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Featuring

FOREST NEWS

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FOREST NEWS

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

Front cover: Young Black Eagle in its nest, high up on the wild mango tree (Photo courtesy of Madhava Meegaskumbura)

OBSERVATIONS OF BLACK EAGLE (Ictinaetus malayensis) NESTING IN SRI LANKA

by Pradeep Samarawickrama, Krishan Ariyasiri, Udeni Menike, Niroshan Samarasingha & Madhava Meegaskumbura

A Black Eagle perched close to its nest, though it is generally understood that these eagles rarely perch, the authors observed one bird sitting for nearly 50 minutes (Photo courtesy of Krishan Ariyasiri)

Observing a perched Black Eagle is considered to be a rare occurrence; even one of Sri Lanka's greatest ornithologists, G. M. Henry, never observed one perched. But its slow and elegant flight has caught the attention of many naturalists, including that of Henry's. In his article to the *Journal Nature*, more than a half a century back, he noted, "I have never seen it perched, and the feature of its flight that has particularly struck me is the slowness with which it can sail without any wing-flapping, even when it finds itself in a deep pocket among the trees where it would seem inevitable that it must either crash or extricate itself by flapping flight. It seems to be able to avoid stalling even at what appears little more than walking pace, and certainly at very low speeds." (Henry, 1933).

But it wasn't the unusual slowness of flight that led us to the discovery of a Black Eagle nest, but rather a piece of nesting material from one of its favorite prey items, the squirrel. In February 2010, three of us initially noticed the fluffy material from the inner linings of a squirrel nest hanging from a tree, while hiking in Gannoruwa forest reserve in Kandy. Pradeep's previous experience in observing many raptor nests alerted his senses – when the squirrel nesting material splayed across a branch was discovered – to the possibility of a raptor nesting close by. Confirming his hunch, upon closer scrutiny he discovered an eagle nest about 10m above where the squirrel nesting material lay.

A nest, containing a single fairly well developed young eagle was located towards the top of a tall tree (*Mangifera zeylanica*), a tall, endemic and threatened Sri Lankan wild mango tree species, located within Gannoruwa forest reserve, Peradeniya, Sri Lanka. This was well within the wet-

zone, an area which gets over 2000 mm of annual rain, at an altitude of about 800 m. On the tree the nest was ensconced just below the canopy. Two sides of the crown were more or less open, determining the direction of the flight path. As is the usual case, the parents used the north-facing gap to arrive at the nest and the east-facing gap to leave the nest. Directly above the nest was also a smaller opening, which the parents used to descend vertically in an emergency.

Emergencies were few and far between and we observed them using the emergency entrance only once, when a group of Torque Macaques (*Macaca sinica*) – generally considered a nest predator of small birds – came to the vicinity of the nest. The alpha male climbed up close to the nest and shook one of the branches, to which the young Black Eagle responded by puffing up its feathers and giving an alarm call. This was followed up by the rapid arrival of the parents, descending vertically. The macaques dispersed quickly and hid well within the undergrowth of the forest until the eagle parents withdrew from the vicinity of the nest. Gunawardena (2001), also noted Black Eagles chasing a different species of monkey, the Purple-faced Leaf Monkey (*Trachypithecus vetulu*s).

Black Eagles also defend their nests against other raptor species. During our period of observation, we saw them attacking a White-bellied Sea Eagle, in flight.

Sometimes we observed one of the parents sitting on nearby trees for long periods; on one occasion for as long as fifty minutes. These long perch times were rather surprising for a bird species that almost never perches. This leads us to speculate that these eagles only perch close to their aerie. So if you see a perched Black Eagle, perhaps it would make sense to scrutinize the area for a nest.

The wild mango tree was mostly covered by *Drynaria quercifolia*, an ephiphytic fern that has a wide distribution from Southeast Asia to Sri Lanka. Their luxuriant growth right around the trunk is an indication that large mammals, including humans, have not been climbing/using this tree for sometime, as climbing would cause the ferns to fall off. For the eagle young, the selection of such trees by their parents may have survival

A Torque monkey (Macaca sinica), a nest predator of birds. (Photo courtesy of Madhava Meegaskumbura)

significance. It would be useful to note if these ephiphytes are also observed on trees that have other raptor nests. The presence of *Drynaria* (or other epiphytes) would also camouflage the nest and perhaps also facilitate the positioning of the nesting material on the large branches on which the nest is built.

A single nest site of a Black Eagle had been located prior to this, in Dolukanda forest reserve, Kurunegala, in the intermediate zone, an area that gets less rain than Gannoruwa and located at a lower elevation (Fernando *et al.*, 2001). Observations were carried out (Gunawardena, 2002) at the same site. Observations were made from November to February, over three months, from an estimated incubation time of 35-40 days and a further 60 days for successful development to a juvenile capable of flight.

We only discovered the nest that we observed in Gannoruwa when the juvenile had almost reached the flight-capable stage. We made five trips to the nest over 12 days, observing from dawn till dusk. The nest was a large stage that lacked a well-defined brim, measuring about 1m in width and 0.5 m in height, made of branches and twigs. In these characteristics, the nest was very similar to those observed at Dolukanda.

During our periods of observation, we did not observe parents bringing in fresh green foliage to the nest, but we noticed some older green foliage that may have been placed a few days before,

lying within the nest. Many raptors line their nests with green foliage, including the nest observed at Dolukanda. Presumably, the absence of fresh green foliage at the Gannoruwa nesting site would have been due to the fact that the juvenile eagle was about to leave the nest.

It appears that the Black Eagle breeding season is towards the end of the year, as the young eagle left the nest in early February 2010. Presumably, if it is assumed that the Gannoruwa population had the same developmental period as the Dolukanda population, the Gannoruwa birds would also have initiated breeding in November.

We were not fortunate enough to see into the nest as it was about 15m above us, but the growing eagle was large enough to be seen from this angle. Nevertheless, to investigate the prey items that were brought into the nest, one of us had to climb a nearby tree that was covered with lianas (which camouflaged it from the eagles, and hence acted as a natural hide), and this tree was located 75 m away from the nest. A spotting-scope was set up on one of the branches.

We concur with Gunawardena's observation that these eagles mostly prey on small mammals, and not eggs and nestlings of other birds, as suggested by some. Most of the prey items that were seen at Gannoruwa were Palm Squirrels (*Funambulus palmarum*), a wide-ranging squirrel also found in India, and a common rat species (*Rattus rattus*). In contrast to the Dolukanda observation, we did not observe Giant Squirrel (*Ratoufa macroura*) being preyed upon. This is mainly because Giant Squirrel is not very abundant in forests in this region, being only recently introduced to the area. We also observed that the parents feed on the remnants of the food items that were fed to the young, and nothing was wasted.

We have observed that *Rattus rattus* also nests within abandoned squirrel nests, even in South India. So rats may be an inadvertent part of the diet when Black Eagles hunt for squirrels. Squirrel nests are usually built on top of trees, using dead material that stands out against the background. Since the Black Eagle's flight is slow and controlled, this would enable them to skim and scrutinize the tree-tops, helping them to target squirrel nests with accuracy. It seems that evidence is mounting to highlight the fact that Black Eagle is a top squirrel predator.

It is difficult to determine whether the squirrel nests are transported to the nest as additional nesting material to line the nest, or to extract immature squirrels within the nest, or both.

We also observed that the young eagle had a curious behavior when it defecated. It usually

The nest, with Drynaria growing on the Mangifera zeylanica tree. (Photo courtesy of Pradeep Samarawickrama)

moved towards the edge of the nest, raised its vent above its head and forcefully sprayed out the fecal matter, often towards the direction of the steepest slope, well away from the nest. The absence of a well-defined brim to the nest perhaps helps this behavior. This action would help keep the nest clean. We are not sure how the nest was kept clean during the early stages of development, but lining the nest with foliage, as most raptors do, would presumably help keep it clean.

The young bird left the nest on February 17, 2010. This was after much preparation for flight, not only by the young eagle but also with encouragement by the parents over several days. Rapid flapping by the young bird started about seven days prior to flying; sometimes precariously holding on to the edge of the nest. The parents reduced the amount of food that they brought to the nest, making only 1-3 daily visits. However, they could be heard and be seen around the nest, calling wildly as they approached the nest and leaving it.

On the day that the young eagle left the nest, one of the parents perched on a nearby tree for about 45 minutes while the other circled the nest with a food item dangling from its claws; both were calling periodically. The young eagle, after much stretching, flapping, and head bobbing, jumped out of the nest onto a branch about 1m above the nest. It then remained on this branch for about two hours, stretching its wings, flapping vigorously several times. Finally it jumped onto a thicker branch momentarily and took flight, mostly gliding off into the distance, to be lost to our sight. Once the young eagle left the nest, the family remained in the vicinity of the nest for the next two weeks, but never really came back to the nest.

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One of the parent eagles bringing a rat to its nest. (Photo courtesy of Niroshan Samarasingha)

ACCOMODATION OF AQUACULTURE AND CONSERVATION TOGETHER: EXAMPLE FROM COMMUNITY-BASED AQUACULTURE IN SEASONALLY WATERLOGGED AREAS OF NOAKHALI, BANGLADESH

by A.K.M. Ruhul Amin Sarker

Introduction

Aquaculture is one of the fast-growing sectors in Bangladesh and it contributes largely to employment and earning, nutritional supplements, booming fish production and export markets. Although aquaculture contributes a lot to economic growth and healthy diets in Bangladesh, there are some contradictions among the experts, scientists and policy makers about some forms of aquaculture. Some people view aquaculture as being contrary to fish conservation, especially aquaculture in the natural floodlands. In this regard, this study can be an example of how small indigenous fish species conservation can be achieved simultaneously with aquaculture through proper planning and management. About 22,186 ha of seasonally waterlogged paddy lands (locally called hator) in 294 polygons were identified in Begumgonj Upazila of Noakhali District, which remain unutilized for about 6 months a year from May to October (Sarker, 2005; Das & Hossain, 2005; Das *et al*., 2009; Hossain, 2009). The regular flooding means that there are few alternative livelihood opportunities available and many poor people have been forced to move out from their villages to seek alternative employment as day laborers or in such occupations as rickshaw/ van pulling (three-wheeled manually driven transport). This situation has led the people in the surrounding area to live at the marginal level, always fighting for their daily needs. However, a number of studies were conducted to determine whether the area is suitable for prawn farming (Karim, 1989; Alam 2001) and what the impacts of prawn stocking would be on biodiversity and local livelihoods (Chowdhury *et al.,* 2003) in the hator, thus supporting the dietary protein requirements (Das, *et al.,* 2009; Hossain, 2009; Sarker, 2004) of the rural people. Thus the conservation of small indigenous species (SIS) by a community-based aquaculture approach in the underutilized waterlogged areas was considered. One hator was selected for community-based aquaculture involving 11 households based on rain fed water. The hator has 4 ponds, where brood stocks of SIS are conserved as ready spawners for the subsequent monsoon. Culture period was about 6 months without supplementary feed. The harvested fishes were sold at nearby markets, earning a total value of Tk.171,778 (US$2,454). A considerable part of the SIS were left to build the next year's self-recruitment and for conservation. The possibilities for replication and expansion of community-based aquaculture approaches in other seasonal waterlogged areas may attract industries depending on the outcome and conservation results. Thus, alternative income options will be available for the local people who remain jobless during rainy season and will also support SIS conservation. Such an example could be a milestone for implementing the conservation of small indigenous fish species, besides having promising benefits from the culture outputs. Bangladesh has huge seasonal floodlands where this management can act as a good way to support conservation and aquaculture together.

Materials and methods

Data collection and analysis

Both qualitative and quantitative data were collected for this study. Qualitative data were collected through different participatory approaches, e.g., focus group discussions (FGD),

participatory observation and key informant interviews. The focus group discussions were conducted by forming small groups of 3-5 community members purposefully selected to address a specific topic (Sarker, 2010; Saint-Germain *et al*, 1993; Fraser *et al.*, 1998; Neogi, 2001). Participatory Rural Appraisal (PRA) was used for different observations and group meetings in the community (Pido, 1995; Pido *et al.*, 1996; Townsley, 1996; and IIRR, 1998) to obtain detailed information about the community-based aquaculture and available resources that applied to the farming systems in hator. Quantitative data were collected from maintaining notes in site visits, farm record books and secondary data from the GNAEP-DANIDA project. Data were included for each and every stage of aquaculture and conservation. Error checking and other necessary corrections were made before executions of the data. Different analyses like graphs, simple tables and diagrams were accomplished by MS Word, MS Excel or Spreadsheet.

Results and discussion

Study area

Begumgonj upazila of Noakhali district is located in the south-western part of Bangladesh, along the northeastern coast of the Bay of Bengal (Figure 1.A) between latitudes 22°50′ and 23°05′ N and longitudes 90°00′ and 91°10′E. This upazila is surrounded by Chatkhil and Senbag upazilas of Noakhali district to the north, parts of Senbag and Feni and Laxmipur Sadar to the east and by Noakhali Sadar and Companygonj upazila of Noakhali district to the south (Figure 1.A & B).

Hator selection

The seasonal waterlogged areas of Begumgonj have varying depths that support multitudes of aquatic flora and fauna (Das, *et al.*, 2009). Among these waterlogged areas, a polygon of 4.5 ha in area was selected for community-based aquaculture which was located in the Ekhlashpur Union of Begumgonj Upazila (Figure 1.C). In the selected hator, there were four ponds of 0.1 ha which were utilized as the SIS brood stock ponds in the dry season (Figure 2). In case of severe water/rain shortage in the dry season (February-May), water was supplied from the paddy irrigation systems by making drains to the ponds.

Community-based aquaculture in Hator

Community members were selected on the basis of having lands in the selected hator, from living in neighboring residence of the hator, having the capability of minimum investment, and people who showed interest in processing the thrust of extra income while preserving conservation objectives in the unutilized hator. A team leader and cashier were selected, and different duties were then delegated. Community members proposed democratic methods to solve any kind of problems raised during the farming period.

In the selected hator there were some ponds and plots of lands owned by outsiders. The ponds within the hator were leased and they offered the plot owners to prepare their lands by trilling before the subsequent paddy farming season. They also promised to give the land owners fish during the harvesting period of the hator. The ponds were quickly prepared for fry/fingerling stocking as well as good support for self recruitment of SIS in the subsequent season. After the fingerlings were stocked in ponds for nursing, they renovated and prepared the hator. In the subsequent monsoon, the hator was fed by the rain water gradually and the whole hator appeared as a single ecosystem and the fingerlings started spreading throughout the hator. Natural precipitation acted as a spawning stimuli for the previously stored SIS brood. Additionally, some white prawns were also stocked depending on the availability in the nearby hatchery.

Feeding was done only in the ponds (nursing) where they stocked the fry or fingerlings which would become juveniles by the time the monsoon started. Some locally available low cost ingredients like mustard oil cake (30%), chewa shutki- goby fish meal (10%), wheat bran (20%), rice polish (30%), wheat flour (8%) and molasses 2%) were used to prepare the feed. A local machine previously owned by one of the community members was used to prepare the feed.

For bigger fishes in the farming stage, they just used fertilizer, cow dung and chicken/poultry

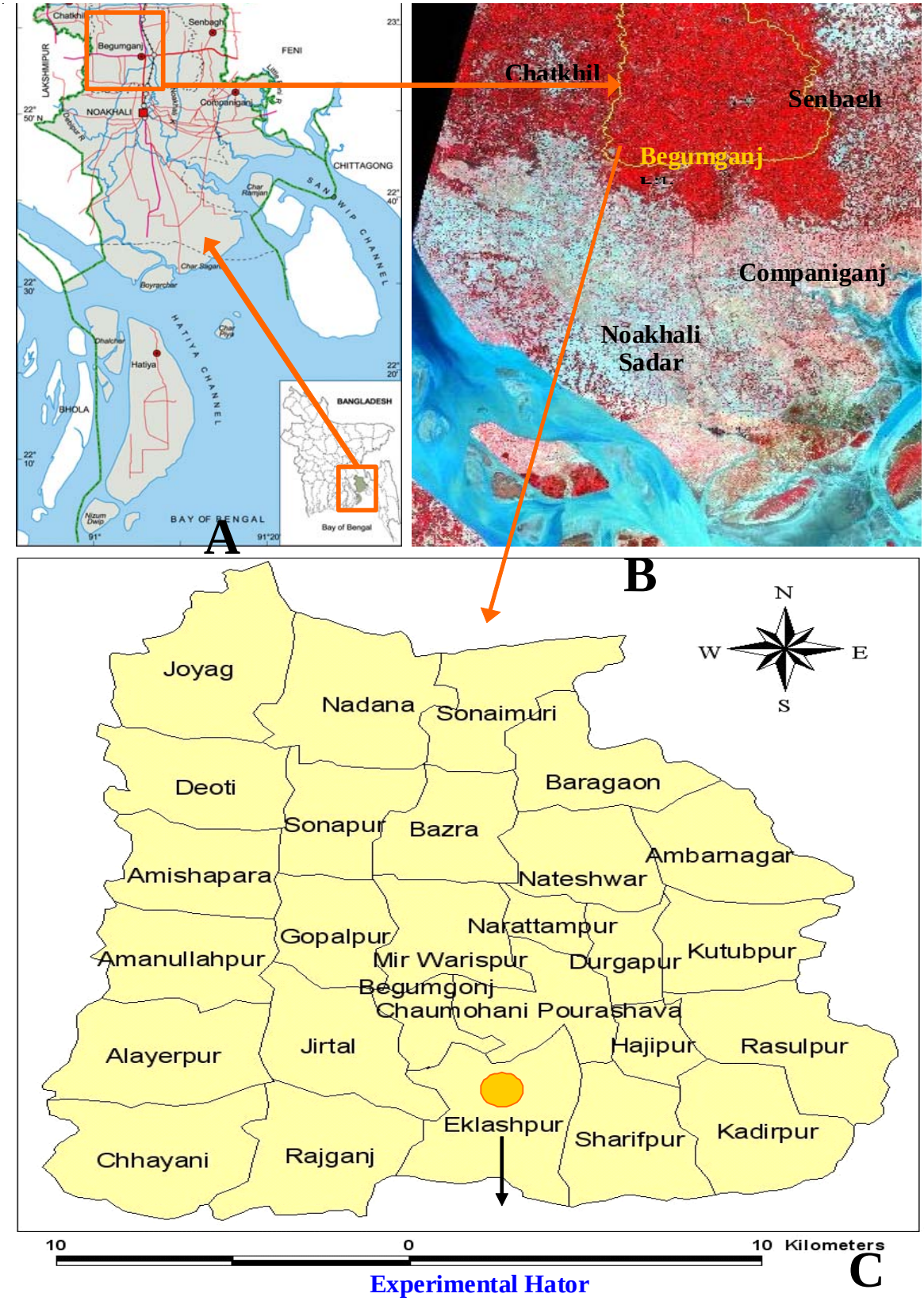

Figure 1: (A) Location of Noakhali District (Banglapedia 2004), (B) Upazilas of Noakhali district in satellite map (Sarker, 2005) & (C) Union boundaries and study site in the Begumganj Upazila (Sarker, 2005).

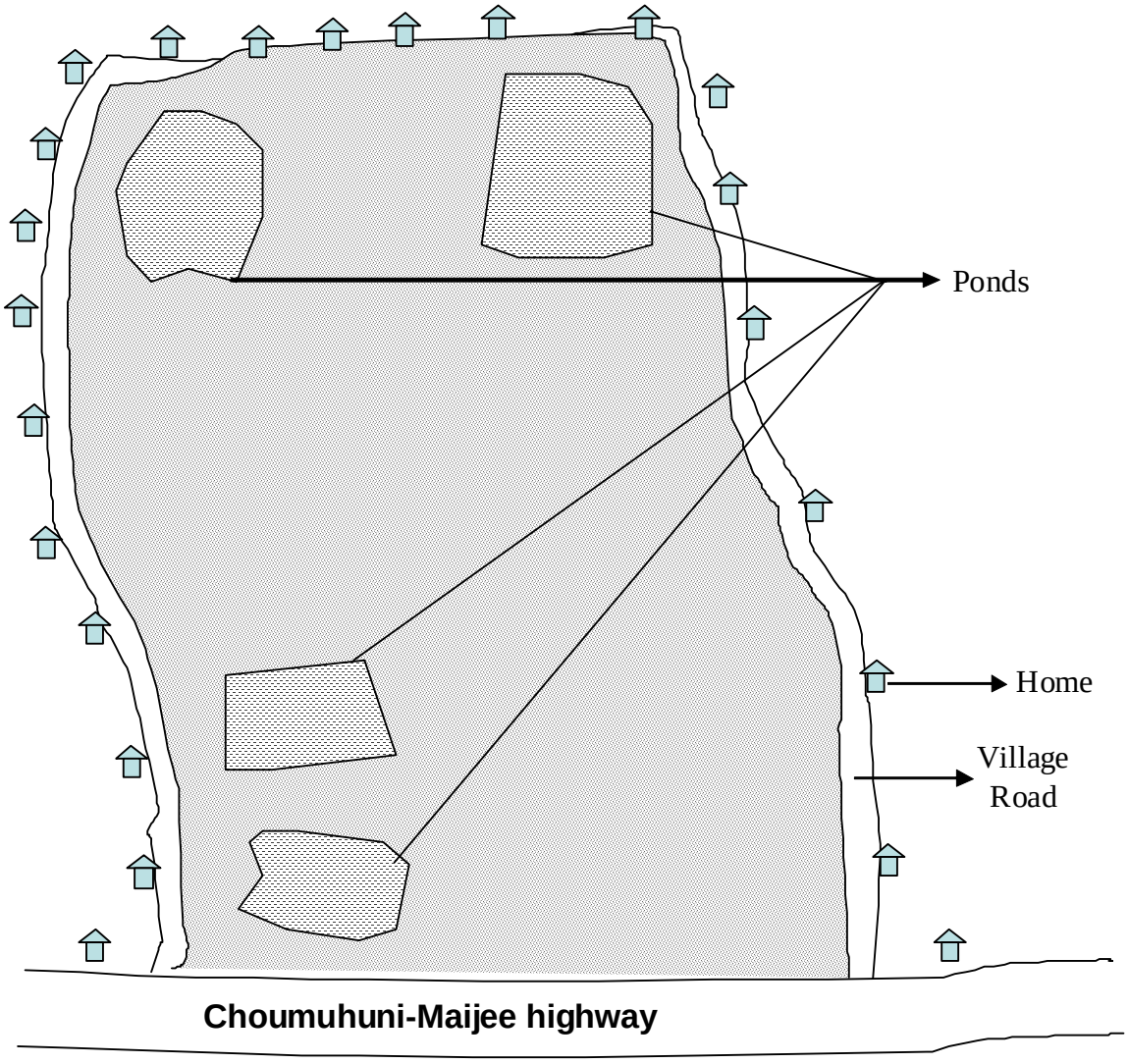

Figure 2: Experimental hator with pond locations for SIS conservation

manure to increase the primary productivity. In the culture phase, the fish mainly fed on plankton, periphyton and different aquatic/benthic plants and animals. A partial harvesting method was followed in the hator which mainly involved dewatering or pumping water manually in the upper portion and netting in the deeper portion (ponds) of the hator with the aim of conservation of SIS. Harvested fishes were sold in the fish *arot* (fish selling broker house), whereas a part was used for household consumption and gifts to the land owners of the hator. All the tasks were mainly conducted by the combined approach of the community members. A number of SIS were found during the harvesting (Table 1) and a considerable amount of them were left for the next year's self recruitment.

Economic return and marketing network

The marketing network for the whole production system from fry collection to the consumer's hand was studied. Hator farmers stocked about 27 fishes/ decimal (different carps mainly) along with the self-recruited SIS and the cost of the each stocked fry was about 0.98Tk. Harvesting was completed by late November before the paddy cultivation season and the same land was used for paddy cultivation. Total production was about 2,850 kg, where 1,795 kg (61%) and 1,055 kg (31%) were stocked fish and self-recruited SIS respectively. The net profit from the 4.5 hector was calculated to be about Tk.120,113 which was very promising. This value was found without calculating the labour cost, arot commission, land trilling cost (end of farming) or the bank interest. It should be mentioned here that the farmers run the whole farming system as their part time work after doing their primary jobs like shopkeeping, service in the GO/NGO offices or agricultural activities.

Aquaculture Action Plan

An Action Plan was made to summarize the activities to be carried out in a specific time frame during the year to make the community-based aquaculture successful in the waterlogged area while preserving the conservation idea. The plan was made for the community-based farmers or for any central organization that was to engage in aquaculture in the waterlogged area. It included five main steps with time frames, namely: 1) hator selection; 2) community motivation; 3) budgeting; 4) activities; and 5) monitoring, which further consisted of a number of sub-steps or activities. Regular meetings and updating knowledge, experience-sharing workshops, a central hator workshop, and rewards were proposed to build awareness for the other farmers who were not involved in community-based farming, especially about the conservation ideas.

Discussion

Aquaculture in a huge water body is not such an easy task that can be managed by a single hand, as the waterlogged areas were found to be bigger than the other forms of aquaculture. A community-based aquaculture approach was found to be an effective means in terms of economic return and conservation. In this study, an extensive method of aquaculture was applied which could be further developed by intensification for better outputs. Sometimes, in the absence of any small indigenous species in a specific hator, community people can collect them from other areas and thus enrich their SIS collection. However, as a better management approach: hator preparation, species selection (stock and self recruitment), water management and restocking SIS were the main tasks for successful farming. Carnivores and predatory species should be avoided considering the SIS conservation and self-recruitment for next year's farming. A shorter marketing network was an advantage for better prices and prior communication with the fish trader or *Arotder* could be more helpful for better prices and hassle-free selling. The net benefit was found to be excellent, which indicated a very good return on investment (ROI) from small enterprises for poor people with small investment.

Conclusion

In conclusion, it can be said that community-based aquaculture was found to give promising outputs in the underutilized waterlogged areas with minimum or locally available resources and is a convenient method for income generation. Depending on the local cultural practices, it can be said that there is great scope for considering conservation and economic outputs together. In order to reach a broader audience across the whole

Table 1: Different Small Indigenous Fish Species found at harvesting the hator

Local Name	English Name	Scientific Name
Aiir	Long-whiskered catfish	*Mystus aor*
Bailla	Tank goby	*Glossogobius giuris*
Bheda (veda)	Gangetic leaffish	*Nandus nandus*
Boal	Wallago	*Wallagonia attu*
Boicha	Thick lipped gourami	*Colisa labiosa*
Boro baim	Zig-zag eel	*Mastacembelus armatus*
Chela	Large razorbelly minnow	*Oxygaster bacaila*
Chimta Kakra	Crabs	*Potamon martensi*
Chola puti	Swamp barb	*Puntius chola*
Darke	Slender rasbora	*Rasbora daniconius*
Foli	Bronze feather back	*Notopterus notopterus*
Guli tengra	Long whiskered catfish	*Mystus golio*
Gura Icha	Unknown	*Leander styliferus*
Guti baim	Barred spiny eel	*Mastacembelus pancalus*
Gutum	Guntea loach	*Lepidocephalus guntea*
Jati Puti	Pool barb	*Puntius sophore*
Kakila	Freshwater needle fish	*Xenentodon cancila*
Kalo telapia	Mozambique tilapia	*Oreochromis mossabicus*
Kata Chanda	Himalayan glassy perchlet	*Chanda baculis*
Kata Kakra	Crabs	*Paratelphusa spinigera*
Kholisha	Banded gourami	*Colisa fasciatus*
Koi	Climbing perch	*Anabas testudineus*
Kuccha	Cuchia	*Cuchia cuchia*
Lal Chanda	Indian glassy fish	*Chanda ranga*
Magur	Walking Catfish	*Clarias batrachus*
Mola	Mola carplet	*Amblypharoyngodon mola*
Shing	Stinging catfish	*Heteropneustes fossilis*
Shol	Striped snakehead	*Channa striatus*
Soto bain	Barred spiny eel	*Macrognathus pancalus*
Sundi Kasim	Turtle	*Lissemys punctata*
Taki	Spotted snakehead	*Channa punctatus*
Tara baim	Lesser spiny eel	*Macrognathus aculeatus*
Telo Taki-Cheng	Walking snakehead	*Channa orientalis*
Tengra	Striped dwarf catfish	*Mystus vittatus*
Tepa	Ocellated pufferfish	*Tetraodon cutcutia*
Tit Puti	Ticto barb	*Puntius ticto*
Different benthic animals, frogs, snakes and aquatic plants	Unidentified	

coastal area where the community-based aquaculture practice is still to be initiated, community people could play a vital role in disseminating the technology by telling their success story.

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Top left: Typical waterlogged paddy fields (hator) in rainy season. Top right: SIS harvested from the hator. Bottom left: Women engaged in preparing the harvested fishes from the hator.

PORTRAIT OF COMMUNITY MAPPING STAGES THROUGH ZONING SYSTEM ON MANAGEMENT OF TELUK CENDARAWASIH NATIONAL PARK, WEST PAPUA

by Sepus Fatem, Jim van Laar, Jhon L. Sroyer and J. Manusawai

Introduction

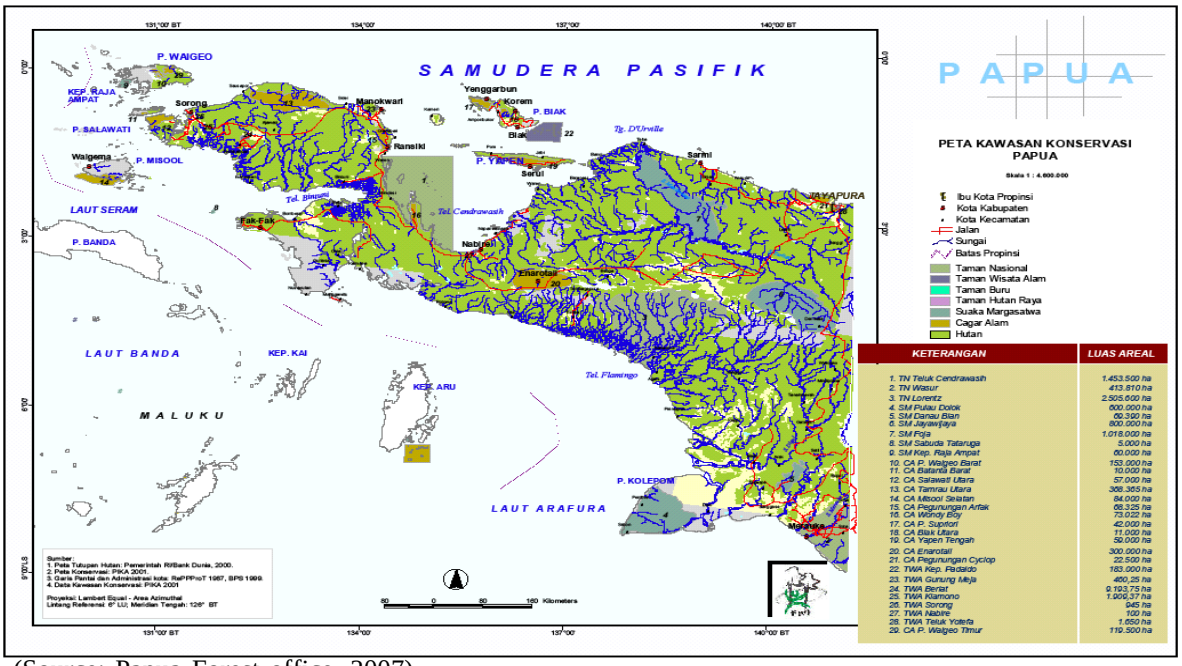
The biogeographic importance of New Guinea and the South West Pacific in general is apparent, considering various aspects of the flora and fauna (Paijmans, 1975; Muller, 2002). The high flora and fauna diversity in these areas is a consequence of tectonic evolution (Petocz, 1987, 1994). New Guinea has many endemic species and a flora and fauna with high uniqueness. Papua, more specifically, has 51 conservation areas including national parks, strict nature reserves, etc. (CI, 1997; Soesmianto, 2005).

Like other national parks in the world, Papua's national parks include local people who have been around for a long period of time. Local people who live on the borders of protected areas often have a holistic relationship with these areas (Trakolis, 2001); a relationship that is sometimes overlooked when management decisions are made.

Decentralization initiatives have been launched in the majority of developing countries, including Indonesia, nowadays. Furthermore, in line with decentralization, local people are now involved in tasks with regard to natural resources management. Thus, different methods are now being implemented to include the participation of the local people. The mapping of indigenous land to secure and manage natural resources and strengthen cultures is a recent phenomenon. A variety of methodologies have been employed, ranging from highly participatory approaches involving local people sketching maps, to more technical efforts.

Community mapping, or participatory mapping, is a method that elicits the relationship between people and their environment by involving community members in drawing maps of their surroundings (Knapp and Herlihy, 2001; Eadens *et al.,* 2008). People construct simplified images of their environment whereby an individual 'acquires, codes, stores, recalls and decodes information about the relative locations and attributes of phenomena in his/her everyday spatial environment. These maps are summaries of an individual's knowledge, preferences, assessment and evaluation of the environment and have a significant effect on people's behaviour, beliefs and attitudes regarding places. Especially in Teluk Cenderawasih National Park, people have a special spiritual relation with certain resources. Therefore, taboos and social norms are still prevalent there (Sastrawan and Manulang, 1999). Furthermore, most conservation biologists, for example, include non-use values, such as spiritual or cultural values, in their reasons for conserving an area (Callicout, 1990; Jones *et al*., 2008). Ostrom (1999) and North (1994) argued that taboos and social norms are informal institutions. Institutions are constraints devised by humans that structure human interactions.

Informal institutions are those not dependent on the state for enforcement and include taboos and social norms. Moreover, it is not only informal institutions involved explicitly in managing natural resources that may be important for conservation. There are many reasons, such as sustainable use, that may cause people to avoid or protect species (North, 1994; Sheil and Lawrence, 2004). Through community mapping on zoning systems, therefore, social norms, community needs and desires will help to ensure long term conservation success.



(Source: Papua Forest office, 2007)

Figure 1. Map of Conservation Area in West Papua

Portrait of zoning system in Teluk Cenderawasih National Park

Teluk Cenderawasih National Park (TNTC) is located in the Bay of Papua Island, the largest bay in Indonesia (1,453,500 ha) and the home of tremendous biodiversity (WWF, 2003). The park is situated at 01° 43' - 03° 22' South Latitude and 134° 06' - 135° 10' East Longitude. It is located in the administrative regency of Wondama Papua Barat Province and Nabire regency, Papua Province. Sixty-four villages with a total of 3,260 people inhabit villages in the Park (CI, 1997; SBSKSDA, 1996; BBTNTC, 2009).

The zoning system is a type of management system especially for national park areas. Permenhut Nomor P.56/MenHut-II/2006, tanggal 26 Agustus 2006 is the law about the zoning manual of national parks. Zoning processes, especially, in TNTC, have been done in several stages and approaches ranging from socialization processes in several villages and districts to public consultations at the regency and province levels. All processes involve local people, NGO's, the local government, people in the villages, the district, the regency, the province, as well as people from universities.

The zoning system is based on the data of: 1) important natural resources; 2) social studies; and 3) religion and culture. The whole process is also covered by several laws:

- Law No.5 of 1990, concerning Conservation of Living Resources and their Ecosystems.
- Law No.41 of 1999, concerning Indonesian Forestry
- Law No.21 of 2001, concerning Special Autonomy for West Papua
- Law No.31 of 2004, concerning Fishery
- Law No.26 of 2007, concerning Spatial planning
- Law No.27 of 2007, concerning Coastal Resources Management and Small Island.

National park zoning is a process of determining space to be included in national park zones (BBTNTC, 2009). The concept of zoning in national park management is an essential aspect, not only as reference to management and conservation development in Teluk Cenderawasih National Park, but also as a system of protection that controls all activity inside the national park. So far, zoning in Cenderawasih National Park has been designed to accommodate all interests inside

the area without ignoring conservation functions (BBTNTC, 2009). The zoning system used in the Cenderawasih National Park is called *"community-based zoning"*.

Process of Teluk Cenderawasih National Park zoning

The Teluk Cenderawasih National Park zone was proposed in 1988 (BBTNTC, 2009). It has gone through various processes and stages, including meetings/forums with the participation of local communities, religious leaders, community leaders, academicians and the local government. Historically the following stages can be noted:

1. The Management of Irian Jaya's Teluk Cenderawasih Marine Conservation Area Plan 1988-1992 (WWF, 1987; Petocz, 1989).
2. The Management of Teluk Cenderawasih National Park 1994-2019 Plan (World Bank Project, 1994) (BBTNTC, 2009)
3. The 5-year Management Plan of Teluk Cenderawasih National Park (1994-2019 (Sub BKSDA I Irian Jaya, 1996).
4. The Management and Zone Plan of Teluk Cenderawasih National Park in cooperative work of Manokwari and Nabire regencies, WWF and BBTNTC (29-31 October 2001).
5. From 2000 to 2009, there have been various seminars and workshops as well as public consultations held in order to get input and zone concepts for the Teluk Cenderawasih National Park area. Stages and processes in implementing the Zone Plan of Teluk Cenderawasih National Park Area are managed through several stages. Figure 3 shows the zoning stages as mentioned above.

Figure 2 shows a flow diagram of the main stages of the zoning process in Teluk Cenderawasih National Park:

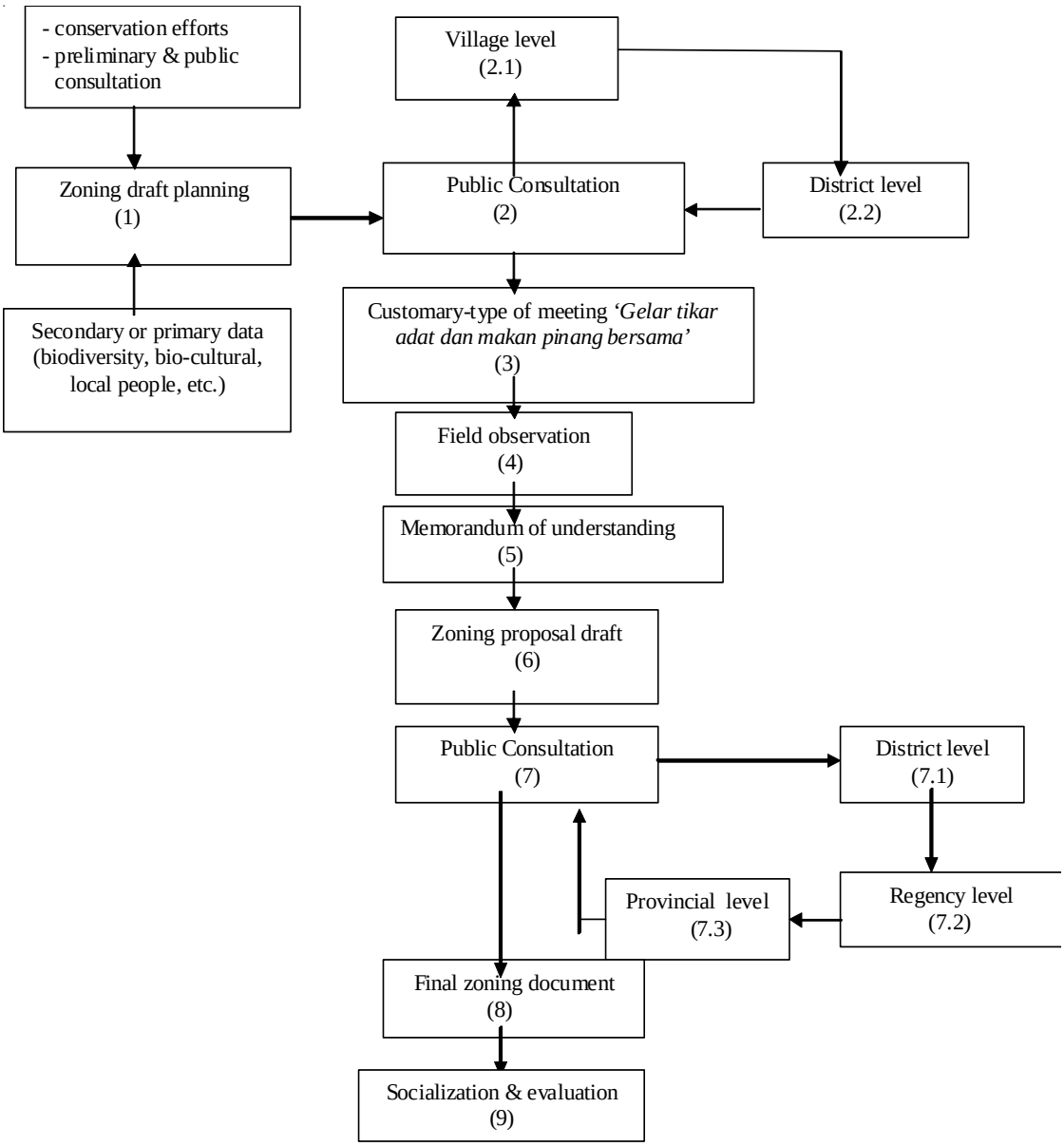
1. *Consultation at village level*
   The consultation at village level aims to ask for moral support and policies in affirming the zone of Teluk Cenderawasih National Park Area. In addition, it aims to identify the property rights towards proposal zones and to design customary meetings regarding the declaration and affirmation of the zone areas.

2. *Consultation at district level*
   Consultation at the district level aims to ask for moral support and policies in affirming the zone of Teluk Cenderawasih National Park Area. The consultation is managed by a team consisting of BBTNTC, NGOs, and Governments.

3. *Customary-type meeting 'Gelar tikar adat dan makan pinang bersama[1]'' (lit: customary mat meeting and chewing betel nut)*
   'Gelar tikar adat dan makan pinang bersama' describes the culture of togetherness to come, sit, discuss and take a decision on particular things for the future of the community. The figurative phrase symbolizes togetherness and brotherhood with outsiders. Such a meeting is held by the consultation team and local communities and aims at asking for moral support in each area with certain measurements.

4. *Forum Group discussion*
   In this part, each person present is given a basic map. The map is used to search and make notes. Participants are asked to show where they live, based on the map. They are expected to point out which areas are under property rights and the local wisdom concerning any areas, e.g., which areas are under the taboo system, which are used for traditional ceremonial purposes. The information gathered is used to determine the zoning system and utilisation functions. In marking the maps, people often cluster their activities based on specific environmental features (Holling, 1992; WWF, 2005; BBTNTC, 2009). These maps are a summary of an individual's knowledge, preferences, assessment and evaluation of the environment and they have a significant

[1]*A term used by Melanesian people of the north coast of Papua when they have a customary meeting to discuss important issues within their communities and/or outsiders. They usually hold the meeting with all participants sitting on mats and having betel nuts while discussing things.*



(Sources: adapted from various references)

Figure 2. The main stages of the zoning system in Teluk Cenderawasih National Park.

effect on people's behaviour, beliefs and attitudes regarding places. The next step is discussing the mapping results together with a BBTNTC officer.

5. *Field orientation*

Field orientation is a cross-checking process. The purpose is to actually see the area that was laid out in the first mapping during the group discussing process mentioned above. This part is essential because authority holders will immediately know the real circumstances. Through field orientation the authority holders also learn what property rights there are, the cultural histories of the area in terms of natural resources management, and how people interact with local resources and other things in a certain area. Therefore, this work will help BBTNTC staff to minimize and avoid property rights conflicts in the future.

6. *Memorandum of Understanding process*

The next step is to legalize all the agreements which resulted from the group

(continued on p.17)

(continued from p.16)

discussion and field orientation through a Memorandum of Understanding (MOU). In this stage, local peoples are facilitated to sign the document. By doing so, it implies that they are concerned about natural resources management for now and for the next generation. At the same time, by signing the document, they show their commitment to future potential development processes. During this process the parties involved are: 1) BBTNTC staff; 2) NGOs; 3) district heads; 4) village heads; 5) religious leaders; 6) cultural leaders; 7) community leaders; 8) women's leaders; and 9) youth leaders.

Note: Developing this MOU process was done from 2006-2008. It took three years to finish this because of the long discussions between the people, the officers and the local government.

Workshop on community perspective for zoning system at District level

Transparency concerning natural resources management is currently a hot issue. In line with this concern, all of the results from the above-mentioned processes were presented during a workshop at the district level. Local people, along with other stakeholders, were invited to witness the results achieved from the processes described above. Moreover, during this session all stakeholders had the opportunity to add more ideas, comments and to give further inputs. One purpose of this workshop was to collect more accurate data and information in terms of zoning documents. Furthermore, the workshop also provided an opportunity to gain more consensus, leading to the advanced workshop at the Regency and Provincial levels (BBTNTC, 2009).

Workshop of zoning proposal on Regency and Provincial levels

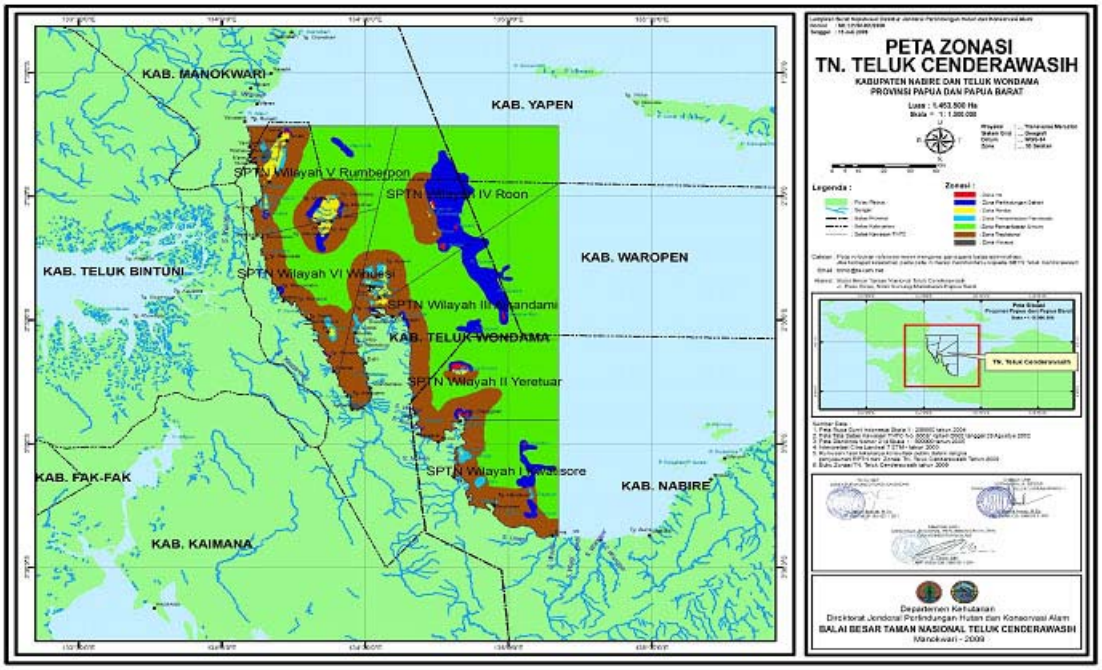
Governments, NGOs and the people are the three main actors in development programs. People can be seen as a development object of this process on one hand, and become a subject on the other hand. NGOs are voluntary and have a partnership approach working for both stakeholders: either for people or the government.

In order to gain more approval and commitment, a workshop on zoning proposals at the Regency and Provincial levels was held. The main target of this seminar was to collect and gain more inputs and constructive ideas until the legal approval of the zoning document.

The document of zoning systems for the National Park is the final product. During this seminar, all parties were invited (i.e., from the government: local and provincial; National Park officers (BBTNTC); representatives of the local people; NGOs; university representatives; and social organizations). Most of the participants actively took part in the whole discussion and decision making process. Six zoning areas resulted from this process. These zonings refer to resource potential, biodiversity value, area characteristics, people interactions and socio-economic aspects. Each zone has, therefore, been characterized as follows (BBNTC, 2009): 1) Core zone; 2) Protection zone: marine for sea and jungle for forest area; 3) Utilization zone for tourism; 4) Public utilization zone; 5) Traditional zone; and 6) Special zone.

Socialization and evaluation process

The next tasks after the workshop are socialization and evaluation. These are essential to how the zoning document will be implemented and applied in the field. Socialization is done in order to spread and distribute the zoning document as a main product to each level mentioned above. The socialization process takes a bottom-up approach: from village to provincial level. According to the zoning document, all stakeholders are expected and obligated to do something based on their own duty and authority. Through the socialization process, each stakeholder will avoid overlapping utilization of certain areas in and around the National Park. Zoning activities control each activity inside the National Park (BBTNTC, 2009). Besides socialization, assessment of the zoning efficiency is important. Evaluation will be done periodically in order to analyze barriers and constraints to the implementation of the zoning program. Through assessment, problems can be detected either by



(Source. BBTNTC Office, 2009.)

Figure 3. Zoning Map of Teluk Cenderawasih National Park, West Papua.

working together with local people on extraction resources activities or from the national park managers. On the other side, by implementing zoning activities, local governments have the opportunity to run development programs such as infrastructure development in order to support and encourage a better life for the local people. These activities were scheduled for May 2010 (BBTNTC, 2009)

Conclusions and recommendations

Although this was an internship field study, during the field work the authors saw that there was a lack of access for local people to education, nutrition and health care. In other words, there was much poverty. This is turn has influenced the management of the natural resources in Teluk Cenderawasih National Park. It was noted that the zoning process ran from 2002-2009. It has been a long process and there were many conflicts and difficult situations in terms of conservation efforts and economic orientations. In addition, although the zoning system document is ready and has been signed by local people, there are still conflicts from time to time. Thus, increasing the economic welfare and prosperity of the local people around Teluk Cenderawasih National Park is a prerequisite, even though it is a big challenge.

The BBTNTC officers need to prioritize dealings with the programs and projects in the national park. High anthropogenic disturbances in Teluk Cenderawasih National Park occur due to economic reasons; therefore, economic programs should be the main priority. The only way to reduce economic problems is through providing alternative economic incentives, which will enable conservation efforts to run for long periods.

Acknowledgements

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TREE DIVERSITY AND BIODIVERSITY CONSERVATION POTENTIALS IN KHADIMNAGAR NATIONAL PARK OF BANGLADESH

by Mohammad Alamgir, Md. Saiful Haque Sarkar, Md. Shawkat Islam Sohel and Sayma Akhter

Introduction

Biodiversity is a concept which refers to the range of variation of differences among some sets of entities within the living world (CBD, 1992). Due to its unique geophysical location, Bangladesh is characterized by an exceptionally rich biological diversity (Nishat *et al.*, 2002; Hossain, 2001; Barua *et al.*, 2001). The economy of a country depends largely on its biological resources, ecosystem and mineral wealth. The ecosystem, species and genetic diversity of the land and water have great impacts on the quality of life, the economy and the environment. On a broader note, these resources are part of the world stock of biodiversity, which have significant social and ethical implications (BBS/UNDP, 2005). In the 1990s, only 3.7% tropical forest protection had been provided in Bangladesh and 12 species were threatened (Anon, 2000). The rational use and management of biodiversity, the habitat, species and genes prevalent in an area are the needs of the day. Once biodiversity is lost, it cannot be reversed. Sustainable use of biodiversity is therefore of paramount importance (Verma *et al.*, 1999).

The Center for Biological Diversity (CBD) defined a protected area as "a geographically defined area, which is designated or regulated and managed to achieve specific conservation objectives" (Mulongoy and Chape, 2004). National parks belong to Category–II of IUCN's protected area management categories (IUCN, 1994). Presently, there are 18 notified protected areas in Bangladesh (NSP, 2006), covering nearly 1.7% of the total landmass and 11.08% of the country's total forest area (Mukul, 2007). The forest area of Bangladesh is about 2.53 million ha, representing approximately 17.5% of the country's total surface area (Hossain, 2005). In the forest policy of 1994, the Government of Bangladesh fixed a target to bring the forest area up to 20% by 2015, with an emphasis on biodiversity conservation. As a part of this process, the Bangladesh Government is putting some forest areas into different protected area categories (such as national park, biodiversity conservation area, wildlife sanctuary, etc.); Khadimnagar National Park is one of them. Measuring the biodiversity of a community or habitat has been one of the central issues of ecology and conservation (Verghese and Menon, 1997). To develop biodiversity sustainably, one has to know the species present in an ecosystem, their interdependence and causes of their disturbance (Verma *et al.*, 1999). As it was only recently declared a protected area, there is very scanty quantitative information available on the tree composition, structure, distribution and potentialities of Khadimnagar National Park to conserve its biodiversity. Thus, the present study was conducted to explore the tree species composition of this national park and also to assess its potential to conserve biodiversity, which will provide information to policy makers and conservationists about this protected area compared to other protected areas in the country as well as the world, so that adequate measures can be taken to conserve and enrich its biodiversity.

Methodology

Study site

Khadimnagor National Park is located at North Sylhet Range-1 (sub division) in Sylhet Forest Division, under the tropical evergreen and semi-

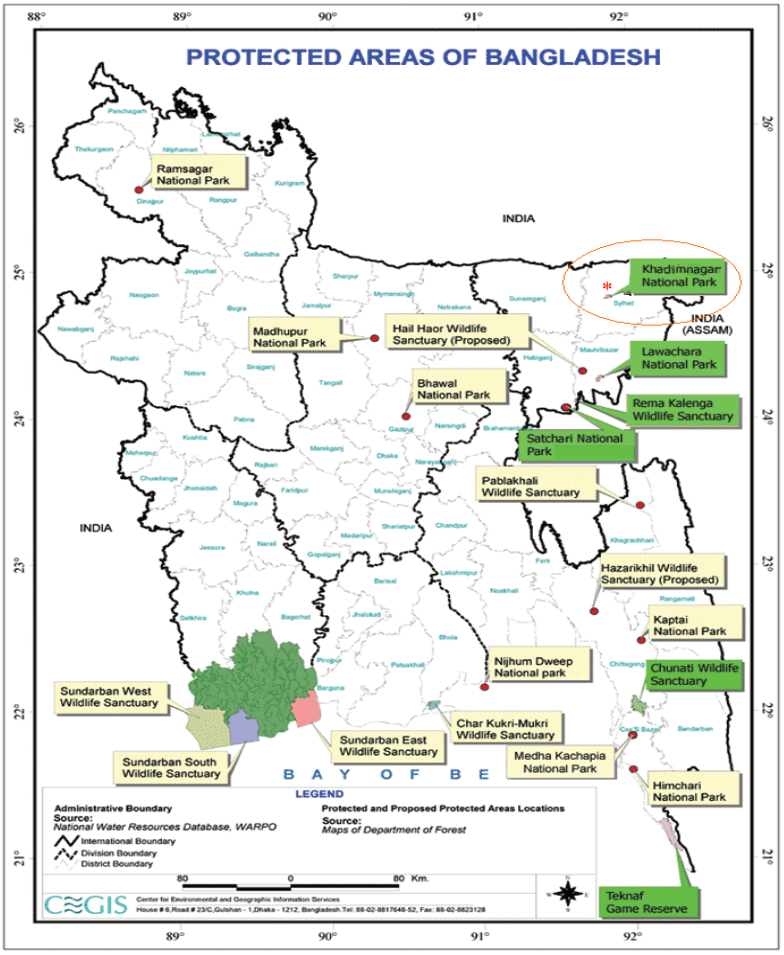

Figure 1: Map of protected areas of Bangladesh showing the study area (Source: NSP 2006)

evergreen biogeographic zone (Figure 1). The total area is 679 ha, surrounded by tea gardens, and is submerged with several watersheds locally known as "chara" (Anon, 2007). The hills are dissected by numerous valleys, separated by ridges rising some 50m above them. The hills are generally low and gently sloping. The soil ranges from clay loams to pale brown (Anon, 2006). The climate is warm and humid. April and May are the warmest months and December and January are the coldest. The tropical monsoon climate prevails in the area with an average maximum temperature of 30.7°C and average minimum temperature of 18.9°C. The average annual rainfall is 3,931 mm, most of which falls between June-September (BBS/UNDP, 2005).

Methods

The study was conducted through the stratified random quadrate method. The area was divided into three slope categories, i.e., bottom hill (valley of the hill), mid hill and top hill (including ridge). There is no significant heterogeneity in the vegetation composition in the different slopes because the hills are very low. A total of thirty plots were selected from three different slopes (ten plots from each slope). The study was conducted from February to August 2007. The optimum quadrate size (10m×10m) was determined by applying a species area curve as carried out by Ambasht (1978), Sharma (1979) and Gareth (1991). Within each plot the number and name of all trees were counted and recorded. Diameter at breast height (dbh) of all trees greater than or equal to 5 cm and total height were measured. Different tree species in the area have been gathered and representative samples have been collected for herbarium preparations. The collected specimens were identified following Prain (1903), Brandis (1906), Heining (1925) and local people and

taxonomists. Basal area, density, relative density, frequency, relative frequency, relative dominance and importance value index were calculated following Shukla and Chandal (2000), Ambast (1978), Moore and Chapman (1986), and Dallmeier *et al.* (1992). In the present study, five diversity indexes were analyzed to get a clear picture of the diversity of the study area.

The Shanon-Wienner's diversity index was calculated according to Michael (1990) as:
$H = -Sum:(P_i \, Ln \, P_i)$

Where, H = Index of species diversity; P_i = (Number of individuals of one species / Total number of individuals in the samples.
Species diversity index was calculated according to Odum (1971)

$SDI = \frac{S}{N}$ Where, SDI = Diversity index; S = number of species; N = No. of individuals.
Index of dominance (ID) was calculated by Simpson index (Simpson, 1949)
$ID = Sum: (P_i)$
Where, ID = Index of dominance; Pi = (Number of individuals of one species / Total number of individuals in the samples.
Species richness index (R) was estimated according to Margalef (1958).

$$R = \frac{S-1}{\log N}$$

Where, R = Species richness index; S= total number of species; N = total number of individuals of all the species.

Species evenness index (E), was estimated following Pielou (1966).

$$E = \frac{H}{\log S}$$

Where, E = Species evenness index; H = Shanon-Wienner's index of diversity; S = Total number of species.

Results and discussion

Species composition

In the present study, 524 individuals of 29 tree species belonging to 18 families were identified. The family *Meliaceae* dominates, represented by five species, followed by *Moraceae*, *Leguminosae* (four species each) and *Verbenaceae* (2 species). The remaining families contained only one species each (Table 1). A similar study done by Nath (1995) in the Sitapahar natural forest of Bangladesh found 86 tree species of 36 families. Another study done by Hossain (1994) in the Bamu natural forest, Bangladesh, found 89 tree species of 31 families. Alamgir and Al-amin (2005) found 32 tree species of 15 families at the biodiversity conservation area in Banskhali, Bangladesh. The tree species composition of Khadimnagar National Park is lower compared to the stated research works, although in the present study 29 tree species were found. This might be due to the previous degraded condition of the forest and that protective measures were taken very recently after declaring it as a national park.

Status of important trees for biodiversity conservation

Among the total number (29) of species, 86% are indigenous and only 14% are exotics. In the present study it was found that 59% of the tree species are suitable for wildlife conservation because their fruits are widely used as food by wildlife. As a result, a large number of wildlife is also found in this national park (in the local people's view). Natural regeneration is also important for tree diversity conservation. In the present study 66% of the tree species were found to be naturally regenerated and most of these are indigenous (Table 2). Some species do not regenerate, possibly due to lack of ecological requirements, e.g., *Swietenia mahagoni*, which requires shade in the early stage of regeneration; *Tectona grandis*, for which regeneration from seeds is very difficult in natural conditions due to the dormancy of seeds; and *Aquilaria malacensis*, which were found in only limited and immature stages. So from the present study it is evident that in the future, regeneration of some other species such as

Table 1: Tree composition of Khadimnagar National Park, Sylhet, Bangladesh

Family	*Scientific name*	*I/E**	*S/NS**	*N/A**
1. Anacardiaceae	1. *Mangifera indica* L.	I	S	N
2. Bixaceae	2. *Bixa orellana* L.	I	S	N
3. Cassuarinaceae	3. *Casuarina littorea* L.	E	NS	A
4. Combretaceae	4. *Terminalia arjuna* Bedd.	I	S	N
5. Dipterocarpaceae	5. *Dipterocarpus turbinatus* Gaertn.	I	NS	N
6. Euphorbiaceae	6. *Baccaurea ramiflora* Lour.	I	NS	A
7. Leguminoceae	7. *Albizia lebbeck* (L.) Benth.	I	S	N
	8. *Cassia siamea* Lam.	I	S	N
	9. *Cynometra polyandra*	I	NS	A
	10. *Xylia dolabriformis* Benth	I	NS	N
8. Lythraceae	11. *Lagerstroemia speciosa* (L.) Pers.	I	S	N
9. Magnoliaceae	12. *Michelia champaca* L.	I	S	N
10. Meliaceae	13. *Aphanamixis polystachya* (Wall.) Parker.	I	NS	N
		I	S	N
	14. *Azadirachta indica* A. Juss.	I	NS	N
	15. *Chickrassia tabularis* Juss.	E	NS	A
	16. *Swietenia mahagoni* (L.) Jacq.	I	NS	A
	17. *Toona ciliata* M.J.Roem.			
11. Moraceae	18. *Artocarpus chaplasha* Roxb.	I	S	N
	19. *Artocarpus heterophyllus* Lamk.	I	S	N
	20. *Artocarpus lacucha* Buch-Ham.	I	S	N
	21. *Ficus roxburghii* Wall	I	S	N
12. Myrtaceae	22. *Syzygium grande* (Wt.) Wall.	I	S	N
13. Palmmae	23. *Borassus flabellifer* Lour.	I	S	A
14. Rubiaceae	24. *Anthocephalus chinensis* (Lam.) Rich ex.walp.	I	S	N
15. Rutaceae	25. *Zanthoxylum rhetsa* (Roxb.) DC.	I	NS	A
16. Santalaceae	26. *Santalum album* L.	I	S	A
17. Thymalaceae	27. *Aquilaria malacensis* Lamk.	E	NS	A
18. Verbenaceae	28. *Gmelina arborea* (Roxb.) DC.	I	S	N
	29. *Tectona grandis* L.F.	E	NS	A
Total 18 families and 29 species				

**Note: I/E - I indicated indigenous and E indicates exotics; S/NS – S indicates fruit suitable for wildlife and NS indicates non fruit trees or fruits not suitable for wildlife; N/A – N indicates natural regeneration found and A indicates natural regeneration absent.*

Swietenia mahagoni and *Aquilaria malacensis* may also be found this national park.

Present tree stock

To determine the present stock of trees in Khadimnagar National Park, the number of stems per unit area (ha^{-1}), basal area ($m^2 ha^{-1}$) was estimated. The number of stems per hectare was found to be 1,747 and the basal area per hectare was 60.314 m^2. The stem density and basal area of the six dominant species were as follows: *Tectona grandis* (320 and 25.13 respectively), followed by *Dipterocarpus turbinatus* (300, 6.46), *Chickrassia tabularis* (217, 3.43), *Syzygium grande* (180, 4.25), *Michelia champaca* (167, 3.04) and *Artocarpus chaplasha* (163, 4.6) (Table 3). Although the number of stems of *Artocarpus chaplasha* (163) is low, the basal area is higher than that of *Chickrassia tabularis*, *Syzygium grande* and *Michelia champaca* due to larger diameter trees. Rahman *et al.* (2000) estimated

Table 2: Status of tree species from biodiversity conservation point of view

Species category	*No. of species*	*Percentage*
Indigenous	25	86
Exotics	4	14
Fruits suitable for wildlife	17	59
Fruits not suitable for wildlife	12	41
Natural regeneration present	19	66
Natural regeneration absent	10	34

1,678 stems ha^{-1} with dbh greater than or equal to 5cm in Chunati Wildlife Sanctuary (Chittagong, Bangladesh). Alamgir and Al-Amin (2005) found 590 stems ha^{-1} at a biodiversity conservation area in Chittagong, Bangladesh. Compared with those research findings, Khadimnagor National Park is a well-stocked forest. Nath (1995) and Hossain (1994) estimated a 55.22 m^2 ha^{-1}basal area in the Sitapahar natural forest and 41.81m^2 ha^{-1} at Bamu reserve forest with dbh greater than 10 cm respectively. Another study done by Alamgir (2003) found 1.415 m^2 ha^{-1} at a biodiversity conservation area in Chittagong. Compared to the above findings, the basal area ha^{-1} of trees of Khadimnagar National Park is higher. The reason is that the present study included all trees above five centimeter dbh.

Quantitative characters of trees

To explore the quantitative characteristics frequency, relative density, relative frequency, relative dominance and importance value index of each species were estimated. The highest frequency was found in *Dipterocarpus turbinatus* (63.33), followed by *Chickrassia tabularis* (53.33), *Tectona grandis* (53.33), *Syzygium grande* (46.67), *Artocarpus chaplasha* (43.33) and *Michelia champaca* (33.33). The highest relative density was found in *Tectona grandis* (18.32) followed by *Dipterocarpus turbinatus* (17.18), *Chickrassia tabularis* (12.40), *Syzygium grande* (10.31), *Michelia champaca* (9.54) and *Artocarpus chaplasha* (9.35). The highest relative frequency was found in *Dipterocarpus turbinatus* (13.77), followed by *Tectona grandis* (11.59), *Chickrassia tabularis* (11.59), *Syzygium grande* (10.31) and *Artocarpus chaplasha* (9.42). The six species with highest relative dominance were *Tectona grandis* (41.66), *Dipterocarpus turbinatus* (10.71), *Artocarpus chaplasha* (7.62), *Syzygium grande* (7.05), *Chickrassia tabularis* (5.71) and *Michelia champaca* (5.04). The results indicated that *Tectona grandis* has the highest importance value index (71.57), followed by *Dipterocarpus turbinatus* (41.66), *Chickrassia tabularis* (29.7), *Syzygium grande* (27.51), *Artocarpus chaplasha* (26.39) and *Michelia champaca* (21.83). The lowest importance value index was found in *Azadirachta indica*, *Baccaurea ramiflora* and *Zanthoxylum rhetsa* (0.92 each). The importance value index indicates the dominance of species in a heterogeneous plant community (Shukla and Chandal, 1980), so the study area is dominated by *Tectona grandis*, *Dipterocarpus turbinatus*, *Chickrassia tabularis*, *Syzygium grande*, *Artocarpus chaplasha* and *Michelia champaca*.

Distribution of trees in dbh classes

Most of the trees (31.11%) belong to the diameter class of 14-16.99 cm and the least number of trees (1.34%) were present in the diameter class of 5-7.99 cm. The distribution of dominant species in different diameter classes were different except for the 17-19.99 cm and greater than or equal to 20cm diameter classes where *Tectona grandis* is dominant. *Aquilaria malacensis* (0.57%), followed by *Syzygium grande* (3.24%), *Chickrassia tabularis* (4.39%), *Dipterocarpus turbinatus* (7.25%) and *Tectona grandis* (3.05%, 10.50%) were dominant in the diameter class 5-7.99cm, 8-10.99cm, 11-13.99cm, 14-16.99cm, 17-19.99cm and greater than or equal to 20cm respectively. *Tectona grandis* was highest (18.32%), followed by *Dipterocarpus turbinatus* (17.18%), *Chickrassia tabularis* (12.40%), *Syzygium grande* (10.31%), *Michelia champaca* (9.54%), *Artocarpus chaplasha* (9.35%) and *Xylia dolabriformis* (8.59%), and the remaining species were less than 5% each. The highest species numbers were in the diameter class greater

Table 3: Different diversity indices for trees in Khadimnagar National Park

Species	*Categories*				
	Shanon-Winner index	*Species diversity index*	*Index of dominance*	*Species richness index*	*Species evenness index*
Tree	1.07	0.06	0.10	10.30	0.73

than or equal to 20cm (18 species), with the highest number of individuals (163) present in the diameter class 14-16.99cm; 19 species with 111 individuals were present in diameter class greater than or equal to 20cm, and the least number of individuals were present in diameter class 5-7.99cm.

Distribution of trees in height classes

Most of the trees (39.70%) belong to the height class 8-10.99m and the least number of trees (1.72%) were present in the height class <5m. The number of trees increased with height classes up to 8-10.99m, and then decreased with further increases of height. *Aquilaria malacensis* (1.15%), followed by *Michelia champaca* (2.10%), *Dipterocarpus turbinatus* (8.59%, 5.34%) and *Tectona grandis* (5.24%, 5.92%) dominated in the height class <5m, 5-7.99m, 8-10.99m, 11-13.99m, 14-16.99m and greater than or equal to 17m respectively. Nineteen species with the highest number of individuals (208) were present in the height class 8-10.99m; 11 species with 109 individuals were present in height class 11-13.99m.

Tree diversity index

Table 3 shows the different diversity indexes for trees. In the present study it was found that the Shanon-Winner index, Diversity index, Index of dominance, Species richness index and Species evenness index were 1.07, 0.06, 0.10, 10.30 and 0.73 respectively. The Shanon-Winner index, Diversity index, Species richness index and Species evenness index for Sitapahar natural forest of Chittagong (North) forest division, Bangladesh, for tree species with dbh >10cm was 2.98, 3.39, 16.92 and 1.84 respectively (Nath *et al.*, 2000). The Diversity index of Bamu reserve forest of Cox's Bazar forest division, Bangladesh, was 3.11 (Hossain, 1994). Another study done by Alamgir and Al-Amin (2005) at a conserved forest area of Banskhali, Chittagong found that the Diversity index, Species richness index and Species evenness index were 2.07, 13.03 and 1.84 respectively. The present study considers only the tree species having greater than or equal to 5cm diameter at dbh. The higher the value of diversity, the greater will be the stability of the community (Rahman *et al.*, 2000). In comparison to the above research findings, Khadimnagar National Park, though declared as a protected area only recently, has a species richness index that is satisfactory to convert it as a species-rich protected area.

Potential of Khadimnagar National Park to conserve biodiversity

The magnitude of the threat to the global biodiversity situation is undoubtedly higher than at any time in history (FAO, 2006). The world has lost about half of its forest cover, from 62 million km^2 to 33 million km^2 (Sunderlin *et al.*, 2005). Over 15 million ha of natural forest are lost in the tropics every year, which is more than the area of Nepal (FAO, 2006). The present rate of species extinction is estimated to be between 1,000 and 10,000 times the historical (pre 10,000 years BP) rate (Wilson, 1988). Most of the world's biodiversity has been held by a majority of the economically poorest countries (Koziell, 2001) and people are somehow responsible for the degradation of biodiversity (CBD, 2006; 2007). The natural forests of Bangladesh have been facing such a serious onslaught that a large portion has already been lost, leaving the country with only a small percentage of forest cover (Anon, 1992), and a resultant loss of the source of biodiversity (Nath *et al.*, 2000). In Bangladesh, the contribution of the forestry sector to the GDP is 3.3% (Siddiqi, 2001). The annual deforestation rate is 3.3%, which is the highest among the Southeast Asian countries (Poffenberger, 2000). The Bangladesh National Herbarium reported

106 vascular plant species under risk of extinction to varying degrees in the country (Khan *et al.*, 2001). Dey (2006) has also prepared a list of 167 plant species that are vulnerable or endangered in Bangladesh. Biodiversity conservation is essential to improving the situation and averting this crisis. Protected areas have long been the most effective and widespread measure for conserving forests and biodiversity (Lewis, 1996).

Since declaring Khadimnagar National Park, some protective measures have already been taken so regeneration is increasing (park official's view). The local people are now more aware about the need to conserve this forest than in the past due to some awareness-raising activities of the forest department such as discussions with the local people about conserving the forest and the involvement of the local elite in conservation activities (local people's view). So illegal felling is decreasing, the forest floor is less disturbed, and good regeneration is coming up.

The nature of forest communities largely depends on the ecological characteristics in sites, species diversity and regeneration status of species. Micro environmental factors vary with seasonal changes which affect the growth stage, i.e., seedling, sapling and young trees of the plant communities that maintain the population structure of any forest. Hence, it becomes an important issue to understand the tree diversity, population structure and regeneration status of forest communities for the maintenance of both natural and control forests (Khumbongmayun *et al.*, 2006). The existence of a species in the community largely depends on its regeneration under varied environmental conditions. Regeneration is a critical phase of forest management, because it maintains the desired species composition and stocking after disturbances (Duchok *et al.*, 2005). The growing of fruit tree species like *Artocarpus chaplasha, Bombax ceiba, Erythrina variegata, Ficus hispida, Macaranga denticulata, Psidium guajava, Syzygium cumini, Terminalia bellerica* and *Terminalia chebula* is a good indication for conserving animal diversity (especially birds) by providing food and natural habitat because all are indigenous species (Alamgir and Al-Amin, 2007). In the present study we found a large number of fruit tree species as mentioned above. Species and individuals in the different diameter and height classes indicated that the recruitment is continuous. So the study area could be a potential biodiversity conservation area. During the past few decades a remarkable amount of forest all over the world has been brought under protection under different IUCN management categories, but nearly half of these legally designated protected areas are heavily used (usually illegally) for agriculture and forest product extraction (McNeely and Scherr, 2003). Adequate measures should be taken to protect Khadimnagar National Park from this problem. The national and international organizations concerned with biodiversity conservation should give more emphasis to good planning and need to ensure the scientific management of existing trees in this potential biodiversity conservation area of Bangladesh.

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DIVERSITY OF ODONATES IN NANDANKANAN ZOOLOGICAL PARK WITH RANGE EXTENSION NOTES OF WHITE DARTLET (*Agriocnemis pieris*) IN ORISSA, INDIA

by S.K. Das, B. Baruah, N. Dash, S. Singhnaik and H.K. Sahu

Introduction

Nandankanan Zoological Park (20°13'N; 85°50'E) is one of the major conservation areas of international importance for wildlife, housing a variety of endangered and endemic animals in Orissa State, India. It is completely surrounded by forest area which was declared a Wildlife Sanctuary in 1979 by the Forest Department of Orissa, together with a botanical garden and Kanjia Lake. Encompassing an area of 4.37 km^2, the park is blessed with natural moist deciduous forest and good water facilities throughout the year. Basically, four types of vegetation are found in Nandankanan, i.e., Tropical Dry Deciduous Forest, Tropical Semi Evergreen Forest, Scrub Forest and Thorny forest. Due to the different types of vegetation, it houses a variety of lesser known fauna, especially among the Odonates (Dragonflies and Damselflies), which are one of the least studied groups of insects (Caastella, 1987). In Orissa, only a few studies have been carried out on Odonates, such as Laidlaw (1915), Fraser & Drover (1922), Srivastava & Das (1987), Mitra (2000), Sethy & Siddiqi (2007) and Das *et al*., (2010). Earlier surveys showed that no study has been carried out so far from this region on Odonates, hence an attempt was made to study the odonata fauna of the park and also to create awareness to conserve these fascinating insects.

Methodology

The study was carried out from November 2009 to July 2010. A direct search technique (Sutherland, 1996) was used during the midday period (1000 to 1400 hrs), because Odonates are most active during this time (Subramanian, 2005). Opportunistic sightings were also recorded. Apart from this, Odonates were also recorded during several visits to the study area before the study period between September 2008 to October 2009. The identification of dragonflies and damselflies is based on Subramanian (2009). Photographs were taken with a Nikon P90 digital camera with double close up mode and a Nikon D3000.

Results and discussion

The survey recorded a total of 26 species of Odonates, representing 20 genera and five families from the study area (Table. 1). Among the five recorded families, Libellulidae was the dominant one with 14 genera and 17 species; followed by Coenagrionidae, represented by 5 species with 4 genera. Among all the Odonates of this family, Ground Skimmer (*Diplacodes trivialis*), Green marsh hawk (*Orthetrum sabina*), Wandering glider (*Pantala flavescens*), and Common picture wing (*Rhyothemis variegate*) were regularly encountered.

White Dartlet (*Agriocnemis pieris*) was also recorded during the study period. From previous records it is known only from Western Ghats and south of Mumbai (Subramanian, 2009). The species was observed close to the Indian Pangolin Conservation Breeding Centre of the Park at 10.53 hrs. The other 3 families, Gomphidae, Aeshnidae and Platycnemididae) were represented by 1 species each.

The present study confirmed that Nandankanan Zoological Park has a good habitat for Odonates, which are valuable indicators of water quality and landscape disturbance (Watson *et al*., 1982). The presence of species like Ditch Jewel (*Brachythemis contaminate*) directly indicates a polluted water system and Granite Ghost (*Bradinopyga geminate*) represents the urban landscapes (Subramanian,

White dartlet (*Agriocnemis pieris*) in Nandankan Zoological Park

Green marsh hawk (*Orthetrum Sabina*) preys on Wandering glider (*Pantala flavescens*)

Presence of Ditch jewel (*Brachythemis contaminate*) indicates polluted water quality in the area.

Granite ghost (*Bradinopyga geminate*) indicates the urban landscape in the Park.

(Photos courtesy of S.K. Das)

Table: 1. Odonates (Dragonflies and Damselflies) of Nandankanan Zoological Park, Orissa. # First Record from Eastern Ghat,Orissa

SL.No.	Common Name	Family/ Scientific Name
I	Clubtail	Gomphidae
1	Common Clubtail	*Ictinogomphus rapax* Rambur,1842
II	Darners	Aeshnidae
2	Blue Tailed Green Darner	*Anax guttatus* Burmeister, 1839
III	Skimmers	Libellulidae
3	Trumpet Tail	*Acisoma panorpoides* Rambur,1842
4	Little Blue Marsh Hawk	*Brachydiplax sobrina* Rambur, 1842
5	Ditch Jewel	*Brachythemis contaminata* Fabricius,1793
6	Granite Ghost	*Bradinopyga geminata* Rambur,1842
7	Ruddy Marsh Skimmer	*Crocothemis servilia* Drury, 1770
8	Black-tipped Ground Skimmer	*Diplacodes nebulosa* Fabricius, 1793
9	Ground Skimmer	*Diplacodes trivialis* Rambur,1842
10	Fulvous Forest Skimmer	*Neurothemis fulvia* Drury, 1773
11	Crimson-tailed Marsh Hawk	*Orthetrum pruinosum* Rambur,1842
12	Green Marsh Hawk	*Orthetrum sabina* Drury, 1770
13	Blue-tailed Yellow Skimmer	*Palpopleura sexmaculata* Fabricius,1787
14	Wandering Glider	*Pantala flavescens* Fabricius, 1798
15	Yellow-tailed Ashy Skimmer	*Potamarcha congener* Rambur,1842
16	Common Picture Wing	*Rhyothemis variegata* Linnaeus,1763
17	Red Marsh Trotter	*Tramea basilaris* Kirby,1889
18	Black Stream Glider	*Trithemis festiva* Rambur, 1842
19	Long-legged Marsh Glider	*Trithemis pallidinervis* Kirby, 1889
IV	Marsh darts	Coenagrionidae
20	White Dartlet#	*Agriocnemis pieris* Laidlaw, 1919
21	Pigmy Dartlet	*Agriocnemis pygmaea* Rambur,1842
22	Coromandel Marsh Dart	*Ceriagrion coromandelianum* Fabricius, 1798
23	Golden Dartlet	*Ischnura aurora* Brauer, 1865
24	Senegal Golden Dartlet	*Ischnura senegalensis* Rambur, 1842
25	Blue Grass Dartlet	*Pseudagrion microcephalum* Rambur, 1842
V	Bush darts	Platycnemididae
26	Yellow Bush Dart	*Pseudagrion microcephalum* Rambur, 1842

2005) inside the area. There is no doubt that the park is one of the best conservation sites for the Odonates, but day by day increased disturbance and pressure from different anthropogenic activities creates the pollution that is degrading the environment. Therefore, it is necessary to keep the human interference in check up to a limited level and promote eco-friendly activities inside the area to minimize the negative impact of human activities on the habitat of these magnificent creatures of nature.

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FOREST NEWS

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CHALLENGES AND OPPORTUNITIES TO FEATURE AT ASIA-PACIFIC FORESTRY WEEK 2011!

The Government of China and FAO are preparing to welcome participants to *Asia-Pacific Forestry Week 2011*. The event will take place in Beijing, China, 7-11 November, and will be the biggest forestry event this year in the region. The first Asia-Pacific Forestry Week was organized in Hanoi three years ago and was a hailed a great success attracting over 750 participants from 57 countries.

Asia-Pacific Forestry Week 2011 is dedicated to helping meet emerging challenges and identify new opportunities. The key concept surrounding the event is to bring together a large number of partner events and stakeholders under a single roof to comprehensively address forestry-related issues, thereby capturing synergies and efficiencies across a range of forestry dialogue streams.

The program encompasses a series of plenary sessions and wide-ranging partner events across the full spectrum of forestry topics.

"It's an opportunity for the entire forestry community in the region to come together to discuss critical issues, share experiences and find solutions," comments FAO Senior Forestry Officer Patrick Durst. "It's going to be the most significant forestry event in the region in 2011 – we're not just providing something for everyone; there's going to be lots of things for everyone."

Key highlights of the week will include four thematic plenary sessions, involving an array

of global experts and world-class speakers, with audience participation a notable feature of each.

The plenary session themes are:

- Opening plenary: New Challenges – New Opportunities
- The Governance Challenge: Impacts on Forests, Lessons Learned and Strategies for the Future
- New Media – New Messages: Forestry Communications in Asia and the Pacific
- Journey to 2020: The Future for Forestry in Asia and the Pacific

The remainder of the week is made up of a diverse range of partner events – meetings, seminars and workshops – covering a broad range of forestry topics including forest tenure, forest rehabilitation, certification, illegal logging and associated trade, community forestry enterprises, indigenous rights, forest health, climate change, REDD+, forest carbon marketing and trading, land degradation assessment, financing, policy, and many more.

The week will comprise more than 40 separate events, including the 24th session of the Asia-Pacific Forestry Commission.

Asia-Pacific Forestry Week 2011 will officially begin on Monday morning, 7 November. Keynote speakers including FAO Goodwill Ambassador Anggun, Director-General of the United Kingdom Forestry Commission, Tim Rollinson, and the World Bank's Special Envoy for Climate Change Andrew Steer will discuss the central theme "New Challenges – New Opportunities". Participants are encouraged to dress in their national costumes to grace the occasion with color and celebrate regional diversity and culture.

Asia-Pacific Forestry Week 2011 will be the culmination of creative and enthusiastic contributions by more than 50 partner organizations. It will attract extensive media coverage and serve to increase the attention given to forestry by the policy-makers and the general public.

People from all corners of the forestry landscape will be making their way to Beijing for *Asia-Pacific Forestry Week 2011*. This includes many of the leading lights in global forestry, high-level forestry officials, representatives from key regional and international natural resource organizations, students, private sector actors and community foresters.

You should also be there!

Secure your participation at:
http://apfw-registration.apfnet.cn/

ASIA-PACIFIC FORESTRY WEEK IS BACK

The Food and Agriculture Organization (FAO) of the United Nations and its partners invite the forestry sector to come together for **the second Asia-Pacific Forestry Week, in Beijing, China, 7-11 November 2011.**

In light of the 2011 Forestry Week theme **"New Challenges – New Opportunity"**, participants will come together to chart new pathways across the evolving Asia-Pacific forestry landscape. Through the diversity of an expected 1500-2000 participants and the combination of the professional forestry sector, cross-sectoral dialogue, youth and civil society perspectives, and the melding of diverse national, cultural and stakeholder viewpoints Forestry Week will form a unique platform for dynamic thinking, inspiration and creativity. Plenary sessions and a wide variety of partner events will provide an opportunity to approach relevant topics from new angles and seek innovative solutions to today's forestry challenges.

APFC

The 24th Session of the Asia-Pacific Forestry Commission (APFC) will convene in conjunction with Forestry Week. The Asia-Pacific Forestry Commission is one of six regional forestry commissions supported by FAO. APFC offers a forum for member countries to share experiences in dealing with forestry challenges, advise FAO on regional forestry priorities, and initiate joint action on key forestry issues. APFC is currently comprised of 33 member countries, making it the region's most inclusive inter-governmental body dealing with forestry.

CONTRIBUTIONS

Forestry Week will present a rich tapestry of discussion, dialogue and opportunity through the active participation of a vast range of partners. You can contribute to the event in the following ways:

- Organize a partner event (could be a collaborative event run by several organizations);
- Sign up for an exhibition booth in the information market;
- Become a sponsor of the event;
- As an individual participant in Asia-Pacific Forestry Week.

Costs for running events and for promotional space are modest. For further information please visit the conference website or send us an e-mail.

PARTICIPATE!

Be part of the second Asia-Pacific Forestry Week by registering online through the link provided at our website before 15 September 2011:
http://www.fao.org/forestry/ap-forestry-week/en/

You may also send an e-mail to:
AP-Forestry-Week@fao.org

STATE OF THE WORLD'S FORESTS

The ninth biennial issue of State of the World's Forests was released at the outset of 2011, the International Year of Forests. The chapters assembled for this year's State of the World's Forests draw attention to four key areas that warrant greater attention during the International Year of Forests and beyond:

- regional trends on forest resources;
- the development of sustainable forest industries;
- climate change adaptation and mitigation; and
- the local value of forests.

Each of these themes has implications for the various upcoming assessments of progress towards sustainable development, including the Rio+20 Summit in 2012 and the Millennium Development Goals Review Conference in 2015.

Forests have unrecognized potential in furthering the development agenda. To maximize the contribution of forests to poverty eradication, this year's State of the World's Forests identifies some of the areas that can enhance or challenge the sustainability of people's livelihoods. Forest industries have the opportunity to maximize energy efficiency, spur innovation, create a reliable fibre supply and contribute to local economies. Negotiators designing climate change policies and actions recognize that, to be successful, efforts related to reducing emissions from deforestation and forest degradation and the role of conservation and enhancement of forest carbon stocks (REDD+) in developing countries must, at the same time, address poverty alleviation. They also recognize that the long-term implications of forest carbon tenure need to be examined more critically to ensure equitable benefit sharing and long-term management of local resources and rights. The contribution of forests to local livelihoods also needs further consideration and research, for example on traditional forest-related knowledge, non-wood forest product (NWFP) governance, the non-cash value of forests, small and medium enterprises and community-based forest

management (CBFM). Taken together, these themes can maximize the contribution of forests to the creation of sustainable livelihoods and alleviation of poverty.

Asia and the Pacific

The extent of forests in Asia and the Pacific has changed dramatically over the past two decades. In the 1990s, the region experienced a net forest loss of 0.7 million hectares per year, while in the last decade the forest area increased by an average of 1.4 million hectares per year. The planted forest area also substantially increased through afforestation programmes, mainly as a result of programmes in China, India and Viet Nam.

The area of primary forests decreased in all Asia and the Pacific subregions in the last decade, despite the fact that the area designated for conservation of biodiversity increased in the same period. Mixed trends were observed in the subregions in the extent to which forests were set aside for soil and water protection.

With the exception of the South Asia and Oceania subregions, the area of productive forests declined over the last decade. Falling levels of wood removals were also observed throughout the region, largely as a result of the reduction in woodfuel removals. Employment in the primary production of forest goods was very high in the region when compared with the global total.

Extent of forest resources

Forests cover slightly less than one-third of the total land area of the Asia and the Pacific region. Based on estimates for FRA 2010, the region's forested area was 740 million hectares in 2010, accounting for about 18 percent of the global forest area. East Asia contained the largest forest area (255 million hectares), followed by Southeast Asia (214 million hectares).

For the purposes of this review, countries and areas in the Asia and the Pacific region are grouped into the following subregions:
East Asia: China, Democratic People's Republic of Korea, Japan, Mongolia, Republic of Korea
South Asia: Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka
Southeast Asia: Brunei, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste, Viet Nam
Oceania: American Samoa, Australia, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, Nauru, New Caledonia, New Zealand, Niue, Norfolk Island, Northern Mariana Islands, Palau, Papua New Guinea, Pitcairn, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu, Wallis and Futuna Islands.

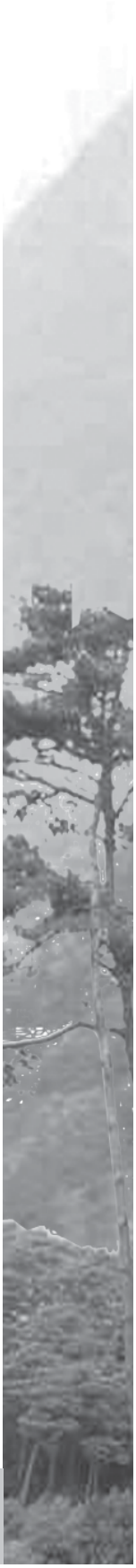
The five countries with the largest forested area (China, Australia, Indonesia, India and Myanmar) accounted for 74 percent of the forest in the region, with China and Australia alone accounting for almost half the forest area of the region. The Federated States of Micronesia reported that 92 percent of its land area was covered by forests, while six countries reported that forests covered no more than 10 percent of their total land area. Two of these, Nauru and Tokelau, reported no forest at all.

The increase in forest area in the Asia and the Pacific region in the past decade was primarily due to large-scale afforestation efforts in China, where the forest area increased by 2 million hectares per year in the 1990s and by an average of 3 million hectares per year since 2000. Bhutan, India, the Philippines and Viet Nam also registered forest area increases in the last decade.

Despite the net increase in forest area reported at the regional level, deforestation continued at high rates in many countries. Southeast Asia experienced the largest decline in forest area in the region in the last ten years, with an annual net loss of forests of more than 0.9 million hectares. However, when compared with figures for 1990–2000 (-2.4 million hectares per year), this represented a significant drop. Oceania also experienced a negative trend, primarily because severe drought and forest fires in Australia have exacerbated the loss of forest since 2000 and caused it to register the largest annual loss of any country in the region between 2000 and 2010. Cambodia, Indonesia, Myanmar and Papua New Guinea also reported large forest losses in the last decade.

Planted forests (i.e., forests established through planting and/or deliberate seeding of native or introduced tree species) made up 16 percent of the forest area in the region. Planted forests experienced a substantial increase within the last ten years in the Asia and the Pacific region. Most of the region's planted forests were established through afforestation programmes. China contributed the bulk of this growth through several large programmes that aimed to expand its forest resources and protect watersheds, control soil erosion and desertification, and maintain biodiversity.

China, India and Viet Nam have established targets for large-scale forest planting and also developed incentive programmes for smallholders to plant more trees. China plans a 50 million hectare increase in the area of its planted forests by 2020, with the aim of covering 23 percent of the total land area with forests, a target which may be reached by 2015 if current planting rates continue. India set a target to cover 33 percent of its land area with forests and tree cover by 2012. Based on figures supplied in FRA 2010, some 25 percent of India's land area was covered by forests, other wooded land or other land with tree cover in 2010. To this should be added an unknown area of line plantings and other "trees outside forests." The Government of Viet Nam aimed to restore forest cover to 43 percent by 2010 and, according to the information provided for FRA 2010, this target was achieved.



Growing stock and carbon storage were also important parameters in determining the relevant trends in the extent of forest resources. Total carbon stored in forest biomass was 44 Giga tonnes (Gt) in Asia and the Pacific region as a whole. Carbon stocks in forest biomass decreased by an estimated 159 million tonnes annually during the period 2000–2010, despite an increase in the forest area in the region. The decreasing trend occurred because the forest converted to other uses contained more biomass and carbon than the newly established forests. East Asia and South Asia registered a positive trend in forest carbon stocks over the period 1990–2010, while Southeast Asia and Oceania experienced a net loss

Biological diversity and protective functions

Primary forests accounted for 19 percent of the total forest area of the region. Data indicated that the area of primary forests decreased in all the Asia and Pacific subregions. Southeast Asia experienced a loss of primary forests, but the trend slowed in recent years. In Oceania, the decline in primary forest accelerated since the 1990s. The data collected did not allow for an analysis of the proportion of net loss of primary forest that was caused by deforestation and conversion compared with the opening of primary forests to selective logging or other human activities, which would move the forest to the class "other naturally regenerated forest" in the FRA 2010 classification system.

The area of forest designated primarily for conservation of biodiversity accounted for 14 percent of the total forest area. Since 2000, this area has increased by almost 14 million hectares in Asia and the Pacific region as a whole. Oceania registered a small contraction in the area designated for conservation of biodiversity since 2000. The area of forest within formally established protected areas represented 22 percent of the forest area in the region. Southeast Asia reported the highest percentage of forest within protected areas in the region (32 percent) while Oceania reported the lowest (16 percent).

Nineteen percent of the forest area in the region was primarily designated for the protection of soil and water resources. The area of forest assigned for protective functions increased by 17 million hectares in the 1990s and by 26 million hectares between 2000 and 2010, primarily because of large-scale ecological planting in China. An odd trend was observed in Southeast Asia, where forest areas with a protective function increased from 1990 to 2000 and then fell from 2000 to 2010 because of the heterogeneous situation within the subregion. There was a steady increase in forest cover with a protective function in the Philippines and Thailand, while the opposite trend was observed in Indonesia, Lao People's Democratic Republic and Timor-Leste. The area of protective forest increased over the period 1990–2000 in Malaysia, Myanmar, Viet Nam and Oceania, although it fell in these areas throughout the next decade.

Productive and socio-economic functions

In Asia and the Pacific region, 32 percent of the total forest area was designated primarily for production of wood, fibre, bioenergy and/or NWFPs. The area designated for production has fallen since 2000 in the region as forests were designated for other management purposes such as conservation of biodiversity and protection of soil and water. Only South Asia and Oceania showed an increasing trend for this category.

Wood removed from forests and other wooded land constituted an important component of the productive function of forests. For Asia and the Pacific region as a whole, total removals declined by 10 percent from 1.16 billion cubic meters in 1990 to 1.04 billion cubic meters in 2010. Reductions in fuelwood removals accounted for the bulk of this fall. Removals of industrial roundwood in the region remained quite stable (approximately 280 million cubic meters per year) over the past two decades. Roundwood supply remained unchanged despite partial logging bans and log export restrictions in some countries (China, Indonesia, Malaysia and Thailand) because the increased supply of wood from planted forests (not covered by the restrictions) and imports replaced supply from natural forests.

The value of wood and NWFP removals is an indicator of the contribution of forests to national economies and of socio-economic benefits of

forests. The value of total wood removals (including roundwood and fuelwood) in 2005 was around US$29 billion in the Asia and Pacific region as a whole. Subregional trends in the value of wood removals between 1990 and 2005 fluctuated and only Oceania reported an increasing trend in the value of wood removals since 1990. Forests in the region also provided a large variety of NWFPs, collected mainly for home consumption, which had an important economic value that was only partially accounted for. Data on the value of these removals were reported by 16 countries, accounting for 70 percent of the forest area of the region. NWFP removals reached a total reported value of US$7.4 billion in the region as a whole.

The level of employment in forestry is also an indicator of both the social and economic value of the sector to society. The reported level of employment in the region was very high (8.2 million) compared with the world total (10.5 million), as a result of the inclusion of people employed to establish forest plantations and other part-time jobs. Conversely, most countries' statistics did not include people collecting fuelwood and NWFPs for subsistence purposes, although some provided partial estimates of subsistence employment. Employment in forestry declined slightly from 1990 to 2005, mainly as a result of China's partial logging ban in the late 1990s and general increases in labour productivity (e.g., increased mechanization of harvesting operations).

UN-REDD APPROVES US$15.2 MILLION FOR FIVE COUNTRIES

At its fifth Policy Board meeting held 4-5 November 2010 in Washington, D.C., the UN-REDD Programme approved US$15.2 million in funding for national programmes in Cambodia, Papua New Guinea, Paraguay, the Philippines and Solomon Islands, bringing the total amount of funding for UN-REDD National Programmes to US$51.4 million.

The Policy Board allocated US$3 million for Cambodia, US$6.4 million for Papua New Guinea and US$4.7 million for Paraguay and provided further guidance and recommendations to the full National Programmes they presented. These Programmes lay out their REDD+ readiness plans including setting up governance, measurement, reporting and verification (MRV) and monitoring systems, safeguarding the multiple benefits of forests and ensuring stakeholder engagement. Initial national programmes in the Philippines and Solomon Islands were allocated US$500,000 and US$550,000 respectively.

The critical funds allocated to these five countries support the capacity of national governments to prepare and implement national REDD+ strategies with the active involvement of all stakeholders, including indigenous peoples and other forest-dependent communities, with the ultimate goal of protecting, better managing and wisely using their forest resources, contributing to the global fight against climate change. With these new funding allocations, the UN-REDD Programme is now working with 29 partner countries across Africa, Asia-Pacific and Latin America, of which 12 are receiving direct support to National Programmes.

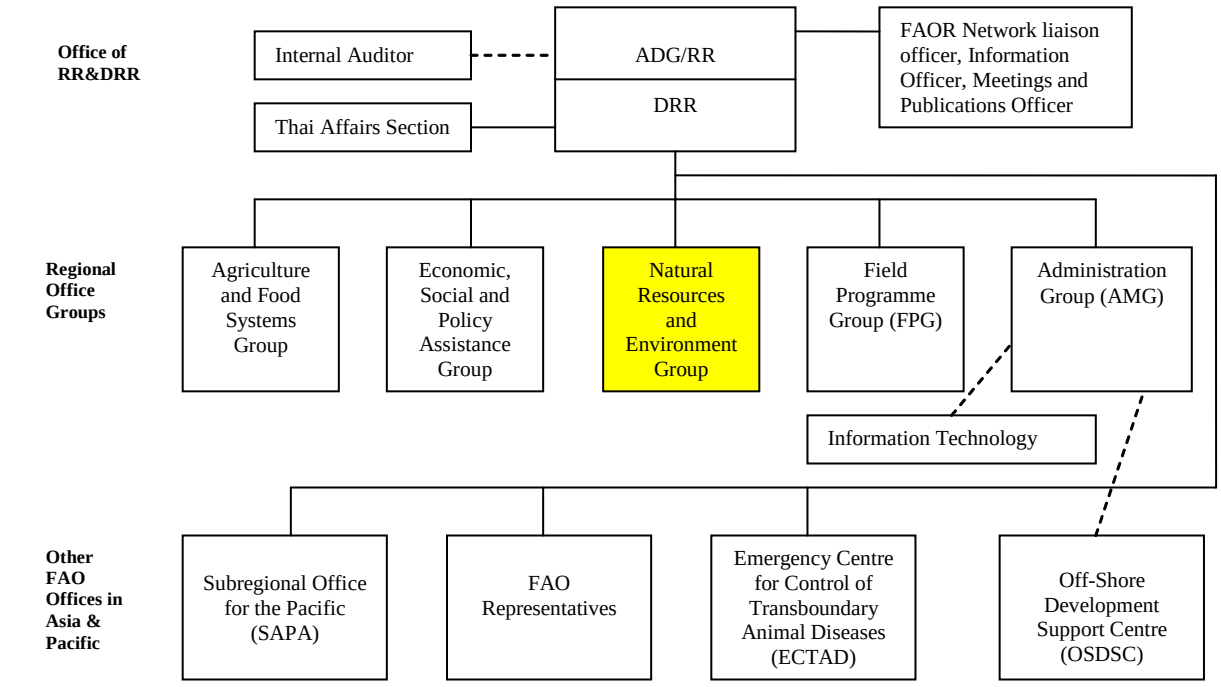
UN-REDD Newsletter November 2010

RESTRUCTURING OF THE FAO REGIONAL OFFICE FOR ASIA AND THE PACIFIC

The 29th Asia-Pacific Regional Conference called on FAO to strengthen the Regional Office for Asia and the Pacific (RAP) to serve the needs of the region and its members in a more timely and effective manner based on a fully formulated Regional Priority Framework. In order to deliver against this, a proposal for the restructuring of RAP was formulated and submitted to the Director-General in September 2009, and was approved in early 2010. The new structure was implemented in the fall of 2010 and the restructured groups are as seen in the chart below.

Under the new structure, the former Fisheries, Forestry, and Natural Resources Management and Environment Groups have now combined to comprise the Natural Resources and Environment Group.

The restructuring is a move away from the traditional technical discipline-based groups to multidisciplinary teams that will function through a wide range of formal and informal networks.



GENERATING INCOME FOR COASTAL COMMUNITIES FROM SUSTAINABLE MANAGEMENT OF MANGROVE RESOURCES

Fishing boat in Wunbaik Reserve Forest, Myanmar (Photo: Jeremy Broadhead)

Contributed by Jeremy Broadhead

With support from the Spanish-funded Regional Fisheries Livelihoods Programme (RFLP), the Natural Resources and Environment group of the FAO Regional Office for Asia and the Pacific conducted a study on the potential to generate income from mangroves through carbon credit sales and payments for environmental services. The main finding of the work was that transaction costs associated with accreditation under widely accepted carbon standards are likely to be greater than the estimated income from carbon credit sales for all but large areas of mangroves or areas where planned conversion can be stopped and soil carbon is included in accounting frameworks. This situation may change as methodologies are developed to include additional carbon pools in accounting frameworks, but significant work needs to be done before this is achieved.

Notwithstanding the potential to quantify and monetise carbon benefits, mangroves are widely considered to be highly valuable in terms of climate change mitigation due to high rates of primary productivity and large amounts of carbon contained within the above and below ground biomass and soils. Mangroves also provide additional benefits to coastal communities and the poorer members in particular, which are lost as unsustainable exploitation increases. Amongst the benefits are wood production, production of non-wood forest products (e.g., crabs, honey, bark for tannin production, etc.) and production of a range of environmental services including protection from coastal hazards, erosion control, water filtration, and bio-diversity conservation.

Many fishing communities in Asia are poor and highly dependent on dwindling fish stocks. Growing

Fishing in Wunbaik Reserve Forest, Myanmar (Photo: Jeremy Broadhead)

populations mean that fisheries resources are being increasingly degraded and fishing livelihoods are becoming unsustainable. At the same time, mangrove resources are being degraded with attendant indirect impacts on fish stocks – both within mangrove areas and adjacent sea areas. By providing payments to conserve and rehabilitate mangroves, local populations will benefit from associated income, from provision of alternative livelihood activities facilitating reduction of pressure on fish stocks, from increasing productivity of mangroves and their impacts on adjacent fisheries and from other services associated with mangroves.

With high transaction costs turning buyers away from markets for forest carbon, and from small-scale projects in particular, a gap exists for lower cost products where variables are less accurately quantified and additional assumptions are made. Selling environmental protection and sustainable development as a bundled product rather than selling carbon credits is expected to appeal to a range of buyers within the corporate social responsibility (CSR) niche and possibly more widely. Importantly, it will allow conservation and rehabilitation of small areas of mangroves that could otherwise be lost.

In response, FAO is aiming to develop a low-cost mechanism enabling corporate investors to promote coastal conservation, reduce carbon emissions and support sustainable development through the provision of funding to communities. The work will involve assessments and consultations to guide development of a payment system. Information on mangrove carbon cycling will also be collated to help construct widely applicable estimates of carbon storage and sequestration. Further work will involve identification of potential mangrove sites and organization of stakeholder meetings to discuss possibilities for sponsorship.

SUSTAINABLE COMMUNITY-BASED MANGROVE MANAGEMENT IN WUNBAIK FOREST RESERVE

Contributed by Jeremy Broadhead

Putting soil in bags for seedling propagation (Photo: Oswin Stanley)

The Wunbaik Reserved Forest is located in one of the largest remaining stands of mangrove forest in Myanmar. The reserve covers an area of 22,928 hectares and was established in 1931 to supply firewood to salt factories and inland steam vessels. An adjacent area of 4,081 hectares was notified as Mingyaung Public Protected Forest by the Ministry of Forestry in 2009. Thirty-four mangrove species have been identified in the reserve and a total of 62 species of fin fish, 5 species of crustacean and 5 species of mollusc have so far been recorded in the surrounding waters.

In recent years, increasing population pressure and rising demands for natural resources have resulted in forest degradation and depletion of fish stocks, while agriculture and aquaculture developments have encroached into the reserve. Commercial collection of wood for fuel and of bark for dyeing has been particularly detrimental to the condition of the forest and large trees are now only seen in some areas. On the whole, the forest remains intact, although construction of shrimp ponds and paddy fields has claimed some 20 percent of the total area. At the same time, a legacy of overfishing means that fish now caught in surrounding areas are universally of small size.

Several villages are highly dependent on the Reserved Forest and the surrounding waters and efforts to bring management of the resources onto a sustainable footing are badly needed. Furthermore, infrastructure developments related to gas drilling in adjacent waters, including a road cutting across the reserve, could lead to further encroachment into the Reserved Forest and political attention has therefore increased.

Project TCP/MYA/3204, was launched in December 2009 following a request from the Ministry of Forestry, Myanmar. It aims to contribute to the sustainable management of the Wunbaik Reserved Forest by developing an integrated mangrove management plan and model of community-based mangrove management that can also be applied more widely in Myanmar.

The project is addressing issues undermining sustainability by conducting technical studies on fisheries and forestry resources, completing a bioenergy assessment and undertaking participatory rural appraisals (PRA) in villages that use the Reserved Forest. Activities during the first phase of the project also included information exchange workshops and training on PRA, forest mensuration, mapping, fisheries management and remote sensing and GIS.

The second phase of the project focuses on development of an Integrated Mangrove Management Plan (IMMP) using information collected through studies and interactions with communities and government institutions. Other activities have included publication of books on the forest and fisheries resources of the Reserved Forest, construction and distribution of improved efficiency cookstoves, information dissemination at the local level, collection of information on owners of encroached land within the Reserved Forest and production of posters on the vegetation and fishes of the area.

The project has also demonstrated "Ecological Mangrove Restoration" to 46 mangrove stakeholders in an area of 2.5 hectares of abandoned paddy land and has provided support for horticultural activities and tree planting. Training on teak nursery management and tree grafting and hybridization techniques has been provided and three community-based organizations were formed to act as village management committees. In addition, 12 hectares of degraded land within the Reserved Forest have been demarcated under the Community Forestry Scheme with support from the Forest Department.

In the final phase of project implementation in 2011, steps will be taken to rehabilitate abandoned land within the reserve with support from local communities and the IMMP will be completed. The project will end in December 2011 and in the long-term, sustainable management of the area will depend on cooperation between the Forest Department, the Fisheries Department and the local communities. As all these parties serve to benefit from improved management, there is hope that the Wunbaik Reserved Forest will still exist in a healthy state for another 80 years and beyond.

Making improved cook stoves (Photo:; Oswin Stanley)

ASIA-PACIFIC FORESTRY CHIPS AND CLIPS

DEVELOPING FORESTRY CAN CREATE MILLIONS OF JOBS: U.N. REPORT

Investing an additional $40 billion annually in the forestry sector can halve deforestation rates by 2030, increase rates of tree planting by about 140 per cent by the year 2050, and catalyse the creation of millions of new jobs, according to a report by the UN Environment Programme (UNEP).

Backed by the right kind of enabling policies, such an investment – equivalent to about two-thirds more than what is spent on the sector at present – could also remove an extra 28 percent of carbon from the atmosphere, thus playing a key role in combating climate change, says the UN report "Forests in a Green Economy: A Synthesis.''

The report underlines that natural capital such as forests can represent up to 90 percent of the GDP of the rural poor. India is among a dozen countries taking the global findings of the Economics of Ecosystems and Biodiversity into national assessment that in turn could translate the value of nature and its services into national accounts. Carefully planned investments would also contribute to increased employment from 25 million now to 30 million by 2050.

– The Hindu 5 June 2011 –

CONCERN OVER FALL IN BIRD NUMBERS

New Zealand's native forests are changing for evermore as falling bird numbers drive the loss of native plants reliant on them for pollination.

Joint research by Auckland and Canterbury University scientists released this week warns of a cascading effect on native biodiversity as bird numbers continue to decline.

University of Canterbury School of Biological Sciences ecologist Professor Dave Kelly said bird populations were falling worldwide, raising concerns that the ecological services they provide, such as pollination and seed dispersal, may fall. The impact of falling bird populations was of particular concern in New Zealand where numbers have nearly halved because of human impacts.

"New Zealand has lost 49 percent of its land bird species which raises concerns about whether bird pollination and dispersal are adequate.

Auckland University scientists found that gloxinia, a native bird-pollinated shrub, was poorly pollinated on the mainland where few native birds were found compared with protected mainland islands.

– The Nelson Mail 17 Feb 2011 –

NEW RECOFTC EXECUTIVE DIRECTOR APPOINTED

The Center for People and Forests (RECOFTC) has announced the appointment of Dr. Tint Lwin Thaung, as the Executive Director designate for RECOFTC. He will succeed Dr. Yam Malla, current Executive Director when Dr. Malla's term expires in September 2011.

Dr. Thaung is a Myanmar-born Australian national who has more than 26 years of professional experience in forest management, forest research, and community forestry.

Dr. Thaung has worked extensively in the region with particular focus on Papua New Guinea, Thailand, Australia, and Myanmar, where he began his career as a national park warden, moving up to become Country Program Coordinator for the Wildlife Conservation Society and Deputy Country Coordinator for SWISSAID-Myanmar.

– http://www.recoftc.org/site/resources/New-Executive-Director-Appointed.php –

Vol. XXV: No. 2 April-June 2011

TRANSFERRING PRACTICAL SKILLS TO FORESTRY PROFESSIONALS IN CHINA

Contributed by Elizabeth Fontein

How can forest policy analysis be used more effectively for addressing the rapid changes in the forestry sector? How can we improve the validity and effectiveness of forest policies for sustainable forest management and rural development? How can we involve key stakeholders in forest policy analysis and policy making?

The Fifth Executive Forest Policy Short Course was held 17-27 May 2011, in Beijing, China. Twenty-seven Chinese forestry officials and researchers, including officials from ten provinces in China, spent 10 days studying, practicing and debating forest policy analysis to answer these questions, globally and in China. In the full-service training center of the State Academy of Forest Administration (STAFA) in Beijing, the participants met with national and international experts to exchange their knowledge and experiences.

The stage was set by the Director of the Forest Policy Division of the State Forest Administration, who elaborated on the evolution of forest policy in China, from the period of central planning to the present transition towards a market economy. Recent forest policies in China have been successful in adapting to different forest conditions, and are gradually adopting more experience-based methodologies. However, several policy issues need thorough rethinking, such as cooperative management and forest tenure. As in many other countries, forestry in China has become a highly interdisciplinary topic, crossing paths with agriculture, industry, social development and environmental protection. The participants were challenged to reflect on where China's forestry stands in 2011, what role China's Forestry Agency should fulfil, and how policy processes can be improved by involving stakeholders more effectively so as to address a wider range of societal challenges.

An initial step in answering these questions was made by identifying drivers of change in China's forest sector. China's rapid economic development was considered to be the main driver for changes in forestry, followed by social, political and institutional drivers.

The theoretical framework was set by reviewing the policy cycle and discussing different perspectives on policy analysis. With this as a basis, the group practiced participatory policy analysis.

The Beijing Forest Society brought the participants to the forest area of Huairo, about 100 kilometers northeast of Beijing City. There, the participants practiced their facilitation, mediation and negotiation skills, helping villagers and local officials to analyze the problems and potential policy solutions for sustainable forest management in the area. The proficiency and success of the newly-trained facilitators was expressed in the words of one of the farmers participating in the exercise, who stated: "This is the first time in 60 years that somebody is actually listening to us." The facilitation of a structured debate through the fishbowl technique, allowing both villagers and officials to voice their opinions, concluded the practical part of the course.

The last part of the course brought in experts to address an array of policy topics and options. Amongst these was bamboo production, as this sector has been a major subject for rapid policy reform, which lent itself to a holistic policy case study addressing issues such as bamboo resource management, local processing, company-community partnerships and bamboo forest tenure reform.

The effect of forest policies on local livelihoods and poverty reduction in rural China was addressed

in other presentations. In state forest areas, household dependence on forest has declined and households have been able to diversify their income sources. At the same time, however, significant variation in these patterns both regionally and in terms of household type suggests that the reforms need to be accompanied by a package of incentives and subsidies targeted at vulnerable households to compensate for any adverse welfare impacts of restructuring.

Other topics included the use of projects for policy experiments, the role of networks in the region and the implications for China of the European Union's Forest Law Enforcement, Governance and Trade (FLEGT) process and the U.S.'s Lacey Act on illegal trade in plants and wildlife. The participants' enthusiasm and knowledgeable inputs contributed much to the success of the course.

The Executive Forest Policy Short Course was organized under the framework of the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet)-funded project "Making forestry work for the poor: Adapting forest policies to poverty alleviation strategies in Asia and the Pacific (GCP/RAS/260/MUL)." Partners in the course development and organization were the State Academy for Forest Administration (STAFA), the Food and Agriculture Organization of the United Nations (FAO), the European Forestry Institute (EFI) FLEGT program, the World Wide Fund for Nature (WWF), the State Forestry Administration of China (SFA) and the USDA Forest Service.

NATIONAL FOREST ASSESSMENT PROJECT IN VIETNAM APPROVED

A new National Forest Assessment Project has been approved in Vietnam. The project and its resulting forest inventory is designed to play a key role in various forestry initiatives (including REDD+). Funding for the project of US$2.7 million is being provided by the Government of Finland to help Vietnam develop its capacity in forest and tree resources assessment over a period of three years.

The project is part of a global programme entitled "Sustainable Forest Management in Changing Climate" launched by FAO. The project aims to enhance the capacity of the Vietnam Forestry Administration, especially the Forestry Inventory and Planning Institute, and to introduce new and appropriate technologies. At the same time, it will help Vietnam in reviewing forest inventory parameters against emerging national and international reporting requirements, harmonizing and updating the information on forests and trees and reviewing the forestry policy in the light of results from the forest resources assessment.

FAO ASIA-PACIFIC FORESTRY CALENDAR

8-9 August 2011. ***Second Regional Forum on People and Forests, Community Forestry: Key to Solving Current and Emerging Challenges.*** Bangkok, 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

31 August - 3 September 2011. ***International Training Programme "Innovations in the Management of Planted Teak Forests."*** Peechi, India. Contact: S. Appanah, NFP Advisor (Asia-Pacific), FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; E-mail: Simmathiri.Appanah@fao.org

8-9 September 2011. ***APEC Forestry Ministers Meeting***. Beijing, China. 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

10-12 October 2011. ***Workshop to strengthen national reporting in support of the implementation of the non-legally binding instrument on all types of forests (GCP/INT/118/JPN).*** Bangkok, Thailand. Contact: Masahiko Hori, Forestry Officer, FOEP, FAO Forestry Department, Via della Terme di Caracalla, 00100, Rome, Italy; E-mail: Masahiko.Hori@fao.org

17-20 October 2011. ***2nd Regional Workshop: Model Forest Development Learning Tour***. Banda Aceh, Indonesia. Contact: Robert Solar, FAO-RAPO TCP/RAS/3210 Consultant and Project Coordinator, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; E-mail: Robert.Solar@fao.org

19-22 October 2011. ***International symposium on the "art and joy of working with wood."*** Bangalore, India. Contact: Adrian Whiteman, Senior Forestry Officer, FOEI, FAO Forestry Department, Via della Terme di Caracalla, 00100, Rome, Italy; E-mail: Adrian.Whiteman@fao.org

26 October 2011. ***Meeting on Forests and Climate Change Adaptation in Asia.*** Bangkok, Thailand. Contact: Jeremy Broadhead, Forestry Consultant, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; E-mail: Jeremy.Broadhead@fao.org

7-11 November 2011. ***Second Asia-Pacific Forestry Week and 24th Session of the Asia-Pacific Forestry Commission.*** Beijing, China. 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

21-29 November 2011. ***Training of trainers on enhancing stakeholder participation in nfps.*** Kathmandu, Nepal. Contact: Contact: Fred Kafeero, Forestry Officer, FOEP, FAO Forestry Department, Via della Terme di Caracalla, 00100, Rome, Italy; E-mail: Fred.Kafeero@fao.org

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- 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)
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- Forest insects as food: humans bite back. Proceedings of a workshop on Asia-Pacific resosurces and their potential for development (RAP Publication 2010/02)
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- Forest out of bounds: impacts and effectiveness of logging bans in natural forests in Asia-Pacific: executive summary (RAP Publication: 2001/10)
- Trees commonly cultivated in Southeast Asia: an illustrated field guide - 2nd edition (RAP Publication: 1999/13)

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