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TIGERPAPER

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: *Melanistic tiger of Similipal Tiger Reserve captured in camera trap exercise (Photo courtesy of Debabrata Swain)*

MELANISTIC TIGERS OF SIMILIPAL TIGER RESERVE, INDIA: BANE OR BOON?

by Debabrata Swain and Basanta Kumar Behura

Melanistic tiger of STR captured in the camera trap exercise conducted during 2007.

About the Reserve

Similipal Tiger Reserve (STR) is located between 20°28' and 22°08' North latitude, and 86°04' and 86°37' East longitude in the Mayurbhanj district of Odisha (Figure 1). The hills, covering an extensive area of 2,750 km^2, have a large number of crests and radiating perennial streams. The elevation of the tableland varies between 500m and 600m with outer areas 1,000-1,100 m above mean sea level. It is covered with a rich canopy of largely tropical moist deciduous forest, and harbors a rich flora and fauna of 1,254 plant species, 55 species of mammals, 304 species of birds, 60 species of reptiles, 21 species of amphibians, 38 species of fishes and 164 species of butterflies (Dutta *et al.*, 2009; Mishra *et al.,* 2011). Important mammalian species include tiger (*Panthera tigris*), leopard (*Panthera pardus*), dhole or wild dog (*Cuon alpinus*), leopard cat (*Felis bengalensis*), jungle cat (*Felis chaus*), hyena (*Hyaena hyaena*), wolf (*Canis lupus*), golden jackal (*Canis aureus*), sloth bear (*Melursus ursinus*), elephant (*Elephas maximus*), Indian bison (*Bos gaurus*), sambar (*Cervus unicolor*), chital (*Axis axis*), barking deer (*Muntiacus muntjak*), mouse-deer (*Tragulus meminna*), four-horned antelope (*Tetracerus quadricornis*), langur (*Semnopithecus entellus*), and wild pig (*Sus scrofa*).

Evidence of melanistic tiger in Similipal

On July 21, 1993, a tribal youth of Podagada village killed a young melanistic tiger in self defense that strayed from Similipal forest and entered his crop (maize) field. The skin measuring 195 cm is now with the Divisional Forest Officer, Karanjia Division, Odisha (India). This was the first evidence of the presence of melanistic tiger in Similipal. But in the 1970s, Bitanath Nayak, then Assistant Field Director, STR, had spotted two full grown black (melanistic) tigers on the road to Matughar situated in south Similipal, but it was not reported in the absence of any evidence. In 1991, Niranjan

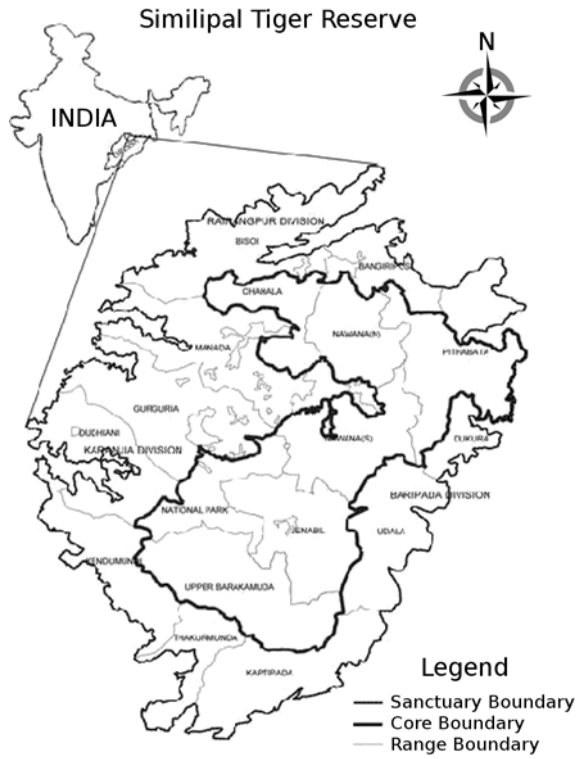

Figure 1

Mohanta, a Forest Guard stationed at Debasthali, claimed to have sighted a whole family of black (melanistic) tigers- two full grown animals and two cubs. But this was dismissed as a case of mistaken identity due to poor light conditions in the dense forest.

During 1992, a 265cm-long skin of a melanistic tiger was seized from poachers by officers of the wildlife protection cell at Tis Hazari, New Delhi. The rare skin was handed over to the National Museum of Natural History following the order of a Delhi Court in February 1993. This was probably the first physical evidence of melanistic tiger in the world. This melanistic tiger is distinguished by yellow stripes on its back and white ventral stripes.

During January 2004, Priyakanta Mohanty, Assistant Field Director, STR, and his driver saw a melanistic tiger in the dense forest on the Debasthali-Nuagaon road inside the reserve. An adult black male tiger was also sighted by Debendra Nayak, jeep driver of STR, along with Solem Deogam, Sabuja Bahini (Green Brigade Volunteer of Jodapal beat) on the Jenabil-Dhudruchampa road under Nawana South Range in the core area of the Reserve on September 5, 2007. The black tiger was sighted with a normal-colored tigress. With the sighting of this new colour variety, Similipal became the home to three different colour variants of tiger that can be distinguished by their skin colour. The normal tiger has yellowish brown coat with black stripes, melanistic tiger has a black coat with yellowish brown stripes, and black tiger has deep black coat with a white abdomen, but no stripes. STR is perhaps the only tiger reserve in the country's tiger reserve network to be inhabited by three different color variants of tigers.

Camera trapping exercises conducted under the direct supervision of the author (as Director, STR) by Wildlife Institute of India from 26.3.2007 to 26.5.2007, captured pictures of seven tigers, of which at least three were found to be melanistic tigers, confirming the abundance of melanistic tigers in Similipal.

Genetic basis of melanism

The question arises about the reason for such melanism in the tiger population of Similipal. Singh (1999) reports from analysis of the records of tigers with aberrant colors – i.e., the stripeless, white, melanistic and black – that the body colour of tiger can vary over a wide range of aberrant colors ranging from 'no stripes' to 'completely black' tigers. The intermediary stages include various shades of white tigers, the pallid or golden tiger, various shades of normal yellow tiger, the brown tigers, the melanistic tigers and the blue tigers. All of these possible colors occur according to a normal distribution curve in the wild gene pool of *Panthera tigris*. The dome is occupied by different shades of 'normal colour' tigers, while the aberrants occupy various regions of the dome on the curve. The aberrants reappear in a population in the normal course of time as throwbacks and not because of identical repetitions of mutations. Singh (1999) further states that normal color tigers are due to dominant genes, whereas white and melanistic tigers are manifestations of recessive genes.

Hoekstra (2006) reports that there are two types of mammalian pigments: eumelanin, which is responsible for black to brown colors, and pheomelanin, which is responsible for red to yellow colors. In melanocytes, several genes are involved in the coordination of 'pigment type-switching' between the synthesis of eumelanin and pheomelanin. This switch is controlled by the interaction of two primary genes: the *Melanocortin-1 receptor* (Mc1r), which encodes a seven-transmembrane receptor expressed in melanocytes, and its ligand, *agouti*, whose protein product is secreted from nearby dermal papilla cells and acts to inhibit Mc1r signaling. In the absence of the agouti protein, basal levels of Mc1r activity keep levels of intracellular cyclic AMP (cAMP) sufficiently high enough to activate the eumelanin synthetic pathway. However, in the presence of the agouti protein, Mc1r activity is inhibited, cAMP levels are reduced, and melanocytes stop producing eumelanin and start producing pheomelanin. The interaction of these two proteins therefore plays a critical role in determining which pigment type is deposited along individual hairs.

Many different molecular and developmental changes can also affect the type, density and distribution of melanin on individual hairs and result in variation in the overall pelage coloration. Close examination of the pigment and pattern on individual hairs can yield insight into the developmental changes and possible genes responsible for overall coloration. However, Hoekstra (2006) emphasizes that these candidates provide no guarantees as often changes in different genes can produce similar phenotypic effects.

Thus, in mammals, melanocytes produce two types of pigment (eumelanin and pheomelanin), and the ratio of melanin types is largely responsible for variations in hair colour. In pigmentation studies, it has been observed that recessive null alleles have resulted in lighter coloration (i.e., loss or reduction of pigmentation) in black bears (*Ursus americanus*) reported by Ritland *et al*. (2001), and among cave fish (*Astyanax fasciatus*) as reported by Protas *et al*. (2006), whereas dominant mutations are associated with darker colors (i.e., gain of pigmentation) in jaguar (*Panthera onca*) reported by Eizirik *et al*. (2003), pocket mice (*Chaetodipus intermedius*) reported by Nachman *et al*. (2003), bananaquit (*Coereba flaveola*) reported by Theron *et al*. (2001), deer mice (*Peromyscus maniculatus*) reported by Dodson (1982), and semi dominant mutations in jaguarundi (*Herpailurus yaguarondi*) reported by Eizirik *et al*. (2003), Arctic skua (*Stercorarius parasiticus*) and lesser snow geese (*Anser caerulescens caerulescens*) reported by Mundy *et al*. (2004) .

Reason for melanism in Similipal tiger

Understanding melanism in the tiger population of Similipal requires knowledge of multiple adaptive traits, and morphological, physiological and behavioral characters of the species in this habitat. It seems likely that the function of the tiger's stripes is to camouflage, serving to help tigers conceal themselves amongst the dappled shadows and long grass of their environment as they stalk their prey. The striped pattern of the habitat is also found on the skin of the tiger. In Similipal, open grasslands are not numerous except for a few frost bitten pockets of South Similipal. The principal prey animal of tiger in this forest is sambar, which is

common in dense tropical moist deciduous sal forest, whereas chitals are common in grassland habitats. The dense forest of Similipal (canopy density more than 40%) is an ideal habitat for sambars. Tigers in Similipal hunt sambar by concealing themselves in dense forest vegetation. High rainfall (over 2,000mm), high temperatures (mean annual temperature 19.1° to 22.2 °C) and high humidity (over 90%) may have resulted in the melanistic mutation of the Similipal tiger, which helped it to camouflage itself in the dense forest vegetation to stalk prey animals such as sambar.

Conclusion

The frequent sightings of black and melanistic tigers and three of the seven tigers captured in photographs during the camera trapping exercise in 2006, all in an area of only 120 km^2 out of the 2,750 km^2 of STR, provide ample evidence of a preponderance of melanism in Similipal tigers. The use of molecular markers and complete genome sequences of these tigers may identify the genetic basis of melanism. However, studies of jaguars, pocket mice, bananaquits, etc. mentioned herein make us believe that melanism in Similipal tigers may be a manifestation of dominant genes, and for this, Similipal occupies a unique position for tiger conservation in the country. In order to save the tigers of Similipal, the distinctive camouflage pattern of the habitat also needs to be preserved.

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SOCIAL ORGANIZATION AND POPULATION DYNAMICS OF INDIAN GAZELLE (*Gazella bennettii*) IN THAR DESERT OF RAJASTHAN, INDIA

by Sumit Dookia and G.R. Jakher

Introduction

The current level of information on various ecological aspects is far from satisfactory for the once widely distributed antelope Chinkara (*Gazella bennettii* Sykes) in this region in Indian subcontinent. Extensive research work on other species of genus *Gazella*, carried out in the African continent, has, on the contrary, not only provided sound ecological data for their intensive management but also allowed some useful conservation practices (Dunham, 1997, 1998, 1999; Bharav, 1983; Bardley, 1977; Furley, 1986; Grettenberger, 1987; Habibi, 1992; Magin and Greth, 1994; and Walther *et al*., 1983). In general, the term 'herd' or 'group' is generally used to designate any temporary aggregation of two or more individuals, which are observed together, but are spatially separated from other aggregations of that species in the area. But in the present study the term 'herd' was applied to designate only aggregations of two or more individuals which were composed of individuals of both the sexes or same sexes and of different ages.

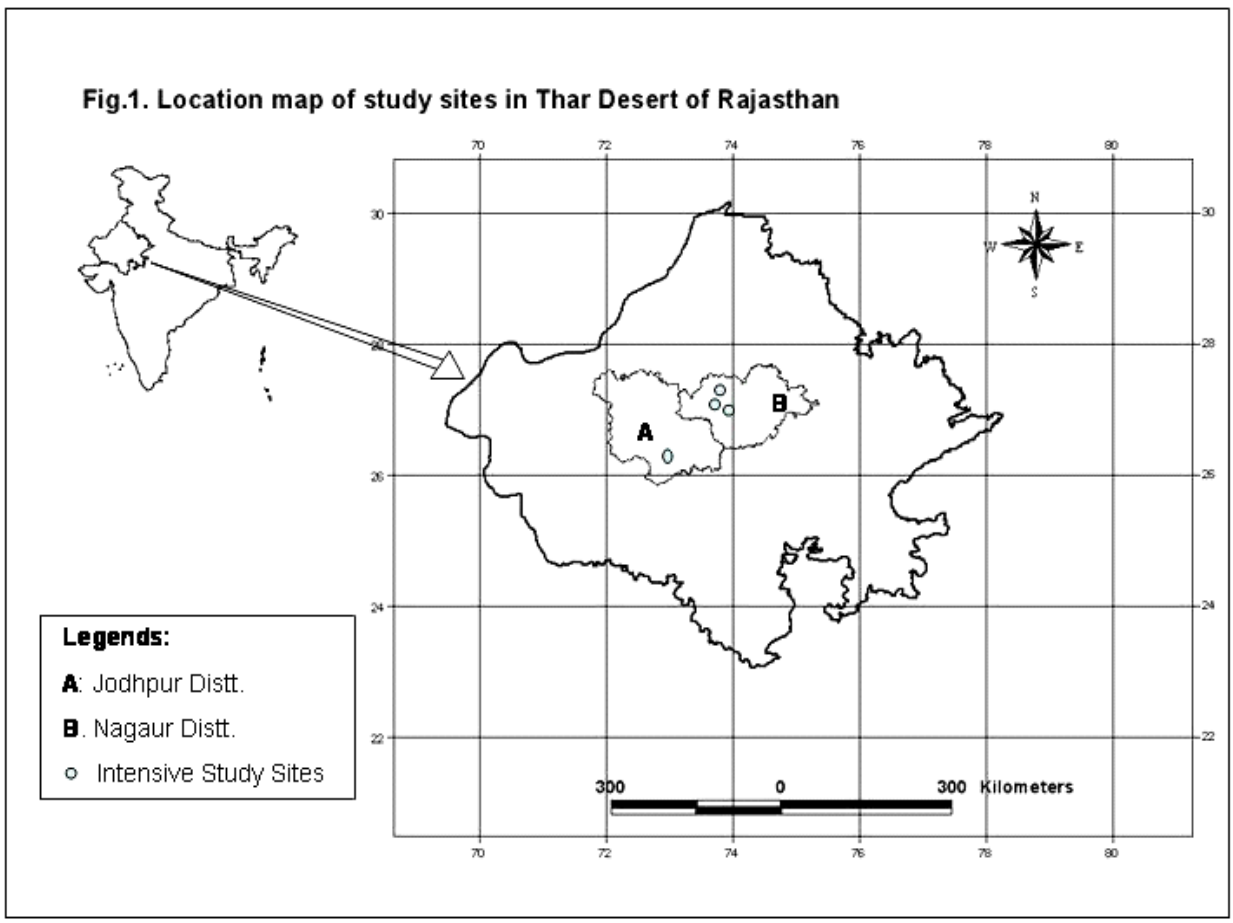
The Indian Gazelle or Chinkara is widely distributed in the state of Rajasthan (India). Indian Gazelles were once the most numerous wild ungulates in the arid and semi-arid regions of India (Rahmani, 1990b). In the last few decades the populations have seriously declined and it is listed in the endangered list (Schedule I) of the Wildlife Protection Act (1972) and in the category of "Lower Risk/conservation dependent" (IUCN Red Data list, 2002). Fortunately, some portions of these populations are well protected in natural habitats and around village complexes by the local people. The Bishnoi community believes in worshiping them as sacred animals hence provide total protection and consider it a taboo to harm them. This paper describes the social grouping and population structure of Chinkara in the Thar Desert of Rajasthan. The study was conducted during November 1999 to October 2001, on the social organization and population dynamics of Indian gazelle in desert part of Rajasthan.

Study area

Rajasthan is situated in northwestern part of India and lies between 23° 30' N and 30° 11' N latitude and 69° 29' E and 78° 17' E longitude, occupying an area of 342,239 km^2. The Aravalli range roughly divides Rajasthan diagonally into two physiological zones, namely the Thar Desert in the west and semi-arid to sub-humid eastern and southeastern Rajasthan. The major part of Thar Desert (over 60%) is located in the northwestern part of Rajasthan State. This study was carried out in the western part of Rajasthan.

For the study, four different intensive study sites were selected in two districts of the Thar Desert, in the semi-arid part of Rajasthan – one in Jodhpur and three in Nagaur district. The four sites differ in habitat types and vegetation composition. Site-I, Guda Bishnoian (GB, here after) in District Jodhpur, has rainfed agricultural fields with some village common lands on the periphery. It consists of a flat alluvial plain with a mosaic of crop fields and saline wasteland. Site-II, Alai (AL, here after), in District Nagaur, was on the outskirts of a village and mainly consists of dunal-interdunal plains, with sandy and gravelly plain scrublands along with scattered crop fields. Site-III, Gogelao Enclosure (GE, here after) in District Nagaur, was an old pasture land, developed and maintained by the state forest department as a "*gauchar*" land for cattle grazing. It consists of sandy alluvial plains with shrubs and scrub vegetation, with some scattered trees of *Prosopis cineraria*, *Acacia tortilis*,

Prosopis juliflora and *Capparis decidua* (Dookia, 2002). Site-IV, Satheran (SA, here after) in District Nagaur, was dunal habitat with scattered hamlets, sand dunes with typical arid vegetation, dominated by shrubs of *Laptadinia-Crotalaria-Colligonum* type (Fig 1). All sites were similar in climatic conditions like temperature, rainfall, humidity, wind speed, etc., but the topography and vegetation varied from one site to another. Except for Site-III GE, all study areas were in and around the agricultural fields.



Materials and methods

Data was collected from November 1999-October 2001 and thereafter randomly from 2006 to 2010 during the "Volunteer's Population Monitoring Program" in the Chinkara Community Conservation Project, supported by The Ruffords Small Grant Foundation, UK. During the present study, long vehicle-driven road transects around these four sites were seasonally followed to collect information on the trends of the Indian gazelle population. The road-strip counts were conducted four times on the same routes in different seasons: winter 1999, summer 2000, winter 2000 and summer 2001. During each count, the existing road network (including the fair weather road) of the village complexes (average 20 km segments) was used in nearby areas about 30 km from the intensive study sites. Each road transect was monitored in the morning and evening hours following methodology by Khan *et al.* (1995). A total of 1,642 km of road transects were monitored during the four counts respectively.

Social groups and composition were recorded for all the sightings and animals were classified into adult male (AM), adult female (AF), sub-adult male (SAM), sub-adult female (SAF) and juveniles (J), by morphological characteristics of the gazelles differentiated into age-sex categories

by Dunham (1999).

Detail morphology of animals considered during the study was as follows:
Adult male: - A fully grown gazelle with horns more than 7 inches long and two-and-a-half years old is considered as an adult male.
Adult female: - One-and-a-half year old females with horns longer than 2 inches are considered as adult females.
Sub-adult male: - A male 6-12 months old, with horns longer than 3 inches, not curved.
Sub-adult female: - A female 6-12 months old, with very thin 2-inch-long horns called spikes.
Juveniles: - All young gazelles without horns, usually below 6 months of age are known as fawns.

The following terms have been used to delimit the various types of the social structures:
Mixed herd (Family herd): - The grouping was comprised of both the sexes and individuals of all ages.
All-male herd (Bachelor herd): - It was composed of only male individuals above the age of 18 months.
Solitary: - The solitary status of an individual is always a temporary phase among gazelles and sometimes the individual animal may be merely accidentally separated from its group. A member of an all-male herd may have separated from the main herd in search of water, food or a female for mating. Pregnant females or females that have just delivered a young one are found as solitary animals but this stage lasts for only 7-10 days.

Results

Group size:

Indian gazelles were found in social units throughout the study time and stayed in clearly defined family units or herds. As a rule, the smallest herd or family unit was composed of one territorial male and one female. During different road counts, each site was also taken into account to see the variations across the seasons. A total 1,868 individuals in 82 herds were encountered during the road transect survey in all four sites.The maximum number of Indian Gazelles (n=143) was sighted in the winter of 1999 in the Alai Study Site (AL), whereas the minimum (n=85) number was sighted from the same site in the summer of 2000. Generally, in winter months, the sightings of the gazelles were greater in all the study sites compared to in the summer season (Fig.2). A probable reason could be the large congregation of animals in the agricultural fields in winter months, after the harvesting of crops. Among the study sites, Site I (GB) had a higher number of gazelles (123 gazelles/ road transacts) compared to the other three sites. Whereas in Site II (GE), gazelle sightings were considerably less (108 gazelles/ road transacts) compared to other places (Fig.3). The reason could be the disturbance from the various human activities and less protection than at other sites. The mean group size (MGS) also varied among the study sites. On a seasonal basis, the MGS was higher in the winter months than during the summer season.

A larger number of groups was seen in the smaller size classes compared to bigger ones (Fig. 4). While looking at the proportion of individuals among group size, 43.3% individuals were found in the group size of 1-4 individuals/ group at all four sites, and 40.9% were in the group size of 5-8 individuals/group. The number of individuals in a group sharply declined just after the group size class of 5-8 individuals/ group. The group size class of 9-12 individuals/ group were represented by only 11.6% of the gazelles and 2.4% fell into the 13-16 individuals/group. Only 0.3% were found in a larger group size, i.e., more than 24 individuals/ group (Fig. 4).

The cumulative distribution of gazelles shows that the group sizes of Indian gazelles ranged from 1-20 individuals per group at all four study sites, except for one large group of 25 gazelles at the Alai study site (Fig. 5). The average MGS was 5.74 gazelles/herd. Looking at the seasonal pattern, the MGS varies according to the season with the winter season supporting larger groups (6.78 gazelles/herd) compared to the summer season (5.10 gazelles/herd).

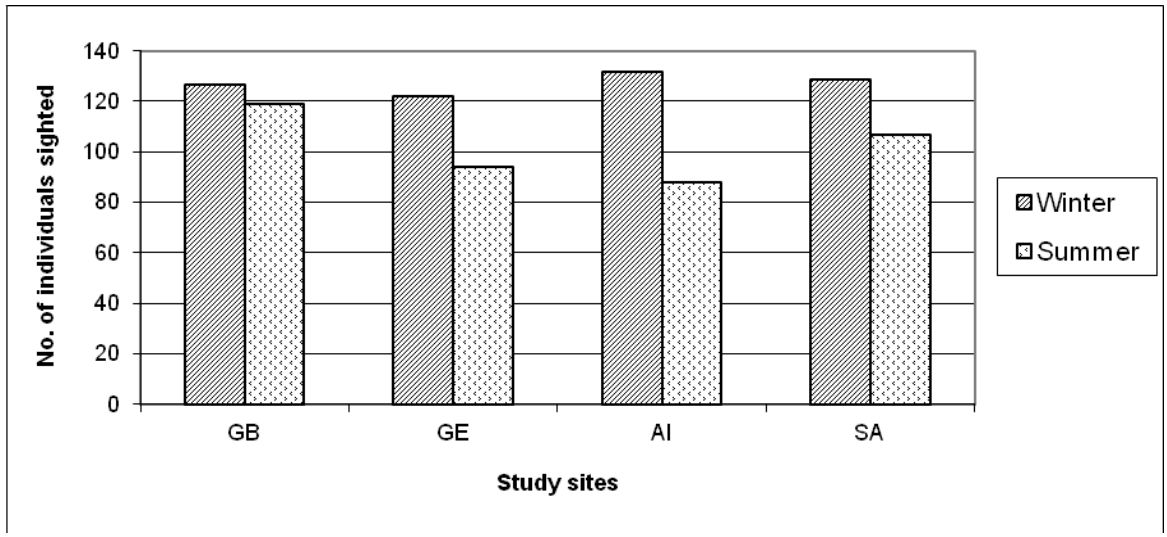


Fig. 2. Sightings of Indian Gazelle in road transacts at seasonal basis from different study sites in Thar Desert of Rajasthan, India.

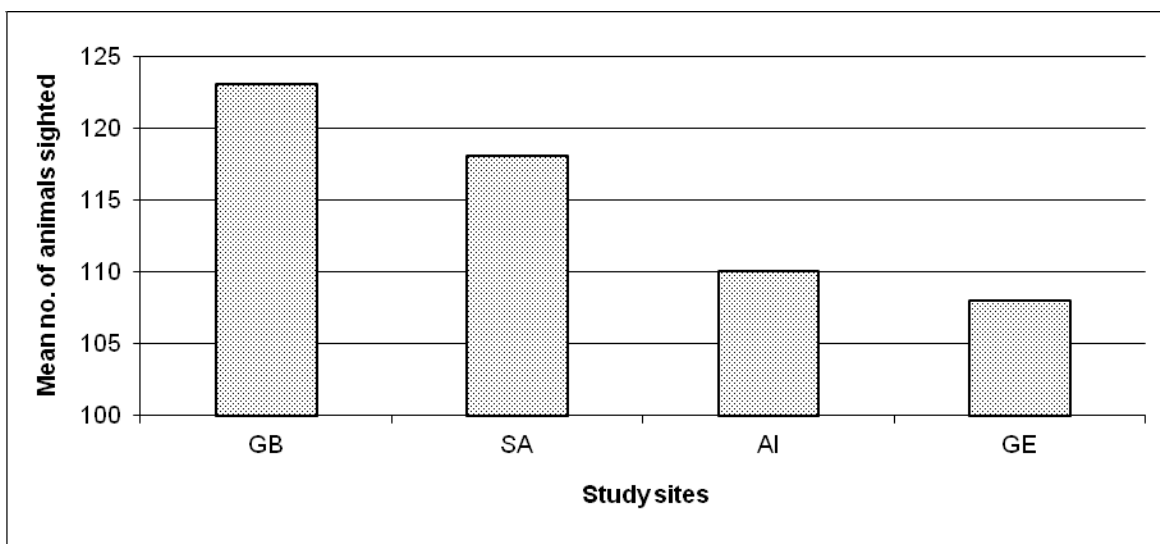


Fig. 3. Mean no. of animals sighted during the four consecutive road transacts.

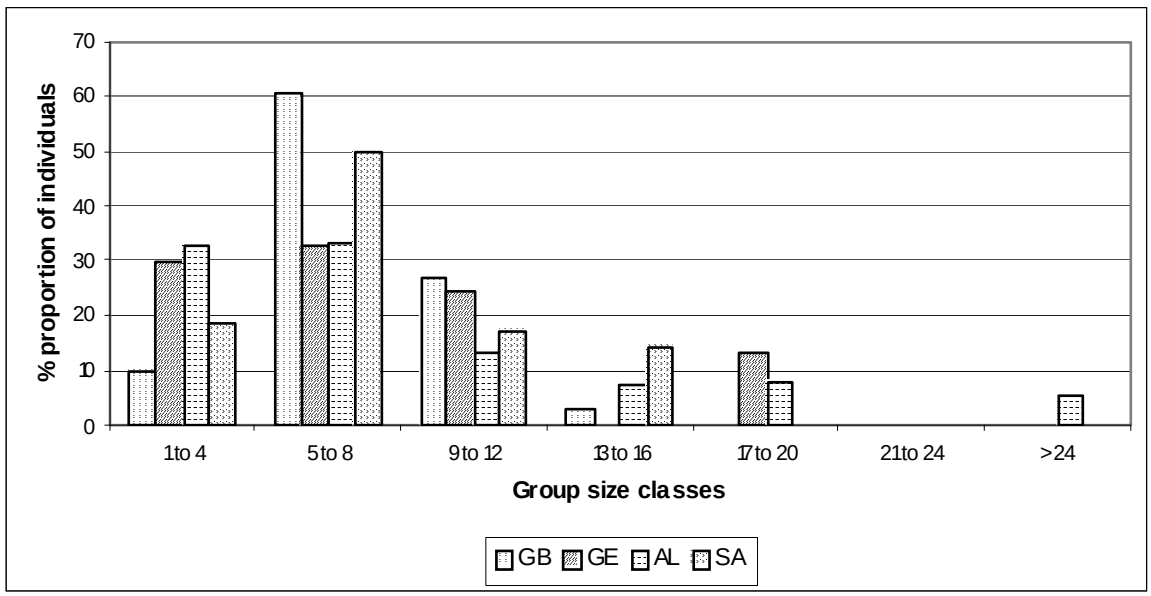


Fig. 4. Proportion of different groups at various group size classes (n=1868).

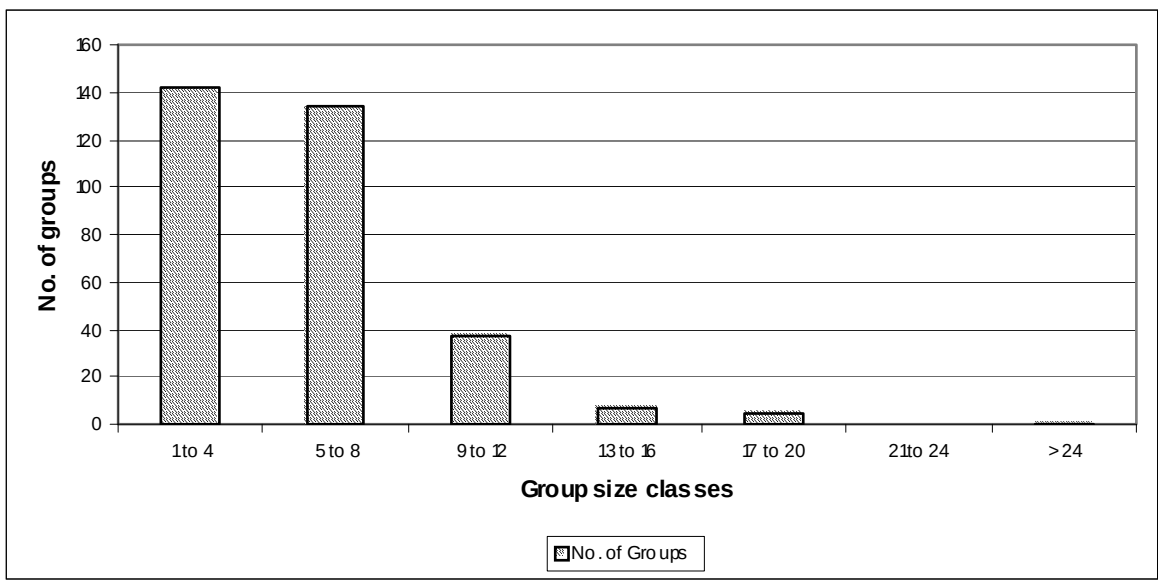


Fig. 5 Frequency of distribution of individuals in different group sizes (n= 1868).

Sex Ratio and Female-Fawn Ratio

In general, the sex ratio of Indian gazelles was female-biased. The average sex ratio of Indian gazelle was 1:1.47 from the road transect, at all four study sites. This varied from place to place: the GB site had 1.11 females per male; at GE it was 1: 1.52; the AL site was holding 1: 1.93; and at the SA site it was 1:1.53. Site III (AL) had the highest sex ratio among all other sites and was also high from the overall general sex ratio, which also shows that the AL site has very good habitat conditions and protection compared to the other sites. The ratio among juvenile and adult females was estimated to be 1:2.62 over the two years of the study period.

Discussion and conclusion

All social animals form some type of group for living together. The Indian gazelle is a social animal and lives in herds (Dookia, 2002, 2007, 2009). There were mostly two types of herds, *i.e.*, all-male herds and mixed (or family) herds. However, Bohra *et al*. (1992) suggested three types of groups: i) a family herd comprised of a single buck, one or more does and the fawns; (ii) a solitary buck; and (iii) a small, all-male herd. During this study, a total of 26 solitary male individuals were noticed, but when followed for longer durations it was found that they eventually join nearby herds, and this solitary herd form did not last longer than 7 days during the entire study period. So it is suggested from this study that the solitary phase is purely temporary. During the study only two types of social groups, all-male and family/mixed herds, were observed at both the selected sites as well as in different other locations during long road transects. Dookia and Jakher (2002) observed similar herd formations and also noted that the single male was just a temporary phase and found only for very short time, particularly in mating time. In the present study, the herds were mostly comprised of different age and sex individuals, and there was no compact social bonding, except between a mother and her fawn of less then 3 months.

In principle, the animals of family Antilopinae, have herds of open societies and members can join and leave the herds anytime; splitting and amalgamating occurs throughout the year (Walther *et al.*, 1983). However, often members of herds may remain constant in size and composition over weeks and months, and that makes their life social. They also have certain individual distance (Hediger, 1941) between each other. This individual distance may vary with sex, age and activity (Walther, 1977a). Good quality habitat supports large-sized groups in ungulates, so the group size of gazelle totally depends on the quality of habitat (Rubenstein, 1989). The composition of herds varied in different habitats as well as in different seasons. The herd size was greater in winter during the present study. The availability of food and other conditions in winter favored large-sized herds.

Social groups and composition were recorded for all the sightings and animals were classified into adult male (AM), adult female (AF), sub-adult male (SAM), sub-adult female (SAF) and juveniles (J), by morphological characteristics of the gazelles as differentiated into age-sex categories by Dunham (1999) for mountain gazelles (*Gazella gazella*) in Central Arabia. The Indian gazelle population comprised five age and sex categories as mentioned earlier, and observed at all four study sites. Dunham (1999) observed that male fawns left their natal territory at 5-6 months of age and joined bachelor groups of the reintroduced population in Central Arabia.

In the Thar Desert study the gazelle population was comprised of 25.12% adult males, 38.51% adult females, 9.32% sub-adult males, 18.20% sub-adult females and 8.82% juveniles. Schaller (1975) categorized Indian gazelles into adult males, yearling males, females, large young and small young on the basis of horn length; a population was comprised of 22% adult males, 3% yearling males, 61% females, 10% large young and 4% small young. Loggers (1992) categorized the Dorcas gazelle (*Gazella dorcas*), a close relative of the Indian gazelle, on the basis of body size and horn size/structure and defined three age classes, *i.e*., fawns (0-12 months), juvenile (12-18 months) and adults (animals capable of breeding). In Morocco, the Dorcas gazelle population was comprised of 60% adults, 13% juvenile and 25% fawns with little seasonal

variation (Loggers, 1992). Loggers (1992) observed that females of Dorcas gazelles (*Gazella dorcas*) live in groups along with their fawns, juvenile females and juvenile males. When accompanied by a territorial male, female groups comprised an average 1.4 fawns (range 1-5) and 2.5 females of reproductive age (range 1-8). Lone adult females were often seen. Males live either as lone territorial males or as members of bachelor groups. Bachelors were found as singles or in herds of up to ten members; during the present study the maximum herd size of all-male herds was 17 individuals during the winter months at the Guda Bishnoian site in Jodhpur district.

During the present study, group size varied from 3-26 gazelles/herd, and mean group size was 5-6. The largest herd size was found at the Alai site and comprised 26 individuals of both sexes, but mostly herds were composed of 3-10 individuals. The highest average herd size (12.67 individuals) was found at the Alai site and the lowest (5 individuals/herd) was at Gogelao Enclosure. Here, big herd size was mostly noted at sites where human settlements were close by. Indian gazelle received full protection from the local people in these areas. This is also supported by Bohra *et al.* (1992), that Indian gazelles are less gregarious than blackbuck and live in small herds of 5 to 20 animals. Stockley (1936) recorded a similar range of herd size of Indian gazelle with a maximum 23 members/herd from Kalabagh in Pakistan, with 29% solitary, 28% of 2 members, 13% of 3, 10% of 6-10, and 5% groups of 11-14 individuals. One group, observed outside the study area, comprised 25 individuals. The average group size, including solitary animals, was 1.9, whereas excluding solitary animals it was 3.0 individuals/herd. Group size variation was also noted for different habitats. The group size with 6-7 individuals represented 30%, whereas herds with 5-6 and 8-9 individuals each accounted for 15% of the total selected herds. As such, 60% of the groups were composed of 5-9 individuals/herd.

Rahmani (1988) earlier reported that Chinkara normally live in small groups of 2-8 individuals, though temporary associations of up to 30 individuals were sometimes seen in crop fields or near water-holes. Sharma (1977) reported that the herd size increased during the rutting season and was also influenced by climatic conditions. Rahmani (1990a) recorded an average herd size of 3-6 individuals/herd from the desert of Rajasthan and the largest herd was comprised of 25 animals (17 males and 8 females) in a pearl millet field. This composition may be rare and appears to be a temporary aggregation of several individuals to a food source. Large agglomerations of both the sexes and different age classes were also encountered during the monsoon season. In addition, nearby herds would come together to face man-made threats or when sensing the presence of a predator nearby. These aggregations were for short durations. Loggers (1992) also reported that large herds of Dorcas gazelle were formed in response to disturbances by humans or dogs, and this increased size was used by reserve guards as an indication of illegal activities. Mountain gazelles in Israel also formed large groups during disturbances (Grau, 1974).

Sex ratio

In the study the sex ratio was 1:1.45 during first year (Nov. 99 to Oct. 2000) and 1:1.62 during the second year (Nov. 2000 to Oct. 2001). This was slightly biased toward the females. Rahmani (1990) calculated the sex ratio of Indian gazelle in the Sudasari enclosure, Desert National Park, and found it biased toward females, (1 male:1.3 female). DharmakumarSinhji (1959) reported a male/female sex ratio of 1:3-4 in Indian gazelle, highly biased in favor of females. But it may differ according to local conditions. Schaller (1977) reported that in a population of 601 Indian gazelle, the male/female sex ratio was 1:2.5. This low proportion of males was caused not only by selective sport hunting, but also probably was due to the emigration of yearling males from the study area.

Birth peaks

Indian gazelle is a yearlong breeder but birth peaks were found twice in a year between Feb.-March and July-Aug. In the present study two females were continuously monitored to determine the gestation period, which was found to be about five and half months. Rahmani (1997) found significant variation in the number of juvenile Chinkara in spring, monsoon and winter seasons ($P<0.001$, X^2

= 31.67), with monsoon values of 14.37, which indicated a high birth rate of Chinkara in the Thar Desert during the monsoon. Schaller (1977) also observed that Indian gazelles breed in all the seasons but the highest natality rate was in April. Bohra *et al.* (1992) also supported the finding of Schaller (1977), Prater (1965) and Rahmani (1997) and the results of the present study also showed a similar conclusion. Sankhala and Desai (1969) observed three births of Indian gazelle in captivity in Delhi Zoo during June to August. Rahmani (1988) reported that after a gestation period of five and half months, pregnant females generally gave birth to a single fawn; however, occasionally there were twins. Chinkaras have no particular breeding season but more births were usually noted after the monsoon.

Habibi *et al*. (1993) also noted that mountain gazelles breed year round, but natality peaks were high in March-April and September-October. Mountain gazelles in Israel produce fawns on average every 9.5 months (Mendelssohn, 1974). The gestation period in Dorcas gazelle was observed to be from 5 months to 5.8 months (Furley, 1986).

Twins were observed in present study, but it was not confirmed whether they were real twins or a fawn of other female who joined the group. Schaller (1977) reported that one young per adult female per year seems to be the rule; however, on two occasions a female was observed with two young of the same age at heel. Bohra *et al.*, (1992) reported one or two fawns born from females of Indian gazelle at a time. Furley (1986) reported that twins were extremely rare in *Gazella thomsoni* and *G. dorcas*, but frequent in *G. cuvieri*. Persian gazelles (*Gazella subgutturosa*) gave birth as a rule only to a single fawn at a time (Blank, 1998).

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EFFECTS OF ECOLOGICAL TRANSITION FROM NATURAL FOREST TO TEA PLANTATIONS AND FOREST MANAGEMENT IN HIGH ALTITUDE REGIONS OF SRI LANKA

by Gajaba Ellepola and Sanjeewa Jayaratne

Introduction

One of the main issues of concern to Sri Lanka is the drastic reduction of forest cover due to the high demand for natural resources, several development activities, as well as illegal deforestation activities (Nanayakkara *et al.*, 2009). Because of rapid deforestation, environmental problems have also accelerated (Williams, 2011; Fernández-Juricic, 2004). The country is therefore looking to conserve the existing forests and increase the forest cover of the island parallel to global conservation activities.

Forest cover in Sri Lanka started declining with the introduction of commercial crops. Clearing forests for agricultural and residential purposes further contributed to reducing the natural forest cover. In 1900, the total land area covered by forests was 70%; today it constitutes a lower figure of 23.9%. About 40,000 ha of forest area are cleared every year (Forest Department, 1992). According to FAO, 28.8% (about 1,860,000 ha) of Sri Lanka is forested. Between 1990 and 2010, Sri Lanka lost forest cover on an average of 24,500 ha or 1.04% per year (FAO, 2010). (Figure 1).

Forest plantations in Sri Lanka are not a new element in the present land use. During the last five decades, forest plantations have spread around the country, especially due to increases in timber requirements. Firewood consumption in the state sector also increased to fill the world tea market requirements. Thus, the concepts of agroforestry and forest plantation emerged (Nanayakkara *et al.*, 2009). Meanwhile, the Government started cultivating several timber-value forest plants on the island and some individuals also managed small scale forest plantations on their own lands. In the estate plantation sector, trees are planted for both timber production and for the firewood requirements of the estates. Most of the abandoned tea lands are used for forest plantations (Hewage and Mallika, 2011). Parallel to the forest degradation, the forest plantation area has also decreased within the last two three decades. In 1990 there were almost 242,000 ha of planted forest, which was reduced to 221,000 ha in 2000, to 195,000 ha in 2005 and dropped to 185,000 ha in 2010 (FAO, 2010).

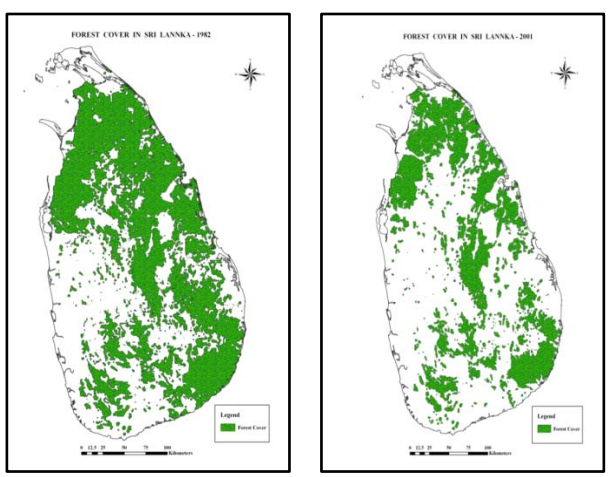

Figure 1: Forest cover depletion of Sri Lanka from 1982 to 2001

Under these circumstances, the exercise of maintaining forest plantation units and preparing management plans for the units is essential. Typically, however, converted land is exhausted, abandoned and allowed to regrow (Nepstad *et al*., 1991); as a result, secondary forests make up an increasing percentage of forest cover. For some countries, secondary forests may soon be all that remains (Laurance and Bierregaard, 1997). While conservation emphasis has been on establishing reserves that protect mature forests, the importance of disturbed areas such as secondary forest for the conservation of fauna has been increasingly recognized (Vandermeer and Perfecto, 1997). However, this study will compare a natural forest (NF), a tea plantation (TP) and a regenerating forest (RF) to discuss the present ecological environment of forest units (natural and planted forests) and the ecological impacts on those forest units due to plantation activities, including forest management, in several tea estates in Badulla district, Uva Province, Sri Lanka

Study area

The area that comes under this study is the Hali-Ela Grouped Estate Area. The study area lies within 6˚50' 45.98"N, 81˚ 0' 33.63"E and 6˚ 57' 31.05"N, 81˚ 6' 40.78"E coordinates. The elevation varies from 480 m to 1,920 m, providing a fine climate and an ideal location to grow tea. The study area extended over a total area of 3,102.90 ha and covered 5 estates in the Hali-Ela estate cluster, located in Hali-Ela of Badulla District in Uva Province (Figure 2). Although the study area is over 3,000 ha, our main focus was only on tea plantations, planted forest units and natural forest patches in the study area. The area of forest units is around 394.78 ha, based on the GIS data base. The studied forest units were scattered throughout the above-mentioned estate area. Some forest units are linked by forest corridors while others are isolated.

The forest units consist of natural and semi-natural forests present within the estate, which is mostly restricted to the hill crests of the mountain ranges found within the Hali-Ela Grouped Estates. Apart from the forested areas and tea plantations there are several abandoned tea plantations and planted areas of fuel trees such as *Eucalyptus grandis, E. robusta* and *E. torelliana* scattered around the estate. These areas contribute to creating habitats and also act as buffer zones for the tea plantations. The forest units present in the estate are found as isolated patches within the boundaries of the estate.

Methodology

The study was carried out from August 2012 to January 2013. The impact area for ecological study included all the forest units together with natural-primary forests, secondary forests, grasslands and planted forest units within the study area. A line transect integrated with the point count method was used to collect data. Night sampling was also carried out. During this survey both direct (direct observations, using binoculars, camera photographs) and indirect methods (pellet analysis, foot prints, call analysis and communication with plantation officers and workers) were used to document the floral and faunal species present in the area. All the species recorded were further clarified by using the most up to date field and taxonomic guides (i.e., Manamendra-arachchi and Pethiyagoda, 2006; Somaweera, 2006; Somaweera and Somaweera, 2009; Phillips, 1935; Kostermans, 1992; Harrison, 1999).

Results

Four major types of habitats were identified within the estate: i) sub-montane, natural and semi-natural forests; ii) tea plantation areas; iii) Eucalyptus plantation areas; and iv) home gardens. But for the purposes of this study only natural forests, secondary forests (abandoned tea lands and planted forests) and tea plantation areas were considered.

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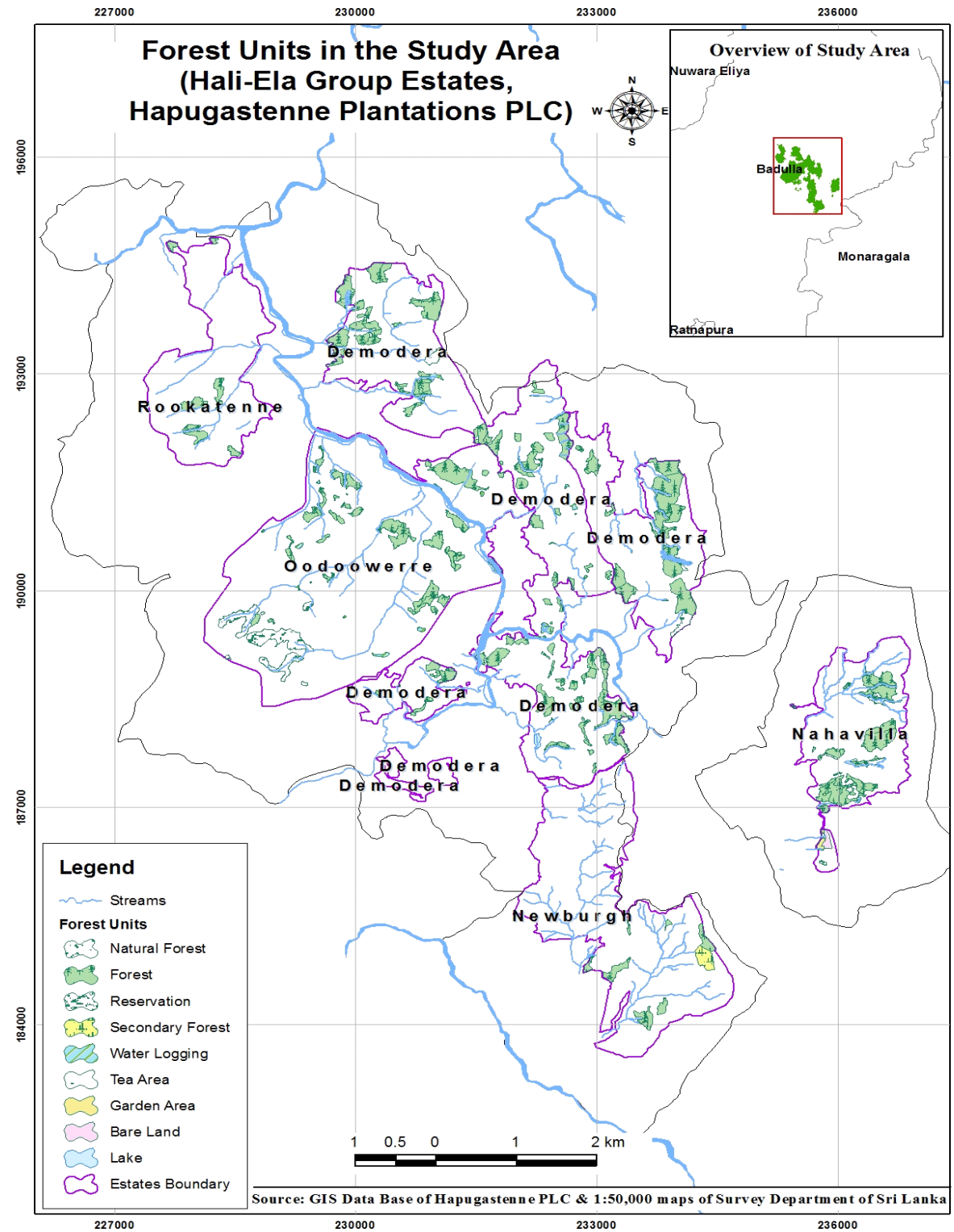

Figure 2: Map of the study area

Source: GIS data base of Hapugastenna Plantations PLC and Survey Department of Sri Lanka (1992)

The floristic survey recorded 126 major flowering plant species, including 92 indigenous plant species, of which nine species are endemic to Sri Lanka. The remaining plants are exotic species including five alien invasive plant species which could become a major threat to the biodiversity of the area. Many of the plant species recorded here had an important role in the livelihoods of the local community such as for food, fuel or medicine (Table 1).

A total of 107 faunal species were recorded in the site. This included both invertebrates (35 species of dragonflies, butterflies, freshwater crabs and land snails) and vertebrates (72 species of fishes, amphibians, reptiles, birds, and mammals). Among the recorded faunal species, 22 were endemic, 2 were possibly endemic to the island and 15 were listed as nationally threatened in the **2007 Red List of Threatened Fauna and Flora of Sri Lanka** (IUCN Sri Lanka & MENR, 2007). Another 13 species were listed as near threatened.

The number of animal species differed in the three selected habitat types of natural forest (NF), tea plantation (TP) and planted or secondary forest (RF) (Table 2). A total of 69 species were recorded in NF, of which 38% were endemic, while TP contained 35 species, of which only 12% were endemic. The highest number of species and highest percentage of endemicity were recorded in secondary forests or regenerating forests (RF) with a total of 81 species and 45% of endemics (Figure 3)

Table 1: A summary of the ecological status of the plant species recorded from the study area

Habitats	Family	Species	Ecological Status					
			Native	Endemic	Cultivation	Introduce	Ornamental	Invasive
Natural forest	28	56	45	8	0	1	0	2
Tea Land	33	62	47	1	2	7	0	5
Planted/Secondary forests	49	94	77	1	1	11	0	4

Table 2: A summary of the fauna recorded from three different habitat types

Animal Group	Natural Forest							Tea Plantation							Planted/2ry forest						
	Total	Endemic	CR	EN	VU	NT	DD	Total	Endemic	CR	EN	VU	NT	DD	Total	Endemic	CR	EN	VU	NT	DD
Crabs	1	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Land snails	3	2	-	-	-	-	2	-	-	-	-	-	-	-	3	1	-	-	-	-	2
Dragonflies	4	3	-	1	1	-	-	1	-	-	-	-	-	-	9	4	-	2	-	-	-
Butterflies	10	1	-	-	-	3	1	9	-	-	-	-	-	-	14	1	-	-	-	-	1
Fishes	2	2	-	-	-	1	-	-	-	-	-	-	-	-	2	2	-	-	-	1	-
Amphibians	2	2	1	-	-	1	-	-	-	-	-	-	-	-	2	2	1	-	-	1	-
Reptiles	5	1	-	-	-	-	-	4	-	-	-	-	-	-	7	1	-	-	-	1	-
Birds	29	4	-	2	1	5	-	18	2	-	2	-	1	-	37	6	1	3	3	-	-
Mammals	13	2	-	-	3	2	-	3	1	-	-	-	1	-	7	1	-	-	1	1	-
Total	69	18	1	4	5	12	3	35	3	-	2	-	2	-	81	18	2	5	4	4	3

Discussion

The study site consists of a mosaic of habitats including natural forests (NF), regenerating forests (RF), tea plantations (TP), and grasslands as well as small water channels. By comparing the floral composition of the NF and the TP it is evident that the species composition has drastically declined in the TP. These tea lands had remained as natural forests before converting them into tea lands. A tea land is simply a monoculture of tea with several other cover crops. Therefore, a tea land is a simple ecosystem. In comparison, a NF is a polyculture of plants and is a complex ecosystem with many interactions of plants and animals (Kimmins, 1997). The use of herbicides, removal of unwanted plants and assisting the

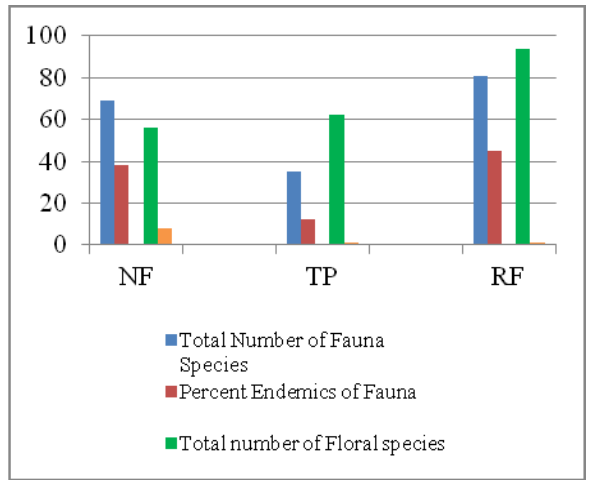

Figure 3: Percentage of Endemic species (flora and fauna) with respect to total number of species recorded in Natural Forests (NF), Tea Plantations (TP) and Regenerating Forests (RF)

growth of targeted plants lowers the number of plant species in a TP (Aktar *et al*., 2009).

In comparison, a RF contains a higher number of plant species than a NF and a TP. The endemicity is also high compared to the other two types of habitats. This is possible when a forest is in its early stages of succession. As the forest grows, the species are reduced in numbers and become stabilized as in a NF (Diaz *et al.*, 2006). But the spread of invasive plants is a problem in a regenerating forest (Wilgen *et al*., 2001). This is evident by the presence of five invasive plant species in the RF and they should be destroyed to support the growth of other plant species.

By comparing the faunal composition in the NF and TP it is evident that the species composition has drastically declined in the TP. By converting a NF to a TP, microhabitats of species are destroyed along with their food sources (Ulzen, 2012); thus, the species composition declines. Another problem in a tea land is the use of pesticides and other chemicals (Aktar *et al*., 2009). These substances destroy a huge number of invertebrate fauna in the soil and disrupt the food chains in the tea plantation habitat. When these chemicals get into water channels it causes the absence of fish, amphibians and mollusks which are sensitive organisms and act as good indicators of environmental pollution (Waddle, 2006). In the case of birds, there still remains a somewhat higher number of species in the tea lands. This is due to the presence of tall, covering crops. Most of the birds in the TP are insectivores and they perch on these covering crops to seek prey. Because the tea lands contain lot of insect pests (Aktar *et al*., 2009) they are good hunting grounds for birds and most of these bird species are generalist feeders (Fernández-Juricic, 2004). Mammals are very rare in tea-dominated lands because they normally avoid open areas (Ulzen, 2012)

The endemicity of animals is very low in the TP compared to the NF. Endemics are most often specialist species (Young, 2007). Only generalist species can survive in human-altered habitats. In comparison to both the NF and TP, the RF supports a higher number of animal species as well as a higher number of endemics since the forests are in its early stages of succession. As it matures the numbers will be reduced and ultimately become stabilized (Diaz *et al.*, 2006).

This suggests that a human-altered land can be transformed into its original state. But for the transformation to be effective the RF should be adjacent to a NF and will require time to repair the damages. To bring the secondary forest to its earlier status, the extinctions of species should be prevented. But as the natural forest degrades, the area of occupancy decreases and thus, species

are driven to extinction. This can be prevented if increasing the forest cover by converting it to its original status is possible and the whole ecosystem would be benefit from this.

Conclusion

This study highlights the impact of converting natural forests in to tea lands in a high altitude region. It concludes that agro lands can be reconverted back to their original status with time if the regenerating forest is adjacent to a natural forest and if extinctions can be prevented. Therefore, forest management plans are essential to increase the green cover of the country and to use it for the benefit of all.

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STUDY OF BIRDS COMPOSITION AT THE BURNED AND UNBURNED FORESTS IN KLIAS FOREST RESERVE, SABAH, MALAYSIA

by Andy Russel Mojiol, Gloria Muring Ganang and Boyd Sun Fatt

Figure 1: Location of Klias Forest Reserve.
(Source: UNDP, 2006)

Introduction

Peat swamp forests are waterlogged areas which can accumulate a thick layer of dead leaves and plant materials up to twenty meters deep. They comprise an ecosystem of acidic water with low nutrients and low dissolved oxygen. Peat is mostly soil with more than 65% organic matter that is composed largely of dead vegetation. The survival of peat swamp forests depends on a naturally high water level which prevents the soil from drying out to expose combustible peat matter. The flora species are uniquely adapted to the conditions of peat swamp (Sabah Forestry Department, 2005).

The peat swamp forest is Malaysia's largest wetland type which accounts for about 75% of the country's total wetlands. However, a large proportion has been degraded by repeated fires. Currently, there are approximately 40,000 ha of peat swamp forest still remaining in Sabah (UNDP, 2006). The Klias Forest Reserve is one of the peat swamps in Sabah gazetted as a Class I Forest Reserve on 14th March 1984. Since its designation as a forest reserve, no commercial logging has taken place within the boundaries, although selective logging occurred during the 1960s. Therefore, the affected forest is still in a recovery stage.

Besides acting as a buffer between marine and freshwater systems, which prevents excessive saline intrusion into coastal land and groundwater, the peat swamp forest also provides goods and services directly and indirectly in the form of forestry and fishery products, energy, flood mitigation, water supply and groundwater recharge.

The burned areas of the Klias Forest Reserve are covered with shrubs, bushes and young or dwarf trees such as melastomes and ferns which are less than five meters in height.

The type of birds found in peat swamp forests have similarities with the birds found in the surrounding lowland forests. However, there is a scarcity of primary forest birds within the peat swamp forests of West and East Malaysia. Out of the 237 bird species found in the peat swamp forests of Malaysia, 27% are listed as globally threatened species (Page, undated).

Methods

The research area is located at the Klias Forest Reserve in Beaufort district, about 10 km southwest of Beaufort town in Sabah. It covers approximately 3,620 ha of peat swamp forest. The forest is still in a recovery stage since it was selectively logged in the 1960s.

The mist net and point count methodologies were used to sample the birds in the area. The mist net method focuses on understory birds. In this survey, the mist net method is used as a guide to produce the checklist of birds in Klias Forest Reserve.

The nets were set at a randomly identified location at about 6.30 am and left in place until 6.30 pm. The nets were properly spread open with the top part hung tight and as high as possible. The lower part of the net was set 5 cm from ground level to ensure that birds walking on the ground looking for food could be captured as well. The net was visited every 1 to 2 hours to make sure birds caught in the net would not be trapped and entangled for a long period of time, which might threaten or kill them. To ensure birds were easily trapped, the net was opened with pockets. Birds captured were identified by referring to the bird checklist book.

The point count method was used in this survey since it involves the comparison of birds at burned and unburned areas. It was conducted by standing at one place and counting all the birds seen and heard within a fixed count period. This method was used to obtain the density of birds. A total of 10 point stations for each burned and unburned area were randomly selected. A distance between census stations of 100 m was standardized with 30 minutes duration for each point station.

Results

Birds caught in mist net

A total of 12 individuals from 4 species of birds were caught in the mist net set at the burned area: *Pycnonotus goiavier* (Yellow-vented Bulbul) (6), *Pycnonotus brunneus* (Red-eyed Brown Bulbul) (4), *Rhipidura javanica* (Pied Fantail) (1) and *Stachyris nigriceps* (Grey-throated Babbler) (1).

Table 1: Number of birds caught in mist nets in burned area

SPECIES	NUMBER OF BIRDS CAPTURED
Pycnonotus goiavier (Yellow-vented bulbul)	6
Pycnonotus brunneus (Red-eyed brown bulbul)	4
Rhipidura javanica (Pied fantail)	1
Stachyris maculata (Chestnut-rumped babbler)	1
Total = 12	

At the unburned area, 4 individual birds from 4 species were captured: *Hypogramma hypogrammicum* (Purple-naped Sunbird), *Prionochilus xanthopygius* (Yellow-rumped Flowerpecker), *Rhipidura javanica* (Pied Fantail) and *Stachyris maculata* (Chestnut-rumped Babbler).

Birds detected using point count method

A total of 11 species of birds were detected at the burned area including *Pycnonotus goiavier* (44.9%), *Hirundo tahitica* (28.8%), *Pycnonotus brunneus* (12.7%), *Nectarina jugularis* (3.9%), *Artamus leucorynchus* (3.4%), *Treron vernans*

Table 2: Number of birds caught in mist nets in unburned area

SPECIES	NUMBER OF BIRDS CAPTURED
Hypogramma hypogrammicum (Purple-naped sunbird)	1
Prionochilus xanthopygius (Yellow-rumped flowerpecker)	1
Rhipidura javanica (Pied fantail)	1
Stachyris maculata (Chestnut-rumped babbler)	1
Total = 4	

(1.9%), *Geopelia striata* (1.5%), *Centropus sinensis* (1%), *Eurystomus orientalis* (1%), *Aplonis panayensis* (0.5%) and *Haliastur indus* (0.5%). Figure 2 shows the total species individuals detected at the burned area.

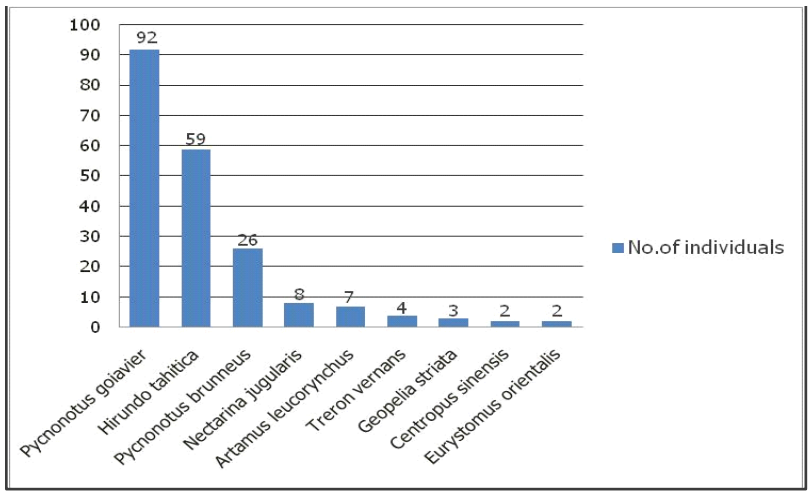


Figure 2: Total species individuals detected at the burned area.

The detected birds in this area comprise 9 families including Pycnonotidae, Hirundinidae, Nectariniidae, Artiminidae, Columbidae, Coraciidae and Cuculidae, Accipitridae and Sturnidae. Figure 3 below shows the number of individuals detected by family.

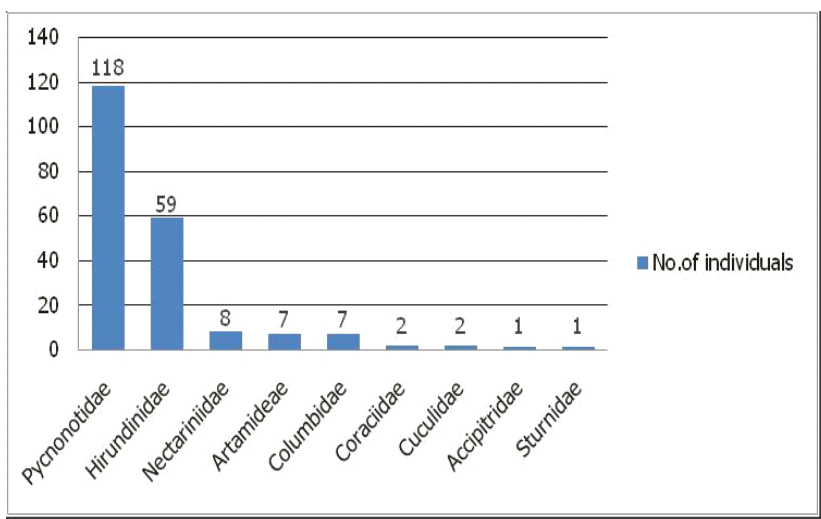


Figure 3: Total birds detected by family at the burned area

The estimated population density (D) of birds at the burned area of Klias Forest Reserve which was analyzed using the Distance 3.5 software is 64.979 birds/ha, with a 95% confidence interval between a range of 38.891 - 108.57 birds/ha. The estimated population of the birds in this area is 650 individuals in 10 ha of the studied area.

Table 3: Estimated population density of birds in the burned area

	Estimate	%CV	df	95% Confidence Interval
D (Density)	64.979	24.10	13	38.891 108.57
N (Abundance)	650.00	24.10	13	389.00 1086.0

The species diversity was calculated using the Shannon Index with the formula:

$H' = -\Sigma P_i \ln P_i$

Where, $P_i = S / N$

S = number of species in the community

N = total number of individuals in a sample

The degree of evenness is calculated with the formula:

$J' = H' / H_{max} = H' / \ln S$

The calculated diversity of birds in the burned area, H' is 1.509 with the degree of evenness in species abundance, *J'* of 0.629.

At the unburned area, a total of 12 bird species were detected including *Collocalia esculanta* (29.8%), *Hirundo tahitica* (16.9%), *Centropus sinensis* (15.3%), *Hypogramma hypogrammicum* (12.1%), *Kenopia striata* (8.9%), *Pycnonotus goiavier* (4.8%), *Aethopyga siparaja* (4%), *Copyschus saularis* (3.2%), *Prionochilus xanthopygius and Anthracoceros albirostris* (1.6%), and *Gracula Religiosa* and *Geopelia striata* (0.8%). Figure 4 shows the total species individuals detected at the unburned area.

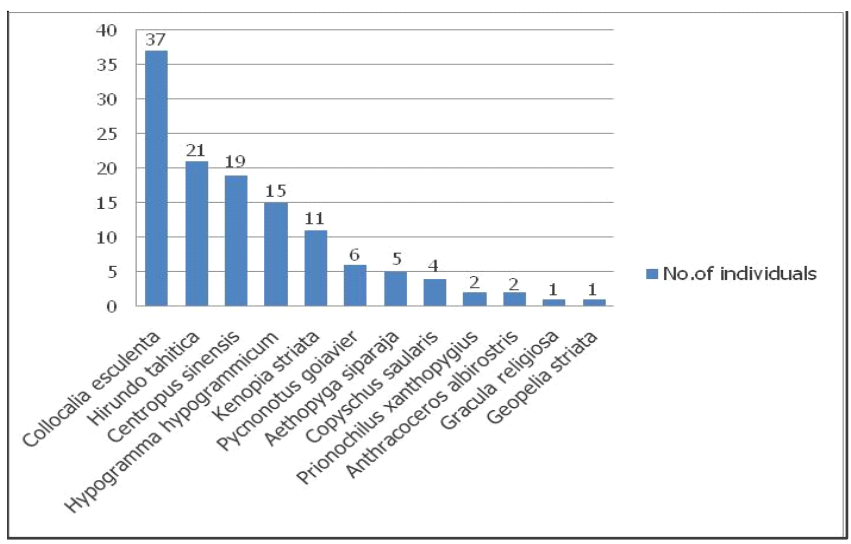


Figure 4: Total species individuals detected at the unburned area.

The detected birds in the unburned area comprise 11 families including Apodidae, Hirundinidae, Nectariniidae, Cuculidae, Timaliidae, Pycnonotidae, Muscicapidae, Bucerotidae, Dicaeidea, Columbidae and Sturnidae. Figure 5 below shows the number of individuals detected by family at the unburned area.

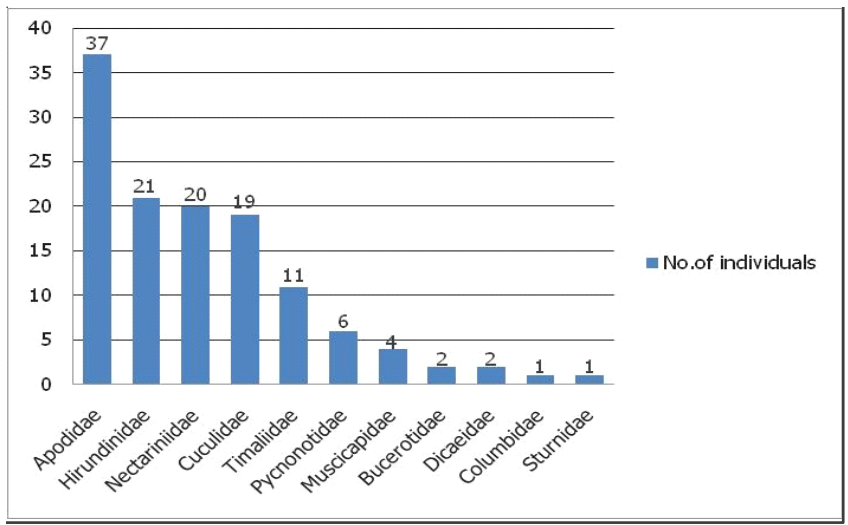


Figure 5: Total birds detected by family at the unburned area

The estimated population density (D) of the birds in the unburned area is 33.301 birds/ha with a 95% confidence interval between a range of 20.596 - 53.870 birds/ha. The estimated population of the birds is 500 individuals in 15 ha of the study area.

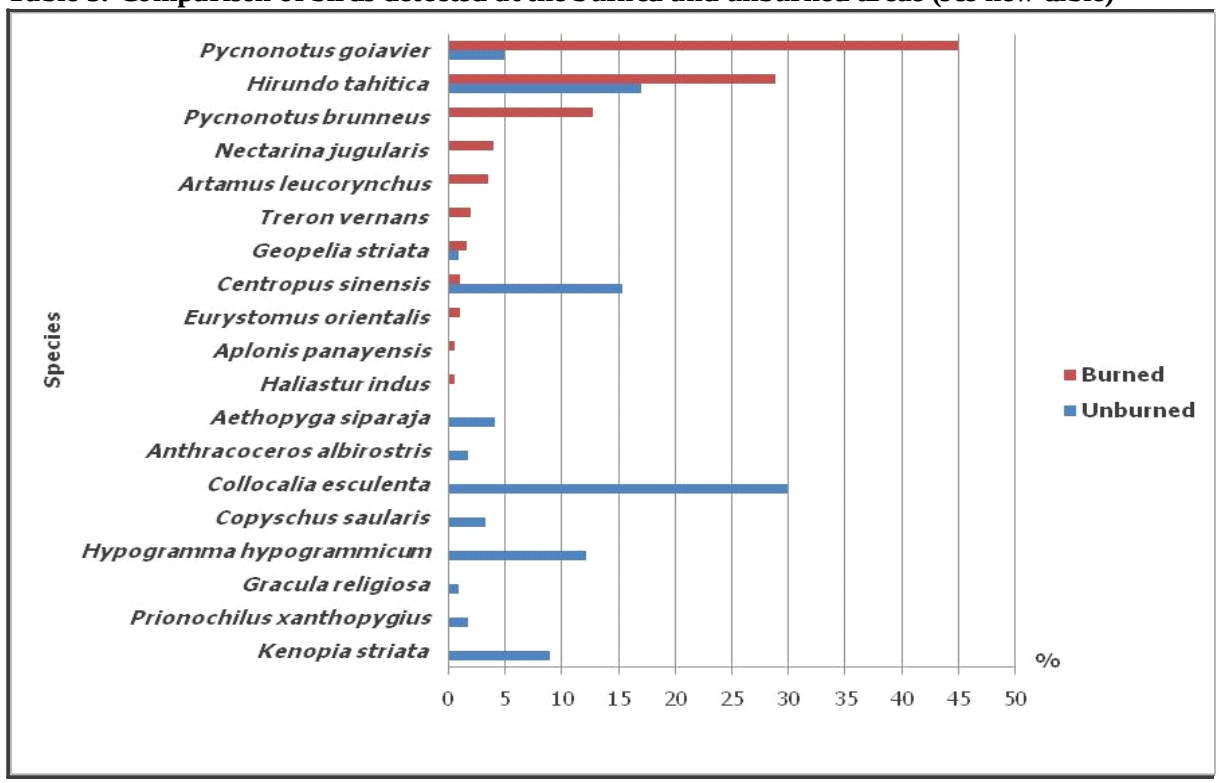
Table 4: Estimated population density of birds in the unburned area

Estimate	%CV	df	95% Confidence Interval	
D (Density)	33.309	24.52	81	20.596 53.870
N (Abundance)	500.00	24.52	81	309.00 808.00

The calculated diversity of birds in the unburned area, H' is 2.0171 with the degree of evenness in species abundance, *J'* of 0.8117.

A total of 19 species of birds were recorded in both burned and unburned areas of Klias Forest Reserve. Table 5 shows four species of birds found in both burned and unburned areas which are the Greater Coucal *(Centropus sinensis)*, Pacific Swallow *(Hirundo tahitica)*, Yellow-vented Bulbul *(Pycnonotus goiavier)*, and Peaceful Dove *(Geopelia striata)*.

Table 5: Comparison of birds detected at the burned and unburned areas (see new table)



Discussion

Differences in the bird species found in burned and unburned areas

The study has shown that there are differences in the type of species found in the burned and unburned areas of the Klias Forest Reserve. However, six types of bird species are found in both burned and unburned areas. According to Peterson (1982), the presence or absence of a bird species in a particular habitat is related to the ability of that species to exist in one or more types of habitat. Other factors that determine the presence of the bird species is the microclimate condition, predation and food availability (Sekercioglu, 2002) which differs in the burned and unburned areas of the peat swamp forest.

Like other tropical forest areas, new vegetation of various species crops up in the burned area due to natural succession. This takes place after the soil is heated when exposed to sunlight, which contributes to the growth of the new vegetation. The new generation of vegetations is a mixture of seeds of the previous trees, weeds, creeping plants, fern and grass of different types which have been buried and preserved in the soil for some time. Once the area is cleared due to wild fires, the seeds within the soil start to germinate and grow into young plants (Miller, 1989). Soon the leaves become food for caterpillars, grasshoppers, beetles, and other insects, and in turn the caterpillars, insects and the beetles become prey for the birds in the area. This has a temporary effect on bird composition in the burned area when the various species are drawn to the area to look for food in the fresh and young vegetation.

The unburned area remains as it was formed by nature. The inhabitants of the burned area come to share the forest, which is their source of food, for some time while the burned area is in the process of recovering. Other fauna from the burned area also dwell in the unburned area nearby for some time. They may face resistance from the local residents and may even be chased away due to scarcity of food, but this will only last for a short period.

Some species which are more versatile, for example, the Yellow-vented Bulbul *(Pycnonotus goiavier)*, Greater Coucal *(Centropus sinensis)*

and Pacific Swallow *(Hirundo tahitica)* can exist in a variety of habitats. Since they are less sensitive to environmental change, these birds are found in both burned and unburned areas of the Klias Forest Reserve. Food availability is also a factor that determines the presence of birds in an area (Sekercioglu, 2002). These species are insectivores and frugivores which eat insects and fruits. Therefore, they can be found in both burned and unburned areas where most insects are present.

Several species recorded in this study like the Oriental Pied Hornbill *(Anthracoceros albirostris)* and the Hill Mynas *(Gracula religiosa)* are only found in the unburned area. This indicates that these species can only survive in certain habitats. Major changes in the forest composition that are caused by logging, fire, or natural succession like that which occurred in the Klias Forest Reserve can affect the existence and population of these birds. This explains the absence of these bird species in burned area.

Factors that determine birds' population density

Based on the results, there is a difference in population density for both areas; the population density of the burned area is higher compared to the unburned area. The presence of bird species that prefer a more open habitat environment is found to be higher in the burned area. For example, 44.9% of Yellow-vented Bulbul and 28.8% of Pacific Swallows were found in the burned area, compared to 4% and 16.9% respectively in the unburned area.

In addition, another factor that accounts for the high population of these species is the rate of increase in food production. The burned area is still in the phase of rapid plant growth and colonization (Wunderle *et al.*, 2005); therefore, insects are abundant in the area due to the suitable habitat. About 91% of the birds detected in the burned area are insectivores, which includes Bulbuls, Swallows, Bee-eaters and Cuckoos. This explains the high population density of the birds in the burned area.

In the unburned area, about half of the detected birds are insectivorous, including Swifts, Swallows, Bulbuls, Thrushes and Cuckoos; the rest are frugivores (Hornbills and Mynas) and nectarivores (Sunbirds and Flowerpeckers). The lesser availability of fruiting and flowering trees in the unburned area vegetation might be the reason for the lower bird population density in that area.

Bird diversity

The results of the study show that bird diversity is higher at the unburned area (H'=2.02) compared to the burned area (H'=1.51). According to Peterson (1982), the greatest bird species diversity is in the over-mature or climax forest. His study shows a drop in bird diversity recorded shortly after clear cutting of forests. However, within a decade after the forest has developed, the bird diversity was found to have increased. This supports the findings in this study, where the diversity of birds is lesser in the peat swamp forest cleared by wildfire, and higher in the fully developed unburned area.

These results are also parallel with the findings of the study done by Shahabuddin and Kumar (2007) where according to them, the lower diversity of bird species in the disturbed forest than the undisturbed forest is caused by alteration of vegetation structure, rather than by changes in forest tree composition. Therefore, the difference in the vegetation structure in the burned and unburned areas of Klias Forest Reserve contributes to the difference in diversity of birds in both areas.

In terms of evenness, the results show a higher value of evenness in species abundance at the unburned area (J' = 0.8117) compared to the burned area (J' = 0.629). Since the value of J' in the unburned area is closer to 1, the distribution of birds is greater even in the unburned area compared to the burned area.

Birds detected most frequently at the burned and unburned areas

The greatest number of birds detected in the burned area are the bulbuls, which includes the Yellow-vented Bulbul *(Pycnonotus goiavier)* and

the Red-eyed Brown Bulbul *(Pycnonotus brunneus)*. This species shows successful adaptation in this area, where they have a wide range of habitat and diet. They can nest in a variety of places from low bushes and creepers to high trees, and they feed on plants (e.g., berries, small fruits and nectar) and insects (Tan, 2001). The burned area of the peat swamp forest which is comprised of scrub vegetation is a habitat for insects such as spiders, moths and grasshoppers, which become the food source of the bulbuls (Anon, 2006). In addition, bulbuls are easier to spot during the point count because they are less sensitive and can adjust well to human presence (Tan, 2001). This also explains the high detection of swallows in the burned area. Their abundance can be obviously seen in the area since these birds feed on swarming insects in flight.

In the unburned area, birds are less easy to be detected compared to the burned area. This is because the vegetation composition in the unburned area comprises tall, closed canopy trees that limits bird detection during point counts. The White-bellied Swiftlets are the most detected bird species in the unburned area, partly because they can be easily spotted flying in the sky between tree canopies and forest gaps. Another factor is because of the food availability in the unburned area. Since the swiftlets are insectivores, their abundance in the area may be due to the availability of insects as a food source in the area.

Conclusion

Bird diversity, abundance and the type of birds present in the burned and unburned areas of Klias Forest Reserve is determined by the vegetation structure of the forest. The burned forest, which has simplified the plant community of peat swamp vegetation, has seen the absence of certain bird species that do not prefer the open habitat environment. Therefore, the application of management practices to protect the remaining peat swamp forest from environmental changes will play an important role in preventing wildfires or illegal logging which may occur if not well monitored. This will contribute to the prevention of habitat loss for the less versatile bird species.

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21st INTERNATIONAL CONFERENCE ON BEAR RESEARCH AND MANAGEMENT: A COHERENT SYSTEM FOR BEAR MANAGEMENT

by Biba Jasmine Kaur

Bears comprise one of the most diverse groups of large mammals. They occupy an extremely wide range of habitats including lowland tropical rain forest along the equator, both coniferous and deciduous forests, prairie grasslands, desert steppes, coastal rainforest, arctic tundra, and alpine talus slopes. They are opportunistic omnivores whose diet varies from plant foliage, roots, and fruits; insect adults, larvae, and eggs; animal matter from carrion; animal matter from predation; and fish.

There are eight species of bears, two of which occur in Europe, three in North America, one in South America, and six in Asia. Four species, namely the Sloth bear, the Asiatic black bear, the Himalayan brown bear and the Malayan sun bear exist in India and are spread across 26 states of the Indian Union. They occupy both protected as well as non-protected areas and are well represented in the diverse range of habitats that India possesses. There is a need to design research projects for studying the various facets

of bear conservation. It is important for bear scientists and researchers across the world to share information and knowledge that will advance conservation efforts at the field level. The 21st International Conference on Bear Research and Management was organized for this purpose and was hosted in India.

In her opening remarks at the conference, Jayanthi Natrajan, Minister of State, Environment & Forests, Government of India, pointed out that India has four species of bears that are seriously threatened due to poaching for illegal trade in bear parts, live-cub trade, and retaliatory killings to reduce conflicts, and also due to habitat loss, degradation and fragmentation.

The eagerly awaited National Bear Conservation and Welfare Action Plan 2012, was launched by the Honorable Minister during the opening session. The plan is a compilation of 26 state welfare action plans. The action plan outlines participatory processes which would ensure ownership and improve prospects for implementation, which would eventually lead to persistent conservation success.

Among the many presentations at the conference was a talk by John Beecham about the 'Best management practices for raising orphan bear cubs for release back to the wild.' He discussed the short and long term implications of release programs on wild bear populations and presented guidelines for establishing a model program for raising, releasing and monitoring orphan bear cubs that are released back to the wild. Jon E. Swenson, University of Life Sciences, Norway, presented his work on 'Bear-Human Interactions: Towards a Holistic Solution. How do 3,300 brown bears cope with 9.4 million Swedes?' He focused on studies where human-bear relations concentrate on how humans cope with bears. He talked about a series of studies on how Brown bears (*Ursus arctos*), which are hunted in Sweden, cope with humans at different spatial and temporal scales.

A study presented by Shigeyuki Izumiyama, Shinshu University, Tokyo, Japan, examined how bears keep distance from humans and its influence on their amount of habitat. She explained how boundary areas between human lands and wildlife habitat may help animals avoid contact with people. Her team investigated Asiatic black bears (*Ursus Thibetanus)* to understand how they keep a distance from humans, and estimated the distribution of the sensitive buffer areas in Japan. There were also presentations on 'Bear rehabilitation in tropics: A case study about the denning behavior of captive brown bears in nature-like large area enclosures of a sanctuary' by Patrick Boncourt from Germany; 'Mental and physical health in captive bears – a behavior-based

approach to ensure conservation fitness and welfare' by Heather Bacon, from University of Edinburgh and Animal Asia Foundation, United Kingdom; and 'Bear Sign Surveys' by Dave Garshellis.

Technical sessions included Bear Specialist Group Presentations. Dave Garshellis presented a range map of Asiatic black bears and Sun bears and also discussed the IUCN resolutions to curtail bear farming. Also presented were developments of principles for dealing with human-bear conflicts, by John Beecham. Other technical sessions were on 'Population estimation and Monitoring' and 'Bear Conservation and Community Participation.' Vivek Menon, Executive Director & CEO of the Wildlife Trust of India, spoke about 'Stalling the tradition of Dancing Bears in India.' He spoke about the Khalandar community in three Indian states: Madhya Pradesh, Chhattisgarh and Bihar. He emphasized that a holistic approach of dialogue and offering alternate livelihoods for ending the illegal bear dancing is needed.

Shaenandhoa Garcia-Rangel, from the Departmento de Estudios Ambientales, Venzuela, presented the 'Spatial analysis of conflict and poaching patterns across Andean-bear distribution.' Amongst mammals, carnivores suffer the most variety of threats around the world. By the year 2011, 25.3% of species within *Carnivora* were known to be already extinct or threatened. Poaching is one of the biggest threats for many carnivores. The historic distribution of some species, for example, has been systematically reduced due to fear for human safety, conflicts related to crop consumption and predation of domestic animals, sport hunting and illegal trade of parts, among other reasons. The Andean Bear Expert Team (ABET) carried out an unprecedented effort to compile the information available on this threat following a systematic review approach and to evaluate the spatial pattern of poaching and conflict events using species distribution model.

The conference also had an exciting and active student discussion session, keeping in mind the changing trends in conservation research across a wide spectrum, and understanding cross-cultural dimensions, as it is important to understand structures and processes created to insure inter-sectoral learning.

One of the aims of the conference was to promote a better understanding of the eight existing bear species. The exhaustive sessions at the conference suggests that this will be a major task, given the ingrained prejudices that exist in many cultures towards bears, particularly in the western world. In spite of some progress, prejudices rather than knowledge about bears still dominate the views of many people. Many common prejudices could be overcome if the behavior and ecology of bears was more widely appreciated. However, scientific knowledge has by and large failed to filter through to the general public. A campaign to modify the current attitudes of people, researchers, conservationist and wildlife managers is needed.

The first ingredient in any bear survival plan is strong institutions at all social levels, said Frank V Manen, President of the International Bear Association, in his concluding remarks. Institutions need improvements in policy coordination, training, and funding. The level of information on bears across the globe and about their needs is in its infancy. There is a dire need for creating a stewardship for bears and their habitat at the local level. Implementation of government policies that allow local communities security of land tenure should be in place. What we need to look at is how we can quantify how human presence affects bear habitats and to how to enumerate the thresholds of habitat disturbance on bear population viability. We need to develop cumulative effects models for development activities affecting regional bear populations.

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ECOLOGICAL IMBALANCE CAUSING MANIFOLD INCREASE IN VECTOR-BORNE DISEASES

by Raza H. Tehsin and Arefa Tehsin

No one is safe from vector-borne diseases. The reasons for the increase in vector-borne diseases are ecological imbalance and global warming. The increasing human population and how to feed it play a large role.

The rice fields used to be full of frogs, but few are seen now. Frogs are major predators of mosquito larvae. In every wetland – flowing or stagnant – there was once an abundance of frogs, which survived largely on mosquito eggs and larvae. Frogs from the water bodies have dwindled and the mosquito population has increased manifold.

The government has allowed frog farmers to export frog legs, but frogs from other water bodies are also captured for export. In 1984, the author warned against the export of frog legs from India to control the increasing cases of malaria. Banswara district in Rajasthan alone exported 200 tonnes of frog legs annually. The government took heed and curbed the export of frog legs then. Now, we are again in the same situation.

The ground water level has gone down drastically and many wells have dried up. We must depend on tube wells for supply of water and the water spilled from the tube wells that collects around them serves as a major breeding ground for mosquito larvae.

With global warming, the top soil dries up in summer considerably. In the northern hemisphere frogs hibernate underground in the moist soil. When the soil dries, they suffer severely.

In almost all the water bodies and wetlands of India there were numerous small fish. These so-called weed fish include Silver Fish, Glass Fish and Putty. The number of weed fish species found in different water bodies has not yet been surveyed and ascertained. They are captured in large quantities to prepare fish pickle. The pickles made from fresh water weed fish are delicious and most of the pickle makers concentrate on these fish. Even in small stagnant waters, in bygone days one could see weed fish. Now their population in our rivers, lakes, ponds, dams has crashed. Most of these fish prey upon larvae and aquatic insects. As their population has been considerably reduced, the population of mosquitoes has gone up.

Many exotic fish are introduced in the water bodies for commercial purposes but there has been no study made to see how this affects the ecosystem of our water bodies. Some of the introduced fish are voracious carnivores, like tilapia and mongoor, which feed on small fish.

In all the major and small water bodies, the fisheries department releases fingerlings of five to six fish species that grow rapidly, so that they can be harvested in a year's time. Some small lakes and ponds near villages, which dry up in summers, are also stocked with these fingerlings. Before the ponds dry up, the fish have to be harvested. Many small species of fish, which are not only predators for vector larvae but also a very important link in the food chain, have become depleted. The fingerlings of these carnivore weed fish are also predators of larvae. With their dwindling numbers, malaria, dengue, chicken guinea and other vector-born diseases are increasing all over India.

The government should increase the population of weed fish in water bodies and wetlands and curb the export of frog legs. It should also carry out breeding of frogs and weed fish and restock the water bodies.

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STRENGTHENING BIODIVERSITY CONSERVATION IN THE SOUTH PACIFIC

Ridge to reef conservation: Taveuni Forest Reserve with view on fringing reef, Fiji Islands (Photo: R. Hahn)

Contributed by Rudolf Hahn, Chief Technical Adviser, GEF-PAS Forestry Conservation and Protected Area Management in Fiji, Samoa, Vanuatu and Niue

Background

The FAO/GEF "Forestry and Protected Area Management" project includes the four Pacific Island nations of Fiji, Samoa, Vanuatu and Niue. These four countries are located in two of the world's 34 "Biodiversity Hotspots", where the richest and most threatened reservoirs of plant and animal life can be found. Vanuatu is at the south-eastern end of the East Melanesian Islands Hotspot and accounts for about 12 percent of the land area and contains 35 percent of the threatened plant and animal species occurring in this hotspot. Fiji, Samoa and Niue are at the southwestern edge of the Polynesia-Micronesia Hotspot that covers most of the southern Pacific Ocean. They account for about 25 percent of the land area of this hotspot and 28 percent of its threatened plant and animal species.

In addition to the importance of these islands for the conservation of global biodiversity, the utilization of natural resources is a major component of rural livelihoods and makes a significant contribution to the economies of these countries. Furthermore, the maintenance of a high-quality environment supports other important sectors of the economy, such as tourism, and

contributes to the overall health and welfare of the people living in these countries.

The land area of the four countries comprises several large volcanic islands and numerous smaller islands of various types. A wide range of habitats are present, including: coastal vegetation; mangrove forests; freshwater swamp forests; lowland rainforests; seasonally dry forests and grasslands; montane rainforests and cloud forests; open woodlands and shrublands. Although most of these habitats contain a relatively low level of biological diversity compared to many other biodiversity hotspots, the remoteness of these islands and their geography has led to high levels of species endemism.

Table 1 presents some key statistics about the current status of terrestrial biodiversity conservation on the islands.

The number of species that are considered threatened is quite low. However, these threatened species account for a very high proportion of the endemic species present on the islands. With the exception of Niue, the proportion of land in protected areas is relatively low and a number of important ecosystems (e.g., montane rainforests and cloud forests in Fiji and Samoa) are either absent or only minimally covered by the current protected area network.

Biodiversity threats and project rational

Fiji, Samoa, Vanuatu and Niue account for a high proportion of the land area of the Polynesia-Micronesia biodiversity hotspot, where species endemism is particularly high and one-third of species are currently threatened with extinction. However, despite this globally significant biodiversity, conservation – whether in formally protected areas or the wider production landscape – is extremely weak. These weaknesses are due to a number of reasons that this project seeks to overcome, including: resistance to change in local communities; poor coordination between stakeholders; lack of capacity and resources; lack of experience with community-based approaches to conservation; and inadequate and out-dated policy and legal frameworks.

Table 1: Protected areas and threatened species in Fiji, Samoa, Vanuatu and Niue

Protected area and species data	Fiji	Samoa	Vanuatu	Niue	Total
Total Land Area (000 ha)	1,827	284	1,219	26	3,356
Terrestrial protected areas in 2009 (000 ha)					
IUCN Categories I-II	*20*	*6*	*0*	0	*26*
IUCN Categories III-V	*1*	*7*	*0*	0	*9*
IUCN Category VI and unclassified	*23*	*11*	*16*	6	*56*
Total area protected (all categories)	44	24	16	6	*90*
Total number of terrestrial protected areas	31	15	33	2	*81*
Protected area coverage (percent of land area)	2.4	8.4	1.3	23.1	2.7
Number of threatened species reported in 2008					
Higher Plants	*66*	*2*	*10*	*0*	*76*
Mammals	*6*	*2*	*8*	*2*	*9*
Birds	*10*	*7*	*8*	*8*	*30*
Reptiles	*6*	*1*	*2*	*1*	*6*
Amphibians	*1*	*0*	*0*	*0*	*1*
Fish	*6*	*6*	*7*	5	8
Total of above species	95	18	35	16	130

Source: Protected area statistics from the World Database on Protected Areas (http://www.wdpa.org), species data from the IUCN Red List of Threatened Species 2008 (http://www.iucnredlist.org).

Kauri (Agathis macrophylla) Forest Reserve on Erromango Island, Vanuatu (Photo: R. Hahn)

Project objectives

The project's development objective is to enhance the sustainable livelihoods of local communities living in and around protected areas. Its global environmental objective is to strengthen biodiversity conservation and reduce forest and land degradation. Global benefits from the project will include: increased representation of important ecosystems in the protected area networks in these countries; enhanced biodiversity conservation in production landscapes (through mainstreaming and marketing of biodiversity goods and services); increased financial sustainability for protected area management; and reductions in the barriers to sustainable forest and land management.

Development strategy

In order to achieve its objectives the project will address the identified issues and weaknesses by strengthening biodiversity conservation and sustainable forest and land management in these four countries.

For this purpose it has been structured into six technical components with the following anticipated outcomes:

1. Policy, legal and institutional arrangements effectively support biodiversity conservation and sustainable land management.
2. Effective and sustainable *in situ* biodiversity conservation areas established and/or strengthened.
3. Stakeholders have the capacity to plan, implement and monitor biodiversity conservation and sustainable land and forest management.
4. Sustainable financing of protected areas in place through a mixture of local income-generation, government finance and innovative measures.
5. Marketing of biodiversity goods and services and sustainable land management practices result in improved livelihoods of local communities.
6. Poor land-use practices and forest and land degradation reduced or reversed in target areas.

Stakeholders and funding

The major stakeholders of this project at the regional and national levels are donor and regional organizations and NGOs involved in conservation, national government agencies, private foundations and private sector organisations. Local stakeholders are the local government agencies, community members and landowners of the proposed protected areas.

The FAO/GEF-FPAM project is a four-year project with a total estimated budget of USD 18.0 million. Total project costs distributed by funding source are: (i) GEF - USD 6.3 million; (ii) national governments - USD 2.2 million, (iii) other co-financiers (NGOs, institutes, universities) - USD 8.0 million; and (iv) FAO - USD 1.5 million.

Landownership and development of Protected Area Networks

Land and its ownership is a vital and integral part of the societies in the South Pacific. Much of the land in the islands is under customary ownership, i.e., owned by tribes, clans, families or other native groups, rather than individuals or governments. The land ownership or land-use has to be adequately addressed in order to achieve a significant impact on the sustainable management of land and forests, the conservation of biodiversity and the establishment of a protected area system.

Currently the project supports the consolidation of 8 existing and the establishment of 15 new protected areas, which will increase the area under formal/legal protection from 30,000 hectares to 110,000 hectares. The land of all protected areas is under customary ownership.

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COMMUNITY FORESTRY, LIVELIHOODS AND CONSERVATION IN CHANGING LANDSCAPES

By Kyle Lemle and Maggie Kellogg, Princeton in Asia Fellows, RECOFTC

Highlights from the Second Annual Dr. Somsak Sukwong Public Lecture, which took place on 21 March 2013, to celebrate the International Day of Forests. The event was entitled "Community Forestry, Livelihoods and Conservation in Changing Landscapes" and was organized jointly by RECOFTC – The Center for People and Forests, the Royal Forest Department of Thailand, FAO, and Kasetsart University.

"How can foresters and the forest sector look beyond the trees, and build bridges with other sectors?" This query was posed by Dr. Tint Lwin Thaung, Executive Director of RECOFTC, to open the Second annual Dr. Somsak Sukwong Public Lecture. The theme of the lecture was chosen in response to the current trend in international environmental discourses towards a landscapes approach. Some foresters fear that forests may become obsolete amidst the new paradigm. But the day's discussions revealed that for the 1.6 billion people around the world who depend on forest ecosystems, the opposite may be true: thinking in terms of landscapes is an ancient practice that will not dismantle forestry as much as it will necessitate improvements in forestry practice and governance.

In his keynote address**,** Dr. Somsak Sukwong offered a "good news" tale on how diverse communities across Thailand have managed trees outside conventional "forest areas" for the benefit of the larger landscape. Dr. Sukwong revealed the diverse practices of Thai people from Chiang Mai to Surat Thani, which include planting strong-rooted trees for landslide protection, and protecting river palms for aquatic nutrient cycling. In response to questions surrounding the slow nature of change, Dr. Somsak stressed that local people's knowledge and thinking about landscapes is already there.

Complementing Dr. Somsak's ethnographic portrayals was the subsequent talk given by Dr. Christine Padoch, Director of the Forests and Livelihoods Programme at the Center for

International Forestry Research (CIFOR). Her talk highlighted how contemporary discourses on landscape-level approaches must look to indigenous groups around the world who, for millennia, have been managing, if not creating, forests for their multiple services. Providing rich examples of indigenous communities in Indonesia and the Peruvian Amazon, Dr. Padoch noted how rural people across the world "enrich" both forests and agriculture for the provision of food. Discussions surrounding food security and nutrition would be incomplete without taking into account the whole landscape. *"Looking at the role of forests in landscapes makes our task more difficult, almost impossible. We must look to real models, real knowledge that we can build on. Where we need to look is at the tremendous wealth of experience in management and governance that we find in local communities around the world."*

Ms. Maria Christina S. Guerrero, Executive Director of the Non-timber Forest Products Exchange Programme (NTFP-EP), echoed Dr. Padoch in the following talk, suggesting that the landscape approach allows us to think of forests for their wider roles in food security and health security. Out-migration and deforestation have caused indigenous knowledge of NTFPs to diminish. Yet, she highlighted the opportunities presented by the private sector to support indigenous NTFP practices, and therefore traditional culture and ecological sustainability. NTFP-EP empowers traditional ecological knowledge and helps to build markets for traditional products. *"It is not just the land, it's about what you are allowed to do on that land, how you can transform it and allow it to transform itself. This adds layers of complication. To put landscapes within these government structures is always difficult."*

Beyond extraction of timber and NTFPs, forests provide a number of key services to the broader landscape, such as storm protection and water filtration. As Dr. Simmathiri Appanah of the Food and Agriculture Organization of the United Nations (FAO) explained in his talk, our economy functions entirely on the depletion of natural resources, yet little value is assigned to ecosystem services or the cultural and spiritual benefits that forests provide local people. Landscapes, he argued, must be seen for their multiple benefits, not all for capital gains.

"The landscape approach has to be meaningful to the participants – economically, culturally and spiritually!"
- Dr. Simmathiri Appanah

To close the day, Ms. Thin Lei Win, a humanitarian journalist from Reuters AlertNet, moderated a lively panel discussion that synthesized the key issues surrounding landscapes and community forestry, which included:

- **Administrative barriers** – Landscapes have been segregated based on conceptual boundaries set by modern planners. Working through these now entrenched sectoral divisions in government will require time and flexibility, if we are to cultivate integrative approaches.
- **Participatory land use planning –** What happens in the forest is primarily determined outside the forest. Forests are at the whim of the complex dynamic and heterogeneous landscapes of which they are a part, as well as the interests of multiple stakeholders from both near and far. In order for natural resource management to be truly sustainable, there is a need to involve local stakeholders who know the landscape for its diverse economic, ecological, and cultural benefits.
- **Landscapes for food security and livelihoods –** The antagonistic rhetoric and dichotomies placed between forests and food are not accurate. Forests provide close to one billion people with nearly 25 percent of their income, much of this in the form of food products. There is a need to recognize this as

one of the key ecosystem services provided by forests, and to coordinate the management of forests for more food in conjunction with the expansion of NTFP markets.

- **Global and spiritual dimensions of landscapes –** Many indigenous communities around the world engage spiritual narratives that support a landscapes perspective. Ecological disturbances in one part of a landscape may result in spiritual ramifications in another. These ancient cosmologies and practices maintain relevance and must be preserved in the modern world, where small actions at the local level affect water flows at the international level, and the carbon cycle at the global level.

The varied and impassioned questions and comments from the audience in and of themselves embodied the complex challenge facing the landscapes approach: to bridge diverse perspectives. While many local people who practice community forestry in the region may already see the forest as part of the larger landscape, it will take considerable time for corresponding institutions to embody this approach in their administrative purviews.

FOREST POLICIES FOR THE 21ST CENTURY

Excerpts from the course report by CTS Nair

Background

Enhancing the capacity for forest policy analysis has been an important thrust of the FAO Regional Office for Asia and the Pacific and since 2008 FAO, in collaboration with other organizations, has been conducting short policy courses to fulfil this objective. These courses have been geared to address regional, sub-regional and national issues and to provide a coherent framework to improve policy analysis skills. The sixth policy course was organized under the aegis of the Asia-Pacific Forest Policy Think Tank at the SAARC Forestry Centre in Thimphu, Bhutan, 27 May to 6 June 2013,

focusing on the theme *"Forest policies for the 21st century."*

Objectives of the course and expectations

As with the previous policy courses, this was also organized with the objective of enhancing the policy analysis capability of forestry professionals in the Asia-Pacific region, particularly focusing on senior policy makers in South and Southeast Asian countries. The thrust was to provide a broad framework, enabling the participants to understand the challenges in the formulation and implementation of forest policies during the coming decades of the 21st century.

The specific objectives of the course were to:

- Develop an in-depth understanding of the implications of larger societal changes including globalization and localization and the imperatives of current and emerging international agreements and conventions on the forest sector.
- Enable sharing of experiences and best practices in adapting the forestry sector in the context of transition to a Green Economy.
- Explore ideas and tools for policy analysis and development and their application in Asia.

By the end of the course, it was expected that the participants would have:

- Gained a better understanding of the complexity of the problems that forestry will face in the next few decades;
- Been equipped to analyze the problems and to identify options appropriate under different circumstances;
- Enhanced their ability to effectively communicate ideas/ perceptions/ views to the different stakeholders; and
- Produced briefs on selected policy-related issues.

Twenty-two participants from 11 countries attended the course with experience ranging from less than 10 years to over 30 years.

While most of the participants belonged to public sector forestry departments, there were also those from civil society organizations, timber trading associations, and academic and research institutions. This diversity of experience and background provided a very rich blend that enhanced the learning experience.

Table 1: Participants in the Sixth Forest Policy course

Country	Number of participants
Bangladesh	2
Bhutan	5
China	1
India	1
Indonesia	1
Laos	2
Myanmar	4
Nepal	1
Pakistan	3
Philippines	1
Sri Lanka	1
Total	22

Course programme

Giving due consideration to the emerging challenges for forestry during the coming decades, the course focused on 10 key areas: i) drivers of change; ii) societal changes; iii) global changes and international agreements; iv) provision of ecological services; v) production of wood and other products; vi) social issues; vii) governance and institutions; viii) effective communication; ix) policy process; and x) national forest policies. The main thrust was to outline key issues under each of the themes and to discuss their implications on forest policy formulation and implementation in the future.

Sessions

A short description of the sessions is provided below.

Change drivers and societal changes:

Short lectures were followed by group discussions encouraging participants to identify important drivers of change and how they affect forests and forestry. Some of the main points emerging from the discussion were:

- Society in the future will be very different from what it is now on account of the collective impact of multiple drivers – demographic, economic, social, environmental, political and advancements in science and technology.
- While individual drivers will impact forests directly and indirectly, this may be accentuated or moderated by other drivers.
- Collectively, the drivers will bring about fundamental changes in societal characteristics and the proportion of different segments – pre-agrarian, agrarian, industrial and post-industrial – will be very different from what it is now.
- Divergence in societal characteristics would also imply divergence in the demand on forests.
- Densely populated countries will face major challenges, especially considering the limited availability of natural resources, and policies will have to be robust to address increasing conflicts over the use of natural resources including forests.

The forest policy process

This session dealt with the following:

- The various phases in the policy process were examined indicating what may be done during policy analysis, development, implementation monitoring and evaluation phases.
- The divergences between theory and practice of policy making and implementation were highlighted.
- Many of the policy problems in forestry are "wicked problems" requiring non-linear approaches.
- Conveying policy issues in a succinct and brief manner is critical.

Production of wood and other products

The main focus was to identify the implications of changing demand for and supply of products (including timber, woodfuel and non-wood forest products) and some of the key issues relating to cross-border trade in the South Asian context.

Presentations and discussions focused on how the objectives of forest policies have been redefined and will continue to evolve in the context of shifts in demand for and supply of products, increasing cross border trade and changes in policies in other sectors. In particular, it was noted that in the context of climate change policies, the demand for wood could increase due to it being a more energy efficient/ environment-friendly material and this may require changes in forest policies. Some of the key points emerging from the session are:

- There could be a significant increase in the demand for wood, especially if countries pursue climate change mitigation and adaptation policies giving thrust to the use of environment-friendly/renewable materials.
- Densely populated resource-poor countries will exert considerable pressure on resources in forest-rich countries. In the absence of effective policies and strong institutions such demands could lead to unsustainable use of resources.
- The challenges due to the rapid increase in demand for wood in countries like India, its implications on cross-border trade and the relevance of forest law enforcement and improvement in governance were highlighted.
- Climate change policies could also pave the way for increased use of wood as energy. There will be a need to enhance efficiency and convenience in the use of wood as fuel.
- The NWFP sector will witness considerable diversification, with domestication and large scale cultivation. Yet collection from the wild will persist for a large number of products, which in the absence of strong policy and institutional arrangements could undermine sustainability.

International agreements and national forest policies

The main thrust was to outline and discuss how international agreements are influencing national forest policies, particularly focusing on the post-1992 developments. Specifically, the presentations and discussions addressed the following:

- Considering the growing linkages between countries through globalization and the trans-boundary nature of environmental problems, international agreements will play an important role in shaping national forest policies.
- Crafting international agreements and their implementation will continue to be challenging, as countries and blocks of countries attempt to balance their national interests with what is expected due to commitments arising out of international agreements. It will remain a slow and often frustrating process.
- Despite the challenges, there will be no escape from the need to forge just and equitable arrangements in a more globalised environment.

Presentations by groups of participants focused on important international agreements and the role playing session helped to critically assess the implications of international agreements. It brought out how conflicts could emerge because of local and national compulsions in resource use as international agreements create obligations to provide global public goods.

Effective communications

The session underscored the critical importance of improving communications in the formulation and implementation of forest policies. It was noted that diversification of stakeholders and divergence of interests and objectives would require improving communications to build consensus. The emerging role of social networking media was also discussed, emphasizing the very rapid changes taking place in communication technologies. Presentations, group-work and discussions focused on the following:

- The 10 steps involved in effective communications at the institutional and project levels.
- Credibility and building alliances were underscored as key to effective communications.
- Making the messages stick depends on simplicity, credibility, concreteness and unexpectedness. Emotion-backed stories enhance effectiveness.
- We should not feel that big changes are beyond our capabilities; all the changes witnessed in the world are outcomes of individual actions.
- Social media will play an important role in bringing about changes; the rapid changes in

communication technologies will impact social networking and many of the existing networking platforms may undergo major changes or even fade out, as new platforms emerge.

Governance and institutions

This session included a series of presentations addressing challenges in reforming forestry institutions, critical issues in forest governance, FLEGT in the larger and Asia-Pacific context and the Bonn challenge of regreening and restoration. Discussions included the following:

- In the context of larger changes it becomes imperative that forestry institutions undergo fundamental changes. While policies and legislation have undergone changes, institutional changes have been very slow.
- The significance of improving governance was highlighted and it was noted that repeated failure to implement solutions is due to unaddressed governance deficiencies and power imbalances.
- Lessons learnt from governance assessments in Brazil and Indonesia were highlighted.
- The implications of EU Timber Regulations and the EU FLEGT Action Plan in the context of the increasing demand for wood in the Asia-Pacific region, especially India and China, were highlighted.

Social issues and forest policies

Substantial thrust was given to elaborate factors that lead to forest-related conflicts and what needs to be done to resolve them. In particular, the following aspects were highlighted:

- Divergent perceptions on the use of forests by different segments of society could accentuate resource use conflicts in the coming decades.
- Equity and justice should form important planks of forest policies and under no circumstances should local communities feel that they are being left out of the process of policy formulation and implementation.
- Forestry institutions will have to be strengthened to provide a level playing field and skills in conflict resolution need to be strengthened.

Provision of ecological services

Important issues discussed in the various presentations and group discussions included:

- Society is becoming increasingly aware of the importance of forests in the provision of ecological services. With the looming water scarcity, improved management of water will remain a major thrust of forest management.
- Managing forests for water could be integrated with the provision of other ecological services like biodiversity conservation, carbon sequestration, arresting land degradation and improving amenity values.
- Although market-driven options like Payments for Ecological Services (PES) could be of some limited use, the role of policies will remain critical in ensuring justice and equity in the provision of ecological services.
- There should be a more systematic assessment of options like REDD+, which should be made an integral component of sustainable forest management (SFM).

Analysis of national forest policies

The thrust of this session was on preparing policy briefs on selected issues. Five policy briefs were prepared by the participants:

1. Addressing governance issues within forest policies of Asia: the need to reform forestry institutions and to build local capacity;
2. Land use conflicts: an interface between forest and non-forest use of land;
3. Agricultural expansion: the driver of deforestation and degradation;
4. Halting forest degradation by co-management of non-timber forest products (NTFPs); and
5. The increasing demand for fuelwood in Pakistan.

Evaluation of the course

At the conclusion of the course, a questionnaire was distributed to all the participants seeking their feedback on the course. In addition to requesting the participants to grade the different components of the course (from very good to very poor), they were requested to give comments on what they found most useful, what parts of the course they

found least useful and suggestions to improve the course in future. More than 95 percent of the participants found the overall arrangements for the course to be very good or good.

Participants were also requested to provide specific comments on the topics they liked most and liked least, topics that should have been included and suggestions to improve future courses. Participants most appreciated modules on governance and institutions, societal changes, social issues and policy process. Responses indicated the need for improving delivery of components on governance and institutions (to avoid the perception of bias against public sector institutions) and to give more examples of how conflicts are actually resolved.

The participants also gave suggestions regarding topics that should have been included in the course as indicated below:

1. Forest tenure and ownership;
2. Negotiation skills;
3. Forest governance and biodiversity monitoring and reporting;
4. Environmental degradation;
5. Timber tracking at national and global levels;
6. Improvement of personal communication skills;
7. Elaboration of factors influencing life cycle of conflicts;
8. Concept of institutions and state and new institutional economics;
9. Hands-on training on SWOT analysis; and
10. Impact of implementation of present policies.

Some of these are outside the realm of a policy course, but may be worth considering for separate courses.

Suggestions to improve the course

The participants gave several suggestions to improve the conduct of future courses, the most important of which are listed below:

- Policy formulation theory should be strengthened with relevant, practical examples from the region;
- Course materials should be circulated in advance;
- Include more case studies and debates;
- More thrust should be given to land-use planning;
- Country-specific needs should be assessed to improve the design of the course;
- The duration of the course should be reduced to seven days;
- The number of hours of the course per day should be reduced by at least one hour;
- More field trips to be included;
- Local forest officers should be given an opportunity to present the issues they deal with and share their experience;
- After the inaugural session, there should be an opportunity to make a presentation highlighting the forest situation, culture, etc. of the host country/ participating countries;
- Need to improve mentoring of group work through intensive facilitation; and
- Need to have unbiased resource persons.

Almost all the participants expressed interest in joining an online discussion group on forest policy analysis. This is something that FAO should facilitate at the earliest while the interest and enthusiasm of the participants is still high.

INTERNATIONAL YEAR OF SOILS 2015

On 24 April 2013 at the 146th FAO Council, FAO member Countries endorsed the request from the Kingdom of Thailand in the framework of the Global Soil Partnership for the proclamation of the International Year of Soils 2015. The IYS will serve as a platform for raising awareness on the importance of sustainable soil management as the basis for food systems, fuel and fibre production, essential ecosystem functions and better adaptation to climate change for present and future generations.

TEAKNET - INTERNATIONAL TEAK INFORMATION NETWORK

TEAKNET is an international network of institutions and interested individuals established for the development of the teak sector. It is governed by an international steering committee consisting of representatives of FAO, the International Tropical Timber Organization, Forest and Landscape (University of Copenhagen), Kerala Forest Research Institute and other reputed organizations around the world.

The TEAKNET directory of traders, planters, government officials and researchers is being updated to effectively link all the stakeholders across the globe and share information and events related to teak.

If you are interested in issues concerning teak and would like to be included in the directory, please visit www.teaknet.org for more details.

GLOBAL PLAN OF ACTION FOR FOREST GENETIC RESOURCES

In a major step forward, the first Global Plan for Action for the Conservation, Sustainable Use and Development of Forest Genetic Resources was adopted in April 2013 by FAO's Commission on Genetic Resources for Food and Agriculture. The Commission has asked FAO to develop an implementation strategy for the Plan of Action and to ensure mobilization of adequate financial resources for its implementation, particularly in support of developing countries.

Conserving forest genetic resources is vital for the future

Estimates of the number of tree species worldwide vary from 80,000 to 100,000. Forest ecosystems remain essential refuges for biodiversity, and 12 percent of the world's forests are designated primarily for the conservation of biological diversity.

The contribution of forests and trees to meeting the present and future challenges of food security, poverty alleviation and sustainable development depends on the availability of rich diversity between and within tree species. Genetic diversity is needed to ensure that forest trees can survive, adapt and evolve under changing environmental conditions. It also maintains the vitality of forests and provides resilience to stresses such as pests and disease.

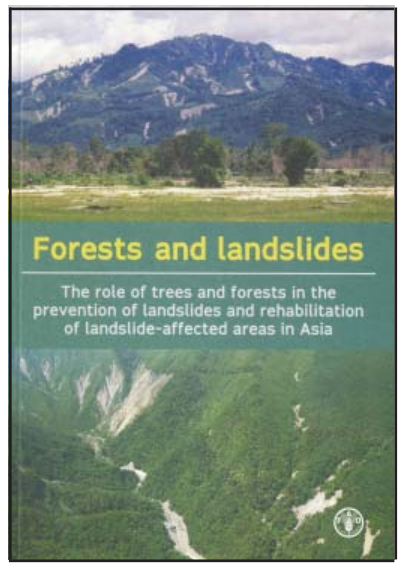
Priority areas for action

The efforts to sustainably manage forest genetic resources at international and national levels need to rely on solid and coherent information. The Country Reports on the State of Forest Genetic Resources as developed following FAO guidelines are the main source of comparable information. They are also the basis for identifying priority areas for action.

The key priority areas for action include improving the availability of and access to information on forest genetic resources; development of the worldwide conservation strategy; sustainable use, development and management of forest genetic resources; establishing and reviewing relevant policies and legal frameworks to integrate major issues related to sustainable management of forest genetic resources; and strengthening institutional and human capacity.

FAO News Release (2013/52/en)

NEW FORESTRY PUBLICATIONS FROM FAO



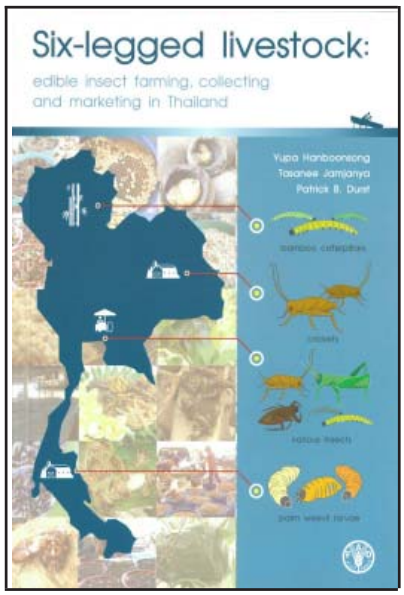
FORESTS AND LANDSLIDES
The role of trees and forests in the prevention of landslides and rehabilitation of landslide-affected areas in Asia
RAP Publication 2013/02

By Keith Forbes and Jeremy Broadhead in collaboration with Gian Battista Bischeti, Francesco Brardinoni, Alan Dykes, Donald Gray, Fumitoshi Imaizumi, Sekhar L. Kuriakose, Normaniza Osman, Dave Petley, Alexia Stokes, Bruno Verbist and Tien H. Wu

Understanding the roles that trees and forests can play in preventing landslides is increasingly important as sloping areas in Asia are further developed and the impacts of climate change affect the region. The roles of trees and forests in rehabilitating landslide-affected areas are also important because of the impacts of landslides on water resources and water quality. Against this background, climate change adaptation in the region is receiving considerable attention. Current rural development trends and predictions of more extreme weather events heighten the need for consolidated information in these contexts.

With natural disasters becoming increasingly frequent in Asia, interest in maintaining forests for the environmental services they provide is growing. In several Asian countries, floods, droughts and landslides have led to major policy realignments that have centered on forests and forestry. However, the resulting policies have often been criticized for their poor technical understanding and disregard for socio-economic considerations. This emphasizes the need for policies to be based on sound science and balanced assessments of the distribution of costs and benefits across society.

This publication outlines the extent to which sound management of forests and tree planting can reduce the incidence of landslides and how forestation can assist in land rehabilitation and stabilization after landslides have occurred. It aims to bridge the gap between science and policy-making to improve management of sloping land both in Asia and elsewhere in the world.

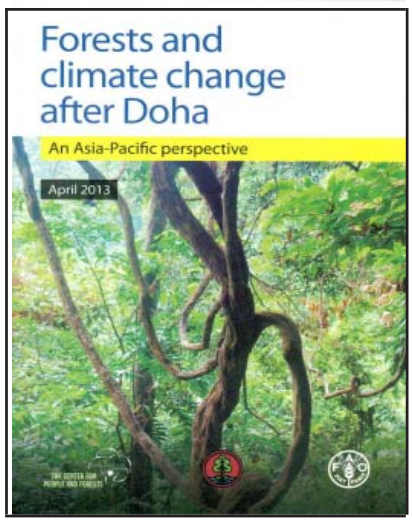


SIX-LEGGED LIVESTOCK: EDIBLE INSECT FARMING, COLLECTING AND MARKETING IN THAILAND
RAP Publication 2013/03
By Yupa Hanboonsong, Tasanee Jamjanya and Patrick B. Durst

The FAO Regional Office for Asia and the Pacific collaborated with Khon Kaen University to review and assess the trends, current status and practices of insect collection and farming, processing, marketing and trade in Thailand. *Six-legged livestock: edible insect farming, collection and marketing in Thailand* is the result of that review and assessment, which included nation-wide surveys and interviews with farmers, collectors, processors, and sellers of edible insects at all levels.

Edible insects are under-utilized foods that offer significant potential to contribute to meeting future global food demands. Insects offer several advantages as human food. Insects are extremely rich in protein, vitamins and minerals, and at the same time are highly efficient in converting the food they eat into material that can be consumed by humans, and with less negative impact on the environment.

Thailand is one of the few countries to have developed a viable and thriving insect farming sector. More than 20,000 insect farming enterprises are now registered in the country, most of which are small-scale household operations. Overall, insect farming, collection, processing, transport and marketing has emerged as a multi-million dollar sector, providing income and employment for tens of thousands of Thai people, and healthy and nutritious food for millions of consumers.



FORESTS AND CLIMATE CHANGE AFTER DOHA: AN ASIA-PACIFIC PERSPECTIVE

Over the past three years RECOFTC – The Center for People and Forests and FAO have brought together regional experts to reflect on the outcomes of the 15th, 16th and 17th Conference of the Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC). The resulting booklets "Forests and Climate Change after Copenhagen," "...after Cancun" and "...after Durban" were distributed widely and very well received.

In February 2013, RECOFTC, FAO and the Indonesian Ministry of Forestry brought together eleven climate change and forestry experts in Bogor, Indonesia, to discuss the implications of decision taken at the COP 18 held in Doha, Qatar in November and December 2012 on the forestry sector of the Asia-Pacific region. This booklet summarizes their responses to a set of 12 key questions raised at the consultation.

FAO ASIA-PACIFIC FORESTRY CALENDAR

19-20 July 2013. ***Asian dialogue on forestry in eco-civilization context***. Guiyang, China. Contact: Patrick Durst, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; E-mail: Patrick.Durst@fao.org

6-8 August 2013. ***Asia Regional Technical Workshop on Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security ("Guidelines")***. Bangkok, Thailand. Contact: Yuji Niino, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; E-mail: Yuji.Niino@fao.org

17-19 September 2013. ***Inauguration Workshop for the Asia-Pacific Forestry Communications Network***. Hanoi, Vietnam. Contact: Patrick Durst, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; E-mail: Patrick.Durst@fao.org

15-17 October 2013. ***Fourth UN-REDD Regional Lessons Learned Workshop: National Forest Monitoring Systems for REDD+***. Bangkok, Thailand. Contact: Ben Vickers, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; E-mail: Ben.Vickers@fao.org

16-17 October 2013. ***Regional Workshop on Capacity Building Needs to Support FLEGT in Asia***. Bangkok, Thailand. Contact: Bruno Cammaert, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; E-mail: Bruno.Cammaert@fao.org

21-23 October 2013. ***International Symposium on Transition to Sustainable Forest Management and Rehabilitation: The Enabling Environment and Roadmap***. Beijing, China. Contact: Patrick Durst, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; E-mail: Patrick.Durst@fao.org

23-27 October 2013. ***Alien Invasive Species and International Trade***. Qingdao, China. Contact: Patrick Durst, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; E-mail: Patrick.Durst@fao.org

5-8 November 2013. ***Twenty-fifth Session of the Asia-Pacific Forestry Commission***. Rotorua, New Zealand. Contact: Patrick Durst, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; E-mail: Patrick.Durst@fao.org

25-28 November 2013. ***Strength in numbers: International Conference on Forest Producer Organizations***. Guilin China. Contact: Sophie Grouwels or Jhony Zapata, FAO Forestry Department, Via della Terme di Caracalla, 00100, Rome, Italy. E-mail: forest-farm-facility@fao.org

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

- East Asian forests and forestry to 2020 (RAP Publication 2010/15)
- Forests beneath the grass: Proceedings of the regional workshop on advancing the application of assisted natural regeneration for effective low-cost forest restoration (RAP Publication 2010/11)
- Forest policies, legislation and institutions in Asia and the Pacific: Trends and emerging needs for 2020 (RAP Publication 2010/10)
- Report of the Asia-Pacific Forestry Commission Twenty-third session (RAP Publication 2010/09)
- Asia-Pacific forests and forestry to 2020. Asia-Pacific Forestry Sector Outlook Study II (RAP Publication 2010/06)
- Forest law enforcement and governance: Progress in Asia and the Pacific (RAP Publication 2010/05)
- Forest insects as food: humans bite back. Proceedings of a workshop on Asia-Pacific resosurces and their potential for development (RAP Publication 2010/02)
- Strategies and financial mechanisms for sustainable use and conservation of forests: experiences from Latin America and Asia (RAP Publication 2009/21)
- Asia-Pacific Forestry Week: Forestry in a changing world (RAP Publication 2009/04)
- The future of forests: Proceedings of an international conference on the outlook for Asia-Pacific forests to 2020 (RAP Publication 2009/03)
- Re-inventing forestry agencies. Experiences of institutional restructuring in Asia and the Pacific (RAP Publication 2008/05)
- Forest faces. Hopes and regrets in Philippine forestry (RAP Publication 2008/04
- Reaching consensus. Multi-stakeholder processes in forestry: experiences from the Asia-Pacific region (RAP Publication 2007/31)
- Trees and shrubs of Maldives: An illustrated field guide (RAP Publication 2007/12)
- A cut for the poor: Proceedings of the International Conference on Managing Forests for Poverty Reduction Capturing Opportunities in Forest Harvesting and Wood Processing for the Benefit of the Poor (RAP Publication 2007/09)
- Trees and shrubs of the Maldives (RAP Publication 2007/12)
- Developing an Asia-Pacific strategy for forest invasive species: The coconut beetle problem – bridging agriculture and forestry (RAP Publication 2007/02
- The role of coastal forests in the mitigation of tsunami impacts (RAP Publication 2007/01)
- Taking stock: Assessing progress in developing and implementing codes of practice for forest harvesting in ASEAN member countries (RAP Publication 2006/10)
- Helping forests take cover (RAP Publication 2005/13)
- Elephant care manual for mahouts and camp managers (RAP Publication 2005/10)
- Forest certification in China: latest developments and future strategies (RAP Publication 2005/08)
- Forests and floods – drowning in fiction or thriving on facts? (RAP Publication 2005/03)
- In search of excellence: exemplary forest management in Asia and the Pacific (RAP Publication 2005/02)
- What does it take? The role of incentives in forest plantation development in Asia and the Pacific (RAP Publication 2004/27)
- Advancing assisted natural regeneration (ANR) in Asia and the Pacific (RAP Publication 2003/19) - 2nd edition
- Practical guidelines for the assessment, monitoring and reporting on national level criteria and indicators for sustainable forest management in dry forests in Asia (RAP Publication: 2003/05)
- Applying reduced impact logging to advance sustainable forest management (RAP Publication: 2002/14)
- Trash or treasure? Logging and mill residues in Asia-Pacific (RAP Publication: 2001/16)
- Regional training strategy: supporting the implementation of the Code of Practice for forest harvesting in Asia-Pacific (RAP Publication: 2001/15)
- Forest out of bounds: impacts and effectiveness of logging bans in natural forests in Asia-Pacific: executive summary (RAP Publication: 2001/10)
- Trees commonly cultivated in Southeast Asia: an illustrated field guide - 2nd edition (RAP Publication: 1999/13)

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