richest watershed in Orissa, giving rise to perennial rivers such as the Budhabalanga, Khadkei, Khairi, Bhandan, West Deo, Salandi, East Deo, Sanjo and Palpala. These rivers are lifelines for the people of Mayurbhanj, Baleswar and Bhadrak districts. Several tribes inhabit Similipal, including Santal, Kol, Bhomij, Bhuiyan, Bathudi, Kharia, Gondo, Mankdias, Pauri-Bhuyan, Mahalis, Sounti and Saharas. Some of these tribes, e.g., the Kharia and Mankdias and Saharas, still live in a primitive state. They depend solely on the surrounding forest for most of their requirements - from food to medicine (Anon, 2003).

Censuses were conducted for herbivores and carnivores in all twelve forest ranges during different periods of the year. Several publications (Srivastava and Singh, 1997; Rout, 2005; Swain and Nanda, 1997; Dutta, 1997; Prusty and Singh, 1997; Rout and Swain, 2005) reported detailed descriptions of the study area and methods for carrying out the census work. This article describes the richness of species diversity, threats to biological diversity by man, and the mode of conservation of Similipal Biosphere Reserve.

Floral diversity

The vegetation of Similipal is comprised of northern tropical semi-evergreen forest, northern tropical moist deciduous forest, dry deciduous hill forests, high level Sal forest, grassland and savannah. With reference to India, the floral composition of Similipal is 7% flowering plants and 8% orchids. It harbors 94 species of orchids and 1,076 other species of plants. These include 3 species of endemic orchids, 8 plants which have endangered status, 8 plant species with vulnerable status, and 34 rare species. Endemism is high among tree ferns, orchids and medicinal plants (Anon, 2003).

Faunal diversity

The diverse topography and soil conditions, coupled with climatic variation and rich diversity of autotrophs, is sure to support a fascinating faunal composition in Similipal. This includes 12 species of amphibians, 29 species of reptiles, 264 species of birds and 42 species of mammals. It is home to two large cats and four lesser cats, including melanistic tiger and black panther. The faunal diversity is not fully understood beyond large prey-predators. High endemism is expected among the invertebrates and insects. Similipal contains over 50% of the entire tiger population of Orissa state. The elephant population is the largest in central India and represents about 25% of the elephant population in Orissa. The Mahasheer fish found in the hill streams are unique to peninsular India. The Chowsingha of Similipal is significant. The common sight of giant squirrels indicates the continuing health of the forest's upper canopy. Honey bee is an insect of great economic importance to the tribals, particularly the Khadia

tribes. Thus, Similipal Biosphere Reserve is a rare expression of nature's bounty.

Threats to biological diversity

Human activities

People affect biodiversity in both direct and indirect ways. Agriculture and animal husbandry alter the biological diversity by destroying or modifying the native biota. It is estimated that since 1950, the area of forest and woodland worldwide has decreased by 15%, primarily in Africa, Asia and Latin America (Bhatnagar and Rao, 1997).

The main human activities observed in the Similipal Biosphere Reserve were domestic livestock grazing, illegal cutting of trees, poaching, akhand sikar (annual mass hunting), collection of non-timber forest products, collection of medicinal plants, and tourism.

Domestic livestock grazing

Grazing is prohibited in the core area of Similipal Sanctuary. But incidences of grazing have been noticed around the four villages in the core area, as well as at the other villages located just adjacent to the core area. A livestock population survey conducted during August 1997 in the four villages revealed that the livestock population consisted of cows (43.42%), buffaloes (2%) and goats (54.65%). These figures fluctuate seasonally, with the lowest number of goats and sheep found during the rainy season, as villagers sell these animals to earn their livelihood. Cows and buffaloes are less productive in respect of milk. Their utility is more for manure and as draught animals.

Illegal cutting of trees

Excessive exploitation of forests has seriously diminished our forest resources. In the core area of Similipal Tiger Reserve, the illicit felling of trees is mainly confined to two economic species, namely *Dalbergia latifolia* and *Pterocarpus marsupium*, and the felling intensity is not high except in the north-eastern fringe areas in and around Pithabata. But buffer areas are more prone to illicit felling and illegal removal of timber. The situation in certain pockets near the buffer zone is quite alarming. All out efforts to minimize illicit felling are being made by the respective forest

divisions of Baripada and Karanjia under the unified control of the Field Director, Similipal Tiger Reserve.

Poaching

Professional poaching *per se* is not practiced in Similipal. However, sporadic cases of organized poaching for elephants are reported. Crop-raiding by the wild animals prompts retaliation by poisoning and other means of killing. For hares and jungle fowls, snares are rarely used. The poaching pressure is more serious on the southeast fringe of the sanctuary, specifically from the foothill villages such as Balma, Dengam, Podadiha, etc. The monsoon is the usual time for elephant poachers. The regular migration of herds of elephants from Dalma Sanctuary of Bihar and West Bengal into Similipal also poses a great threat to these elephants, as they are more vulnerable at that time due to their confinement to the peripheral villages of Similipal Tiger Reserve. Elephant corridors between these two states and Similipal need to be maintained. During 1999, 48 elephants migrated from Bihar; during 2000, 52 elephants entered the forests of Mayurbhanj. Fortunately, stringent protection measures by the park management during the rainy season with deployment of mobile staff at vulnerable spots has controlled the incidences of elephant poaching.

Akhand shikar

Tribal people in and around Similipal indulge in 'akhand shikar' (mass hunting) as a ritual. Formerly practiced during mid-April, now this unrestricted hunting occurs throughout the year, barring a few months during the rainy season. This change of practice is due to the strong anti-hunting measures undertaken by the park management during April. Another significant deviation in their practice is that of carrying the prey animals back to villages. Previously, they simply killed animals, cooked and ate them inside the forest. But at present, consumerism and commercialism prompt them to sell their kills in the markets of the foothills in contravention of traditional practice.

Collection of non-timber forest products (NTFP)

The Similipal forest has been the chief source of

major and minor forest produce that provides subsistence for the tribes and forest dwellers residing in the sanctuary area. Besides timber and bamboo, non-timber forest products also play a major role in the day-to-day life of tribals. Important items amongst them are sal seeds, mahua seeds, kusum seeds, tamarind, honey, resin, arrowroot, tussar cocoon, lac, sabai grass, etc. Nearly 40% of the total annual income of the tribal household is derived from the sale of NTFPs. The percentage of income from this source increases with the poverty of an household (Patnaik, 1997).

The Kharias, a primitive tribe inside the sanctuary, subsist on the collection of non-timber forest products. Honey, gum, arrowroot and wild mushrooms are collected by them – all illegally. The bark of the Paja tree (*Litsea monopetala*) is collected by the professional smugglers. The collection of the seeds and flowers of Mahua and of sal seeds also cause disturbances in the area. Forests are deliberately burnt to clear the floor to collect these items. However, in the core area, the intensity of disturbance is comparatively less than in the buffer areas.

Medicinal plants

The Similipal Biosphere Reserve is an ideal habitat for approximately 600 plant species, representing 74 families in 34 compartments, which are used in the treatment of different diseases (Rout, 2005). Tribals living inside and outside the forests possess knowledge to some extent about these medicinal plants and how they are used in treatments. Various ethnomedicinal plant parts have been documented by the people of Mayurbhanj district for use against diseases like gastro-intestinal disorders, skin diseases, gynecological disorders, skeletal diseases, jaundice, piles, bronchitis, diabetes, neurological diseases, snakebite, ophthalmic infections and cardiovascular diseases (Kumar and Rout, 2005). The illegal and unscientific collection by local people, and over-exploitation by village vaidyas and local kavirajs has led to a drastic reduction in the number of medicinal plant species such as *Asparagus racemosus*, *Boerhavia diffusa*, *Dioscorea* sps., *Helicteres isora*, *Litsea monopetala*, *Rauvolfia serpentina*, *Smilax macrophylla*, etc. (Pandey and Rout, 2002). Since the exploitation of these valuable resources is increasing rapidly, many species of medicinal plants

are becoming rare and are included in the list of endangered plants.

Tourism

Tourism is an integral part of the management of Similipal Biosphere Reserve. Before the promulgation of the Wildlife (Protection) Act, 1972, the Similipal Hills was a shooting range of the erstwhile Maharaja of Mayurbhanj and other dignitaries. Nowadays, every year thousands of tourists visit Similipal to enjoy the wildlife, have a glimpse of natural bounties, and to visit the deities. Hence, there is a lot of pressure from tourism on Similipal. The meadow of Chahala, the magnificent waterfall at Barheipani, Nawana valley, the banks of the river Budhabalanga near Jamboo, the waterfall and majestic hills at Joranda, Lulung, and the shrine at Deokund, all attract the tourists.

Discussion

India is one of 12 megabiodiversity countries of the world. In India, there is increasing interest and concern for biodiversity conservation in biosphere reserves. The ecological dependence of biotic elements is the mainstay in any sustainable environment. Thus, the coexistence of mankind with the plants and animals in Similipal, which is yet not very seriously affected by outside interference, will be an asset for the security of the ecosystem and conservation of biodiversity. Similipal has suffered many ravages of destruction due to population pressure, domestic livestock grazing, illegal cutting of trees, poaching, akhand sikar, and the collection of non-timber forest products and medicinal plants. The ecological balance has evolved and stabilized over millions of years and once destroyed it will be impossible to get it back.

The collection of NTFPs provides more than half of the total person days employment per household and involves more women than men. Nearly 40% of the total income of the tribal household is derived from the sale of NTFPs. Recognizing the fact that forest products cannot be protected or conserved by alienating the tribals, their participation was mooted.

The uniqueness of Similipal as a center of biodiversity is its important geological formation

— the phytogeographical mixture of floristics and fauna from north and south India and the Andamans. As a true tropical forest, its flora and fauna are very diverse. The progressive exploitation of Similipal has opened up the forest and the resultant loss of the flora and fauna will be impossible to replace, along with the accompanying change in the ecological balance and the climate of north-east and south-west Orissa. The flora and fauna of Similipal are not only rich in biodiversity and contain many rare and endangered species, but Similipal also contains vast treasures of natural resources, which can be exploited and developed sustainably and economically. Its water resources in the form of 10 rivers, rivulets and springs are also an invaluable gift of nature.

The biodiversity-rich forests of Similipal constitute a vast treasure of diverse wild genes, with wide adaptability to the different climatic and ecological conditions prevailing there. These can be used to improve the established crops and develop new ones. Many of the species carrying genes have been identified and many more are yet to be identified. Therefore, steps must be taken to identify them and ensure their conservation, both *ex situ* and *in situ*. The property rights for conservation of the species and the genes must be vested with the local tribals.

Steps taken towards conservation

For the successful conservation of biodiversity, both proximate and ultimate causes of environmental degradation and species loss must be considered. The best way to protect biological diversity is to protect the habitats of Similipal.

The Forest Management Plan is aimed to protect the interests of the inhabitants, as well as the biodiversity. Different eco-developmental programs are taken into consideration to meet the ecological demands, as well as to protect Similipal.

A number of projects for the conservation of endangered species have been launched, of which the Elephant project, Project Tiger, and the Crocodile Breeding Project are worth mentioning. Many of the plant species which have been identified as threatened, rare or endangered are

being preserved successfully in the nurseries of Ramatirtha and Pithabata.

Efforts are being directed toward wildlife education, awareness, research and training of the common people by the different government organizations and many NGOs.

Many protection strategies have been implemented to protect the Similipal Biosphere Reserve. Some important activities are the closure of roads during the rainy season, joint patrolling conducted by the staff of Similipal Tiger Reserve and Territorial divisions, the deployment of captive elephants in protection duty, the deployment of Sabuja Vahinee (Green Brigade) in the sensitive pockets of the Tiger Reserve, and developing an intelligence network in the villages inside the reserve to tap information regarding the movement of poachers or timber smugglers in the Similipal Tiger Reserve.

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A PRELIMINARY SURVEY ON THE HERPETOFAUNA IN THE ANAWILUNDAWA WETLAND SANCTUARY: THE SECOND RAMSAR SITE OF SRI LANKA

by Roshan K. Rodrigo, M. Sandun J. Perera, Naalin Perera, T.N. Peries, Sanjeeve de Silva and C.N.B. Bambaradeniya

The Anawilundawa wetland sanctuary (7°42'N, 79°49'E), 1,400 ha in extent, is located between the coast and the Negombo-Puttalam railway, in Puttalam District of the North Western Province of Sri Lanka. Chilaw, 10 km to the south, and Puttalam, 35 km to the north, are the nearest main towns. The wetland consists of an ancient group of shallow cascading tanks, ranging from 12-50 ha in extent, built around 1140 AD by King Parakramabahu. The system consists of seven small irrigation tanks, namely, Pinkattiya, Wellawala, Maradansole, Irakka-wela/Ihala Wewa, Anawilundawa, Suruwila and Maiyawa, aligned from north to south. The surface area of the tanks totals about 188 ha, with none exceeding a depth of 4 m at the deepest point (generally near the bund) when at full storage level. They are separated from each other by low earthen bunds, which now are largely overgrown. To the west of the reservoirs is a large area of paddy fields (412 ha), interspersed with islets of natural vegetation. Further west is a canal, constructed by the Dutch, joining the Mundel Lake in the north, and the Deduru Oya and Sengal Oya (oya is the local term for stream) estuaries in the south (CEA, 1994).

Anawilundawa is a rainfed tank system. Its main sources are surface run-off water from Rathambala Oya basin with a catchment of 215 km², and spill water from the Katupotha tank located upstream. Water levels are highest when the rainfall peaks during the northeast monsoon, from October to November. Any excess water is released through an outlet in the bund of Maiyawa tank, into the Sengal Oya connected to the Dutch canal, which flows into the sea (CEA, 1994). Usually the tanks are completely dry by the middle of the following September.

The Anawilundawa sanctuary is in the dry zone of the western lowlands of Sri Lanka, and has a

moderately hot and dry climate. The mean annual temperature recorded at the Puttalam observatory is 26°C. The average relative humidity is 75% and is highest in December. The annual rainfall for the area is about 1000-1500 mm. Geologically the sanctuary area is largely quaternary deposits, including sand dunes, clay, silt and red earths, on underlying Precambrian crystalline rocks. The wetland complex borders an ancient lagoon that was formed behind a barrier beach (CEA, 1994).

Due to the rich bird diversity associated with the Anawilundawa wetland, the Department of Wildlife Conservation (DWC) declared it a Sanctuary in June 1997, under the provisions of the Fauna and Flora Protection Ordinance. According to the Government Gazette No. 979/15 of 11th June 1997, the boundaries of the sanctuary are demarcated by the Udappuwa – Battuluoya road in the north, the Chilaw – Puttalam railway in the east, the Sengal Oya in the south, and the Dutch canal in the west. Based on its unique biodiversity, cultural heritage, functional value as a feeding ground for migratory waterfowl and its contribution towards the sustenance of local livelihoods, the Anawilundawa Sanctuary was recognized as a Wetland of International Importance under the Ramsar Convention in August 2001, following a joint request made by DWC and IUCN – The World Conservation Union.

A number of local communities continue to live within Anawilundawa Sanctuary and directly depend on it for their livelihoods and food security. Approximately 90% of the estimated 2,500 families in and around the sanctuary area depend on agriculture, primarily paddy cultivation, based on irrigation water from the tanks. Local people are also engaged in subsistence fishery in the tanks. Other commercial activities include coconut cultivation, coastal fishing, and prawn farming,

while a number of local and foreign eco-tourists visit the sanctuary, mainly to observe birds.

The Ramsar Convention requires contracting parties to assess the biodiversity status of sites declared as Ramsar wetlands, followed by subsequent monitoring at regular intervals. It has been observed that this wetland of global significance is deteriorating due to several anthropogenic factors. Therefore, establishing a baseline of the biodiversity status of the sanctuary is of utmost importance. With a view to contributing towards the future conservation and participatory management of the Anawilundawa Sanctuary and Ramsar Wetland, IUCN – The World Conservation Union, undertook a biodiversity assessment during the latter part of the year 2003. It was intended to document the current status of biodiversity in the sanctuary and the various threats it faces, to support and facilitate informed management decisions.

Methodology

Taxonomic and ecological data on herpetofaunal species in the area were gathered systematically from 1 August 2003 to 31 January 2004. The area was represented by seven sampling sites (related to the tanks described above). Field sampling was carried out every other week; each sampling session spanned six continuous days. Each selected site was sampled in the morning, evening and night throughout the study period in order to avoid the time bias for a particular location in the case of transects.

Direct counts of amphibian individuals at spawning sites in the study area were often used (Sutherland, 2000). Night sampling, carried out between 1900 hrs to 2400 hrs, was carried out to survey nocturnal herpetofauna in the study area with the aid of a spotlight. The Visual Encounter Method and Visual Observation were used to survey the herpetofauna in each site during the day and night (Wickramasinghe and Bambaradeniya, 2001). Belt transects (100m x 5m) were laid out in selected locations in the study sites. Each transect was searched up to a 2 m height from ground level. One replicate for each transect was done in an analogous habitat (location). The total number of herpetofauna individuals recorded at each location

throughout the study period was taken into account for calculations.

The following guides and keys were used for the species identification and nomenclature: for amphibians Dutta, S.K. & Manamendra-Arachchi, K. (1996); and for reptiles Deraniyagala, P.E.P (1953), De Silva, P.H.D.H. (1980), and Wall, F. (1921). Site-specific data was gathered and analyzed using Shannon's diversity index.

Results and discussion

The following species of amphibians were recorded.

Class: Amphibia

Order: Anura

Family: Bufonidae; Genus: Bufo

1. *Bufo melonostictus* (Schneider, 1799)

This is a widely distributed and commonly seen species in the study area. It was recorded in home gardens. The microhabitats were decaying coconut husks bulks, under decaying logs, and under rocks. A number of live specimens were recorded and also one adult female road kill was noted.

Family: Microhylidae; Genus: Uperodon

2. *Uperodon systoma* (Schneider, 1799)

This is an uncommon species found on tank bunds. It is seen more frequently in the rainy season than in the dry season. The species was found at only two sites, namely Anawilundawa and Suruwila.

Genus: Kaloula

3. *Kaloula taprobanica* (Parker, 1934)

This microhylid appears to be rare in this sanctuary, as it was only recorded from a single site – Anawilundawa. The specimen was seen on a tree trunk on the tank bund, during a rainy night around 20.30 hrs. Only a single specimen was recorded throughout the study period.

Genus: Ramanella

4. *Ramanella variegata* (Stoliczka, 1872)

This species is uncommon in the area and was found only in the Anawilundawa home gardens. In general, the habitat of this species is the rough barks of trees, but all observed individuals were seen on residential water tanks. At night they come

out from the crevices of the water tank walls and feed on insects. Especially during light rain, males and females would gather at the water's edge in the tanks and exhibited mating behavior. Eggs and tadpoles were not seen in the tanks during the survey, but small individuals were recorded several times.

Family: Ranidae; Genus: Limnonectes

5. *Limnonectes limnocharis*

A very common species recorded from the seasonally flooded lands, paddy fields, home gardens and tanks. Most of them were seen and heard calling from the grass and *Echiconia*. When it rains, road kills are more common on tar roads. During night sampling, juveniles, sub adults and adults were found on roads as they were crossing over to wetland habitats such as paddy fields and marshes.

Genus: Hoplobatrachus

6. *Hoplobatrachus crassus* (Jerdon, 1853)

The species was very common in the study area. All observed individuals were found in large tanks and water canals. This species was found only at night and has a unique call. All observed individuals were adults; it was significant that no live juveniles could be found. Five road kills were observed – one juvenile and four adults.

Genus: Rana

7. *Rana gracilis** (Gravenhorst, 1829)

A very rare species found in the sanctuary; was recorded from only one locality – Anawilundawa. This is the only endemic amphibian species found in the study area and it is listed in the national *Red List* as “threatened.” Only one specimen (an adult) was found during a night search. It was crossing from a paddy field to a tank.

Genus: Euphlyctis

8. *Euphlyctis cyanophlyctis* (Schneider, 1799)

This was the commonest amphibian species found in the sanctuary and was recorded from temporary rainwater pools, ponds, water canals and tanks.

9. *Euphlyctis hexadactylus* (Lesson, 1834)

This very common species was found in tanks, water canals and temporary rainwater pools. It is a large-sized frog and can be seen at the water edges at night. The individuals observed in the sanctuary

were resting at the water edges. Three road kills were observed during study period – one juvenile and two males.

Family: Rhacophoridae; Genus: Polypedates

10. *Polypedates maculatus* (Gray, 1845)

A commonly found species, it was recorded from tree trunks, bushes and walls on the water canals. During the field survey this species were observed at night.

The following species of reptiles were recorded.

Order: Testudinata

Family: Trionychidae; Genus: Lissemys

1. *Lissemys punctata* (Bonnaterre, 1789)

This species was uncommon in the study area. According to IUCN's national *Red List*, it is listed as “threatened.” During the dry period in the area this species hibernates under the mud and large tree roots. When hibernating they burrow 3 to 4 feet deep into the mud. The species is largely culled for meat consumption in the surrounding villagers.

Family: Bataguridae; Genus: Melanochelys

2. *Melanochelys trijuga* (Lesson, 1830)

A common species, it was recorded in the Suruwila and Anawilundawa areas in marshlands and tanks. This threatened terrapin is culled by villagers for meat consumption.

Family: Testudinidae; Genus: Geochelone

3. *Geochelone elegans* (Schoepff, 1795)

The species appears to be rare in the area and is listed as “threatened” in IUCN's national *Red List*. During the study period, the species was only found in two localities, namely Anawilundawa and Suruwila. In these two localities 4 juveniles, 5 adult males and 7 adult females were found. The species was observed between the 16.30 hrs and 20.30 hrs. Some of the individuals observed were infected by mites, an external parasite, on either side of the neck, limbs and vent areas. Only one road kill was found in Anawilundawa, and it was a juvenile.

Order: Squamata

Sub order: Tetrapod

Family: Gekkonidae; Genus: Hemidactylus

4. *Hemidactylus frenatus* (Dumeril & Bibron, 1836)

A very common species found throughout the sanctuary. Home gardens, forested tank bunds, marshlands and scrub jungles were its habitat. This species was especially active from dusk to midnight. When comparing specimens found near homes and in the forest, the home specimens were lighter in color pattern than the forest specimens. During the survey period, 4 eggs were found in a small tree hole near a water canal in Anawilundawa. An interesting behavioral observation made on these observed geckos was that when resting on tree trunks, their heads were always pointed down.

5. *Hemidactylus brookii parvimaculatus* (Deraniyagala, 1953)

Very common, frequently found in human habitations, especially on house walls. They were seen actively feeding at night on insects attracted by the lights. When the lights are on in the houses, they gather in groups of 5-10. This is a highly territorial gecko found in houses.

6. *Hemidactylus triedrus lankae** (Deraniyagala, 1953)

An uncommon species, it is usually found in termite hill mounds. Is active at night and feeds on insects. Only one specimen was seen in Anawilundawa, on a termite hill on a tank bund. This specimen was found every sampling day at the same place, and it seems to be highly territorial.

Family: *Scincidae*; Genus: *Mabuya*

7. *Mabuya carinata lankae* (Deraniyagala, 1953)

A very common species found in every habitat in the sanctuary. This ground-dwelling species was more frequently found on rocks.

8. *Mabuya macularia macularia* (Blyth, 1853)

An uncommon species, only one specimen (male adult) was found in an Anawilundawa home garden. One road kill was recorded in Anawilundawa, and it was a female.

Genus: *Lankascincus*

9. *Lankascincus fallax* (Peters, 1860)

A rare species; during the study period it was recorded only from the Anawilundawa area. Its habitat was seasonally flooded lands and riverine forest in the sanctuary. It can be seen on leaf litter where the sun creates shadows. They were active

from late morning to late afternoon. The species is endemic to the island.

Genus: *Sphenomorphus*

10. *Sphenomorphus rufogulus** (Taylor, 1950)

Only two specimens were recorded during the study period in only one locality in Anawilundawa. The habitat was riverine forest and the microhabitat was under leaf litter and under rocks and rotting logs.

Genus: *Lygosoma*

11. *Lygosoma punctata* (Gmelin, 1799)

One specimen was found in a home garden in Anawilundawa. It was a juvenile and had a red tail.

Family: *Agamidae*; Genus: *Calotes*

12. *Calotes calotes* (Linnaeus, 1758)

This is an uncommon species, found on bushes and tree trunks. Some were seen basking in the sun during the early morning. Two sleeping juveniles were observed on a 2 m high bush near a road.

13. *Calotes versicolor versicolor* (Daudin, 1802)

The species was very common in the study area. Yellowish-colored juveniles were seen. Two dead males and one gravid female were observed during the field study and all specimens were road kills. Most of the observed individuals were seen on bushes near roads.

Family: *Varanidae*; Genus: *Varanus*

14. *Varanus bengalensis* (Daudin, 1802)

Very common in the home gardens, coconut plantations and scrublands. One juvenile road kill was recorded in the Suruwila area.

15. *Varanus salvator kabarangoya* (Deraniyagala, 1947)

Very common in the tanks, water canals and marsh areas in the sanctuary.

Sub order: *Serpentoid*

Family: *Boidae*; Genus: *Python*

16. *Python molurus molurus* (Linnaeus, 1758)

Family: *Colubridae*; Genus: *Ahaetulla*

17. *Ahaetulla nasuta* (Lacepede, 1789)

This arboreal snake was commonly seen in green hedges and bushes near roadside habitats. Seven specimens were observed, including 3 juveniles, 2 males and 2 females. Five road kill specimens were recorded including one male, one female and three juveniles. All specimens were recorded during the early morning hours.

Genus: Amphiesma

18. *Amphiesma stolatum* (Linnaeus, 1758)

This semi-aquatic ground dwelling colubrid snake commonly occurred in the marshlands, home gardens and seasonally flood lands in the sanctuary. Juvenile road mortality was high in the sanctuary in the wet season in the early and late morning.

Genus: Atretium

19. *Atretium schistosum* (Daudin, 1803)

An uncommon, semi-aquatic and ground-dwelling snake. Only one road kill specimen was recorded in the Wellawa-Maradansole area, and it was a juvenile.

Genus: Boiga

20. *Boiga forsteni* (Dumeril & Bibron, 1854)

Rare; one specimen was observed in a tree hole in Anawilundawa tank.

Genus: Dendrelaphis

21. *Dendrelaphis tristis* (Daudin, 1803)

Commonly seen in bushes beside roads at midday. When the ambient temperature increased, the activity of the observed individuals also increased. Six road kills were recorded after 12.00 noon and all were males.

Genus: Elaphae

22. *Elaphae helena* (Daudin, 1803)

Uncommon; mostly observed in home gardens at noon. The live specimens were seen in two areas, namely Anawilundawa and Suruvila. Captured individuals would attack. Four road kills were recorded during the survey period – two males and two females.

Genus: Lycodon

23. *Lycodon aulicus* (Linnaeus, 1758)

One live specimen was seen in a home garden in the Anawilundawa area.

Genus: Oligodon

24. *Oligodon arnensis* (Shaw, 1802)

An uncommon, ground dwelling species. When captured, the animals would savagely bite. Three male and one female road kills were recorded in the morning hours during the study period.

25. *Oligodon taeniolatus* ceylonicus (Wall, 1921)

An uncommon, ground-dwelling species recorded near a home garden in Anawilundawa area.

Genus: Ptyas

26. *Ptyas mucosa maximus* (Deraniyagala, 1955)

A common species mostly associated with home garden habitations. One male road kill was recorded in the Anawilundawa area.

Genus: Xenochrophis

27. *Xenochrophis piscator piscator* (Schneider, 1799)

Very common in tanks, water canals, paddy fields and ponds. Ten road kills were observed during the study period; significantly, it was during the rainy season. Seven of the specimens killed were juveniles and three were females. In the sanctuary, the species was culled by fishermen because they thought the fish harvest was decreased by *X. piscator*.

Genus: Bungarus

28. *Bungarus caeruleus* (Schneider, 1801)

Rare; only two road kill females were observed during the study period in the Anawilundawa and Maiyawa areas.

Genus: Naja

29. *Naja naja* (Linnaeus, 1758)

An uncommon species; one live specimen was seen in a home garden in the Anawilundawa area.

Genus: Daboia

30. *Daboia russelii russelii* (Shaw & Nodder, 1797)

An uncommon species found in the sanctuary. Three road kills were recorded – two juveniles and one female.

Acknowledgements

The Department of Wildlife Conservation is gratefully acknowledged for granting permission to work in the Anawilundawa wetland sanctuary.

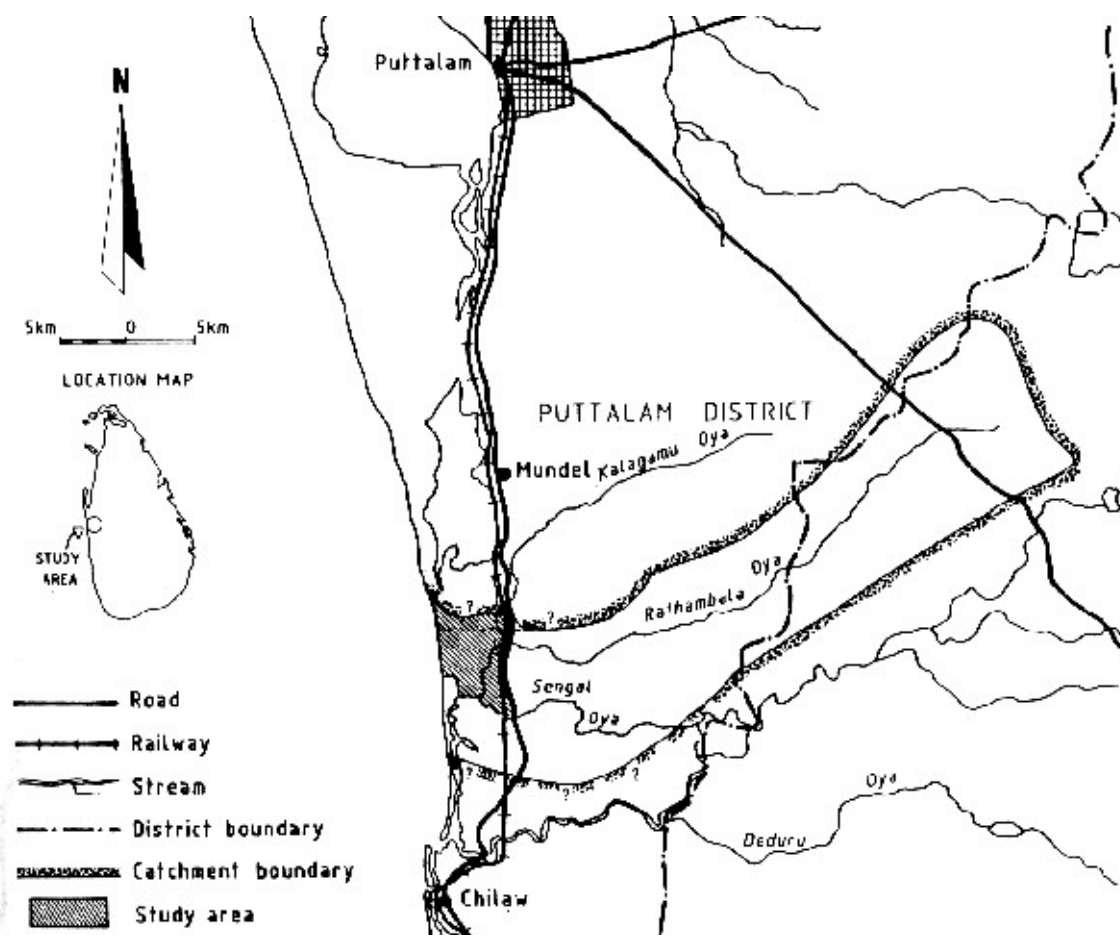
This study was carried out as a part of a major project – the “Conservation and Sustainable Use of the Anawilundawa Sanctuary” project, funded by the RAMSAR bureau. The author would also like to thank Mis. Lishanthi Siriwardana, librarian of IUCN Sri Lanka, for her kind support.

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Figure 1.1: Location of Anawilundawa wetland sanctuary (Study Area)
Source: CEA/Euroconsult (1994)



FOREST NEWS

Vol. XXII: No. 3 Jul-Sep 2008



Photo: Courtesy of Sichuan Forest Department, China

Assessing forestry-related damage resulting from Wenchuan earthquake, China

Contributed by Patrick B. Durst, Senior Forestry Officer

Background

On 12 May 2008, a magnitude 8 earthquake hit southwest China, with the epicenter located in Wenchuan County, Sichuan Province. Official casualties included more than 69,000 dead, 18,000 missing, and 370,000 injured. An estimated 5 million people were left homeless. The quake caused extensive damage to infrastructure, with many roads and railroads left impassable, and thousands of buildings damaged beyond repair.

The Chinese Government has rightly placed initial priority on emergency relief operations and reconstruction of basic infrastructure. Millions of temporary housing units were rapidly constructed

from pre-fab materials to accommodate those whose homes had been destroyed, and strong ongoing efforts are aimed at rebuilding roads, and re-establishing electricity and communication links.

Although the reconstruction of infrastructure, homes and businesses are certain to continue for several years, attention is now also turning to longer-term rehabilitation of forest resources and facilities, and forest-related livelihoods. As local communities were heavily dependent on forest resources for their income and livelihoods prior to the earthquake, local people have a strong affinity for forests and are very supportive of proposals and efforts aimed at



Photo: Courtesy of Sichuan Forest Department, China

rehabilitating forest resources and forest-based enterprises and facilities.

“Flash Assessment”

At the request of the Chinese Government, FAO supported a “flash assessment” of forest-related earthquake damage, 19-23 September 2008. Mr. Patrick Durst, Senior Forestry Officer (FAO-RAP) participated as a team member in conducting the assessment, in collaboration with Mr. Liao Chongguang (FAO Programme Officer), Mr. Xiao Yunlai (FAO National Coordinator), Mr. Zhang Zhongtian (Department of International Cooperation, State Forestry Administration), Mr. Liu Guolin and Mr. Zhang Liming (Division of Exchange and Cooperation, Sichuan Forest Department), and other officials of the Sichuan Forest Department.

The assessment team made field visits to Pengzhou, Dujiangyan, Shifang, and Mianzhu Counties, and held extensive discussions with staff of the Sichuan Forest Department, the Sichuan Academy of Forestry, Forest Bureau staff in the visited counties, and local residents.

The team reviewed, and verified to the extent possible, initial damage reports compiled by the Sichuan Forest Department and reports from local forestry staff), summarized as follows:

- At least 289 forestry staff were killed in the quake, with another 663 injured and 84 missing.
- Direct economic losses in the forestry sector are estimated at RMB 20.94 billion, with indirect losses of more than RMB 183 billion.
- Extensive damage to forests resulted from landslides, rock falls, and flooding caused by the formation of quake lakes; some 330,000 hectares of forests were affected across 46 counties.
- An estimated 19.58 million cubic meters of standing timber was lost (although some can potentially be salvaged).
- Thirty-six nature reserves suffered varying levels of damage, including 29 giant panda reserves, covering 120,000 hectares; landslides have caused considerable habitat fragmentation and disruption of traditional migration routes.
- More than 1,700 hectares of seed orchards and nurseries and 261,000 square meters of greenhouses were destroyed.

- Some 4,859 kilometers of forest pathways and roads were damaged, and more than 400 associated bridges destroyed.
- Nearly 3 million square meters of housing for forest workers and forest-related offices were destroyed or damaged beyond repair.
- Thousands of pieces of machinery and equipment, including fire-fighting equipment, was destroyed or damaged.
- More than 47,000 hectares of commercial (timber-producing) forests were destroyed.
- 192 wood processing facilities (including sawmills, panel manufacturing plants, and furniture manufacturers) were badly affected.
- An estimated 36,600 hectares of “economic forests” (fruit orchards, bamboo, ginkgo, herbal and medicinal plants, etc.) were damaged or destroyed.
- Ecotourism facilities were severely damaged, including more than 175,000 square meters of guest facilities, 185 kilometers of sightseeing plank roads, and 714 kilometers of pathways in 25 nature reserves.
- Severe disruption of normal water flows has occurred due to massive landslides, soil erosion and rock fall.

- Loss of documents and maps was extensive in some forest farms, research stations, and conservations centers.

The most extensive direct damage to forest resources occurred as a result of landslides, with lesser amounts of forest destroyed by flooding caused by the formation of quake lakes and rock falls. Many of the most massive landslides will be impossible to “rehabilitate” by tree planting or seeding. These areas will simply need to be left for nature to reclaim over time. However, other areas of shallower landslips can effectively be rehabilitated and stabilized through reforestation efforts.

Most of the damaged forests were natural forests located on steep slopes, affected by landslides. Considerably less damage was inflicted on artificial forests and “economic forests” that were generally planted on the lower slopes and in valleys.

From field assessments, it is evident that massive landslides have rendered some previously inhabited areas unsuitable for human resettlement. Other areas remain highly unstable and pose serious risks



Photo: Courtesy of Sichuan Forest Department, China

for future habitation. Still other areas pose less risk, but require urgent stabilization of loose soil and debris through revegetation and engineering structures. The Forest Department has estimated that some 12,000 sites are vulnerable to secondary damage from further landslides and shifting rocks and soils. This reality was highlighted by reports of at least 16 deaths and 48 people missing, and closure of a critical highway for quake relief, as a result of more than 30 secondary landslides that occurred just one day following the visit of the assessment team..

Many earthquake-affected areas remain inaccessible to vehicles. Many roads remain blocked by landslides and collapsed bridges. As a result, hundreds of thousands of people remain in temporary housing. Many others have just recently been able to return to their former permanent homes to begin rebuilding.

Due to the heavy dependence of local people on forest resources prior to the earthquake (timber, fruit, bamboo, ginkgo, herbal and medicinal plants, ecotourism, etc.),¹ local residents are very supportive of proposals to rehabilitate forest resources and forest-related infrastructure. Good opportunities exist to involve local people in revegetation efforts, replanting of “economic forests” and rebuilding of forest-related infrastructure.

It is difficult to anticipate to what extent the area will be able to regain its former position as a major ecotourism destination. Much of the scenic, natural beauty of the area existing before the earthquake has been severely diminished. While ecotourism infrastructure can eventually be rebuilt, it is difficult to ascertain if tourists will return now that the area is extensively scarred by massive landslides and rubble-clogged rivers. On the other hand, it is possible that the earthquake damage itself may become a tourist attraction for some people.

The Sichuan Forest Department has developed preliminary plans for forest-based rehabilitation over the next three years. These plans call for restoration of the 300,000 hectares of damaged forest lands through artificial reforestation, mountain closure, and seedlings; replanting of “economic forests”; rehabilitation of nature reserves; re-establishment

of nurseries, forest roads, pathways and other infrastructure, and provision of social services.

Based on experience and lessons learned from tsunami rehabilitation and reconstruction following the massive 2005 earthquake in Pakistan, FAO is well positioned to provide useful support to China in forest-based rehabilitation in Sichuan.

Recommendations

It must be emphasized that forestry inherently requires a long-term perspective and forest-based rehabilitation following the Wenchuan earthquake is no different. Successful forest-related rehabilitation cannot be viewed and managed as an “emergency” project with expectations of completion within 6 or 12 months. Project formulation related to rehabilitation in the forest sector in Sichuan would best take a long-term perspective and plan for project support of a minimum of three years.

It is recommended that proposed projects focus – at least initially – on one or more areas of manageable size (counties perhaps), where a holistic, comprehensive approach to rehabilitation could be applied. Such an approach should include participatory planning and prioritization of activities, hazard mapping, livelihood activities, support for re-establishment of “economic forests,” reforestation and stabilization of landslide areas, capacity building, and strengthening of local forest-related institutions.

A second focus on providing support to the Sichuan Forest Department in developing its more detailed forest sector rehabilitation strategy.

State Forestry Administration officials have proposed to conduct a workshop for interested international organizations and donors to inform them of the needs for forest-related rehabilitation and consider a coordinated, long-term response.

¹ An estimated 60 percent of local residents’ income in affected mountain areas was obtained from forests and forest-related economic activity prior to the earthquake. Even in wealthier villages, as much as 30 percent of income was forest-based.

Views from the region's youth

Two of the events held in conjunction with the Asia-Pacific Forestry Week, convened in Hanoi, Vietnam, 21-26 April 2008, were the Young Professionals' Essay Contest and a Photo Contest, both organized by the FAO Regional Office for Asia and the Pacific, with the winners of both contests invited to attend Forestry Week in Hanoi, Vietnam. The essay contest was open to young professionals studying or working in the fields of forestry, natural resource management or other related fields. Contestants were requested to elaborate their visions on "Forestry in a Changing World" and what they considered to be the most challenging issues facing forests and forestry in Asia and the Pacific today.

We present here the three winning essays in this issue of Forest News. We are also pleased to showcase the winner and some of the photo contest entries on the cover of this issue of Tigerpaper.

Bringing culture back in: nurturing the forests of Asia-Pacific for the present and future generations

by Armand Camhol

Nurturing local culture

As a development worker in an NGO, and lately in the government, I find myself barraged with questions regarding my activities and projects. A village elder in a far-flung barangay (village) would, at my attempts of ferreting out facts regarding indigenous organic farming methods, ask why I'm interested in such "mundane matters." Why, he asks, am I interested in learning about the old ways which "do not command a price?" In an elementary school, I have been quizzed by starry-eyed kids about my interest in dragonflies which, in my early childhood in the late 1980s, flew about in our village of Maggok, Ifugao (northern Philippines), like miniature planes circling the world's busiest airports.

When I worked full-time for the Save the Ifugao Terraces Movement, a local NGO, I found myself getting really close and aligned with my people in the villages of Ifugao, one of the remaining few forest-covered watershed areas in the northern Philippines. I worked first as researcher and site manager, then later as team leader of the Nurturing Indigenous Knowledge Experts Among the Young Generation (NIKE) Project, a Japanese NGO-funded endeavor which aims to correct

discontinuities in the transmission of indigenous knowledge and skills from the few remaining indigenous knowledge experts to the young generation. Here, I learned lots of things about the ways of our forefathers – which before, I had deemed unnecessary for people's existence. I learned that our ancestors practiced land zoning, delineating areas for production, replenishment, and settlement. I became aware of the sustainable agroforestry practices of my elders which put a premium on future croppings and fauna replenishment, contradicting "green revolution" ventures of monocropping, intensive application of toxic pesticides and herbicides and heavy use of inorganic fertilizers, and massive deforestation. My eyes were opened to the fact that our forefathers valued the *muyong* – private woodlots – and forested mountains, hence special care was allotted and customs tailored to safeguard them for future generations.

The forests of Asia-Pacific

Future generations in the Asia-Pacific region and the entire world depend upon our actions and/or inactions at present. This specifically applies to forests, the value of which is beyond question. As a source of clean water, they are indispensable to

the lives of people, whether ethnic highlander or lowland urban folks. The forests feed rivers and streams that irrigate rice fields and crop areas, maintain underground aquifers for land stability, and provide water to an ever-increasing human population. As sources of oxygen and converters of gases otherwise poisonous to both animals and human life, forests are irreplaceable. Moreover, forests supply human and non-human needs of timber, food, income and dwelling.

Indeed, the value of forests is beyond question. Yet, current developments have raised the stakes at the highest levels. Climate change, for example, is real and a clear-and-present danger that makes us more aware of the importance of our forests. As well, increased wealth in the Asia-Pacific area has led to the acceleration of development and modernization, which has led to increased deforestation.

The Ifugao *muyong* – microcosm of the degenerating forests of Asia-Pacific

The Ifugao *muyong*, or private woodlot, has seen various transformations since the early pre-Columbian period when forests were in a pristine state. As a rule, the *muyong* is owned by a clan with management responsibility transferring to every firstborn (the so-called primogeniture rule), regardless of sex. The other *muyong* principle of ownership is “land-locked” meaning it may not be divided by the siblings nor parts of it sold. The one who inherits the *muyong* may have primacy over its use, yet it means also shouldering the responsibility of taking care of less endowed siblings, giving them free access to it. Nowadays, the entry of Western concepts of titling and the money economy has eroded this practice to almost nil existence. Only a few families still adhere to the primogeniture and land-locked tenure principles of land ownership, which means skills and knowledge on proper *muyong* maintenance are not being transmitted to the younger generations. Nowadays, the *muyong* is mainly seen as a source of fuel and money; sustainability is too often put aside.

Another indigenous practice of the ancient Ifugaos is land zoning and delineation. From the top of Ifugao’s peaks to the rivers and communities

below, people have identified areas for production of primary needs, replenishment and recharge zones, and buffer zones. From the middle part of the mountains up to their peaks are the recharge or watershed zones. Human activity is restricted except for hunting and selective harvesting of non-timber forest products (NTFPs). They call it *tudong di payo* (literally “rice field umbrella”). Below that zone are the private woodlots or *muyongs*, production areas for timber to be used in house construction and for fuel. Below the *muyong* are the rice terraces – production areas for rice, the main staple of the Ifugaos. Gathered in one area near the terraces are the settlements or villages where the people live.

Buffer zones exist to check human encroachment into vital natural systems. The woodlots act as a buffer to minimize human activity in the mountain watershed areas. Between the rice fields and the settlements is the *agidayan* (greenbelt) encircling the village, a deterrent to stop the encroachment of housing into the rice fields. The greenbelt also has its purpose as an orchard area for the growing of citrus fruits, guava, avocado, and others.

The *muyong* is cared for by the owner and his family and clan through several methods. First is selective harvesting. Trees are only felled when they are most needed – for example, for the construction of houses. For fuel, people gather dead trees, fast-growing indigenous trees, and misshaped trees. Fruit trees are rarely cut owing to their importance as a secondary food source. Secondly, after trees are felled for construction and/or firewood, the owner replants it with a like variety to ensure that the forest cover is constant. Thirdly, the owners practice the removal of unwanted vines, weeds, and shrubs which restrict the growth of trees. Fourthly, *muyong* thanksgiving rituals and superstitions controlling human activity underscore the importance of the forest as giver of water and healthy air.

Nowadays, the indigenous practice of land zoning and delineation is increasingly being forgotten by the Ifugao people due to problems in transmission of knowledge. Land erosions are frequent because of deforestation and the resultant drying up of underground reservoirs. Rivers are shrinking, evidenced by the exposure of formerly submerged

caves and boulders. Rice fields are being abandoned, partly to the drying up of brooks and streams which once flowed abundantly.

In the Asia-Pacific area, most of the remaining forest cover is in montane areas, populated by indigenous peoples who live differently from their lowland brethren and who are closer to Mother Earth. Hence, as in Ifugao, problems of deforestation are partly caused by ignorance among the young generation of indigenous peoples who have not learned the values and skills of their forefathers on the maintenance of forests. On the side of the lowlanders, the preeminence of modern living, emphasized by rapidity in everything people do, is fast draining what remains of their forests, and fast encroaching into the last remaining watersheds in the mountains. This has dire consequences not only for the indigenous peoples but more so for the lowlanders who depend upon the former for their irrigation and electricity needs.

Solutions – bringing back culture and zoning

If the current trend of forest and environmental (mis)management continues, the future is indeed bleak for everyone, whether living in the highlands, coastal areas or in the flatlands. Deforestation will lead to increased competition for natural resources, thus increasing conflict and poverty. To address the problem, we must go back to the age-old wisdom of our forefathers.

About the author:

Armand Nocod-am Camhol is an Ifugao from the Philippines. He has a B.A. in Political Science from the University of the Philippines, Diliman, and now works for the “Save the Ifugao Terraces Movement (SITMo),” an organization devoted to uplifting the lives of the peoples in the Ifugao rice terraces (IRT), UNESCO World Heritage Sites. He has worked as a tour facilitator, volunteer researcher and writer, and team leader of a Japanese-funded indigenous knowledge (IK) transmission project. He is also one of the writers of the forthcoming publication “IM-PACT Ifugao” from UNESCO, Bangkok.

To protect the montane forests from total deforestation, the ways of the old must be understood and re-learned by our environmental planners and decision-makers. Culture, as the highest expression of people's union with nature, should be promoted and the skills, values, and practices on the maintenance of the mountains, forests, rivers, and rice fields should be transferred to the young generation. The remaining indigenous knowledge holders should be nurtured to perfect the transfer modes and educational systems should be refined to include teaching of indigenous knowledge.

Accompanying this should be the serious implementation of land zoning to halt the demise of remaining forests. Buffer zones should be established to serve as barometers of modernization. Reforestation should be a priority for the Asia-Pacific countries. However, care should be observed so that errors of the past like the use of fast-growing paper trees in watershed areas can be avoided. As much as possible, indigenous species should be used.

Bringing back culture and indigenous knowledge and zoning are big steps which need the involvement of everyone including the local communities, government, NGOs, academe, and the international community. To be successful, it should be a multi-concerted effort. It should be achievable as the few remaining forests of the Asia-Pacific are worth uniting for.



Forests: thrillers, martyrs and healers

by Packiaraj Asirvatham

Introduction

Forests are a treasure of tranquility, a symbol of integrity, a source of diversity and a place of unity. We can find plenty of flora, fauna, trees, animals, birds and species living together with abounding love in the forest. Mixed fragrances, pure air, healthy herbals, roaring streams, descending falls and moving beings make a forest a lively playground of peace. Above all, its serene presence always leads into a celestial experience of all who enter and experience it. This essay is an exploration of the contribution of forests to the welfare of humankind, and human response to forests in order to understand the present scenario and reflect on the future of the human-forest relationship.

Forest as thriller

From my childhood onwards I was indoctrinated about forests through various ways. Most of my childhood bedtime stories started with, "*There was a deep forest in which...*" In addition, heroic adventures and especially movie thrillers were often shown as taking place in forest settings. Christian missionary organizations often portrayed forest and tribal people as individuals who were in danger from evil beasts, living in a threatened environment. In addition, Indian literature mostly portrayed forests as places for hermits and areas for divine mediation to escape from the chaos of the world.

Being fed with this kind of imagery, I was led into believing that people who lived in forests, particularly tribes, lacked culture. On the whole, I was educated that forests are dangerous places and the people who were living in forests were also dangerous.

These kinds of notions and inputs led me into anti-forest sentiments until I undertook intensive fieldwork in Similipal forest range in Orissa in August 2007. The 25-day stay at Similipal forest range, living in the forest with the people of the

forest, changed my perception about forests and helped me to live and experience the real situation, rather than living in a strange imagination.

Forest as martyr

Forests always stand for human welfare and benefit. Everything found in the forest is used by human beings for sustaining their lives. For example, major deforestation took place in India beginning from 1853 to start railways; numerous trees were cut down to make "sleepers" and simultaneously used for fuel. Flowers, fruits, roots, leaves, stems, and seeds, everything has been given to humans, but the question persists as to why humans are concentrating on cutting trees, and destroying their lives? Trees have lives of their own; they live, bloom, and grow. How unethical is the human attitude towards trees in the forests! We, who call ourselves educated people, need to learn something from the people living at the grassroots.

The Dheever caste of Bhandara district of Maharashtra never catch fish going upstream on spawning migration, although they are exhausted and easy to catch. There are entire sacred groves and ponds in which no plant or animal is damaged.¹ During my fieldwork with tribal people in Similipal forest range and throughout our stay, we could not get milk for consumption, though there were numerous cows around. Once, we asked a lady who owned two cows, "Did you get milk from the cows?" Immediately she replied, "How can I get milk from the cow? Cow's milk is the life of its calves and it is unethical to suck one's life to nourish ourselves." I then understood why they didn't drink cow's milk; they were only using cow dung as manure in their fields.

It is very important for us as a literate human generation to ethically look into the issue of deforestation. We have been taking each and every product of the trees; we have been cutting the generous friend – the God-given gift that is the tree itself – out of our utter selfishness.

Certainly, we should regard all the trees as martyrs as we get rains through them, we get good air through them, good food through them, and so on. On the whole, when we acknowledge the sacrifice of trees simultaneously, it is our commitment to save and sustain their life in order to create a greener and healthier world.

Forest as healer

Human atrocities over nature have increased, and consequently human beings and the earth have both become ill. Climate change is one of the worst effects in this regard. It is the time to heal our earth as well as the human generation. When the tsunami devastated South Asia in 2004, one of the major reasons for the damage was the eradication of mangrove forests and coral reefs in the shore area by the shrimp industry. Now governments and NGOs are planting mangroves and nurturing coral reefs in the sea shore. From this example it is very clear that trees are not only martyrs, but also healers. If we grow trees we will enhance water resources; perhaps we may be saved from tsunamis and save the world from climate change. Trees and forests are the hope of the world; they heal the human spirit, enrich life's experience and give people peace.

Poet and Zen master Thich Nhat Hanh from Vietnam, who was nominated for a Nobel Peace Prize by Martin Luther King Jr., in his book *Touching Peace, Practicing the Art of Mindful Living*, describes a human-nurturing tree-ritual:

"Ten years ago, I planted three beautiful Himalayan cedars outside my hermitage [in France], and now, whenever I walk by one of them, I bow, touch its bark with my cheek, and hug it. As I breathe in and out mindfully, I look at its branches and beautiful leaves. I receive a lot of peace and sustenance from hugging trees. Touching a tree gives both you and the tree great pleasure. Trees are beautiful, refreshing, and old. When you want to hug a tree, it will never refuse. You can rely on trees. I have even taught my students the practice of tree hugging ... In the same way we touch trees, we can touch ourselves and others, with compassion. Yes, trees are our friends. They listen to us, care for us, speak to us through their soft leaves, kiss us with beautiful

*flowers and feed us with kindness through their fruits. How sweet it is!"*²

Conclusion

The main challenge is to connect humans and forests. The social understanding and the so-called development theories have clearly divided people from the forest. It is very important for people to understand that forests are part of our world and that they should be taken care of by us. For example, my stay at Similipal forest range in August 2007 was quite strange and scintillating – in the deep forest with no mobile phone tower or television, low voltage power – just a transistor radio which received programs from All India Radio, and only a few people. Every night when I went to sleep, I checked my bed and nearby places fearing the presence of snakes. So much did I feel uncomfortable, and filled with hatred towards the forest. However, after 25 days, I realized that it was the most peaceful place in the world; a pure world of nature, and people with nature, and this learning experience led me to care for trees, because of which I am now concerned about nature. This is the real scenario of 75-90 percent of the population of India towards the forest.

It is my sincere suggestion that the Government and institutions should concentrate on the youngsters and teach them the reality of the forest and its life and work for humanity. If they witness this truth, no one would harm trees and they would promote forestation and also begin to nurture nature.

Practically speaking, school and college children should be taken into the forest and given a chance to explore its beauty and appreciate its nobility from their childhood, through excursions, study trips and picnics. Misinterpretations and wrong indoctrinations about forests need to be stopped.

The tourism department of India is advertising Indian forests to foreign tourists only to generate wealth, but local people are poorly aware or misinformed of forest tourism. This has to be rectified. Media, such as newspapers, radio, television, and so on, promote the importance of forests throughout their programs. Tribal people and their good social values and practices need to

be imparted to the mainstream. Philosophical and religious understanding of forests should be reconstructed with optimism and hope.

Above all, as committed human beings we should spend much time in promoting forestation and eradicating deforestation collectively. I believe that these things would create a greener environment and help us to enhance the existing forests and to create more.

About the author:

Packiaraj Asirvatham is an ordained minister of the Church of South India Tirunelveli Diocese, India. He founded the NGO SMILE in his college days and intensively engaged with vulnerable communities to meet their health needs, which led to his winning the Global Young Social Entrepreneur award in 2007 for creating social change through his innovative leadership. He is very interested in participatory research, community forestry and promoting climate change mitigation at the grassroots level. He would like to continue his research in "eco ethics" and "bio ethics" and become a policy maker.



To conclude, I would like to say that when we enjoy forests and their resources we should always remember our responsibility to care for forests and pass them to the coming generations, inviting them to express their solidarity with us in this noble mission. The idea of forest as a thriller should be enjoyed, forest as martyr should be remembered, and forest as healer should be practiced.

¹1994. M. Gadgil and K.C. Malhotra. **The ecological significance of caste.** In: Ramachandra Guha (Ed.) *Social Ecology*. Oxford University Press, Delhi, p.36.

²1960As quoted in Howard Clinebell, *Ecotherapy*. Fortress Press, Minneapolis.

Balancing environment, protecting livelihoods: issues facing forest and forestry in Asia and the Pacific today

by Anupama Mahat

Me

This is a story about me, my sister, my brother and my forest. I live in a Terai village of Nepal. Nepal is a country situated in South Asia. The Asia-Pacific region comprises some of the richest and the poorest economies, most populated and the least populated countries and countries with the most extensive and least extensive national forest area. My country is an example of one of the poorest economies, though rich in natural resources, especially forest resources. My family

consists of my father, mother, a younger brother and an elder sister. My sister got married in the hills while my brother went abroad (to one of the leading economies of the world) for employment. So my blind father, sick mother and I work in others' farms to survive.

Nepal is a country where more than 40 percent of the land area is covered with forests, but we do not have land of our own. We have a thick protected forest close to where we live in a hut, which is very vulnerable to wind and heavy rain.

It is surrounded by army camps. My father was once attacked by a tiger and blinded.

We need firewood for cooking and fodder for two goats. Feeding the goats is a major problem as we can neither graze them inside the forest nor collect fodder and grasses from there. So, sometimes we steal into the forest to collect some, but most of the times get chased by the army. The forest has huge trees and many wild animals. Had we been allowed to cut some of the old trees, we could have made a small but proper house for ourselves.

Researchers from so many places come to see the forest. They say our forest is very rich as it has so many valuable trees, herbs and shrubs which can serve as a source of livelihood for us. However, the forest is “for our eyes” only. A signatory of the Convention on Biodiversity told us that the government is trying to protect the forest for biodiversity conservation. However, I feel our sufferings are overlooked. We are always vulnerable to life-threatening attacks by the wild animals. Some wild animals killed our goats and destroyed the crops in our farms, minimizing our share of subsistence.

There are some rich households in the village who own plenty of land and employ us as laborers in their farms. They have contacts with some high-ranking officials, with whose help they can enter the forests and acquire their necessities. They even smuggle timber and earn large sums of money. One of the gentlemen has operated a big hotel to provide lodging and food services to the tourists visiting the area but we locals are not employed there as we do not have enough qualifications. People from the city are hired for the jobs. So I feel the forest is getting rich and helping the rich get richer, but the poor who depend on the forest for livelihoods are getting poorer.

My sister

My sister Rugu lives in the middle hills of Nepal. She is a widow. Her husband died in a factory accident in a Gulf country. Her family comprises two sons, 4 and 3 years old, and a daughter 2 years old. They have a community forest in their village which is very healthy.

The forest was not always green and beautiful. About 20 years ago there was no greenery. Deforestation was rapid. People in the village highly suffered from landslides and floods.

Now that the forest is protected they have no such problems. The CFUG (Community Forestry User Group) momentum brought about a lot of changes in the village. Poor people were identified and inclusive approaches were used in the forestry (CFUG) committee representation of the group. Thus, the so-called low castes – mainly women and poor households – got a chance to explore their leadership qualities.

It has been a year now since my sister has been elected the vice-secretary of her CFUG. Due to this, she has developed leadership qualities and has become more confident. However, lack of human resources at home is always a problem for her. She has to look after her small children and earn a living for the family too. Thus, she has not been able to give as much of her time to the committee as she would like.

The family has a small piece of land (a huge part of land was taken away by landslide many years ago) which provides food sufficiency to her and her three children for three months per year. She has to work for others for the rest of the year to make a living. The CFUG provides fuelwood and fodder to her family, but due to lack of laborers at home, she could only collect and carry half of her share. Because of this, her livestock are not healthy. This has degraded the fertility of her land as the livestock would not give enough manure to use as fertilizer.

Every year she is indebted because her land would not yield much and she can not pay back the loan taken for buying seeds. Hence, not being able to fully utilize the resources from the well-managed, rich community forest, my sister is getting deeper into poverty.

My brother

Poverty drove our brother to the United States. He works for a refrigerator manufacturer and drives about 200 kilometers every day. His job involves heavy carbon emissions but he is satisfied that



whatever he earns there is far better than what he could have earned in Nepal. He is enjoying his life there. Use of refrigerator, television, radio, telephone, mobile, car, oven, microwave, electric cookers, etc. are very common there. Millions of people have access to these items. So has my brother. His daily routine depends on these. He is not aware that through these utilities he has been emitting a huge amount of greenhouse gases such as carbon dioxide and methane which have been contributing to ozone depletion, greenhouse gas effect and glacier melting. Global warming has changed the climate pattern. Sometimes there is too much rain and sometimes drought.

I am proud that though we have not been able to fully collect our daily necessities from our own neighborhood, we have contributed the equivalent of millions of dollars through these forests in absorbing the carbon emitted by our brother and the “civilized” people from developed countries. His wealth means nothing if he still gets subsidized by his poor sisters. If he has ethics, doesn’t he need to pay us for what we deserve in return for the services we provided at the cost of our livelihood for the global betterment?

Major challenge

Yes, this is a reality-based story that depicts inequitable and unjust access to forest resources and services, north-south cooperation in

minimizing global warming, and the way forward for equity and harmony in the world and joining hands for global cause.

Issues related to me and my family are the issues of all poverty-ridden people of the developing countries of the globe. We need secure livelihoods from our forests. The challenge here lies in “balancing environment and protecting livelihoods,” which is also the most challenging issue facing the forests and forestry sector in Asia and the Pacific today.

The situation of forests is better now. We know how to conserve forests and protect wild animals. We have also realized that it is the source of our livelihoods. However, the only thing we have been reaping from it is fresh air. We need food security, better health and a better life to survive.

The way forward

A convincing solution can be a deal with my brother and millions of his friends that a certain percentage of the tax they pay comes to us for our forest’s carbon sequestration services. We know our Asia-Pacific forests have the potential to sequester 18-20 percent of the global carbon emissions. Now, we are ready to share the greenery with them, but not at the cost of our own livelihoods any more. In return, we need to be paid for these services.

About the author:

Anupama Mahat is a young Masters student of Human and Natural Resources Studies at Kathmandu University, Nepal. She has been working at the Nepal-Swiss Community Forestry Project in the field of knowledge management for the past two years. She is a promising natural resource management practitioner and believes that the livelihood of people should first be ensured and then the people will be interested in protecting nature. in Kathmandu, Nepal.





Patrick Durst receiving the medal and certificate from MARD in Hanoi, Vietnam.

FAO forestry expert receives award for contributions to Vietnam agriculture and rural development

Vietnam's Ministry of Agriculture and Rural Development (MARD) recently awarded a medal to Mr. Patrick Durst, Senior Forestry Officer of FAO's Regional Office for Asia and the Pacific, for his contributions to agriculture and rural development in Vietnam.

Mr. Andrew Speedy, FAO Representative in Vietnam, said the award given to Mr. Durst 20 August 2008 is a great honor to FAO because it acknowledges high government recognition of FAO's contribution to the development and improvement of forestry-related works in Vietnam.

Mr Durst has worked as FAO's Senior Forestry Officer for the region since 1994. He is responsible for coordinating FAO forestry programs and providing technical support to countries in the region.

Mr Durst said he is fascinated by the transformation and progress Vietnam has made over the years. When he first visited Vietnam in 1994, Mr. Durst said the country had just around 9 million hectares of forests that were steadily being lost. In contrast, Mr. Durst said that, "Today,

Vietnam can proudly point to being one of the few developing countries of the world that is actually increasing its forest cover – now reaching a level of more than 13 million hectares."

"In little more than a decade, Vietnam has increased its forest cover by 40 percent, and the country has now become a major exporter of furniture and other forest products, and also provides jobs and livelihoods for millions of people throughout the country," added Mr Durst.

He said the real credit goes to the hard work, dedication and commitment of the Vietnamese people – from the senior leadership in MARD, through the rank and file forestry officials throughout the country, right down to the rural farmers who struggle to plant and protect the country's forests.

Mr. Durst has written, co-authored and edited more than 80 books and scientific articles on Asia-Pacific forestry. He also serves as the Secretary of the Asia-Pacific Forestry Commission, which convened the 22nd session in Vietnam in April 2008.

Intact coastal forests reduce cyclone damage!

Contributed by Jeremy Broadhead, FAO Consultant, and S. Appanah, NFP Adviser

Intact coastal forests can play an important role in defending coastlines against tsunamis and other large waves and coastal hazards. Evidence from Myanmar suggests that coastal forests could have reduced damage resulting from the waves and inundation associated with cyclone Nargis.

Much of Myanmar's coast has been cleared of mangrove forests in past decades to create agricultural land and fishponds, and also to produce woodfuel for export to Yangon. Settlements have been established closer to the sea and the combination of proximity to coastal hazards, including cyclones, and lack of a protective forest buffer has increased the risks to human populations.

The mangrove area in the Ayeyarwady Delta, which was severely hit by the cyclone, is now less than half the size it was in 1975, or just over 100,000 hectares. Of equal concern is over-exploitation of the mangrove resource, which has led to a dramatic decrease in the density of the forest cover.

In some areas of the delta inundation levels were measured at up to 5m and waves were reported to have been up to 3.5 meters in height during the passage of the cyclone¹. Although porous barriers such as coastal trees and forests cannot prevent inland flooding during storm surge events, there is considerable potential for intact and dense coastal vegetation to reduce the impacts of waves and currents associated with the storm surge. Coastal forests can also act as windbreaks in reducing devastation in coastal communities resulting from cyclones and provide structures for survivors to cling to until waters calm and subside.

Furthermore, healthy mangrove forests are particularly good at reducing the force of waves because of the resistance provided by stilt roots as well as the tree's trunks and branches. A wide area of forest with higher densities of stems, branches and stilt roots will provide greater protection than a degraded forest or a forest in

which stems are widely spaced or there are few branches. Mangroves also trap and stabilize sediment and reduce the risk of shoreline erosion – which brings waves closer to habitations – by dissipating surface wave energy. During cyclone Sidr that struck southern Bangladesh in November 2007, the Sunderbans forests played a crucial role in the mitigation of the deadly effects of the cyclone.

In the future, rising sea levels and increased frequency and intensity of storms arising from climate change are expected to put coastal areas at greater risk of damage. Lessons learned following the 2004 Indian Ocean tsunami and earlier efforts to conserve and rehabilitate the mangroves of the Ayeyarwady Delta suggest that much can be done to improve the sustainability of coastal development in the region.

Discouraging further expansion of settlements close to the coast and maintaining healthy mangroves and other coastal forests will be important measures to protect coastal assets and populations in the future. Early warning systems, evacuation plans, effective communication and transport infrastructure, and storm shelters should be implemented as necessary measures to protect lives in the future from cyclones such as Nargis.

Considering the importance of the mangroves for protection and livelihood needs of the people in the Ayeyarwady Delta, FAO/RAP has already mounted three project formulation missions to the area following the Nargis cyclone damage. As a result, one project is being formulated to bring about sustainable community-based mangrove management in the Wunbaik Forest Reserve. In addition, the Italian/FAO/ Cooperative Programme (2008) has approved additional support for developing best practices for mangroves so as to minimize the impact of aquaculture development.

¹ Dr. Hermann Fritz, Dr. Swe Thin, Nyein Chan and Mae Kyaw Thu, "Cyclone Nargis storm surge field survey in the delta."

ASIA-PACIFIC FORESTRY CHIPS AND CLIPS

GOA'S PRIVATE FORESTS IN DECLINE

Increases in the value of coastal land in the state of Goa, India, have precipitated concerns that privately-owned forest cover in the area is quickly disappearing to make way for commercial development. Forest department surveys have found that a number of private-forests no longer satisfy the criteria for classification as forest land. Forest officials believe much of the forest is being illegally felled or burnt.

– *The Times of India* –

NEW TREES BREATHE LIFE INTO DEGRADED LANDSCAPE

On June 6, 2008, 48,000 trees were planted in the Doi Mae Salong watershed of Northern Thailand as part of a 14-year project which will restore 1,440 hectares of a degraded mountainous landscape in the region. The event which was organized by IUCN, the Supreme Commander's Office and the tambon (sub-district) administrative organization (TAO) Phatueng of Mae Chan District involved the efforts of 300 people from 19 villages along the Mae Chan River.

– *IUCN Forests News* –

VIETNAM MAY NOT REACH FOREST TARGET

The Vietnamese Ministry of Agriculture and Rural Development has expressed concern that it will be unable to achieve its reforestation target of five million hectares by 2010. Since the launch of national reforestation plans in 2006, authorities have only been able to grow slightly more than 50 percent of the scheduled forest area. The Ministry believes that the poor result is due to challenges in providing satisfactory incentives for growers.

– *Viet Nam News* –

RESEARCHERS: CARBON SCHEME PUTTING FORESTS AT RISK

Two researchers from the Australian National University have warned that the inclusion of plantation forests in an Australian emissions trading scheme could encourage the logging of native forests. Their study indicates that under the

proposed emissions trading scheme, plantation owners are likely to make more money from using plantations for carbon storage rather than for logging. As a result, the logging of native forests will be required to meet shortfalls in timber supply.

– *ABC News* –

FORESTS IN CENTRAL VIETNAM TARGET OF ILLEGAL LOGGING

Large tracts of forest in Phu Yen and Quang Ngai provinces in central Vietnam have been illegally destroyed. According to reports, hundreds of hectares of protected forest have been cleared by enterprises that were authorized to clear undergrowth for the purpose of planting more trees.

– *Thanhnie News* –

INDONESIA TO PLANT 100 MILLION TREES IN ONE MONTH'S TIME

Thursday, 9 October 2008. The Indonesian government plans to plant about 100 million trees within about one month's time starting November 28, as part of its program to mark 100 years of National Awakening, a cabinet minister said Thursday.

"President Susilo Bambang Yudhoyono will declare November 28 as Indonesia's "Planting Day." As part of the 100 years of National Awakening celebration about 100 million trees will be planted across the country," Forestry Minister M.S. Kaban told Antara.

Kaban said the "Planting Day" would be launched in a ceremony at Bangen, where 100,000 trees would be planted on 250 hectares of land. Each province, he said, would also plant trees on at least 100,000 hectares of land. About 60 percent of the total trees would be hardwood trees. The government has prepared funds of Rp280 billion (about US\$29 million) to procure 100 million tree seedlings.

— *Jakarta Post* –

FAO ASIA-PACIFIC FORESTRY CALENDAR

14-15 October 2008. Kuala Lumpur, Malaysia. **Asia-Pacific Regional Workshop on the Preparation of a report on the State of the World's Forest Genetic Resources.** Contact: Oudara Souvannavong, Senior Forestry Officer (Biological Diversity and Conservation), FAO Forestry Department, Via della Terme di Caracalla, 00100, Rome, Italy; Tel: +39 0657054750; Fax: +39 0657055137; E-mail: Oudara.Souvannavong@fao.org

14-17 October 2008. Jakarta, Indonesia. **Asia-Pacific Forum on Promoting Wood-Based Bioenergy Using Wood Residues and Wastes.** Contact: Maxim Lobovikov, Chief, FOIP, FAO Forestry Department, Via della Terme di Caracalla, 00100, Rome, Italy; E-mail: Petteri.Vuorinen@fao.org

14-18 October 2008. Beijing, China. **23rd Session of the International Poplar Commission.** Contact: Jim Carle, Senior Forestry Officer, FOMR, FAO Forestry Department, Via della Terme di Caracalla, 00100, Rome, Italy; E-mail: Jim.Carle@fao.org

12-14 November 2008. Hua Hin, Thailand. **APFC Executive Committee Meeting.** Contact: Patrick Durst, Senior Forestry Officer, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; Tel.(662) 697-4139; Fax: (662) 697-4445; E-mail: Patrick.Durst@fao.org

10-13 November 2008. Pekanbaru, Indonesia. **Regional Workshop Fire Management Needs and Actions in the South East Asian Region.** Contact: Petteri Vuorinen, Fire Management, FAO Forestry Department, Via della Terme di Caracalla, 00100, Rome, Italy; E-mail: petteri.vuorinen@fao.org

17-19 November 2008. Nadi, Fiji. **Sub-regional workshop on strengthening of FRA2010 reporting and forest MAR in Pacific Islands.** Contact: Masahiro Otsuka, Forestry Officer, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; Tel.(662)697-4130; Fax:(662)697-4445; E-mail: Masahiro.Otsuka@fao.org

26-28 November 2008. Rome, Italy. **Expert Consultation on National Forest Monitoring and Assessment (NFMA): Meeting Evolving Needs.** Contact: Mohamed Saket, Forestry Officer, FOMR, FAO Forestry Department, Via della Terme di Caracalla, 00100, Rome, Italy; E-mail: Mohamed.Saket@fao.org

1-3 December 2008. Kuala Lumpur, Malaysia. **Asia and Pacific Forest Health Workshop.** Contact: Patrick Durst, Senior Forestry Officer, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; Tel.(662) 697-4139; Fax: (662) 697-4445; E-mail: Patrick.Durst@fao.org

15-17 December 2008. Kuala Lumpur, Malaysia. **Regional training on ASEAN Criteria & Indicators.** Contact: Masahiro Otsuka, Forestry Officer, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; Tel.(662)697-4130; Fax:(662)697-4445; E-mail: Masahiro.Otsuka@fao.org

4-6 January 2009. Bangalore, India. **Invasive Plants in the Tropics: Ecology, Management and Livelihoods - An International Conference.** Contact: ATREE, info@atree.org

March 2009. Rome, Italy. **Committee on Forestry (COFO) - 19th Session.** Contact: Douglas Kneeland, Chief FOEL and Secretary COFO, FAO Forestry Department, Via della Terme di Caracalla, 00100, Rome, Italy; E-mail: Douglas.Kneeland@fao.org

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

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

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- Helping forests take cover (RAP Publication 2005/13)
- Elephant care manual for mahouts and camp managers (RAP Publication 2005/10)
- Forest certification in China: latest developments and future strategies (RAP Publication 2005/08)
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- Advancing assisted natural regeneration (ANR) in Asia and the Pacific (RAP Publication 2003/19) - 2nd edition
- Bringing back the forests: policies and practices for degraded lands and forests (RAP Publication 2003/14) **out of print**
- Community forestry – current innovations and experiences (CD-ROM included)
- Community-based fire management: case studies from China, The Gambia, Honduras, India, the Lao People's Democratic Republic and Turkey (RAP Publication: 2003/08)
- Practical guidelines for the assessment, monitoring and reporting on national level criteria and indicators for sustainable forest management in dry forests in Asia (RAP Publication: 2003/05)
- Giants on our hands: proceedings of the international workshop on the domesticated Asian elephant (RAP Publication: 2002/30)
- Communities in flames: proceedings of an international conference on community involvement in fire management (RAP Publication: 2002/25)
- Applying reduced impact logging to advance sustainable forest management (RAP Publication: 2002/14)
- Monograph on benzoin (Balsamic resin from *Styrax* species) (RAP Publication: 2001/21)
- Proceedings of the International Conference on Timber Plantation Development, 7-9 November 2000, Manila, Philippines
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- Forest out of bounds: impacts and effectiveness of logging bans in natural forests in Asia-Pacific: executive summary (RAP Publication: 2001/10)
- Forest out of bounds: impacts and effectiveness of logging bans in natural forests in Asia-Pacific (RAP Publication: 2001/08)
- Regional strategy for implementing the Code of Practice for forest harvesting in Asia-Pacific (July 2000)
- Development of national-level criteria and indicators for the sustainable management of dry forests of Asia: background papers (RAP Publication: 2000/08)
- Development of national-level criteria and indicators for the sustainable management of dry forests of Asia: workshop report (RAP Publication: 2000/07)
- Asia-Pacific Forestry Commission: the first fifty years (RAP Publication: 2000/02)
- Decentralization and devolution of forest management in Asia and the Pacific (RAP Publication: 2000/01)
- Asia-Pacific Forestry Towards 2010 - report of the Asia-Pacific Forestry Sector Outlook Study
- Trees commonly cultivated in Southeast Asia: an illustrated field guide - 2nd edition (RAP Publication: 1999/13)
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