



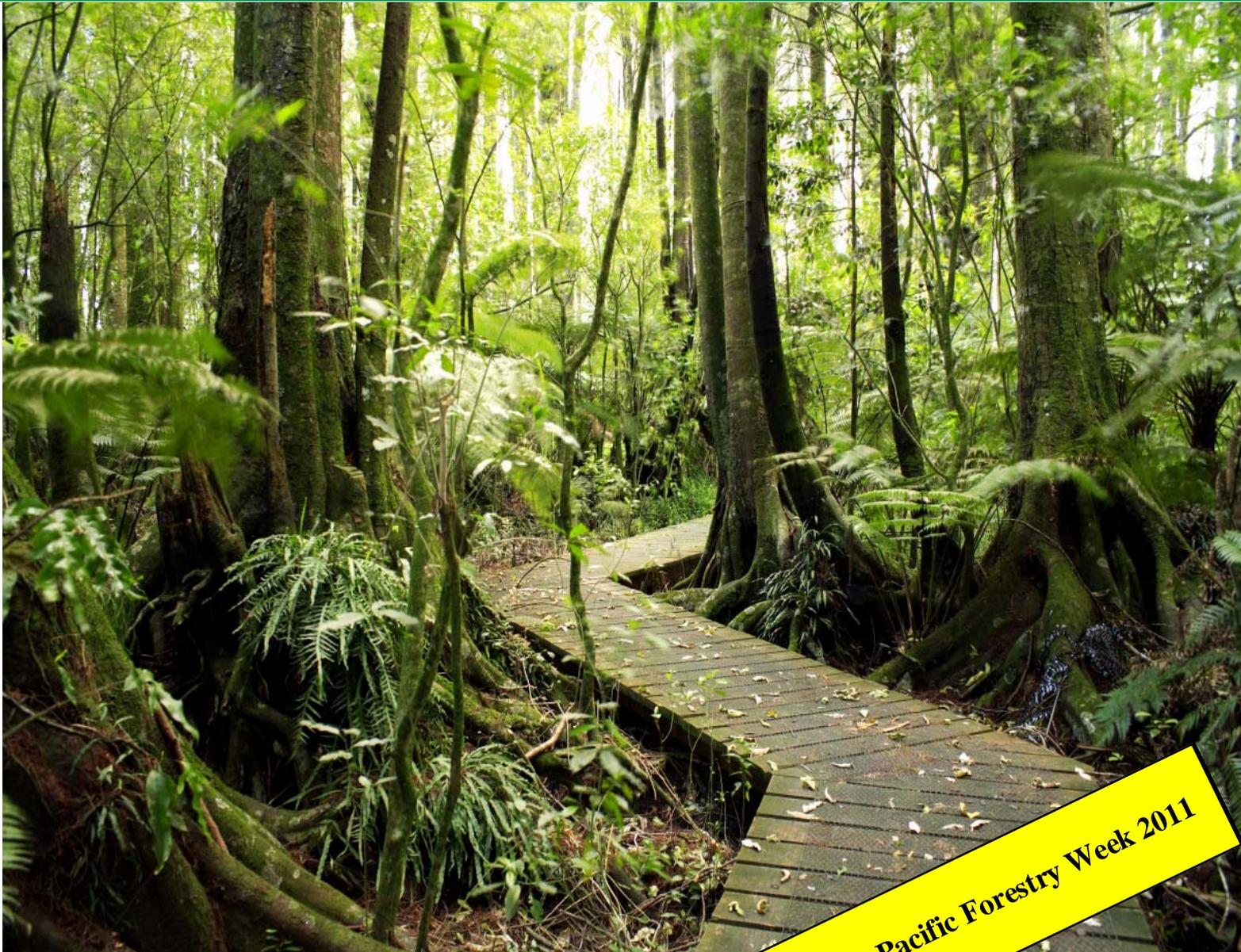
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*Featuring*

# FOREST NEWS

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## TIGERPAPER



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# PAKKE TIGER RESERVE: AN OVERVIEW

by Pranab Bujarbarua and Prabal Sen

## Introduction

Pakke Tiger Reserve is a land of majestic beauty located in the outer range of the Himalayas at the junction of western Arunachal Pradesh and northwest Assam. It lies between 92°75' to 92°22' E longitude and 26°53' to 27°16' N latitude in East Kameng District of Arunachal Pradesh and covers an area of 862.95 km<sup>2</sup>. The reserve is bounded in the east by the Pakke river and Papum Reserve Forest; at the western boundary is the Bhareli or Kameng River, Doimara Reserve Forest and Eagle Nest Wildlife Sanctuary. The Bhareli River along with Shergaon Reserve Forest bounds the north; and Nameri National Park of Assam touches the southern part of the tiger reserve.

Geologically the whole area consists of comparatively new alluvial deposits of clay, sand, silt and small boulders. Soils are loam, covered with humus. The terrain of the reserve changes from flat and undulating hills at an altitude of 200m in the Assam plain up to the mountains at an altitude of 2000m above mean sea level. Many annual and perennial rivers, streams and nallas criss-cross the entire reserve. Some of the main rivers and streams in the area are Pakke, Bhareli, Nameri, Khari and Upper Dikrai, all flowing in southerly directions in the reserve. The area enjoys a tropical to subtropical climate with cold weather from November to March with a mean annual minimum temperature of 12°C, and maximum temperature of 36°C. Two monsoon cycles, the south-west (May-Sept.) and north-east (Nov.-April), shower the area with average annual rainfall of 2,500 mm.

The area of the present Pakke Tiger Reserve was originally known as Pakke Reserve Forest and was declared a Game Sanctuary in 1977. Subsequently, it was declared as Pakhui Wildlife Sanctuary and Tiger Reserve in 1999. In 2002 the area was renamed Pakke Tiger Reserve vide notification no. For/CWL/D/26/94/1742-91 dated 23.04.02 under the Project

Tiger scheme of Government of India. It is the 26<sup>th</sup> tiger reserve in the country.

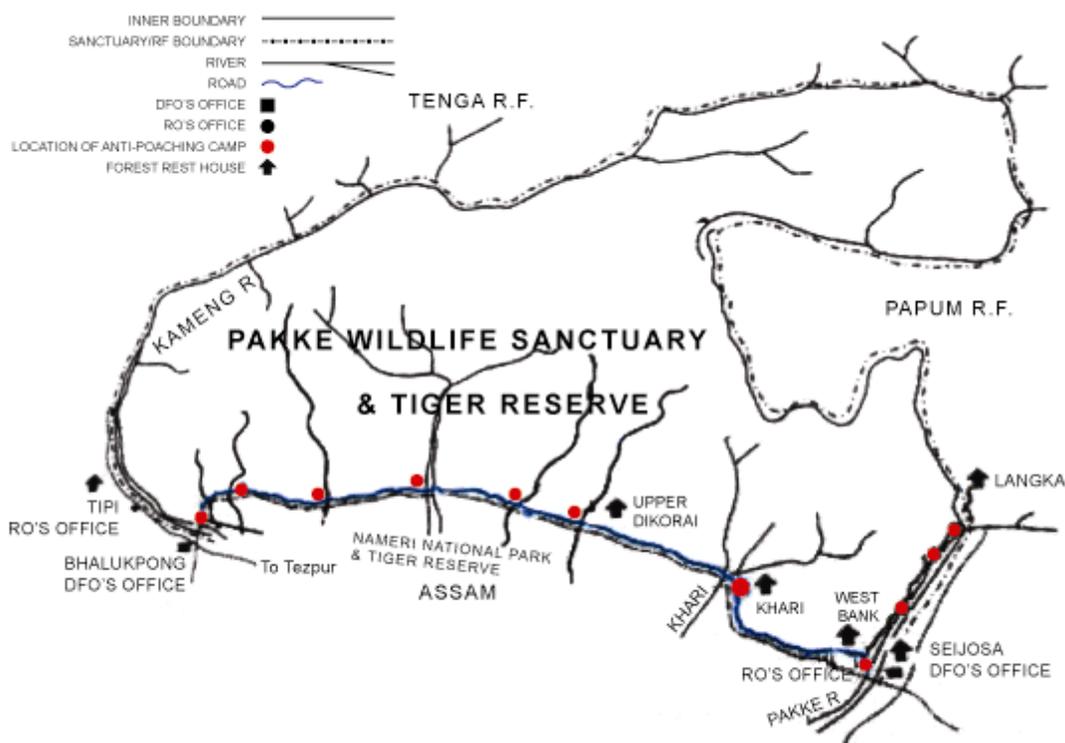
## Vegetation and flora

In general, the vegetation and forest types of the entire northeast India have already been described by Champion and Seth (1968). Accordingly, the vegetation of Pakke Tiger Reserve is a mosaic of tropical semi-evergreen and evergreen forest largely corresponding to the Assam valley tropical semi-evergreen forest (2B/C1). Other forest types of the area include:

- sub Himalayan light alluvial semi-evergreen forest (92b/C/151);
- eastern Hoolock forest (3/152 b);
- upper Assam valley tropical evergreen forest (IB/C2B);
- tropical riverine forests (4E/RS1); and
- secondary moist bamboo tract (E1/2/SI).

The high altitude area of the reserve is mainly dominated by sub-tropical broad-leaved forest. The floristic composition of the sanctuary is remarkable in its diversity and luxuriance. A total number of 246 taxa of angiosperms belonging to 148 genera under 62 families have been reported from the reserve so far. These figures are based on the sporadic explorations carried out in the buffer areas of the reserve, but the actual number of taxa will be much more and it is estimated that there are around 600 comprising angiosperms, gymnosperms, ferns and fern allies.

The lofty dense tropical evergreen and semi-evergreen forests present a complex façade with a multiplicity of species on multistoried canopies. Many trees found have characteristics of northeast India and eastern Himalayan flora attaining their best development here. Common tall trees of the area include *Artocarpus chama*, *Duabanga grandiflora*, *Pterygota alata*, *Phoebe goalparensis*, *Gmelina arborea*, *Aglaia hiernii*, *Tetrameles nudiflora*,



**Fig 1: Map of Pakke Tiger Reserve**

Source: [www.pakketigerreserve.org](http://www.pakketigerreserve.org)

*Terminalia myriocarpa*, *Alianthus grandis*, *Stereospermum chelonoides*, *Terminalia bellerica*, *Michelia champaca*, *Altingia excelsa*, *Lannaea coromandelica*, *Michelia champaca*, *Chukrassia tabularis*, *Lindera sebifera*, *Polyalthia jenkinsii*, *Bombax ceiba*, *Ficus benghalensis* and *F. religiosa*. Trees that form the second story forests are *Castanopsis indica*, *Dysoxylum binectariferum*, *Albizia procera*, *Mesua ferrea*, *Cryptocarya amygdalina*, *Aquilaria malaccensis*, *Alastonia scholaris*, *Sterculia villosa*, *Bischofia javanica*, *Syzygium cumini*, *Kydia calicina*, *Morus laevigata* and *Mallotus philippinensis*. Third story trees are comprised of *Talauma hodgsonii*, *Dillenia indica*, *Bauhinia* spp, *Baccaurea ramiflora*, *Euodia glabrifolia*, *Embllica officinalis*, *Garcinia cowa*, etc. Some of the common large and small shrubs are *Ardisia virens*, *Brassiopsis glomerulata*, *Debregeisia longifolia*, *Maesa indica*, *Micromelum minuotum*, *Morinda angustifolia*, *Murraya paniculata*,

*Saurauia* sp., *Vernonia volkamerifolia* and *Mussaenda roxburghii*. Many orchids of genus *Bulbophyllum*, *Coelogyne*, *Cymbidium*, *Dendrobium* and *Eria*, along with species of *Agapetes*, *Hoya*, and *Loranthus* grow as epiphytes in the tall trees of the reserve.

Tropical evergreen and semi-evergreen forests have entangling webs of thick liana, wiry climbers, creepers and weak-stemmed stragglers. Some of the common liana and climbers of the reserve are *Tetracera tomentosa*, *Dalbergia pinnata*, *Acacia pinnata*, *Hodgsonia macrocarpa*, *Schefflera venulosa*, *Combretum flagocarpum*, *Entada pursaetha*, *Tetrastigma* sp., *Cissus assamica*, *Dioscorea alata*, *D. pentaphylla*, *Argyrea argentia*, *A. nervosa*, *Paederia scandens* and different species of *Piper*. The reserve is one of the richest cane areas of Arunachal Pradesh and several commercially important cane species grow in the moist places of the reserve, particularly in

the nallas. Common among these are *Calamus flagellum*, *C. tenuis*, *C. leptospadix*, *C. gracilis*, *C. erectus* and *C. floribundus*. Apart from canes, 7 species of bamboo have also been reported from the area.

The riverine forests are primarily dominated by *Dillenia indica*, *Magnolia hodgsonii*, *Bombax ceiba* and *Albizzia procera*. The larger perennial streams with small stone and boulder beds are dominated by tall grasses. The subtropical broad-leaved forest of the reserve is confined to the high altitude areas and dominated by members of the families Fagaceae and Lauraceae. Some of the common trees found in the hill tops are *Castanopsis echinocarpa*, *Elaeocarpus aristatus*, *Beilschmedia roxburghiana*, *Cinnamomum bejolghota*, *Exbucklandia populnea* and *Schima wallichii*.

The flora of the reserve has a distinct affinity with Indo-Malayan, Indo-Chinese and Indo-Burmese floristic elements and are represented by species like *Bischofia javanica*, *Mesua ferrea*, *Michelia champaca*, *Albizzia procera*, *Bombax ceiba*, *Talauma hodgsonii*, *Altingia excelsa*.

An analysis of the diversity pattern of the plant species with >10cm DBH made by laying 10m x 10m random quadrats in the buffer areas of the reserve revealed that *Phoebe goalparensis* with an IVI value of 36.14 is the most dominant species in the reserve. Other co-dominant species are *Pterygota alata*, *Albizzia procera*, *Terminalia bellerica*, *Syzygium cumini*, *Dillenia indica*, *Aglaia hiernii*, *Duabanga grandiflora*, *Altingia excelsa*, *Pterospermim acerifolium*, *Terminalia myriocarpa*, *Dysoxylum binectariferum* and *Artocarpus chama*. High IVI values in species indicate good regeneration and wide ecological amplitude.

The vegetation and flora of the sanctuary has immense utilitarian value. The area is abundant in tree species, many of which are timber-yielding, plus other plants of economic significance like medicinal, ornamental and also various non-timber forest products. The area is inhabited by various wildlife viz. elephant, tiger, sambar, deer, wild boar, different species of primates and avifauna and most of these animals depend upon the plants of the

sanctuary for their food and shelter. In addition, the reserve shares one of the important elephant corridors with bordering Nameri National Park of Assam.

### Plant and animal relationship

Pakke Tiger Reserve harbors a wide range of animals and is one of the richest wildlife refuges in the state of Arunachal Pradesh. Mammals, viz. elephant, gaur, sambar, barking deer, wild boar, serow and goral inhabit the high areas of the reserve. Carnivores such as tiger, leopard, clouded leopard, wild dog and other lesser cats are also present in significant numbers. Primate species such as Assamese macaque, Rhesus macaque and Capped langur are very common in the area. Several species of viverrids and mustelids including Binturong, Yellow-throated Marten, Himalayan black bear, Malayan giant squirrel, Pallas red-bellied squirrel and Hoary-bellied squirrel are also available. About 257 species of birds have been reported from Pakke and its adjoining areas (Dutta *et al.*, 1998); important among these are Great Hornbill, Wreathed Hornbill, Oriental pied hornbill, White-winged wood duck and pheasants. The reserve is also a safe habitat for many amphibians and reptiles. Turtles, viz. Indian peacock softshell, Indian Map shell, Assam roofed and Asian leaf turtle are also present in the reserve. Apart from these, the hill streams are full of fish fauna. Most of the faunal species found in the reserve are either rare or threatened in nature. Ten species, viz. Capped langur, Clouded leopard, Binturong, Gaur, Leopard, Tiger, Indian soft shelled turtle, Peacock-marked soft shelled turtle, Great Indian hornbill and Indian pied hornbill are also included in Schedule I of the Indian Wildlife Protection Act of 1972.

Animals depend directly or indirectly on plants for their existence (e.g., for food, shelter and breeding). The general theory is that the species richness of vertebrate communities in tropical forests is due to the continuous availability of food resources (Orions, 1969). All the carnivores of the reserve are predator species and subsist on a wide base of herbivorous prey animals, which in turn are sustained by an even wider base of vegetation. The tropical semi-evergreen mixed forest interspersed with moist bamboo and cane tracts

with reed-covered stream-beds in the lower meadow provide adequate shelter for tiger and other prey animals and have excellent forage potential for herbivores. Sambars and deer have a wide range of food preferences including grasses and foliage of herbs, shrubs, bamboo, regenerating trees and various fruits. Primate species, in particular Capped langur, are leaf eaters. Kumar and Solanki (2003) identified 25 food plants of Rhesus macaque from the area including *Sterculia villosa*, *Chukrassia tabularis*, *Dillenia indica*, *Polyalthia jenkinsii*, *Bombax ceiba*, *Altingia excelsa*, *Terminalia myriocarpa*, *Kydia calycina*, *Morus laevigata*, etc. Hornbills, which are generally frugivorous, are dependent on the fruits of different species of *Ficus*, *Artocarpus chama*, *Aglaia hiernii*, *Dysoxylum binectariferum*, *Bischofia javanica*, etc. One of the threatened birds, White-winged wood duck, also inhabits the grassland habitat bordering Assam. Several exotic species of plants have become naturalized in the area. One such species is *Mikania micrantha*, which is also fed on by the primate species of the reserve. It is therefore required to study the long term consequences of such types of feeding.

### Present status of the Tiger Reserve

Pakke Tiger Reserve is one of the richest refuges of biodiversity in the foothills of Arunachal Pradesh. Apart from valuable plant species, the reserve supports rare and threatened species and 10 Schedule I species in the Indian Wildlife Protection Act. Although there are no major anthropogenic threats as yet, the occasional felling of timber, particularly in areas bordering with Assam, poses a threat to the wildlife of the reserve. Since it is an important elephant corridor, due to habitat loss and scarcity of foods, elephants often migrate to the nearby cultivated fields and villages causing severe damage to the crop plants and human life as well. Timber felling is substantiated by the spread of various native and exotic weeds, which are posing a threat to the natural regeneration of tree species. Although huge quantities of canes are extracted from the reserve, the sustainability of such collections should be maintained. Fish poisoning in the hill streams by local people is very common in the area and creates a threat to the fish fauna. There are also reports of hunting of wildlife, particularly barking deer, sambar and

primates, which should be checked. Various developmental activities such as construction of roads and buildings at the Kameng hydro electric project are becoming a matter of concern for the very existence of the reserve. The location of the power house at Kimi and Tenga Reserve Forest is not only right on the boundary of Pakke Tiger Reserve, but in the middle of a rich biodiversity zone. Therefore, the power house should be relocated.

### Conclusion

Pakke Tiger Reserve is an important natural ecosystem of scientific, educative and recreative interest in the state of Arunachal Pradesh, where plants and animals live in perfect harmony. The salient feature of the vegetation with the combination of luxuriant semi-evergreen, evergreen and riverine forests is that it harbors a good amount of biological diversity. Although a detailed floristic study of the area has yet to be made, it is certain that the area harbors a vast array of vascular plants with a number of endemic, rare and threatened plant species. As far as the protection of tiger and other wildlife are concerned, the maintenance of intact natural ecosystems is the topmost priority. Therefore, tiger conservation is not merely an effort to save an endangered species, but equal importance should also be put on preserving biotypes of sizeable magnitudes.

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## SCIENTIFIC APPROACH FOR TIGER CONSERVATION IN THE SUNDARBANS

by Nirmol Kumar Halder

### Introduction

Bengal Tiger (*Panthera tigris tigris*) is evenly distributed in its present home in the sub-continent, especially in the Sundarbans (Bangladesh). Tiger has a wider ecological tolerance than other big cats can live in diverse habitats. Although the Bangladesh Sundarbans is rich in suitable tiger habitat, due to various factors like habitat change, inadequate fresh water supply, lack of prey population in certain places, poaching, human pressure, disease and natural calamity, etc., the tiger population in the Sundarbans is going to decrease. A detailed inventory on the wildlife population was conducted during 1993-94 under the Integrated Resource Management Project. It showed that there were about 350-400 tigers in the Sundarbans. The joint tiger census (India-Bangladesh) in 2000 recorded that the Bangladesh Sundarbans has about 400 tigers. The census was based on pugmark surveys. The Sundarbans possesses potential habitat for sustainable conservation of Bengal tiger through appropriate initiatives.

### Why tiger conservation?

The tiger is a globally threatened species and is one of the few star species in the world. Its conservation is endorsed by CITES. The need for its conservation has already been recognized by the formation of the Global Tiger Forum. The tiger plays pivotal role in controlling the deer population in the Sundarbans. It is a valuable species in the world market. It maintains the food chain in the Sundarbans ecosystem; consequently,

it is one of the most important factors for this unique ecosystem and occupies the top of the ecological pyramid. It is believed that protecting the Bengal tiger of the Sundarbans is a matter of immense importance and value.

The Bengal tiger is facing the following problems:

- Shortage of prey population at certain places, especially in the northern part of the Sundarbans;
- Destruction of tiger habitat due to human pressure;
- Scarcity of fresh water;
- Scarcity of sufficient high ground for breeding;
- Onslaught of tidal surges; and
- Easy access and means of transportation by poachers.

We must take urgent steps to conserve tigers in the Sundarbans.

### Role of the Forest Department in tiger conservation

Under Bangladesh Wildlife Preservation (Amendment) Act 1974, tiger was included in the third schedule of the ordinance of conservation. According to the Wildlife Preservation Ordinance, 1973 three sanctuaries were included in the Sundarbans. The sanctuaries are known as East, West and South sanctuaries. The total area of wildlife sanctuaries is 139,700 ha. This is helpful to increasing habitat, which establishes a broader base for a stable population of Bengal tiger and prey populations. But the best way of conservation and management of Tiger in the country is definitely

to conserve and manage the whole of the Sundarbans, stopping anybody from inflicting any damage to tiger or the prey population or any damage to the habitat.

A tiger project in the Sundarbans was undertaken by Forest Department. This project is looking at all aspects of tiger conservation, management research, studies, training and education for the officers and other employees, raising the awareness of people about tiger conservation through leaflets, posters, newspapers and other communication media.

The first general assembly meeting of the Global Tiger Forum was held at Dhaka, Bangladesh, 18-20 January 2000. It culminated in the Dhaka declaration on tiger conservation, which recommended 10 major issues to be addressed on a priority basis to secure the future of the tiger in the wild. The country delegate of IUCN in Bangladesh presented a paper in which he mentioned that the Forest Department of Bangladesh has succeeded in protecting the Sundarbans from encroachment and there is one permanent human settlement inside the forest. In that sense, the entire Sundarbans is protected. It was concluded that the Forest Department of Bangladesh must take appropriate initiatives to: maintain the continuity and quality of the tiger habitat; improve transborder cooperation and partnership; create linkages between *in situ* and *ex-situ* conservation; and develop ecotourism (GTF Assembly, 2000).

### **Need for human resource development on tiger conservation**

UNESCO declared the Sundarbans as a World Heritage site in 1997 and the Sundarbans has been a RAMSAR site since 1992. Bangladesh ratified CITES in 1982, and is also a member of GTF (Global Tiger Forum). Bangladesh is a signatory to many conservation treaties and conventions, but there is a lack of resource persons for various aspects. With this in mind, the Forest Department is going to work for tiger conservation. But when we will talk about scientific management of Bengal tiger, first we have to develop resource persons on this subject not only among the field staff and at the officer level, but also at the grass roots level.

### **Action plan of the Forest Department for human resource development on tiger management**

The Bangladesh Forest Department is working for conservation and development of habitats for tiger as well as prey populations. This includes:

- Capacity building of officers and staff of the Forest Department;
- Training and education at different levels and phases;
- Research by departmental existing specialists;
- Creation of awareness among people for tiger conservation; and
- Training at grass roots level (Tiger Action Plan, Forest Department).

### **Need for scientific management of tigers**

In Bangladesh, only the Sundarbans has viable tiger populations at the present time. Tigers can be found in a wide variety of environments, although they require adequate cover so they can ambush their prey (e.g., large herbivores). To conserve tiger populations in the Sundarbans proper scientific management is a must. But some basic needs are required to adopt the scientific management of tiger:

- Assess the population structure of Bengal tiger in the Sundarbans;
- Identify the habitat of tiger and the suitability for the tiger's growth;
- Know what problems tigers are facing;
- Determine the status of poaching, disease and the natural condition in which tigers live;
- Determine the market for tiger trophies (e.g., different parts of the body) the price and where it has market demand;
- Carry on research about the behavior and ecology of tiger;
- Understand the tiger-prey relationship;
- Find out the status of prey populations;
- Know the tiger-human conflicts;
- Research how forest resources are being exploited;
- Determine what natural calamities are mainly responsible for the decrease in tiger populations;
- Monitor the administrative policy of handling wildlife in the Sundarbans;

- Keep records on tiger populations, including age, sex, health condition, etc.;
- Adopt proper survey techniques for gathering recent data on tiger;
- Analyze how seasonal changes affect tiger abundance in the Sundarbans ecosystem;
- Learn about the feeding habits of Bengal tiger;
- Examine prey density and biomass; and
- Update the previous tiger action plan.

### Important approaches for the scientific management of tiger

#### Participatory approach

The tidal ecosystem is not so suitable a habitat for tigers, but they were forced to take shelter in this last natural habitat of Bangladesh due to human disturbances and the loss of other types of forestland. The size and potentially aggressive nature of tiger towards people, and particularly to farm livestock, has meant that tiger conservation, following decades of big game hunting, represents a particular challenge (Alderton, 1993). In this aspect, people in impact zones surrounding the Sundarbans are the most important factor. Over the last century the tiger's landscape has changed dramatically. An expanding human population has put increased pressure on the tiger's habitat, prey and on the tiger itself. Forests and grassland have been lost and degraded, land has been fragmented and unregulated tiger populations have declined precipitously both in abundance and distribution. Tiger numbers are now small and isolated in the Sundarbans. In the last 25 years these changes have accelerated, increasing concern over the continued existence of tigers (Sunquist *et al.*, 1999). Very often poaching is done with the help of local people. They can easily identify the areas in which most of the tigers in the Sundarbans are found, that means its preferred habitat. They become greedy for more money from the poachers. They do not know the importance of tigers in the natural ecosystem. So first they have to be awakened about the need for conservation of tigers. The Bangladesh Forest Department has taken a new approach to gain the participation of local people with the help of departmental personnel who are going to train in a different manner. About 1.5 million people surrounding the Sundarbans are directly or indirectly dependent for

their livelihoods on extracting various forests produces. The Forest Department is now concerned about finding alternative income sources that will not put pressure on forest. By motivating the local people we can involve them in tiger management.

People's involvement can be motivated by the following activities:

- Seminars, workshops, meetings;
- Conveying messages to civil society;
- Awareness-raising through various media;
- Through advertising with the help of television and radio;
- Direct contact.

#### Zonation approach

The Sundarbans Reserved Forests include three Wildlife Sanctuaries most likely divided into management zones and buffer zones.

**Management zone:** This is a subdivision of the Sundarbans management area where a definite type of use of resources is preplanned and implemented. Management zones of the Sundarbans are categorized into strict protection zone, sustainable use zone, rehabilitation zone, habitat management zone, multiple use zone, special use zone and others (IUCN/CNPPA, 1976). In the case of the Sanctuaries, the following zones are included:

- i) **Strict protection zone:** This zone is defined as an area in which rich biodiversity is present and it is closed to human settlement. The strict protection zone allows for scientific studies and research and controlled outdoor recreation activities.
- ii) **Rehabilitation zone:** This is a degraded area for the restoration of natural habitat associated with biodiversity on a long-term basis and re-zonation to a stricter protection level. Here natural regeneration is aided with controlled fire, enrichment plantations with indigenous species and sometimes with exotics for the restoration process.
- iii) **Recreational zone:** The zone in which high recreational, tourism, educational or environmental awareness values are allowed with priority on sustainable conservation and ecotourism.

iv) Special use zone: This zone is the area containing existing infrastructures and fenced compounds and installations of natural

importance such as Bangladesh Naval Base and Bangladesh Port Authority at Nilkamal inside the south sanctuary.

**Table 1: Areas of the management zones (in ha)**

<u>Management zone</u>	<u>East sanctuary</u>	<u>South sanctuary</u>	<u>West Sanctuary</u>
Strict protection zone	38,976	43,772	162,060
Rehabilitation zone	518	744	2,296
Recreational zone	1,055	590	2,449
Special use zone	5	15	24
Total	40,554	45,121	166,829

Source: Final report on FRMP, 1997

**Buffer zone:** Buffer zone is defined as a strip of land/water body outside each sanctuary, but adjoining it. This zone is intended to be managed to provide a social fence and at the same time used for controlled economic activities such as seasonal fishing, gathering of fuelwood, small-sized timber, golpata, honey, wax and other forest product collection and seasonal hunting of game species.

The gathering of forest products and fishing shall be strictly prohibited in the buffer zones. Controlled outdoor recreational activities such as fishing, hunting, boating, etc., shall be allowed in this zone. A strip of about 5-kilometer wide around each sanctuary will serve as a buffer zone (Rosario, 1997).

**Table 2: Buffer zones**

<u>Buffer zone of each sanctuary</u>	<u>Area (ha.)</u>
East sanctuary	27,699
South sanctuary	23,705
West sanctuary	15,095

Source: Final report on FRMP, 1997

**Integrated management approach**

An integrated management approach introduces different sectoral management systems to attain a specific goal. In forestry practices it not only deals with trees, but is also about soil, water, the forest microclimate, land use patterns, watersheds and communities in or surrounding the forest. So when there is a combination of various sectoral management approaches like forest management with land use management, soil science, Resource Management Information System (RIMS),

watershed management, while also giving priority to community development surrounding the forest, then it is easy to achieve sustainable benefits from forest because every sectoral management is correlated with each other. In the Sundarbans wildlife management is integrating habitat management of wildlife, land use management, water resource management, RIMS, community development of impact zones, etc. Especially for tiger management an integrated management system is a must. For example, to conserve tiger in the Sundarbans, the participation of local people

has a potential role, which means giving priority to their awareness about the needs of tiger conservation.

### Conclusion

Conservation of tiger is now a global concern. Without proper scientifically field knowledge the planning, management and conservation of tiger are impossible. At present, no scientific proven field data is available on tiger on the Sundarbans and there is no doubt that without human resource development tiger conservation is quite impossible. So the Forest Department must take adequate steps to collect data on tiger population, behavior, habitat, etc., with the help of trained people, which will eventually help measures on the planning of tiger management in the future.

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## A DRAGON-FLY PREYS ON DRAGONFLIES

by Imesh Nuwan Bandara, Nilusha Somaweera and Nayana Wijethilaka

The group Odonates, which includes dragonflies and damselflies, is a dominant predatory insect group in the world and shows an ancient evolution. Sri Lanka is home to 120 species of odonates, of which 57 are endemic to the island (IUCN, 2006). Adult odonates, being fast flyers, are not frequently preyed on by other insects due to the difficulty in catching them.

During some of our recent field work sessions in Segiriya – 07° N and 80°45' E (Matale district), Laggala – Pallegama – 07°32' N and 80°49' E (Matale District), Kithulgala - 07°00' N and 80°24' E (Kegall district), Gannoruwa – 07°17' N and 80°35' E, Doluwa – 07°11' N and 80°36' E and Teldeniya - 07°17' N and 80°46' E (Kandy district), we observed a dragonfly-like dipteran

preying on dragonflies. This insect was nearly 30 – 35 mm in size with piercing and sucking-type mouth parts with a short proboscis. The body was stout and hairy. The thorax was globular with two pairs of horizontally-placed wings which were shorter than the abdomen. The last segment of the abdomen was elongated; the tapered abdomen was either curved upwards or downwards with respect to different individuals who may have belonged to different species. The long and strong legs were bristled to aid in prey capture. Apparently the insect morphologically mimics a dragonfly to a considerable extent. They were observed feeding on *Diplocodes trivalis* (Little blue Darter), *Acisoma panorpodies* (Asian Pintail), *Trithemis aurora* (Crimson Dropwing) and *Neurothemis tullia tullia* (Pied parasol) in the field. Most of the prey were larger than the fly itself. They were active during the daytime. They were observed to fly fast and were found to inhabit low vegetation and usually perch on branches in open sunny areas. They used their bristly legs to intercept the prey by grasping it around the head or back. Usually 1 – 2 individuals were observed within the given areas. The needle-like mouthparts were used to suck up the prey. Moreover, they were also observed to feed on housefly-like dipterans and lepidopterans.

The above-described dipteran that was observed preying on dragonflies was identified as a robber fly belonging to the Family Asilidae; Order Diptera; Suborder Brachycera Genus; a poorly studied group of insects in Sri Lanka.

The robber flies are an abundant and diverse family within the order Diptera that are known for their predatory behaviour. Asilidae diversity can be attributed to their broad distribution; most species tend to occupy a selective niche. As their common name implies, robber flies have voracious appetites and feed on a vast array of other arthropods, which may help to maintain a healthy balance among insect populations in various habitats (Joern and Rudd, 1982; Shurovnekov, 1962).

Robber flies are opportunistic predators, their diet often reflecting prey availability in a particular habitat. Diet was more than 85% composed of insects from the Orders Diptera, Coleoptera, Hymenoptera and Homoptera, and furthermore,

large species tended to consume a greater diversity of prey taxa (Shelly, 1986).

As with other aerial predators, robber flies have excellent vision characterized by two conspicuous, prominent compound eyes. The mouthparts of this family have been modified to form a stabbing proboscis. Asilidae adults attack wasps, bees, dragonflies, grasshoppers, other flies, Lepidopterans and some spiders. The robber fly injects saliva that contains nerve toxins and digestive enzymes into its prey, which quickly paralyzes the prey and liquefies its tissues. The robber fly then sucks out the insides.

The ecological relationship between predator and prey is one which is beneficial to the predator and detrimental to the prey. The result of this interaction is adaptations in prey species to avoid being killed, while adaptations in predators result in greater hunting abilities. Aggressive mimicry is the mimicking of something seen as desirable by the prey so that it is not startled by the predator which can then get close to the prey unnoticed. This may also provide the flies with protection against potential predators, while enabling the robber flies to more easily approach and attack the dragonflies themselves.

It's an uncommon strategy among arthropods and extends to levels where mimicry is shown among taxa in different classes (e.g., Mantids often resemble brightly coloured flower parts and sit and wait for their prey). However, in most situations the mimic is the prey species and the occasions where aggressive mimicry is found is an uncommon situation where the predator mimics the prey.

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*Robberfly preys on dragonfly (Photo: Nuwan Bandara)*



*Robberfly preys on housefly (Photo: Nayana Wijayathilaka)*

# STUDY ON COMMERCIALY EXPORTED CRAB SPECIES AND THEIR ECOLOGY IN CHILIKA LAKE, ORISSA, INDIA

by Sandeep Ranjan Mishra, Debiprasad Sahoo, Hemanta Kumar Sahu & Srustidhar Rout

## Introduction

About 600 crab species occur in Indian waters; however, only a few of them are used for human consumption. Most important among these are *Scylla serrata*, *S. tranquedarica*, *Portunus pelagicus*, *P. sanguinolentus*, *Charybdis crustia*, and *C. ferita*. *Scylla serrata*, commonly called Mud-crab or Green-crab, forms the mainstay of the crab fishery of India and is economically the most important. It has a wide distribution, occurring abundantly along both east and west coasts of India. It is the most popular species in the Indo-Pacific region because of its size, meat quality, high price and export potential. Crabs, both alive and dead, are exported from India to Japan, the USA, France, Hong Kong and Malaysia.

In India, the crab fishery is small scale and is based mainly on capture fishery. Crabs (e.g., *Scylla serrata* and *Neptunus pelagicus*) constitute a minor fishery of some importance in certain parts of Chilika Lake. Though these crabs are caught throughout the year from all over the lake, the marketable catches come from the southern and central sectors with the peak fishing season being August to October. Crab fishery provides an additional source of livelihood for the five-month period from August/September to January after the main prawn fishing season is over. Important crab fishing grounds of the lake were estimated recently with an annual landing as 64.525 tonnes. Large-sized crabs dominate the catch during July to February and small ones constitute the bulk during March to June. The average carapace length of male and female specimens in different months ranged between 93.74 mm and 135.62 mm. One of the most important aspects of the abundance of crabs in the northern and central sectors areas is the availability of the plankton (Bhatta, 1992).

## Study area

Chilika Lagoon was designated a Ramsar Site (Wetland of International Importance) on 1 October 1981. The water spread of the lagoon varies between 1,165 km<sup>2</sup> in the monsoon season to 906 km<sup>2</sup> during the summer and extends over Puri, Khurda, and Ganjam districts. The lagoon itself can be broadly divided into four natural sectors based on salinity and depth: Southern Zone; Central Zone; Northern Zone; and Outer Channel.

One of the submerged (potential) islands covering an area of 15.53 km<sup>2</sup> was notified as Chilika (Nalabana) Wildlife Sanctuary on 17 December 1987. The whole area of the Chilika Lake, excluding the area notified as a Sanctuary, was declared a closed area for a period of five years with effect from 16 December 2002. 546 species of angiospermic plants belonging to 379 genera and 107 families, over 100 phytoplankton genera, 20 species of weed and 7 pteridophytic species have been documented so far in the lagoon and the islands.

Several villages and towns around the lagoon are closely associated with the wetland. About 70% of this population depends on fishing as their means of livelihood. This wetland is the habitat for the largest congregation of waterfowls in India. Over a million birds congregate in this water body for feeding and roosting. Migration commences in late September and the birds remain up until April, but the peak congregation period is mid-December to mid-January. Birds belonging to over 230 species (32% aquatic, 22% waders and 46% terrestrial, including 14 birds of prey species) are seen in this lake. Of these, 95 species are intercontinental and local migrants. The other vertebrate fauna includes

217 species of fish (freshwater, estuarine and marine species), 7 species of amphibians, 30 species of reptiles (12 species of lizards and 18 species of snakes) and 18 species of mammals. Two major crab species (i.e., *Scylla Serreta* and

*Neptunus pelagicus*) available in Chilika are of commercial importance. The population of Irrawady dolphins (locally known as Bhuasuni Magar) in the lake is threatened due to intensive fishing and plying of mechanized boats in the lake.

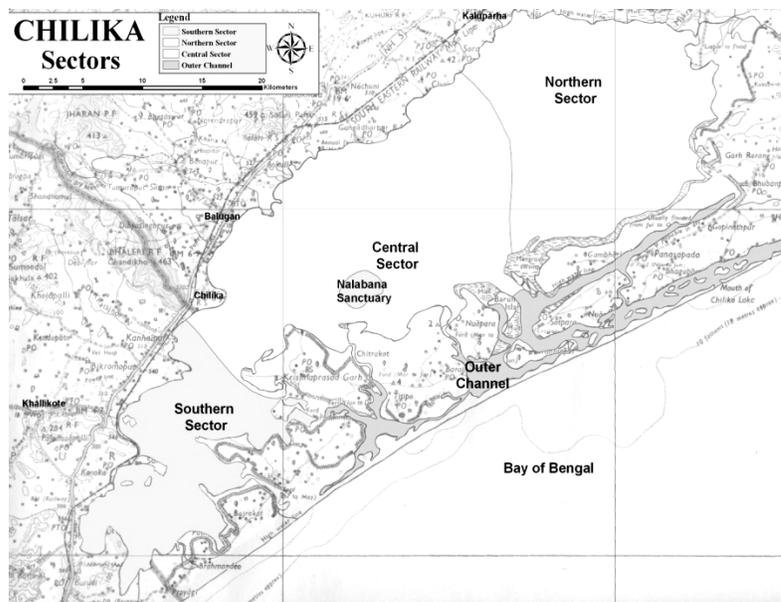


Figure-1: Map of Chilika Lake showing different sectors

## Methodology

The study was carried out over a period of nine months, from October 2004 to June, 2005. Four sectors were surveyed to assess the status of crabs along Chilika Lake. The data was collected in regular intervals of seven days from gill-netters. Outboard motor boats were used to collect the data from the selected sectors. In addition to the field survey, secondary information was also collected from different sources such as local coastal villagers and fishery departments. Data was collected directly from the field. The month-wise abundance of the number of species was noted. Hydrogen ion concentration (pH), salinity, dissolved oxygen and depth of water were also recorded.

Crabs that are found among rocks and tide pools were collected with a fine mesh hand net and a wide bore pipette. Crabs are generally easy to collect and most often hand picking, netting and draping are the commercial fishing practices.

The biomass of the entire study area was surveyed. For calculating the biomass the quadrat method (1.0m x 1.0m) was used to collect the data on biomass in gm. First the phytoplanktons were collected in polythene; after complete drying it was weighed. It was found that the availability of crab species was related to the abundance of the biomass. Crabs were preserved in formalin for laboratory purposes. Crabs were narcotized first with a few menthol crystals or by adding a few drops of chloroform and then preserved in formalinated spirit for a day or two to make the atomizing muscles as well as their breaking planes rigid. After this crabs were preserved in 6-10% formalin for the laboratory studies.

## Results and discussions

During the nine-month (October 2004 - June 2005) study of the crustaceans (in particular crabs) of Chilika Lake, it was found that the ecology of the species is highly diversified. Their distribution is related to the biomass concentration, temperature variation and salinity concentration. There are about 32 species of crabs found in Chilika Lake, out of which 5 species were chosen for more in

depth study (i.e., *N. pelagicus*, *M. lineaus*, *Spider crab*, *P. sangunlentus* and *S. serrata*).

The salinity profile in the lake exhibits a wide range of variation (0-34%) both in its subsurface and bottom water through different sectors and seasons. In general, the southern sector recorded a higher average salinity while the northern sector recorded a lower average salinity. The salinity profile in the northern sectors and outer channel fluctuated widely between 0-14.5% to 34% respectively. The annual sweet-saline mix regime of the lake in turn indicates other cyclic changes in the lake environment triggering interesting changes in the overall biotic profile of the lake. Based on the "Venice system" the lake water masses were categorized. The range of pH values observed varied widely from 7.0-10.66 over two seasons during the course of studies. Sector-wise the southern and central sectors showed a lower and lesser range of variation in pH (7.9-8.7) than the northern sector, which recorded a higher average pH range (7.2-10.66) and is host to luxuriant growth of aquatic weeds. The range of pH values for bottom water shows similar behavior sector wise/season wise.

The dissolved oxygen content in the subsurface water shows wide variations in different sections of the lake. The northern sector recorded a higher average D.O. concentration, coinciding with periods of high phytoplankton production or an influx of riverine inflows into the lake.

All the species that were studied are mostly found in all study sectors. The highest numbers of crabs were found in the northern and central sectors. The majority of the species were found in the northern sector, probably due to the ecological conditions. The abundance of the five species under observation was greater in the central sector than in the southern sector.

## Crab species abundance in relation to biomass

Large aquatic plants are abundantly found in the northern sectors. *Potamogeton pectinatus*, *Najas falciculata* and *Halophila ovata* are the dominant species (Bhatta, 1992). The average biomass is in the range of 0.03-0.27 m (K.V. Rama Rao). Two peaks of net plankton production occur – the first

around April-August and the second during October-January, the former being the more dominant. In August/September to January the abundance of crabs in these sectors gradually increases. Chilika Lake is rich in both planktonic and benthos biomass, which provides a suitable environment for the crabs in the lake. As the planktonic and benthos biomass is very rich in the lake, *Scylla serrata* and *Portunus pelagicus* are seen in all sectors (Mishra, 1988). During the study period the abundance of crab species was seen to be directly proportional to the biomass as they depend on it for their feeding.

### Crab species abundance in relation to temperature

The water temperature of the lake stays in the range of 17.5°C-32°C (data collected from CDA). This provides good ecological conditions for the crabs to breed and sustain a good population. All the species under study, except *P. sanguinolentus*, showed an overall increase in their population with the rise in temperature in all the sectors. This means that all the species of crabs (except *P. sanguinolentus*) grow optimally when the temperature increases. But *P. sanguinolentus* does not show any sign of growth under the temperature for optimal growth and reproduction.

### Crab species abundance in relation to salinity

The ecological condition in the lake ranges from saline to brackish to even fresh water. The salinity of the lake shows extreme annual cyclic changes in the range of 0.1%-36.02% (Bandyopadhyay *et al.*, 1991). The northern, central sector goes nearly fresh water in the flood season. This suggests that the crabs residing in the lake are adaptable to changes in the salinity of water. The salinity increases slowly beginning in March and is highest in April. It is evident that three crab species (*N. pelagicus*, *M. lineatus* and *Spider Crab*) show increases in their populations up to March when the salinity starts increasing, but after that they all show decreases in their population size during April. The two other species – *P. sanguinolentus* and *S. serrata* – show variable responses to the change in salinity. The population size of the former starts

decreasing from January and the latter shows a sudden rise in population in April.

### Effect of other physiochemical parameters on crab populations

Other physiochemical properties of the lake that help maintain the crab populations are dissolved oxygen (0.8-13.0ppm), pH (6.7-9.7) and depth (30-229 in cm). Salinity and pH levels influence crab catching to a great extent. When the salinity and pH increases the crab catch is much less, and when the salinity and pH decreases or is 50:50 the crab catch increases. It was also found that the full moon is also an important factor for the occurrence of the crabs.

The study further revealed the impact of the chemicals, medicines and pesticides used in the prawn hatchery that drain into the sea water indirectly through rivers, which adversely affects the natural life cycle of crabs. The most important local issue is the sustainability of fishing in the lake. Prawn and crab became the main catches accounting for 45% and 17% respectively during the 1980s. (data collected from local sources and CDA) and the pen and cage culture was gradually replaced by the Jano and Bahani technique. Prawn culture also attracted non-fisherman to the trade since it does not require any traditional knowledge of fishing. Catching juvenile crabs, over-exploitation of lake marine products, growth of weeds, declining salinity and lake shrinkage have all adversely affected the biodiversity of the lake and also the population of the crabs.

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## URBAN WILDLIFE: LEGAL PROVISIONS FOR AN INTERFACE ZONE - A CASE STUDY

by A.K. Sanyal, J.K. Dey and P.L. Kankane

Since ancient times, our philosophy has held that relations between nature and society and between biological diversity and human beings are critical for achieving the goals of conservation. Recently, we had an opportunity to study such an assemblage in a century-old club campus in the southern part of Kolkata, surrounded by a dense human population, where a healthy breeding population of jackals has been thriving for many years. We would like to convey our concern about habitually calling such assemblages “man-animal conflicts.” The existing legal provisions dealing with such circumstances, under the Indian Wildlife (Protection) Act, 1972, were also analyzed.

A golden jackal (*Canis aureus*) population of 40-45 individuals resides permanently within the premises of the Tollygunge Club Ltd., which has a 10-foot-high concrete wall around the club built approximately 20 years back. Thus, most of the members of the existing jackal population were

born and brought up within the club perimeters. During colonization, many exotic and indigenous plants were systematically planted in the area; therefore, it now hosts 118 species of plants, 93 species of birds, 12 species of mammals, 7 species of reptiles and 5 species of amphibians, along with many fishes, mollusks and butterflies. The jackals have become habituated to living with humans after so many years, but their inherent habits sometimes frighten the club members, who are seeking input on the population, carrying capacity and feeding habits of jackals. Consequently, the present study was carried out under the shadow of so-called man-animal conflicts.

### Results and discussion

Primarily, what was found is that the jackal population of the Club has adapted to their surroundings and display quite different behavior from their cousins in the wild. The most important

*(continued on p.17)*

(continued from p.16)

adaptation is their predominantly diurnal habits and unconcerned attitude towards human beings. The most suitable explanation would be that due to long association, both man and animal have accepted each other in their shared social space. Historically, there are no records of jackals posing any threat to humans, except perhaps on the rare occasion when an animal is infected by rabies.

The transect census method yielded an estimated 40-45 jackals (including four juveniles and two pups) inhabiting the club at present. Though the basic social unit of the golden jackal is a mated pair or a mated pair and their young (helpers), as much as 30% of the club population (16 animals) are singles, which indicates that the jackal groups in the Club are not as cohesive as in the wild. Probably they feel more secure within the premises; hence, consistent groups may be formed only during the breeding and rearing periods. Though it was difficult to draw a dividing line between the groups, the total population of jackals may be separated into approximately 7-8 loose family groups. Most of them are confined to southern part of the club, except for two groups roaming in the north. None are found in the central constructed area; however, this area may fall within the feeding range of some of the groups. In the wild, hunting jackal families hold territories of 2-3 km<sup>2</sup> throughout the year, portions of which are marked with urine by either the male or the female jackal to ward off intruders. However, in present case, the healthy breeding population of jackals in the 100 acre area of the club is an indication that the carrying capacity of club is still in favor of jackals, especially when no fighting was observed to defend territories. Also, it is known that once a population of canids reaches its saturation point, they control their own numbers. Therefore, we can conclude that the jackal population is yet to reach its point of saturation.

The jackal is an opportunistic feeder and not a persistent hunter, with a diet consisting of 54% animal source and 46% plants. It is a very capable hunter of small- to medium-sized prey such as rabbits, rodents, birds, insects, fish and monkeys. This is an important habit that contributes to their successful survival in spite of various actions taken by the club authorities to see that the club refuge is not accessible to them. Rodents, birds and their

eggs, reptiles, frogs, fish, mollusks, soil arthropods and fallen fruits are available in plenty in the club environs, enough to sustain the jackals. If average good health is any indication, then food and food habits are not limiting factors as far as the jackals of the club are concerned.

Where then did the conflict originate? It is in the human brain, not in the jackal. Man's fear leads to the conclusion that jackals are wild animals so they must pose a potential hazard to club visitors and hence should be removed from the club premises. Even the Wildlife (Protection) Act, 1972, gives protection to human beings under such circumstances and provides measures on how to rehabilitate such animals. The State Forest Department is empowered to take decisions to this effect. So, there is no chance for them to remain within the Club boundaries.

The Tollygunge Club case is an isolated one and unique in the sense that the jackals were trapped in a private property and the natural habitat was altered drastically during their occupancy. In nature, animals migrate due to population pressure, migratory habits or non-availability of food so as to occupy newer areas. In the wildland-urban interface (WUI), the situation is altogether different. Moreover, it focuses our attention on the lack of data available on animal movements, spatial assessment of the WUI across the country and the absence of legal provisions to support such animals/populations. Hence, we discuss WUI and associated issues below.

### **Wildland-urban interface**

The wildland-urban interface (WUI) is the area where human habitats meet or intermingle with undeveloped wildland vegetation. The WUI is thus a focal area for human-environment conflicts such as habitat fragmentation, introduction of exotic species and biodiversity decline. Urban and suburban development in or near wildland vegetation poses a major threat to the environment. Housing development causes habitat loss and fragmentation, threatens wildlife populations and results in declines in the biodiversity. It has been estimated that 50% of all federally-listed threatened and endangered species in the United States are in peril due to urbanization. Urban and rural growth

in the India has been strong in recent decades, yet we do not have any data to provide a framework for scientific inquiries into urban growth effects on the environment and to inform both national policymakers and local land managers about the WUI and associated issues like potential man-animal conflicts zones.

### Wider scope: the legal angle

In the Indian scenario where the human population exploded from 445 million in 1961 to 1.18 billion in 2010, man-animal encounters are inevitable. But what is not widely known is that they are customarily termed as man-animal conflicts and usually the animals face the onus of such situations. They are usually termed as intruders and conflict creators, despite the fact that human beings intruded into their habitat long ago. Even the Wildlife (Protection) Act, 1972, does not encourage such intrusions and provides measures for how to rehabilitate such animals. Under these circumstances, the animals that lost their earlier territory will never regain it. The best example of such a scenario is the good work of the Gujarat Forest Department, due to whose efforts the lion population is not only increasing but is now visible in newer areas of their historical range where they have not been sighted in the recent past. These animals sometimes, in absence of natural prey, even visit nearby human habitations and also prey upon their livestock. The Government of India has introduced a system of compensation if there is loss of property or livestock due to such a situation. It is working well, but in the long run it is unfavorable to continued survival of such animals and easy to brand them conflict creators and physically remove them from the site. Therefore, it is the right time to review the provisions in the Act as far as so-called man-animal conflicts are concerned. We should encourage such intrusions and immediately declare such areas protected (Conservation Area/Conservation Reserve/Sanctuary) under the Act. At the same time, the payment of compensation should be gradually withdrawn and the process of shifting human habitations outside the animals' home range should be initiated, after a period of about three years from date of the first and regular sightings of animals in the newly occupied areas. Effective management plans should also be developed

ensuring a sufficient build up of naturally propagating prey base/vegetation in such areas. A separate section may be introduced in the Act dealing exclusively with interface zones of man-animal interactions which favors animals regaining their earlier territories. The ever-increasing encroachment into wilderness can only be stopped by enforcing such legal actions.

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## STUDY OF THE REPTILIAN FAUNAL DIVERSITY OF A FRAGMENTED FOREST PATCH IN KUKULUGALA, RATNAPURA DISTRICT, SRI LANKA

by D.M.S. Suranjan Karunaratna, A.A. Thasun Amarasinghe and D.M.G.

### Introduction

Sri Lanka, despite its small area of 65,610 km<sup>2</sup>, has an estimated population of 18.7 million people (IUCN Sri Lanka, 2005). It is one of the biologically richest countries in South Asia and considered as a global hot spot in biological diversity (Bossuyt *et al.*, 2004; Gunatilleke *et al.*, 1995; Gunawardene *et al.*, 2007; Meegaskumbura *et al.*, 2002). Its natural forest areas constitute over 12% of the total land area (Tan, 2005). Favorable environmental factors such as high rainfall and humidity and the high density of undergrowth found in this region support a rich diversity of herpetofauna (Karunaratna *et al.*, 2008). However, the natural forests in the island are rapidly diminishing as a result of the expansion of settlements and agricultural land, leading to adverse impacts on the rich biodiversity (Bambaradeniya *et al.*, 2003; Giri and Chaturvedi, 2001).

The loss of natural forests over the past 100 years has led to the extinction of nineteen species of *Philautus* and one species each of *Adenomus* and *Nannophrys* (Manamendra-Arachchi and Pethiyagoda, 2005; Meegaskumbura *et al.*, 2007). Based on published sources, 200 species of reptiles have been recorded in Sri Lanka to date, of which 111 (55.5%) are endemic (De Silva, 2006; Manamendra-Arachchi *et al.*, 2006; Manamendra-Arachchi *et al.*, 2007; Samarawickrama *et al.*, 2006; Wickramasinghe, 2006; Wickramasinghe and Munindradasa, 2007; Wickramasinghe *et al.*, 2007).

The wet zone forests harbor more than 60% of the indigenous herpetofauna of Sri Lanka (Bambaradeniya, 2006; De Silva, 1996). Furthermore, a high percentage of endemism can

be seen in the southwest lowland forests where almost 90% of the endemic vertebrates are concentrated (Bambaradeniya *et al.*, 2003; IUCN and MENR, 2007; Senanayake *et al.*, 1977; Wijesinghe and Dayawansa, 2002). Previous studies have focused on the avian, butterfly and fish diversity of Kukulugala Forest (Jayaneththi and Maduranga, 2004; Sirimanna, 2005), while this paper hopes to enhance the current knowledge of reptilian diversity and conservation in this forest habitat.

### Study area

Kukulugala Forest (KF) is situated within the western boundary of Ratnapura District, Sabaragamuwa Province, and is located 15 km away from Bulathsinhala town. The study area is located between 6°38'30.52" – 6°40' 51.00" northern latitudes and 80°15'07.39" – 80°17'35.25" eastern longitudes. The forest ecosystem forms an important part of the forest cover of the Dumbara Manana Village (Sirimanne, 2005) and covers an area of 2,000 acres within the Ayagama secretariat division. It can be categorized as a lowland evergreen rain forest (Gunatilleke and Gunatilleke, 1990). This lowland wet forest consists of dominant tree species such as *Dipterocarpus* sp., *Mesua* sp., *Doona* sp., *Schumacheria castaneifolia*, *Artocarpus nobilis*, *Calophyllum inophyllum*, *Mangifera zeylanica*, *Humboldtia laurifolia*, *Oncosperma fasciculatum* and *Canarium zeylanicum* (Karunaratna and Amarasinghe, 2007).

The general forest floor is covered with cascading large boulders and leaf litter. Kukulugala Mountain, also known as "Horanae Kanda" in the Sinhala language, rises 705m above sea level. The area supports a rich hydrological network which includes

two waterfalls – Ritigas Ella and Miyunu Ella. Among the number of small streams which originate from this mountain, Thaberum ela and Era-Hadapana ela are the major tributaries that flow throughout the year (Karunaratna *et al.*, 2004). The average annual rainfall is around 3,849 mm, with most rainfall occurring from December to May. The weather gradually becomes drier from July to October. The mean annual temperature in the Kukulugala Forest is 28.7°C, with a maximum of 32°C and minimum of 21.3°C. The study area is accessible via the Horana – Bulathsinhala road or via the Rathnapura – Panadura road (Jayaneththi and Maduranga, 2004).

### Materials and methods

The present study was carried out from November 2001 to February 2002. A pilot field visit was conducted in the study area to identify the major forest habitats in order to determine a suitable field method. Fieldwork was then conducted for a total of 20 days (9 hrs / day) over the 4-month study period. Each field visit comprised of four night and two day surveys per week (two field visits per month x 3). General area surveys were carried out in three elevation types (<200m / 200m – 400m / >400m) within the KF and with sampling using 100 X 2 m transects. One hour was spent at each of the 72 randomly selected transects that were located within several habitat types found in the area. Surveys were conducted both day and night and flashlights were used at night.

All habitats such as water bodies, rock crevices, logs, trees, decaying vegetations and bushes up to 5 m, were thoroughly searched for the presence of specimens. All collected species were examined carefully and noted down before being released back into the same habitat. Some reptile species were carefully identified using a 10X Triplet brand hand lens. All species and color morphs were photographed alive, using a digital camera. The specimens were studied by visual encounter survey (VES) according to Sutherland (1997). Following this, the species were divided into abundance categories as follows; very rare (1-2), rare (3-5), uncommon (6-10), common (11-15) and very common (>15) species. The diagnostics used for species identification followed: Deraniyagala (1953, 1955); Das and De Silva (2005); De Silva

(1980); De Silva (1990); Greer (1991); Whitaker and Captain (2004); and Wickramasinghe and Somaweera (2003).

### Results

During the survey a total of 58 species, representing 33 species of serpentoid reptiles and 25 species of tetrapod reptiles were recorded from the main ecosystems of the KF. Although the diversity of serpentoid reptiles was higher than tetrapod reptiles, the abundance of the former was higher. They belong to 12 families, 41 genera and include 21 endemic reptile species (11 serpentoid reptiles and 10 tetrapod reptiles). The endemic relict genera *Aspidura*, *Balanophis* and *Cercaspis* and tetrapod reptiles of *Lyriocephalus*, *Ceratophora*, *Lankascincus* and *Nessia* were found in KF. According to IUCN Sri Lanka (2000), out of the 58 species recorded, 25 (43.1%) are threatened species and according to IUCN and MENR (2007) 4 endangered and 7 vulnerable species have been recorded in KF.

The reptile fauna of the KF includes 2 non-marine turtles, 23 lizards and 33 snake species. The relationships of these species are diverse. Some, such as *Geckoella triedrus*, *Aspidura guentheri*, *Balanophis ceylonensis*, *Oligodon calamarius*, *Lankascincus gansi* and *Otocryptis wiegmanni* occur in the same habitat at the same elevation. Different families recorded a different number of species as follows: Bataguridae (N=1) 1.72%, Trionychidae (N=1) 1.72%, Agamidae (N=6) 10.34%, Gekkonidae (N=9) 15.52, Varanidae (N=2) 3.45%, Boidae (N=1) 1.72%, Typhlopidae (N=1) 1.72%, Cyliodrophidae (N=1) 1.72%, Elapidae (N=2) 3.45%, Viperidae (N=4) 6.90%, Scincidae (N=6) 10.34% and Colubridae (N=24) 41.38%. The reptilian diversity of KF is represented by 4 very rare, 12 rare, 12 uncommon, 15 common and 15 very common species.

### Discussion

Most of the species were recorded after a rain shower, particularly in the well-shaded canopy-covered areas. Several species were also recorded within the well-wooded home gardens that were dominated by native plant species. As most of the sampling was conducted during the day time, the

data collection was biased towards lizards. Had we spent equal time at these sites at night, the snake species recorded would probably have been higher. Even diurnal snakes are more easily found at night while sleeping in vegetation where their camouflage is ineffective in torch light. Out of the 58 species, the middle area of KF contained a higher number (57) of reptiles than lower areas (56) and upper areas (25 species in KF). According to the present survey the most abundant Herpetofauna family is Colubridae, while Bataguridae, Trionychidae, Boidae, Typhlopidae and Cyliodromidae were the least abundant.

The results of this study showing the higher diversity in middle and lower forest habitats are mainly due to the availability of a number of microhabitats, including man-made habitats that are favorable for reptiles. The lower diversity of the upper forest habitats may be due to the open canopy, resulting in the exposure of the forest floor to high temperature and winds, and resulting in increased disturbance, desiccation and predation. *Melanochelys trijuga*, *Lissemys punctata*, *Varanus salvater*, *Atretium schistosum*, *Xenochrophis asperrimus* and *Xenochrophis piscator* species were not recorded in the upper forest area. This may be due to the lack of large water bodies. The snakes *Chrysopelea ornata* and *Liopeltis calamaria* were recorded only once during the study period.

*Hemiphyllodactylus typus* and *Lepidodactylus lugubris* are parthenogenic species that are restricted to the large boulders and crevices of old houses in the KF. *Cnemaspis jerdoni*, *C. tropidogaster* and *H. depressas* are distributed moderately inside the forest, even those areas rich in rocks and the houses of human habitats. *Geckoella triedrus* was only observed under large logs on the forest floor. The second most recorded species, *Hemidactylus brookii*, was found occupying every conceivable niche (terrestrial and arboreal) within the KF. Several gecko eggs were observed in rock crevices in the middle area of the forest. The villages have much more aversion to geckos, perhaps through superstition or squeamishness.

*Melanochelys trijuga* and *Lissemys punctata* are generally active during the rainy season and found

in the vicinity of temporary water bodies. *Calotes liolepis* and *Lyriocephalus scutatus* are diurnal, arboreal lizards commonly found in undisturbed closed canopy forest. The ground dwelling *Ceratophora aspera* is easily camouflaged by the dark brown leaf litter in very shaded areas and is generally found in pairs, but during this survey only a single specimen was recorded. *Otocryptis wiegmanni* was generally found in shady places near streams, where some egg clutches were also recorded. They generally dig holes in the sandy soil into which they lay 3-6 eggs at one time. During some night surveys groups of *Cercaspis carinatus* were observed digging in the soil and feeding on the eggs of *Otocryptis wiegmanni*. This indicates that *Cercaspis carinatus* are social feeders. This behavior was also observed from a previous survey at Beraliya Mukalana forest.

### Conservation

It is evident that the Kukulugala Forests provides suitable wildlife habitat, particularly for reptiles. Habitat loss and deterioration remains the dominant threat to KF reptile populations. Some areas of the KF are being felled to clear land for tea and rubber plantations. This poses a major threat, not only for reptiles, but also for the other flora and fauna of the area and its surrounds. In addition, the villagers kill snakes that have been incorrectly misidentified. This preliminary survey indicates that the KF is high in reptilian diversity. However, this study was conducted over a short period of time and therefore, it is recommended that similar surveys be conducted over longer periods of time to truly assess the reptilian faunal diversity in the area.

According to IUCN and MENR (2007) 4 Endangered and 7 Vulnerable species have been reclassified in KF; this is a critical point. The slash-and-burn technique of shifting cultivation involves intermittent clearing of a forest patch for agricultural practices, which destroys the habitats of several endemic reptile genera. This and other human activities that involving the cutting of trees inside the forest will contribute to the decline of such arboreal reptile species. Tree-dwelling reptiles, particularly those belonging to the genus *Cnemaspis*, *Lyriocephalus* and *Lankascincus*, show irregular distribution due to their habitat specificity.

A point which has perhaps been overlooked as regards monitoring by members of the local communities, is that it helps to raise awareness about the value of species and habitats. It is recommended that awareness programmes on managing the forest and its resources are conducted for the local communities, which could in turn contribute to the protection of these species. If this awareness can be integrated into conservation and management efforts, then the likelihood of its success will be higher than otherwise might be the case. Measures should also be taken to declare the Kukulugala Forest as a Forest Reserve under the Forest Department due to its high diversity of endemic and threatened species.

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**Table 1 - Description of the habitat types in three study areas of Kukulugala Forest in Ratnapura District, Sri Lanka.**

Study Area	Description of Habitat
1). Lower area of the KF (<200m)	Mixed cropping with woody and non woody plants like <i>Mangifera indika</i> , <i>Artocarpus heterophyllus</i> , <i>Dipterocarpus</i> spp., <i>Chaetocarpus</i> spp., <i>Myristica</i> spp. and <i>Cinnamomun</i> spp. trees grows up to 25 m, shade is about 60%, and leaf litter content is high and moderately wet. Among the most abundant understory tree species were <i>Garcinia</i> spp and <i>Gyrinops</i> spp. In lowland forest area of KF are perennial flowing water bodies, 1m to 10m wide. Rarely home gardens.
2). Middle area of the KF (200m – 400m)	Plants like <i>Dipterocarpus</i> spp., <i>Chaetocarpus</i> spp., <i>Chaetocarpus</i> spp., <i>Mesua</i> spp., <i>Myristica</i> spp., <i>Shorea</i> spp. and <i>Calophyllum</i> spp. trees very dominant, growing up to 40 m; shade is about 80%, and leaf litter content is very high and wet. Flowing water bodies, 1m to 4m wide; visibility high and turbidity low. Large rock boulders areas with seasonally moist cascade habitats.
3). Upper area of the KF (>400m)	Plants like <i>Strobilanthes</i> spp. very dominant. Rock boulders and grassy areas with seasonally moist cascade habitats. Shade is 30% with small trees. The bushes and trees 1m to 5m tall and randomly distributed with open soil. Bamboo species along with those of <i>Eriocaulon</i> spp. and <i>Osbeckia</i> spp. common also in the open grasslands near rocky outcrops. Leaf litter content is very low and dry; flowing water bodies, 1m or 2 m wide.

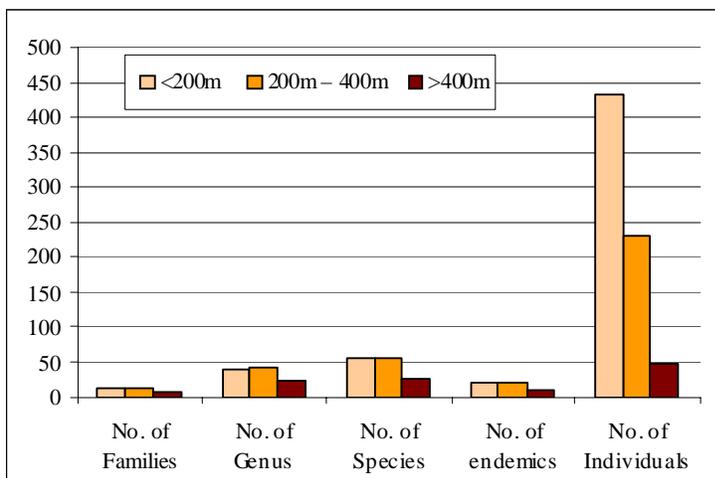
**Table 2. Checklist of the Reptiles fauna recorded from Kukulugala forest. (Abbreviation: TR – threatened / † endemic genus / \* endemic / VR – very rare / R – rare / UC – uncommon / C – common / VC – very common) species. (Source: IUCN Sri Lanka, 2000; IUCN and MENR, 2007).**

Family and Scientific Name	Common Name	Status IUCN 2000 & 2007	Status IUCN & MENR	Total Individuals and Percentage	Species Abundance
<b>Tortoises and Turtles</b>					
<b>Bataguridae</b>					
Melanochelys trijuga	Black Turtle	TR		13 (1.83)	C
<b>Trionychidae</b>					
Lissemys punctata	Flapshell Turtle	TR	VU	11 (1.55)	C
<b>Lizards</b>					
<b>Agamidae</b>					
Calotes calotes	Green Garden Lizard			24 (3.38)	VC
Calotes liolepis	Whistling Lizard *	TR	VU	3 (0.42)	R
Calotes versicolor	Common Garden Lizard			31 (4.37)	VC
Ceratophora aspera	Rough Horn Lizard *†	TR	EN	3 (0.42)	R
Lyriocephalus scutatus	Hump Snout Lizard *†	TR		5 (0.70)	R
Otocryptis wiegmanni	Sri Lankan kangaroo Lizard *	TR		13 (1.83)	C
<b>Gekkonidae</b>					
Cnemaspis jerdoni	Jerdon's Day Gecko *	TR		18 (2.54)	VC
Cnemaspis tropidogaster	Roughbelly Day Gecko	TR	EN	29 (4.09)	VC
Geckoella triedrus	Spotted Bowfinger gecko *	TR		2 (0.28)	VR
Gehyra mutilata	Four-Claw Gecko			11 (1.55)	C
Hemidactylus brookii	Spotted House Gecko			38 (5.36)	VC
Hemidactylus depressus	Kandyan Gecko *	TR		10 (1.41)	UC
Hemidactylus frenatus	Common House Gecko			22 (3.10)	VC
Hemiphyllodactylus typus	Slender Gecko		EN	3 (0.42)	R
Lepidodactylus lugubris	Scaly Finger Gecko		EN	7 (0.98)	UC
<b>Scicidae</b>					
Lankascincus fallax	Common Lanka Skink *†			56 (7.90)	VC
Lankascincus gansi	Gans's Lanka Skink *	TR		6 (0.84)	UC
Lygosoma punctatus	Dotted Skink			16 (2.25)	VC
Mabuya carinata	Common Skink			18 (2.54)	VC
Mabuya macularia	Bronzegreen Little Skink			10 (1.41)	UC
Nessia burtonii	Threetoe Snake Skink *†	TR		3 (0.42)	R

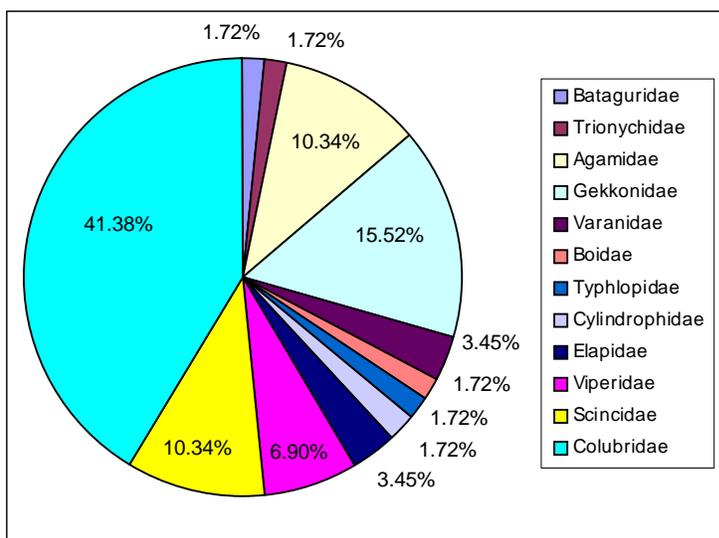
Varanidae					
Varanus bengalensis	Land Monitor			12 (1.69)	C
Varanus salvater	Water Monitor			8 (1.12)	UC
Snakes					
Boidae					
Python molurus	Indian Python	TR		13 (1.83)	C
Typhlopidae					
Rampotyphlops braminus	Common Blind Snake			24 (3.38)	VC
Cylindrophidae					
Cylindrophis maculatus	Sri Lanka Pipe Snake *†	TR		10 (1.41)	UC
Colubridae					
Ahaetulla nasutus	Green Vine Snake			16 (2.25)	VC
Ahaetulla pulverulentus	Brown Vine Snake			2 (0.28)	VR
Amphiesma stolata	Buff Striped Keelback			13 (1.83)	C
Aspidura guentheri	Ferguson's Roughside *†	TR		4 (0.56)	R
Atretium schistosum	Olive Keelback Watersnake			14 (1.97)	C
Balanophis ceylonensis	Sri Lanka Keelback *†	TR	VU	3 (0.42)	R
Boiga ceylonensis	Sri Lanka Cat Snake			6 (0.84)	UC
Boiga forsteni	Forsten's Cat Snake			4 (0.56)	R
Cercaspis carinata	The Sri Lanka Wolf Snake *†	TR	VU	11 (1.55)	C
Chrysopelea ornata	Ornate Flying Snake	TR		1 (0.14)	VR
Coelognathus helena	Trinket Snake			19 (2.68)	VC
Dendrelaphis bifernalis	Boulenger's Bronze Back			7 (0.98)	UC
Dendrelaphis caudolineolatus	Gunther's Bronze Back		VU	4 (0.56)	R
Dendrelaphis tristis	Common Bronze Back			15 (2.11)	C
Liopeltis calamaria	Gunther's Reed Snake		VU	1 (0.14)	VR
Lycodon aulicus	Common Wolf Snake			13 (1.83)	C
Lycodon osmanhili	Flowery Wolf Snake *	TR		9 (1.27)	UC
Oligodon arnensis	Common Kukri Snake			11 (1.55)	C
Oligodon calamarius	Templeton's Kukri Snake *	TR	VU	5 (0.70)	R
Oligodon sublineatus	Dumerul's Kuki Snake *	TR		5 (0.70)	R
Ptyas mucosus	Common Rat Snake			28 (3.95)	VC
Sibynophis subpunctatus	Jerdon's Polyodont			10 (1.41)	UC
Xenochrophis asperrimus	Sri Lanka checkered Keelback *	TR		16 (2.25)	VC
Xenochrophis piscator	Checkered Keelback			12 (1.69)	C

Elapidae					
Bungarus ceylonicus	Sri Lankan Krait *	TR	3 (0.42)	R	
Naja naja	Common Cobra		22 (3.10)	VC	
Viperidae					
Hypnale hypnale	Merrem's Hump Nosed Viper		11 (1.55)	C	
Hypnale nepa	Millard's Hump Nosed Viper *	TR	5 (0.70)	UC	
Trimeresurus trigonocephalus	Green Pit Viper *	TR	7 (0.98)	UC	
Vipera russelli	Russell's Viper		12 (1.69)	C	

**Species composition in three habitat and elevation types in KFA.**



**Species composition of amphibian families in KFA.**



# STATUS AND DISTRIBUTION OF GREY-CROWNED PRINIA (*Prinia cinereocapilla*) IN CHITWAN NATIONAL PARK, NEPAL

by Dharendra Kumar Pradhan and Sunita Ulak

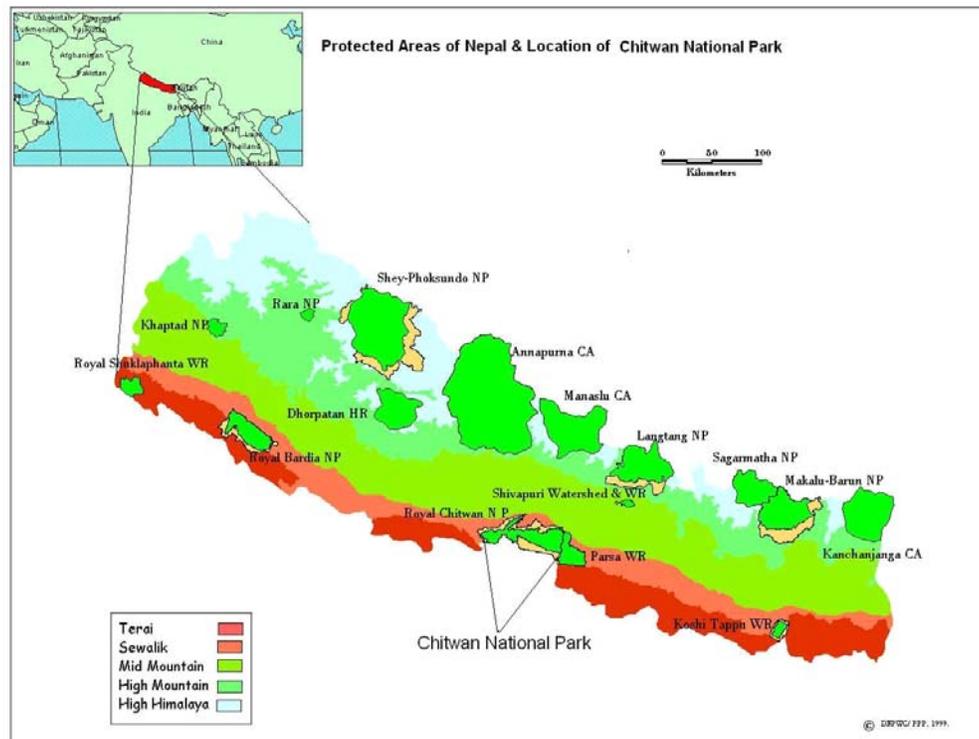


Figure 1: Location of Study Area

## Introduction

The avifauna of Nepal is exceptionally diverse; about 863 bird species have been recorded (BCN, 2006). Nepal's species richness is partly attributed to the wide range of altitude, climate and vegetation in the country. Nepal represents the Palearctic and Indomalayan bio-geographical regions and is a major floristic province of Asia, encompassing a unique and rich diversity of life. Nepal possesses a disproportionately large diversity of flora and fauna at genetic, species and ecosystem levels (HMG/N/MFSC 2002).

Grey-crowned prinia (*Prinia cinereocapilla*) is a small, globally-threatened, grassland-nesting bird. It is categorized as vulnerable by Birdlife International. This species is endemic to the Indian sub-continent. In Nepal, it is confined to a few protected areas. Nepal's Chitwan National Park is probably the largest stronghold of Grey-crowned prinia in the world (Baral, 2002). Grey-crowned prinia frequents dense forest and secondary growth, particularly around forest clearings and edges from the fringe of the plains up to 1,350 m (Ali and Ripley, 1968; 1998). It also occurs in

shrubby grasslands, especially those close to *Shorea robusta* forest. Its main habitat is forest edges and grasslands. Its world population is estimated to be less than 10,000 (Birdlife International, 2002).

Due to its small body size and drab-coloured plumage, it is likely that both the government and the established larger conservation organizations have overlooked the welfare of this bird. One of the prerequisites of the management of a wildlife species is to establish a database for the species, including the status and distribution (Baral, 2002). The establishment of protected areas like Chitwan National Park has provided protection to the Grey-crowned prinia population, but due to lack of adequate information about its status and distribution it is very difficult to predict their long term survival. This study aimed to generate some data, especially about the status and distribution in Chitwan National Park.

### Study area

Chitwan National Park (CNP) was established in 1973 as the country's first national park. It covers an area of 932 km<sup>2</sup> and lies between 27°15'-27°35'N and 83°45'-84°58'E. The park is an inner valley between the Siwalik Hills in the south and the Mahabharat Hills to the north, ranging in altitude from 150m to 815m above sea level. CNP is popularly known as a bird paradise and was named a UNESCO World Heritage Site in 1979. CNP is also home to more than 570 species of flora, 56 species of mammals (of which 17 species are carnivores), more than 500 species of birds, 47 species of reptiles, 9 species of amphibians, 126 species of fish and 150 species of butterflies (DNPWC 2005).

### Material and methods

A preliminary reconnaissance survey was conducted to determine the potential habitat of Grey-crowned prinia. This was done through discussions with park authorities (park rangers and game scouts), local natural guides and an expert from Bird Conservation Nepal. On the basis of a literature review and close consultation with the field birders, it was known that this species is closely associated with Themeda grassland and *Shorea robusta* forest, so by using participatory

tools, potential areas (mixtures of Themeda grasses and *Shorea robusta* forests) were identified on the base map of CNP and these areas were thoroughly visited on bicycle. The areas chosen for laying the transects were Kasra (the park HQ area), Lami tal, Tiger Tops areas, Old Padampur, Kachaouni, Khagendra Malli, Sunachuri, Amrite, Dhurba, Dumaria, Sukhibar, Bhimle, Bankatta and Sauraha areas.

### Transect survey

Open width line transects were adopted as the main technique. Several factors restricted the selection of transects such as danger from large animals such as tiger, wild elephant, rhino, sloth bear. To avoid potential risk and to maximize the visibility, existing dirt foot trails were followed.

The basic information about the line transects was obtained from Bibby *et al.* (1992, 1998). The actual fieldwork was conducted twice, in May 2005 and August 2005. Variable distance line transects were randomly laid out in the potential habitat as indicated from a reconnaissance survey. All observations were recorded, and the frequencies of distance at which individuals/groups of birds seen were used to estimate an optimum strip width (Rodgers, 1991). Environmental data were recorded every 100 m. Data such as the point where the birds observed, habitat features, geographic information and estimated distance to the right or left of transect between bird and the observer were recorded. To maximize the level of precision, interval estimations of distance were made. The length of transects reached up to 10 km. The variation in the length of transects was mainly due to habitat structure and inaccessibility due to dense grass cover or the presence of dangerous mammals. Bird surveys were not carried out on rainy, stormy or strongly windy days to avoid biases due to the change in intensity of bird activities.

Density was simply calculated by using the formulae  $D = \{n / (L \times r \times 2)\}$

Where:

D = density per sq. km

L = total length of transects

n = no of birds

r = single mean angular sight distance

And numeric figure 2 is for each side of the transect (Rodgers, 1991)

### Distributional map of Grey -crowned prinia

The locations of transects and the points where birds were sighted were recorded in GPS. This geo information was fed into GIS software (Arc View 3.2) to prepare a distributional map/spot mapping of the species within CNP.

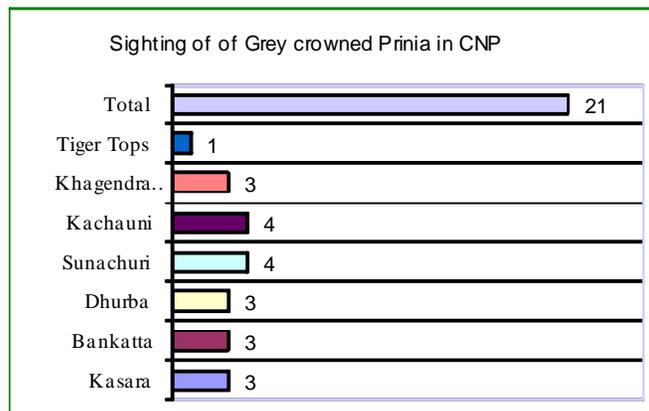
### Results and discussions

#### Status and distribution of Grey-crowned prinia

Grey-crowned prinia was recorded in the Kasra area, Bhimle, Tamor Tal, Dhurba, Tigertops, Souraha, Sukhibar, Gaida camp, Sunachuri,

Khagendra malli and Bankatta areas. The density of the Grey-crowned prinia in the surveyed areas was found to range from 8.3 ~ 9.3 per km<sup>2</sup>. The largest numbers of Grey-crowned prinia were observed in Sunachuri and Kachauni areas. This bird species was seen in association with Grey-breasted prinia (*Prinia hodgsoni*), Yellow-eyed babbler (*Chrysomma sinense*), White-tailed stonechat (*Saxicola leucura*), and Chestnut-capped babbler (*Timalia pileata*). Though Grey-crowned prinia can be seen all year round, its sightings are higher in August and September. This bird species was found to be active on sunny days after mild rain showers. The reason for this could be that the bird comes out to feed on insects when small holes are full of water following rain. Grey-crowned prinia is a perching bird; its flying height was estimated at about 10 m.

**Chart: 1 Sighting of Grey -crowned prinia in different location within CNP**



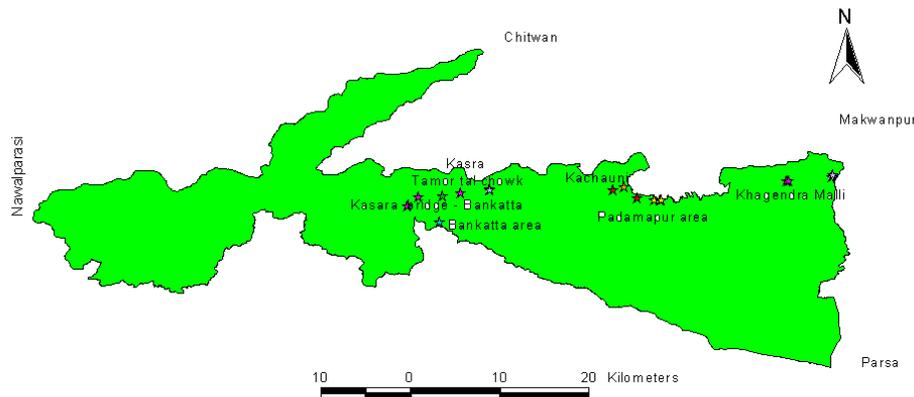
#### Habitat preferences

A few bird species show a strong preference for certain vegetation or grassland types; such bird species are specialists while others which do not show such strong preference over certain grass species or vegetation and occupy a wide range of grass types and habitat structures are generalists (Baral, 2001). Grey-crowned prinia, a grassland bird, is strongly associated with *Themeda arundinacea* grass species. Themeda grassland assemblages are found in the well-developed soil and close to *Shorea robusta* forest. Themeda grassland is also characterized by the presence of some woody species components. This type of grassland, which is the dominant grassland type in Chitwan, is not found in open areas far from forest

edges (Peet *et al.*, 1999). Environmental data showed that Grey-crowned prinia and Pale-footed bush warbler (*Cettia pallidepes*) are highly correlated with *Themeda arundinacea* grassland extended in moist *Shorea robusta* forest with scattered clumps of *Apluda mutica*, *Narenga porphyrocoma* and *Imperata cylindrica*. Other secondary vegetation comprises tree species such as *Eugenia oporculata*, *Bombax ceiba*, and shrubs like *Malotus philipinensis*. More than 70% of the birds were sighted in Themeda-dominated habitat and the rest were sighted in *Narenga porphyrocoma*, *Imperata cylindrica* and other grass species with scattered clumps of Themeda.

Grey-crowned prinia was absent in grazed areas and in the moderately grazed areas (with

## Distribution of Grey-crowned prinia in CNP



## Legends

## Birds Observed Sites

- ★ Grey Crown Prinia & Chestnut Capped Babbler
- ★ Grey Crown Prinia & White Stone chat
- ★ Grey Crown Prinia & Yellow E yed Babbler
- ★ Grey Crown Prinia, Grey BrestedPrinia & Chestnut Capped babbler
- ★ Grey Crown Prinia, Yellow E yed Babbler & White Stonechat
- ★ Grey Crown Prinia & Grey Brested Prinia
- ★ Grey Crowned Prinia (GCP)

■ Royal Chitwan National Park

Saccharum grassland). Plain prinia (*Prinia inornate*) and Ashy prinia (*Prinia sociatis*) were recorded in greater numbers than other species. Grey-crowned prinia was not present in large open grasslands where *Themeda* grassland appeared less frequently or was absent.

### Conclusions

In Chitwan National Park, the density of the Grey-crowned prinia was estimated to range from 8.3 ~ 9.3 per km<sup>2</sup>. The density of this species has not been estimated elsewhere in Nepal, but it is reported to occur in Bardia National Park, Shukla Phanta Wildlife Reserve and Laukah Daha area of Parsa Wildlife Reserve.

Grey-crowned prinia is a specialist bird and prefers grasslands dominated by *Themeda arundinacea* and *Apluda mutica*. *Themeda* grassland assemblages are found close to the moist *Shorea robusta* forest. *Themeda* grassland is also characterized by the presence of some other woody species like *Bombax ceiba*, *Terminalia*

species, *Mallotus philipinensis* and *Coolebrokia oppositifolia*. The sightings of Grey-crowned prinia were high in the forest edges created naturally or artificially in the course of habitat management and trails formed by human movement inside the park.

Sunachuri, Kasara, Kachauri, Tiger tops, Bankatta, Old Padampur, Khagendra Malli and Dhurba were found to be main habitats of the Grey-crowned prinia. These areas are all facing serious problems from cutting and burning of grasses, illegal collection of forest products and grazing by livestock. At the same time, controlling cattle grazing has been a cumbersome task for park authorities and is also inevitable because the park boundary is not fenced. Weak enforcement of grazing controls motivated local people to graze inside the park. These issues are serious because the local people have been enjoying access to the park resources long before the park was established. There is continuing shrinkage of forest resources outside the park because of exploitation by local people and a

growing number of unproductive cattle. This will eventually be detrimental for the long-term survival of Grey-crowned prinia and other threatened species in and around the park.

### Recommendations and practical implications for conservation

Grey-crowned prinia is one of the least known globally-threatened bird species. Educating the people, especially those residing in the periphery of CNP, is the most important method for implementing conservation measures for this species. Furthermore, an intensive awareness campaign among park officials and local naturalists should be launched to increase knowledge of this species among them.

Forest products, especially grasses, are important for people living adjacent to the park. Themeda grass is locally used by ethnic groups such as the Tharus, Bote, Derai and Kumal for paneling of houses, weaving baskets and making fish traps. Local traditions can continue with optimal exploitation and careful management of resources.

Habitat management in CNP and other protected areas in Nepal is focused on mega fauna. Birds and small animals seem to be overlooked. Grey-crowned prinia is not getting the proper attention that it deserves. Therefore, habitat management should also focus on the management and conservation of small creatures of the ecosystem as well. Generally, it is believed that habitat management for big animals will simultaneously manage the habitats of small animals, but different animals have different habitat requirements. Therefore, Themeda grassland should be managed scientifically for better conservation of Grey-crowned prinia.

### Acknowledgements

The authors would like to thank Dr. Peter Clyne, Asian Programme Director, Wildlife Conservation Society, USA, and Dr. Hem Sagar Baral, Bird Conservation, Nepal, for providing information and literatures and also thanks to the Wildlife Conservation Society and Rufford Small Grant Foundation for funding this study.

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# FOREST NEWS

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## **CHINA HOSTS 24<sup>th</sup> SESSION OF THE ASIA-PACIFIC FORESTRY COMMISSION AND 2<sup>nd</sup> FORESTRY WEEK**

The 24<sup>th</sup> session of the Asia-Pacific Forestry Commission was held 7-11 November 2011, in Beijing, China, at the invitation of the Government of China. Approximately 200 participants, including delegates from 29 member countries and one United Nations organization; representatives from 3 non-member countries and 10 regional and international inter-governmental and non-governmental organizations participated in the session. The Heads of Forestry from 18 member countries attended. The Commission was convened as the core event of Asia-Pacific Forestry Week, which attracted more than 750 participants from over 45 countries. Special plenary sessions were organized on three separate mornings of

Forestry Week, focused on forest governance, improving forestry communications and the outlook for forestry. Forty-five parallel events were organized by partners during Forestry Week. An Information Market featured 24 organizational booths, 25 posters and 3 photo and drawing exhibitions.

The objectives were to discuss and assess technical and policy issues and trends of relevance to forestry in the region; to develop and advance mechanisms for regional and sub-regional cooperation in addressing forestry problems; and to advise FAO on policy

formulation and on priorities for its forestry programmes in the region.

### **Opening ceremony**

The Opening Ceremony for Forestry Week featured addresses by the Minister of the State Forestry Administration, Government of China; the Secretary-General of the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet); the Assistant Director-General of the FAO Forestry Department; and the Director of the United Nations Forum on Forests (UNFF). Prominent keynote speakers included Mr. Andrew Steer, Special Envoy for Climate Change, World Bank; Mr. Tim Rollinson, Director-General, Forestry Commission, Government of the United Kingdom; and Ms. Anggun Cipta Sasmi, FAO Goodwill Ambassador.

### **State of forestry in the Asia-Pacific region: new challenges – new opportunities**

The Commission considered the state of forestry in the region. Delegates noted the relevance of the overall theme of Asia-Pacific Forestry Week, “New challenges – new opportunities” and particularly emphasized prospects to turn challenges into opportunities.

The Commission noted significant progress in enhancing forest cover, including achievements in afforestation, reforestation and forest rehabilitation. Several countries reported the establishment of ambitious forest expansion targets and “greening” initiatives. Delegates highlighted efforts to develop and enhance coastal protection forests and rehabilitate mangrove areas. Several countries reported on forest plantation development, forest sector revitalization plans, and urban forestry initiatives.

Delegates noted increasing emphasis on participatory approaches, community forestry, and devolution of forest use rights. Forestry contributions to poverty alleviation and livelihood development were emphasized, including the need to strengthen and support community forest management capacities.

The Commission recognized the need for dynamic institutional structures that evolve to meet new and emerging challenges. Several countries highlighted institutional strengthening initiatives. Challenges associated with unstable political environments were noted.

The increasing demands for forest ecosystem services were noted, including those provided by planted forests. Delegates highlighted the importance of biodiversity conservation, soil and water protection, recreation and ecotourism, but noted that efforts to implement payment systems for ecosystem services are constrained by high establishment and transaction costs.

Delegates recognized that impacts of climate change are increasingly in evidence in the form of extreme weather events in the region and biotic disturbances. The need for increased emphasis on adaptive and mitigative measures to respond to climate change was noted. The Commission noted urgent needs to develop, strengthen and standardize methodologies for measuring carbon sequestration, accelerate REDD readiness, and develop capacities to participate in, and respond to, an increasing range of carbon market mechanisms and carbon-related frameworks. The Commission expressed concern at the high costs associated with REDD compliance.

The Commission welcomed the numerous collaborative efforts reported, including establishment of subregional forestry networks, collaborative work related to the improved use of criteria and indicators for sustainable forest management, and transboundary cooperation on issues such as wildlife migration and water.

### **The governance challenge: impacts on forests, lessons learned and strategies for the future**

A special Asia-Pacific Forestry Week plenary session highlighted the importance of governance in achieving the desired balance among social, economic, ecological and climatic values. The session emphasized the following points: i) acknowledging that illegal logging is a major challenge is, in itself, significant progress; ii) participation of all stakeholders, including communities, is critical for success in addressing

governance challenges and ensuring social justice; iii) transparency, accountability and access to information are core elements of good governance; iv) laws and regulations need to be suited to local conditions and developed in the context of local cultures; and v) new financial instruments and mechanisms, including payments for ecosystem services and REDD+, will contribute significantly to improved forest governance.

### **FLEG-T: continuous improvement in forest governance**

The Commission acknowledged that significant governance challenges continue to affect forestry in the region. Countries reported on concrete measures to improve forest governance, especially in relation to regulatory frameworks and institutional arrangements. Several countries reported significant progress in developing legislation and methodologies to support improved forest governance, including more stringent timber legality verification and enforcement procedures, increased enforcement capacities, certification, guidelines for national companies operating abroad, criteria and indicators for sustainable management, and new monitoring techniques and technologies.

### **Progress in implementing APFC and FAO-supported activities in the region**

The Commission highlighted the central importance of activities to reduce deforestation and forest degradation and alleviate poverty. Delegates stressed the important contribution of non-wood forest products (NWFPs) in supporting rural livelihoods, particularly of the poorest and most vulnerable.

### **New media – new messages: forestry communications in Asia and the Pacific**

Another special Asia-Pacific Forestry Week plenary session examined experiences with the use of new media channels to market messages related to important forestry initiatives.

Key points raised in the session included: i) there is a need to improve forest-related communications to increase awareness and update entrenched perceptions; ii) a wide variety of new media tools

and innovative communication channels are available, but presently underutilized by the forest sector; iii) forestry organizations are competing in many spheres, intra- and extra-sectorally, including for financial resources, political attention, land and market share. Effective communications are a key to success in implementing programs and achieving objectives.

### **Journey to 2020: the future for forestry in Asia and the Pacific**

This special Asia-Pacific Forestry Week plenary session offered a diverse range of perspectives on how the complex future that confronts forestry in the region may unfold. The following key points emerged: i) the immediate future for Asia-Pacific economies will be difficult and no economy will be insulated from the current financial crisis; ii) in the longer term, “green economy” concepts relating to the earth’s capacity to sustain human populations and demands will gain increasing importance; iii) forestry for future economies is about forests for development and forests for people; iv) forest governance and benefit sharing will be important; and v) the positive vision of REDD+ is compelling, but outcomes remain uncertain and strong efforts are needed to ensure the desired results.

### **Heads of forestry dialogue: defining the forest sector’s role in the emerging “green economy” concept**

A special Heads of Forestry dialogue provided an opportunity for direct exchange of views among delegates on defining the forest sector’s role in defining the forest sector’s role in the emerging “green economy” concept.

Forests provide natural capital that assists many other sectors to participate in the “green economy”. The Commission emphasized that the “green economy” should not be a “top down” process, nor should it commoditize nature, compromise national growth, or constitute a trade barrier. The “green economy” should support participatory approaches, contribute to new livelihoods, include equitable sharing of benefits among stakeholders, assist in poverty alleviation, and build on low-carbon economies. It was emphasized that the concept of “green economy” should complement,

and not replace, the concept of sustainable development.

### **Climate change adaptation and ecosystem resilience**

Delegates noted the importance of mitigating and adapting to, the impacts of climate change. The Commission emphasized the importance of incorporating climate change actions into national programs, plans and strategies.

The Commission noted that climate change reduces biodiversity and ecosystem resilience and increases the risks of fire and of pest disease incursions. The importance of strengthening monitoring systems to assess the impacts of climate change was noted.

Delegates noted that the poorest, including forest dwellers, are the most vulnerable to the impacts of climate change. Delegates also observed that discussions on REDD+ should emphasize simplicity, flexibility and cost effectiveness.

### **Responding to increased demands in fire management**

The Commission recognized that fire should be managed in an environmentally responsible manner to ensure properly functioning and sustainable ecosystems into the future. Delegates acknowledged that effective management of wildfire for any particular area of land depends on the management objectives for the land.

### **Results and recommendations**

#### ***State of forestry in the Asia-Pacific region: New challenges – new opportunities***

- The Commission requested FAO to collaborate in promulgating forestry information related to mitigation against natural disasters, including providing collaborative support for an international conference on forests and natural disasters being planned for early 2012 in Japan.
- The Commission requested that FAO give additional attention to monitoring, reporting and verification aspects of forestry including:

(i) potential needs to review and clarify forest definitions; (ii) preparation of voluntary guidelines and other support for conducting forest inventories and assessments, with particular focus on requirements for REDD+ reporting; and (iii) development of Global Forest Resources Assessment (FRA) reporting methodologies that provide greater interpretive capacity for key forestry statistics; and support to strengthen capacities for reporting to the FRA 2015 assessment.

#### ***FLEG-T: continuous improvement in forest governance***

- The Commission urged FAO to collaborate with partner organizations to assist with the development of measures in national forest programmes to support and build capacities for forest law enforcement and improved governance.
- The Commission recommended that FAO collaborate with other partners, including the Asia Forest Partnership, to continue awareness-raising efforts, sharing of experiences, and development of capacity to address forest law enforcement and governance challenges.
- The Commission recommended that FLEG-T awareness-raising activities should encompass broader groups of stakeholders, including the judiciary, customs officials, extra-sectoral government officials and others.
- The Commission requested FAO, in collaboration with donors and other development partners, to facilitate countries in sharing FLEG-T experiences and seek collaborative solutions to improve forest law enforcement and governance.

#### ***Progress in implementing APFC- and FAO-supported activities in the region***

- The Commission requested FAO to provide increased support to build capacities and raise awareness in relation to REDD+, FLEG-T and greening activities, including in rural communities.
- The Commission endorsed the key priorities identified by the second Asia-Pacific Forestry Sector Outlook Study and urged FAO to

support efforts to promote, promulgate and interpret the findings.

- The Commission requested FAO to support studies on the roles that forests can play in emerging “green growth” frameworks, and assist member countries in formulating and implementing related policies and programs.
- The Commission requested FAO to collaborate with donors and partners to support the development of REDD+ readiness and demonstration activities.

#### ***Climate change adaptation and ecosystem resilience***

- The Commission urged FAO to assist countries to share experiences in climate change adaptation and to help further refine national climate change adaptation strategies.
- The Commission requested FAO to help countries develop national action plans on climate change adaptation.

#### ***Responding to increased demands in fires management***

- Delegates observed that they had not had sufficient time to fully review and consider the paper (on *Integrating the management of wildfire-related risks in rural land and forest management legislation and policies*) tabled by Australia and New Zealand. The Commission therefore recommended that member countries further review the paper and its recommendations and consider it more fully at the next session of the Committee on Forestry.

#### **Other business**

- The Commission agreed to establish a Forestry Communications Working Group, under the auspices of the Commission, to pursue the following objectives: (i) share experiences and knowledge related to forestry communications among member countries and international partner organizations; (ii) exchange communication materials, photographs, mailing lists, expertise, etc. and facilitate the access to other resources for effective

information management; and (iii) strengthen member countries’ capacity to effectively address communication issues and challenges.

#### **Regional issues identified by the Commission for the attention of the Committee on Forestry**

- The need to promulgate forestry information to mitigate against natural disasters, including floods, cyclones/typhoons and tidal surges, landslides, tsunamis and wildfires.
- The increasing demands for additional attention to monitoring, reporting and verification aspects of forestry, including: i) potential needs to revisit forest definitions; ii) methodologies to measure forest degradation and trees outside forests; iii) preparation of voluntary guidelines and other support for conducting forest inventories and assessments, with particular focus on requirements for REDD+ reporting; iv) development of Global Forest Resources Assessment (FRA) reporting methodologies that provide greater interpretative capacity for key forestry statistics; and v) support to strengthen capacities for reporting to the FRA 2015 assessment.
- The importance of developing measures in national forest programmes to support and build capacities for forest law enforcement and improved governance.
- The demands for awareness-raising efforts, sharing of experiences, and development of capacity to address forest law enforcement and governance challenges.
- The desire of countries for opportunities to share FLEG-T experiences and seek collaborative solutions to improving forest law enforcement and governance.
- The roles that forests can play in emerging “green growth” frameworks, and assist member countries in formulating and implementing related policies and programs.
- The importance of supporting the development of REDD+ readiness; the need to assist countries to share experiences in climate change adaptation and to help further refine national climate change adaptation strategies; and to help countries develop national action plans on climate change adaptation.

- The establishment of an Asia-Pacific Forestry Communications Working Group, under the auspices of the Commission, to pursue the following objectives: i) share experiences and knowledge related to forestry communication among member countries and international partner organizations; ii) exchange communication materials, photographs, mailing lists, expertise, etc. and facilitate access to other resources for effective information management; iii) strengthen member countries'

capacity to effectively address communication issues and challenges.

### **Date and place of the next session**

The Commission noted with appreciation the offer of the delegation from New Zealand to host its twenty-fifth session. The delegation from Malaysia indicated interest in hosting the twenty-sixth session of the Commission.





#### OPENING ADDRESS

by

**Eduardo Rojas-Briales**

*Assistant Director-General, Forestry Department*

*Food and Agriculture Organization of the United Nations*

Honorable Ministers, Distinguished Guests and Participants,

It is my great pleasure to welcome you to the second Asia-Pacific Forestry Week. The Week is your key opportunity as members of the forest community to set regional priorities for FAO Forestry's work for the coming biennium and discuss important themes affecting the region. This week builds on the success of the first Asia Pacific Forestry Week, held in Vietnam in April 2008. Much of the original concept for regional forestry weeks was pioneered in Vietnam in 2008, and because of its great success, the format has been replicated in other regions. We now see the success of these events turning full circle, back to this week, in Beijing, China.

This would not have been possible without the extensive and helpful cooperation of the Government of the People's Republic of China, particularly the State Forestry Administration, as well as the Asia-Pacific Network for Sustainable Forest Management. Your immense efforts to

prepare this week I know will ensure the success of this event for the region.

I would also like to thank the numerous organizational partners who have come together to arrange events for Asia-Pacific Forestry Week, provided support and resources, and contributed to making this a notable event and one that will impact the forest community in the coming biennium.

The theme of Asia-Pacific Forestry Week 2011 is "New Challenges – New Opportunities". This theme encapsulates the dichotomous state of our world today, a world on the brink of another financial crisis, a world struggling to address the challenge of providing global food security, and one that is coming to grips with climate change and environmental degradation as the global population passes the 7 billion mark.

Despite this high population density, the Asian region has been able to reverse deforestation trends and showed positive gains in forest area over the last ten years, thanks to successful halting of

deforestation, impressive afforestation programmes and natural expansion of forests. No other region of the world has ever shown such a dramatic positive change in such a short period of time.

Many lessons can be drawn from this experience: first, these lessons must be shared with other countries in the region that lag behind in reversing deforestation. These lessons could also be spread to Latin America and Africa, where some of the progress in halting deforestation is still slow. Economic development, urbanization, and political will have been in all cases essential to contributing to the Asian region's positive experiences in reversing deforestation. China has taken the lead in this process, working in cooperation with a number of its partner countries in the region.

The region is gathering impressive experiences in forest restoration that are worthy of being shared more broadly. However, these restoration efforts will only be sustained if forest management is effectively implemented and successfully addresses the threats of thinning, forest fires and forest pests in a changing climate.

In recent international debates on forests many forest ecosystems and issues have not received equal attention. For instance, semi-natural forests are frequently ignored even though they account for more than 60 percent of the world's forests. Most forests in the Asian region are semi-natural and excellent initiatives such as the Satoyama Initiative can help provide examples of how these types of forests can thrive when given adequate care and attention.

Beyond whole ecosystems, forest soil and water will receive increasing attention in the coming years. Water scarcity is expected to rise due to climate change. Yet, insufficient attention has been given to dryland forests in comparison to other forest types. The interaction between forests and water in quantitative and qualitative terms will need further attention in the coming years, especially in a densely populated, mountainous region such as Asia.

However, the future is not all doom and gloom for the forestry community and sector. Out of the challenges come many new opportunities, new ways of thinking, new ways of working, new ways

of doing business, new products, new technologies, and new markets.

For instance, the critical challenge of climate change has provided opportunities for the forest community. We see carbon as a new forest product and new markets have emerged in which carbon can be sold. New funding streams to improve forest management within reducing emissions from deforestation and degradation schemes have emerged, which could provide potential new income streams, opportunities for conservation and protection, the creation of jobs, and improved revenues and livelihoods for forest-dependent people.

Additionally, emerging economies will raise energy prices and at the same time more pressure to reduce carbon emissions will lead to increased substitution of fossil fuel sources. As a result, biomass from agriculture, forests and waste will gain increasing attention. Building materials will also be affected. Conventional concrete buildings are considered high-risk materials in earthquake-affected areas and have a high environmental impact in comparison, but lower-risk building construction could be achieved through the increased use of wood or bamboo. In the run up to the Rio+20 debates, the forest sector can make a significant contribution in moving towards a green economy and promoting green growth, including through countries' use of emerging industrial processes and products like bio refineries.

For the forest sector, the principal challenge is to understand the forces that are shaping the world and anticipate the resultant opportunities that will emerge. What will be the impacts of changing demographics? How will the economic landscape change? What social and ecological pressures will come to the fore? How do we need to adapt our policies and institutions to best confront these challenges? How can technology help us?

The program for the week centers around three dynamic plenary sessions that will address such issues confronting forestry in the region:

- (i) The first session, "The governance challenge: Impacts on forests, lessons learned and strategies for the future" will

- lay out key governance challenges, highlight the successes and set the foundation for active and engaging dialogue with participants.
- (ii) A less traditional session, “New media – new messages: Forestry communications in Asia and the Pacific” will highlight ways to better convey forestry messages to the rest of the world and showcase cutting edge examples of forestry communications. A specific meeting of forest communicators from the region will follow with the aim to consolidate a network for the Asia and the Pacific region on this important topic; and
  - (iii) On Thursday, a session titled “Journey to 2020: The future for forestry in Asia and the Pacific” will help us chart how key forestry trends will unfold and identify opportunities for the upcoming decade.
  - (iv) You may also wish to use the Heads of Forestry dialogue “Forestry’s role in the Green Economy”, which takes place on Thursday afternoon, to further explore new opportunities for the forestry sector and take into account outcomes of the European Forestry Commission discussions on this same topic less than a month ago.

All of these will be supported by a myriad of other inspiring events that collectively will constitute a superb Asia-Pacific Forestry Week 2011.

In FAO, as in other organizations, we are working to adapt to rapid change, to evolve into a 21st century organization – one that is more flexible, collaborative and responsive – and to reinvent ourselves in ways that enable us to successfully confront new challenges.

As the Immediate Plan of Action for FAO Renewal takes effect, this meeting is an important part of showing how regional forestry commissions are key statutory bodies for FAO and link to its core work. These sessions allow us to incorporate the views, perspective and proposals from the Heads of the national Forest Services from a regional

perspective, by first prioritizing FAO engagement in the region in forestry and second to identify the priorities of FAO on a global scale. Regional Conferences as well as the Committee on Forestry profit extraordinarily from the strategic work done by the Regional Forestry Commissions. In the absence of these Commissions, a comprehensive regional perspective that includes forestry as part of its priorities would not be sufficiently taken into account.

At the heart of change in FAO is the recognition that knowledge is essential for sound decision making. FAO has committed to being a knowledge organization, serving as a knowledge network and bringing new knowledge to the field. To ensure this outcome and build FAO’s ability to deliver relevant and timely information, FAO Forestry would benefit from the establishment of an Advisory Panel on Forest Knowledge to promote education and knowledge initiatives on forests worldwide.

As you know, this session of the Asia-Pacific Forestry Commission also provides a critical opportunity to shape FAO’s program of work for the next biennium and beyond. When deciding on your priorities for the coming biennium, I would invite you to consider the outcomes and recommendations of the recently concluded European Forestry Commission in Antalya, Turkey. This will help the upcoming the Commissions in other regions when they meet in 2012 (Africa, Near East, Latin America and North America) forming a comprehensive picture of the discussions taking place around the world and form a consistent view of our priorities at the global level.

I would like to applaud you all again for your helpful efforts in making this event possible and am pleased to see the enormous attendance at this Forestry Week. It is clear that the large numbers of attendees are a reflection of how the region has successfully mobilized support for the regional forestry commissions and embraced the concept of the Asia Pacific Forestry Week.

I wish you the best in concluding your work this week and look forward to our discussions together.



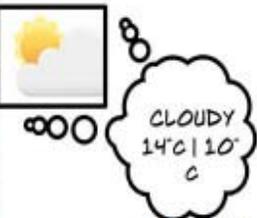


QUOTE OF THE DAY: KEEP A GREEN TREE IN YOUR HEART AND PERHAPS A SINGING BIRD WILL COME - CHINESE PROVERB

**Welcome to Beijing and APFW 2011**

Dear Guests,  
 On behalf of the State Forestry Administration of China, it is my pleasure to welcome you all to Beijing to attend the 24th session of APFC and APFW 2011. The Forestry Week is a grand gathering of foresters in the Asia-Pacific region. The Chinese hosts will do our utmost, in cooperation with FAO, to provide a platform for our forestry colleagues from various countries and international agencies to conduct candid exchange and discussions with an aim to better share experiences on forestry development, through discussion of opportunities and challenges facing forestry development in the Asia-Pacific region and finding solutions to regional forestry development constraint.

-- H.E. Yin Hong, Vice Minister of SFA



- MAIN PARTNER EVENTS!**
- WOOD ENERGY IN A-P
  - REDD-PLUS GOVERNANCE
  - CHINA FORESTRY CERTIFICATION SYSTEM
  - SFM AND LAND TENURE REFORM IN CHINA
  - COMMUNITY FORESTRY ENTERPRISES FOR LIVELIHOODS
  - APFNET PROMO EVENT

**DON'T MISS IT!**

**WHOLE DAY:** tour around the exhibition area

**17.30:** Join the opening celebration of the **CANopy Room (Room 308)** tonight, experiencing the special culture and networking space while enjoying pre-reception refreshments.

**At your service!**

APFW SECRETARIATE IS IN VIP ROOM 3-2

**18.00:** Reception at Ball Room A/B, Level 1

**WHO IS THE EARLY BIRD?**

APFISN organized the workshop on Forest Health Technology and Phytosanitary Standards on November, 2011, in collaboration with US, SFA and APAFRI.



WE'LL BE BACK ON TUE, THURS AND FRI, SEE U!

**SPOTLIGHT FIGURES TODAY!!**

- ANDREW STEER**  
 special Envoy for Climate Change, The World Bank
- TIM ROLLINSON**  
 Director General, Forestry Commission, Government of the United Kingdom
- ANGGUN**  
 FAO Goodwill Ambassador

- Lunch Location on Monday: 4<sup>th</sup> floor Plenary Hall B
- Partner Event Flyers have the most up-to-date information on the partner event agenda's. Partner Event Flyers can be found near the registration table.

# USEFUL VOCABULARY



CHINESE COSTUMES  
CHI-PAO

NI ZHEN PIAO  
LIANG  
(YOU'RE SO  
BEAUTIFUL)

QING WEN GUGONG ZAI NA LI  
(WHERE IS THE FORBIDDEN  
CITY, PLEASE?)



XIE XIE NI!  
(THANK YOU)

## BEIJING FACTS!

### WHO'S YOUR NEIGHBOUR

**THE WATER CUBE:** AN AQUATICS CENTER THAT WAS BUILT ALONGSIDE BIRDS' NEST FOR THE SWIMMING COMPETITIONS OF THE 2008 SUMMER OLYMPICS.

**BIRDS' NEST:** THE STADIUM WAS DESIGNED FOR USE THROUGHOUT THE 2008 SUMMER OLYMPICS AND PARALYMPICS LOCATED IN THE OLYMPIC GREEN.



MY NEST



NIHAO  
(HOW ARE YOU)

THE WATER CUBE:  
COME TO SWIM  
DURING A BREAK!



## HIGHLIGHTS OF THE DAY!



HARD-WORKING BLONDE

SUNNY  
BIG  
BOY



## TOMORROW!

FLEGT RELATED  
SFM  
"KIDS TO FORESTS"  
FOREST CARBON  
MANAGEMENT AND  
MARKET TRADE

-----  
INFORMATION MARKET

-----  
AND

HAPPY HOUR BY  
TNC RAFT!

I SEND  
BEAUTIFUL  
VOICES TO  
U ON CALL



WHEN YOU  
SMILE, YOUR  
COMPUTER'S  
CRYING



## ASIA-PACIFIC FORESTRY WEEK 2011, BEIJING, CHINA

*Asia-Pacific Forestry Week attracted more than 750 participants from more than 45 countries. More than 70 partners supported Asia-Pacific Forestry Week organizing events and providing financial and in-kind contributions. Forty-five parallel events were organized by partners during Forestry Week, a few of which are summarized below.*

### **Reflection Workshop of the *Kids-to-Forests Initiative* in Asia and the Pacific**

In many countries, there is a lack of inspiring and comprehensive education for children about sustainable forest management (SFM) and diverse forest benefits, including ecosystem services. To address this educational deficiency and to expose younger generations to the multiple benefits of forests through hands-on learning experiences leading to a better understanding of SFM, in early 2011 the National Forest Programme Facility and FAO's Regional Office for Asia and the Pacific launched the *Kids-to-Forests* initiative in six countries of Asia and the Pacific, including Cambodia, China, Fiji, Lao PDR, Mongolia and the Philippines.

A Reflection Workshop was held on 8 November 2011, inviting representatives from the above six participating countries and other interested stakeholders to share experiences and lessons learnt from implementing country-level activities and discuss the way forward.

Country representatives presented reviews of each country's programme including recommendations for future improvement and follow-up, with particular focus on the following:

- establishment of a mechanism for building closer relationships between educators and forest managers in relation to sustainable forest management;
- identification of feasible approaches to include environmental and forestry issues in the education programs of primary and secondary schools in each country; and
- continuation and expansion of the *Kids-to-Forests* programme in the region and beyond through additional opportunities and funding sources.

With the active and enthusiastic participation of all participants, the discussions were very open and fruitful. The main recommendations can be summarized as follows:

- Develop training modules and materials to enhance capacity building (i.e., training-of-trainers programme), with special focus on school teachers in order to improve their understanding on forestry and forestry-related subjects;
- Summarize methodologies and approaches applied by each country in implementing *Kids-to-Forests* and develop modules for duplication in more countries and regions;
- Establish a regional network in which FAO and the NFP Facility can play a key role (e.g., a website, Regional Kids' Forum, etc.);
- Organize cross country and regional visits to learn from each other and share experiences;
- Increase public awareness on forestry and related issues by developing advocacy materials and translating existing FAO education materials into local languages so that they can reach more readers (e.g., *Natural Inquirer* magazine);
- Sustain forestry knowledge in the long term through curriculum development;
- Seek to get forestry included within the framework of existing curriculums (e.g., in Science) by motivating teachers and providing them with teaching materials;
- Expand the "*Kids-to-Forests Initiative*" into a "*Kids-to-Forests Movement*."



### **From Bali to Beijing: Lessons Learned and Remaining Challenges from a Decade of Work on Forest Law Enforcement and Governance in Asia and the Pacific**

The Asia Forest Partnership (AFP) Dialogue 2011 was themed ‘Bali+10: Looking back at the East Asia Ministerial Declaration on Forest Law Enforcement and Governance – and looking ahead to the next decade’. The dialogue aimed to bring together prominent representatives from governments, intergovernmental organizations, NGOs, academic institutions and the private sector in the Asia-Pacific region to exchange information and lessons learned from their 10 years of experience working with FLEGT. Another aim was to have participants discuss the magnitude of related issues, such as new perspectives on the importance of addressing climate change beyond forests, forest governance, and law enforcement.

The dialogue convened on 8-9 November 2011, as one of the Partner Events at the second Asia-Pacific Forestry Week, held in Beijing. It attracted around 200 participants representing key stakeholders from various forestry-related sectors, including governments, businesses, international organizations and NGOs.

Participants in the dialogue agreed that the new structure, which combined a variety of different formats, such as talk shows, plenary sessions, breakout groups and interactive discussions, succeeded in capturing new ideas and valuable input on the following important issues:

- trade dynamics;
- market incentives;
- corruption;

- illegal logging, timber legality and timber trade issues in the context of consumer, producer and transformer countries; and
- lessons learned from REDD+ implementation in Asian countries.

### **Pacific Islands Expert Panel on Challenges and Opportunities in the Region**

The Pacific Island Countries (PICs) attending the 24th Session of the Asia-Pacific Forestry Commission (APFC) included the following: Fiji, Kiribati, Papua New Guinea, Solomon Islands, Tonga, Samoa and Vanuatu. To take advantage of the opportunities provided by such a well attended regional forum, the PICs organized an Expert Panel Meeting. Each country, in line with the meeting’s theme, “New Challenges - New Opportunities”, presented the developments, progress and potential areas for collaboration and investment in their respective countries.

At the regional level, forests are still recognized for their social, cultural, economic and environment significance and contributions. A principal role of forests now being strongly advocated is in climate change mitigation and adaptation. This role can be more effective and contribute to reducing the level of deforestation and forest degradation now experienced in many countries, particularly in the larger island countries with formal forestry sectors. The materialization of financial mechanisms and tools now available to countries under processes such REDD/REDD+ provide real opportunities for countries to safeguard and sustainably manage their forests and forestry development. For small and medium size islands such as Kiribati, Samoa, Tonga and Vanuatu, protection of trees and forests alone is critical for safeguarding the environment – in particular, the fragile island ecosystems.

Experiences across the Pacific islands indicate that despite a host of issues and challenges ranging from lack of funds, poor policy formulation and implementation, weak institutions, and lack of political will, there are still positive lessons that can be learnt and built on for successful forestry development. In Fiji, with a total wood-based export value of USD 28 million in 2010, over

60% of this contribution originates from the mahogany and pine plantations. In Solomon Islands, 1,583 small holders successfully planted 14,000 ha of high-quality seedlings of teak, mahogany and gmelina. Thirty-five percent of these small woodlots are now more than 20 years old, which at harvest time would fetch substantial amount of cash for the local communities and generate other economic benefits.

In PNG, one initiative to note is the recognition of the rights of customary land owners within the Forestry Act in PNG. The formation of the Forest Management Agreements (FMA) and Incorporated Landowner Groups (ILGs) has established mechanisms for the meaningful involvement of landowners.

A topic of common interest which was raised and passionately discussed in the meeting was the success of smallholder tree farms in Solomon Islands and Vanuatu. In Vanuatu, sandalwood (*Santalum austrocaledonicum*) is native to the country and the export of the wood and oil have been a lucrative business for local entrepreneurs. Replanting sandalwood is now totally the domain of smallholder tree farmers with a decreasing role of Government in providing inputs, incentives and promoting the fast-growing, high value species. Over the last 10 years, with the best provenances of sandalwood identified in terms of oil content, the high demand for seedlings has seen growth in private nurseries and areas planted as well as creation of new markets for different products and services run by small-scale, forest-based entrepreneurs. The Solomon Islands experience in smallholder farmers growing teak, mahogany and gmelina is similar to the Vanuatu experience; however, it differs in that in the Solomon Islands, the Government subsidizes the tree planting through provision of seedlings and a small amount cash (around US\$400) per farmer.

Countries in the region could improve their forest management practices if success stories from the countries were published and the experiences gained more widely adopted and adapted. The key question of what makes the smallholder tree farms in Vanuatu and Solomon Islands successful compared to similar schemes in other Pacific Island Countries is critical. Likewise, the positive

experiences of Fiji and PNG and other island countries should be analyzed to determine what is needed for countries to achieve sustainable management of forest and tree resources.

The meeting recognized and recommended the following actions:

- Land-use planning is critical and governments must carry this out at the national level – the high conversion rate of forest lands to other land uses is threatening the existence of all kinds of forests and biodiversity;
- Countries must reduce the rate of deforestation and forest degradation through good forest governance and engage in emerging financial mechanisms and management tools like the REDD/REDD+ processes;
- Empowering and building the capacities of landowners to fully understand and engage in forest decision-making processes and activities is vital for the success of the forestry sector;
- An appropriate level of assistance and incentives must be given to smallholder farmers to increase their participation in tree planting, growing forests and creating wealth to support sustainable livelihoods;
- Countries should focus on fast-growing, high-value species – research should be carried out to test and identify the best planting materials;
- Forest certification is important and can be used to bring other benefits – countries are urged to use existing recognized international standards or develop national standards that can be recognized by an international certifying body;
- Downstream processing and value-added are important for a maintaining a viable and contributing forestry sector – countries must prepare and organize policies and incentives for smooth transition and implementation;
- Protection and conservation of tree and forest resources is important and efforts must be made to recognize the different roles forests play;
- To complement the success of smallholder tree farmers in some countries, time and appropriate resources must be invested in developing products, markets and capacities of tree farmers to fully understand and participate in markets.

## REDD+

The UN-REDD Programme and USAID's Lowering Emissions in Asia's Forests (LEAF) Programme co-hosted the REDD+ Partner Event. The event provided a platform for APFW delegates to share and discuss experiences and opinions on Reducing Emissions from Deforestation and Forest Degradation (REDD+), one of the most significant international initiatives in forest policy to emerge in recent years.

Despite the social, economic and environmental benefits forests bring to millions of people throughout the Asia-Pacific region, they continue to be destroyed and degraded at an alarming rate. Although many forest sector stakeholders view REDD+ as an opportunity to reduce emissions while improving forest management, this is no easy task. Several challenges remain and risks need to be managed and openly discussed.

The REDD+ Partner Event offered an opportunity for such open discussion through presentations from three of the region's most experienced commentators on REDD+: Ibu Nur Masripatin, the Government of Indonesia's REDD+ focal point; Amanda Bradley of PACT, technical adviser to the REDD+ project in Oddar Meanchay, Cambodia; and Marlea Muñoz of CoDeREDD, the alliance of civil society organizations that is a leading force behind the Philippines National REDD+ Strategy. The presentations were followed by a panel discussion involving David Ganz of LEAF, Thomas Enters of UN-REDD, Regan Suzuki of REDD-net and Hiroki Miyazono of JICA, with numerous contributions from the floor.

The discussions elicited several lessons regarding the opportunities, challenges and risks of REDD+ in the Asia-Pacific region. In terms of opportunities, the involvement of the private sector was repeatedly highlighted. Not only does REDD+ present the opportunity for addressing private sector activities as key drivers of deforestation and degradation, it also encourages private investment through corporate social responsibility and, potentially, carbon trading. REDD+ also offers an opportunity to scale up the lessons on effective benefit distribution systems from decades of experience in community-based forest management, and to use the numerous existing regional partnerships and platforms on forestry policy

and practice (particularly social forestry) to facilitate effective sharing of these lessons.

Among the key challenges to effective implementation of REDD+ in the region, creating viable incentives to change the behavior of all forest sector stakeholders is perhaps the most significant. This will require the bundling of other ecosystem services, beyond carbon, into REDD+ incentive schemes. Stakeholders will consider these other services when calculating the opportunity costs of REDD+, even though REDD+ does not explicitly cover these costs. Furthermore, REDD+ once again brings the challenge of gender integration in forestry policy and practice to the fore, as well as other issues of social exclusion in forest sector decision-making. There is also a flip side to the opportunity to engage with the private sector, mentioned above; the challenge of building and retaining the trust of investors who require short-term returns and accurate assessments of the risk of project failure. Another set of challenges arises from the expectations heaped on REDD+. The donor community, in particular, must ensure that resources continue to be directed towards basic infrastructure and skills development and governance reform while maintaining countries' potential for additional improvement in forest policies and measures, and thus their eligibility to benefit from REDD+ finance.

Many of the risks of REDD+, as discussed during the event, are intricately linked with the challenges described above. However, one particularly significant risk for this region is the potential for REDD+ to draw funding and expertise away from climate change adaptation efforts, and in particular from the potential of the forest sector to contribute to these efforts. For most countries in the region, there is greater practical and political need for achievement of adaptation-related goals, rather than mitigation. There is also a risk that REDD+ is initiated without a thorough appreciation of the capacity building requirements, which would lead to failure. On a more fundamental level, there is a risk of getting the incentives wrong, in particular through failing to account for some key stakeholders, and thus for REDD+ strategies to actually exacerbate deforestation and degradation rather than reduce it.

### Food Chain and Nutrition Issues in Forestry

The Partner Event “Food chain and nutrition issues in forestry” provided an opportunity to raise awareness and build consensus among the participants on the value and contribution of forestry to dietary diversity, health and nutrition by sharing experiences and learning lessons for effective policy and programme planning and evidence-based research. It also highlighted key components of the link between forest biodiversity and the viability of contemporary food systems.

Sixty participants, experts from the fields of agricultural and rural development, environment, food and nutrition security, attended the event. Panel presenters from selected institutions highlighted key elements drawing on case studies and lessons learned. Showcased were best practices in enabling and promoting multi-stakeholder participation in institutions and mechanisms at national and regional levels contributing to conservation and sustainable use of forest resources for improving food and nutrition security. These experiences provide inspiration for the countries in the region that can serve as an inventory of best practices to promote sustainable use and conservation of forest resources for nutritional security.

It was evident that the knowledge about the state of edible forest plants, as source of foods that supplement and complement what is obtained from agriculture and how these contribute to nutritional improvements, is very limited and more advocacy work is needed. There is need for a review of the role of forest resources in food systems, focusing on dietary changes and diversity-based strategies for improving nutrition.

Research on indigenous forestry food plants requires correct taxonomic identification, chemical analysis, and nutritional data. The research institutes presented research results focusing on enhancing the knowledge base on traditional foods: knowledge of the foods that are part of the traditional food systems is imperative.

There is evidence that indigenous communities recognize the health and nutritional benefits of some of the edible forest products that are part of their traditional food systems. They are well aware of cultivar specific differences in agronomic and dietary attributes, and they often describe certain cultivars or indigenous varieties as having particular nutritional or therapeutic value. This indigenous/traditional knowledge must be preserved and documented and made accessible to those developing food security and nutrition interventions and policies.

## FAO ASIA-PACIFIC FORESTRY CALENDAR

14-16 May 2012. *Workshop on climate change adaptation and agricultural investment in East Asia and the Pacific*. Bangkok, Thailand. Contact: Beau Damen, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; E-mail: [Beau.Damen@fao.org](mailto:Beau.Damen@fao.org)

31 May - 2 June 2012. *Regional workshop on underutilized food*. Khon Kaen, Thailand. Contact: Patrick Durst, Senior Forestry Officer, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; E-mail: [Patrick.Durst@fao.org](mailto:Patrick.Durst@fao.org)

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

- East Asian forests and forestry to 2020 (RAP Publication 2010/15)
- Forests beneath the grass: Proceedings of the regional workshop on advancing the application of assisted natural regeneration for effective low-cost forest restoration (RAP Publication 2010/11)
- Forest policies, legislation and institutions in Asia and the Pacific: Trends and emerging needs for 2020 (RAP Publication 2010/10)
- Report of the Asia-Pacific Forestry Commission Twenty-third session (RAP Publication 2010/09)
- Asia-Pacific forests and forestry to 2020. Asia-Pacific Forestry Sector Outlook Study II (RAP Publication 2010/06)
- Forest law enforcement and governance: Progress in Asia and the Pacific (RAP Publication 2010/05)
- Forest insects as food: humans bite back. Proceedings of a workshop on Asia-Pacific resources and their potential for development (RAP Publication 2010/02)
- Strategies and financial mechanisms for sustainable use and conservation of forests: experiences from Latin America and Asia (RAP Publication 2009/21)
- Asia-Pacific Forestry Week: Forestry in a changing world (RAP Publication 2009/04)
- The future of forests: Proceedings of an international conference on the outlook for Asia-Pacific forests to 2020 (RAP Publication 2009/03)
- Re-inventing forestry agencies. Experiences of institutional restructuring in Asia and the Pacific (RAP Publication 2008/05)
- Forest faces. Hopes and regrets in Philippine forestry (RAP Publication 2008/04)
- Reaching consensus. Multi-stakeholder processes in forestry: experiences from the Asia-Pacific region (RAP Publication 2007/31)
- Trees and shrubs of Maldives: An illustrated field guide (RAP Publication 2007/12)
- A cut for the poor: Proceedings of the International Conference on Managing Forests for Poverty Reduction Capturing Opportunities in Forest Harvesting and Wood Processing for the Benefit of the Poor (RAP Publication 2007/09)
- Trees and shrubs of the Maldives (RAP Publication 2007/12)
- Developing an Asia-Pacific strategy for forest invasive species: The coconut beetle problem – bridging agriculture and forestry (RAP Publication 2007/02)
- The role of coastal forests in the mitigation of tsunami impacts (RAP Publication 2007/01)
- Taking stock: Assessing progress in developing and implementing codes of practice for forest harvesting in ASEAN member countries (RAP Publication 2006/10)
- 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)
- Forests and floods – drowning in fiction or thriving on facts? (RAP Publication 2005/03)
- In search of excellence: exemplary forest management in Asia and the Pacific (RAP Publication 2005/02)
- What does it take? The role of incentives in forest plantation development in Asia and the Pacific (RAP Publication 2004/27)
- Advancing assisted natural regeneration (ANR) in Asia and the Pacific (RAP Publication 2003/19) - 2nd edition
- 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)
- Applying reduced impact logging to advance sustainable forest management (RAP Publication: 2002/14)
- Trash or treasure? Logging and mill residues in Asia-Pacific (RAP Publication: 2001/16)
- Regional training strategy: supporting the implementation of the Code of Practice for forest harvesting in Asia-Pacific (RAP Publication: 2001/15)
- Forest out of bounds: impacts and effectiveness of logging bans in natural forests in Asia-Pacific: executive summary (RAP Publication: 2001/10)
- Trees commonly cultivated in Southeast Asia: an illustrated field guide - 2nd edition (RAP Publication: 1999/13)

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