



Biodiversity of
Tropical
Peat Swamp
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of SARAWAK

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Universiti Malaysia Sarawak
Kota Samarahan

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WILDLIFE CONSERVATION IN PEAT SWAMP FORESTS

J. Mohd-Azlan and Indraneil Das

"..if it is wet and hard to survey, it is a swamp.."

Magnussen (2012)

INTRODUCTION

Peat Swamp Forests (PSF) are important globally in terms of maintaining global carbon balance, providing reservoirs of fresh water, stabilizing water level, and buffering against saline intrusion. They are also reservoirs of biodiversity, and frequently support indigenous knowledge, and many have been declared as RAMSAR sites, especially for the conservation of waterfowl species (Sawal, 2003; Yule, 2010). Peat swamps have historically occupied vast tracks of Borneo (Anderson, 1964). Peat swamp forest in Sarawak faces the South China Sea to the west, with its inland boundaries formed by large and complex river systems. They can be classified into phasic communities, differentiating the forest patch based on species composition and vegetation structure (Anderson, 1961). For example peat swamps in the Ulu Baram region are

considered to have six phasic vegetation communities, ranging from a structurally complex species-rich community around the edge of the peat dome to a species-poor 'padang' community on deep peat. However most peat swamps in Sarawak consist of Mixed Swamp Forest (MSF). Nearly all of the PSF in Sarawak have been extensively logged for their valuable timber (especially for high quality timber, such as ramin, (*Gonystylus bancanus*). Additionally, some of the Totally Protected Areas (TPA) are not free from illegal felling and hunting by local communities (Chai, 2005; Mohd-Azlan, 2004).

At present, only three blocks of Peat Swamp Forests remains, representing approximately 30% of the Totally Protected Areas system in Sarawak. The largest PSF block is in Maludam National Park (MNP). It was established in 2000 and is the most recently proclaimed totally protected peat swamp area in Malaysia. The other two PSF blocks are in Loagan Bunut National Park (LBNP) and in the Sungei Medalam basin. The PSF in LBNP covers about 7,000 hectares out of the total 10,736 hectares area of the Park. The PSF in the Medalam River basin has an area of 52,800 hectares and forms a small part of the Gunung Mulu National Park (Chai, 2005). These two National Parks are both located in the upper Baram basin in Miri Division. Established in 1991, LBNP is located between Sungei Tinjar and Sungei Teru, bordering the eastern and western side of the park, respectively. The lake can reach up to a maximum size of 650 hectares, and the water fluctuation observed throughout the year is in response to the change in water levels of the Tinjar and Baram rivers. The lake is almost dry during the month of June, which lasts up to five weeks. These three National Parks, including the 303,456 hectares declared as PFE, constitute approximately 60% of the protected

PSF in Sarawak (Chai, 2005). Together, these National Parks play an extremely important role in *in situ* conservation of the peat, at the state level, in fulfilling political, socio-economic and cultural targets and values, and in maintaining natural and ecological processes.

Peat Swamp Forest supports biological resources of global importance and harbour species from a variety of taxonomic lineages that have aesthetic or conservation values. Yet, much are being rapidly degraded and destroyed (Yule, 2010). Peat swamp forest is the main habitat for commercially important timber trees, such as *Gonystylus bancanus* (Ramin) and *Dactylocladus stenostachys* (Jongkong), Sepetir paya (*Copaifera palustris*), and four species of *Shorea*, including *Shorea albida*. In general, forest gaps are common in most areas, as a result of falling trees, clearing for trails, and over logging. At the lower canopy level, most peat swamp forests are dominated by *Pandanus andersonii*, several species of *Eugenia*, the herb *Hanguana malayana* (Bakong), and the fan palm *Licuala petiolulata* (Palas/Palah). Patches of elevated landscape is rather uncommon in lowland peat swamp forests. Exceptionally, the peat swamp of the Maludam Peninsular is of the raised bog type, and forms the single largest peat swamp dome in northern Borneo (Whitmore, 1984). The existing small hill forest such as Bukit Pelaku in MNP is rather unique and has logging history that resulted in disturbed forest with dense undergrowth, particularly in the south. Dense stands of invasive ferns such as *Dicranopteris* sp. and *Gleichenia* sp. are common in large forest gaps, especially near the summit. Dense undergrowth and shrubs with mosaics of pioneer tree species such as *Macaranga* are also observed in some parts of this forest. Emergent tree species are scattered along the ridge, but

are not abundant. The middle and lower storey tree species are relatively denser in Bukit Pelaku, MNP. Other tree species noted on this hill are *Artocarpus anisophylus*, *Cratoxylum arborescens*, *Ilex cymosa*, *Durio* sp., *Eugenia* sp., *Gluta* sp., *Santiria* sp., *Brakenridgea* sp., *Ficus* sp., *Helicia* sp., *Palaquim* sp., *Blumeodendron* sp., and *Diospyros* sp., climbers such as *Connarus* sp., *Calamus* sp. and *Tetracera* sp. are also observed in this area.

This chapter highlights some terrestrial vertebrates (mammals, birds and herpetofauna) recognized as threatened and documented from peat swamp habitats, some of which can potentially be used as umbrella, keystone and/or flagship species for conservation.

MAMMALS OF CONSERVATION IMPORTANCE

Excluding members of the Chiroptera and Muridae, over 57 mammalian species have been recorded from the peat swamp forests in Malaysia (Sebastian, 2002). Compared to mixed dipterocarp forests, peat swamps appear not to support a great diversity of terrestrial mammals, especially representatives of frugivore guilds (or species dependent on fruits), presumably due to the low productivity in the forest type (Whitten *et al.*, 1984). The absence of megafaunal wildlife in this forest type is quite intriguing and warrants further research. Nevertheless, Bennett and Gombek (1991) recorded many endangered species of primates in the peat swamp forests of Sarawak, which include the orangutan (*Pongo pygmaeus*), proboscis monkey (*Nasalis larvatus*) and red-banded langur (*Presbytis melalophos*). MNP is the last stronghold for the red-banded langur, where they are known to subsist especially on fruits and leaves of peat swamp trees (Hon and Gumal, 2004).

Bornean orangutans are reported more abundant in low-lying forests (below 500 meters ASL) than in higher elevations. Water-logged forests and PSF produce more regularly larger fruits than dry dipterocarp forests and probably be a major factor for PSF to harbour the highest orangutan densities (Ancrenaz *et al.*, 2008). About 40 individuals of orangutan were reported in the Ulu Sebuyau area of MNP (Ancrenaz *et al.*, 2008).

In Sarawak, less than 1,000 individuals of proboscis monkey are thought to remain and their populations are distributed in patches (Meijaard *et al.*, 2008). Bennet and Sebastian (1998) suggested that proboscis monkeys are restricted to the coastal areas and areas near rivers because the interior areas have soils that are low in minerals and salts, which are important part of their diet. In MNP, the more uncommon primate species, including the red banded langur and the proboscis monkey are distributed in isolated pocket of peat swamp forests, compared to the more widespread *Macaca* species (e.g., long- and pig-tailed macaques; Hon and Gumal, 2004). Additionally, 60 species of mammals have been recorded in MNP, of which approximately 57% (n = 34) are small mammals. Surveys in Bukit Pelaku which is a small, elevated area in the MNP, have recorded approximately 25% of the total medium to large mammals found in Borneo. This indicates a low diversity of terrestrial large mammals in mixed dipterocarp forest surrounded by PSF. However, in dipterocarp forests adjacent to PSF, such as LBNP, large mammals appeared to be relatively common (compared to the isolated dipterocarp forest in MNP). Large mammals, such as the Bornean sun bear (*Helarctos malayanus euryspilus*), barking deer (*Muntiacus muntjak*) and sambar deer (*Rusa unicorn*) were recorded in habitats bordering the peat swamp of LBNP, especially the sambar which feeds on shrubs and

grasses during the short dry period. Peat swamp forest appears to be an important habitat for the endangered flat-headed cat (*Prionailurus planiceps*) (Figure 1) (Wilting *et al.*, 2010; Cheyne and MacDonald, 2011). The cat's morphological features suggest its diet to be largely of fish, and thus its distribution being closely associated with wetland habitats (Medway, 1977; Payne *et al.* 1985). This species was recorded both in MNP and LBNP, where its habitat is protected (Gumal, 2010). The remaining populations of flat-headed cats are probably small, isolated, and probably increasingly utilizing polluted, turgid watercourses resulting from agricultural expansion. The flying fox (*Pteropus vampyrus natunae*) categorized as Near Threatened by the IUCN, 2011 (Bates *et al.*, 2008) forms large colonies mainly near lowland areas, including peat swamp forest (Mohd-Azlan *et al.*, 2001; Gumal, 2004). The flying foxes have been reported to utilize 20 families of trees (from 27 genera and 31 species) for roosting in the PSF (Gumal, 2004). Flying foxes are known to pollinate economically important trees and disperse large seeds over a long distance (Mickleburgh *et al.*, 1992). This keystone species was recommended for upgrade to inclusion in the protected species list in the Sarawak Wildlife Master Plan, 1996 and was later adopted in the 1998 Wildlife Protection Ordinance (WCS & SFD, 1996). Over-hunting for the wild meat and Chinese traditional medicine was suggested as the main reason for the rapid decline of flying foxes in Sarawak (Gumal *et al.* 1998). Three species of otters have been reported on Borneo. These otters are important indicator species of wetland environment. The hairy-nosed otter (*Lutra sumatrana*) is listed as endangered and is known to occur in a few localities of freshwater swamps in Borneo. The other two species, smooth-coated otter (*Lutrogale perspicillata*) and Asian small-clawed otter (*Aonyx cinereus*) are considered vulnerable and have wider distribution.



Figure 1: The flat-headed cat (*Prionailurus planiceps*) closely associated with aquatic habitat

BIRDS OF CONSERVATION IMPORTANCE

The bird fauna recorded in the PSF comprise approximately 38% of the overall Malaysian avifauna excluding seabirds. Over 200 species of birds have been recorded in the Peat Swamp Forests in Sarawak, which represents approximately 56% of the bird species reported on Borneo. Among the notable species observed in the PSF in Sarawak are the Chinese egret, *Egretta eulophotes* (VU), lesser adjutant stork, *Leptoptilos javanicus* (VU), Jerdon's baza, *Aviceda jerdoni* (LC), lesser fish-eagle, *Ichthyophaga humilis* (NT), short-toed coucal, *Centropus rectunguis* (VU), red-crowned barbet, *Megalaima rafflesii* (NT), hook-billed bulbul, *Setornis criniger* (VU), Bornean bristlehead, *Pityriasis gymnocephala* (NT), grey-headed babbler, *Stachyris poliocephala* (LC), ferruginous babbler, *Trichastoma bicolor* (LC), grey-breasted babbler, *Malacopteron albogulare* (NT), white-chested babbler,

Trichastoma rostratum (NT), wrinkled hornbill, *Aceros corrugates* (NT), Asian black hornbill, *Anthracoceros malayanus* (VU), rhinoceros hornbill, *Buceros rhinoceros* (NT) and Malaysian blue flycatcher, *Cyornis turcosus* (NT). Species such as Storm's stork, *Ciconia stormi* and masked finfoot, *Heliopais personatus*, which are listed in the endangered category (Birdlife International, 2008) were also reported in the PSF in Sarawak. Many of these bird species are currently showing decreasing population trend primarily due to habitat destruction and anthropogenic pressures, including the conversion of forests to agriculture lands. The climate, topography and vegetation have attracted 18 Palaearctic migrants to the PSF in Sarawak, especially in the southern regions. Although PSF support lower understorey avifauna compared to lowland dipterocarp forest, they are important in supporting habitat-specific species and in providing feeding options for frugivores from surrounding matrices at sporadic intervals (Gaither, 1994), especially during periods when fruits are not abundant in adjacent forest habitats (Leighton and Leighton 1983).

REPTILES AND AMPHIBIANS OF CONSERVATION IMPORTANCE

The generalized amphibian fauna of peat swamps tend to be widespread across a swathe of habitats in the lowlands, and a majority (17 of 22; 77%) are in the Least Concern ('a taxon [that] does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa..') category. Two swamp frog species (*Limnonectes ingeri* and *L. malesianus*), both of which are large-growing and hunted for local consumption are in the Near Threatened ('A taxon [that] is close to qualifying for or is likely to qualify for a threatened category in the near future')

category. A further amphibian species (*Pelophryne signata*) is listed in this category perhaps for its dependence on trees, and therefore, existence of some sort of forested habitat. The endotrophic tadpoles of this species develop in tree holes, and presumably require old growth or at least mature secondary forests. No threatened species of amphibians occur in the peat swamps of Borneo, and one, a caecilian, *Ichthyophis monochrous*, is classified as Data Deficient (“a taxon [for which there is] inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its range and/or population status”) and is known from the peat swamps of Kota Samarahan on the basis of a single specimen collected.

Borneo’s peatland reptiles, numbering 30 species, too show similar trends, with the predominance of widespread, lowland species. Excluding 12 species (43%) that are Not Evaluated (“a taxon [which has] not yet been evaluated against the criteria”), for lack of conservation assessment of most of the world’s lizard species, seven of 28 species (25%) are in the Least Concern category. Nonetheless, significant populations of two threatened reptile species, the Malayan false gharial (*Tomistoma schlegelii*) and the Malayan black turtle (*Orlitia borneensis*), both classified as Endangered (“A taxon [for which] the best available evidence indicates ...[it to be] facing a very high risk of extinction in the wild”) are found in such habitats (Stuebing *et al.*, 2006; Sharma and Tisen, 2000). An additional crocodylian species, *Crocodylus siamensis*, locally referred to as ‘Buaya Badas hitam’ (= black peat swamp crocodile), is known from such habitats (see Cox *et al.*, 1993), and is placed in the Critically Endangered (“a taxon [for which] the best available evidence indicates [that it is] facing an extremely high risk of extinction in the wild”) category in conservation assessments. Finally, two freshwater turtles, *Cuora amboinensis* and *Amyda cartilaginea*,

classified as Vulnerable (“a taxon [for which] the best available evidence [suggests it] to be facing a high risk of extinction in the wild”) are also known to occur in peat swamps. Both are harvested, the former as pets both in local longhouses and for sale in towns across Borneo and export to east Asian markets, the latter as a source of protein-rich food, chiefly for local consumption.

No amphibian or reptile species are known to be obligates of peat swamps on Borneo, but several (including the aquatic bufonid, *Pseudobufo subasper*; Lim and Ng, 1992 (Figure 2); Sukumaran *et al.*, 2006, and the crocodylian, *Tomistoma schlegelii*; Stuebing *et al.*, 2006) have important populations in such habitats. Plausibly some species of herpetofauna will be shown to be obligates of such habitats in the future, as the recent discovery of a widespread bufonid- *Ingerophrynus kumquat* (Das and Lim, 2001), close to the urban centre of Kuala Lumpur, suggests.



Figure 2: Aquatic bufonid (*Pseudobufo subasper*) considered a peat swamp specialist.

While *Tomistoma schlegelii* has been recorded from other habitats, such as lowland swamps, lakes and rivers (Figure 3) (Bezuijen *et al.*, 2010), many of the extant localities are within peat swamp regions (see Stuebing *et al.*, 2006). Nests of the species have been reported from mature peat swamp forests (Bezuijen *et al.*, 2001). A requirement of raised peat platforms was noted by Bezuijen *et al.* (2005), and with records of nesting presented by these authors from burnt swamp forest suggests some degree of tolerance for disturbed habitats.



Figure 3: The Malayan Gharial (*Tomistoma schlegelii*), a species restricted to Sundaland, that is largely restricted to peat swamp forests.

DISCUSSIONS

Peat swamp forests face the highest levels of deforestation with an average annual rate of 2.2% in south-east Asia, and representing approximately 5.0% of the annual forest loss in Sarawak (Miettinen

et al., 2011). Anthropogenic activities have reduced the extant and quality of peat swamps in the past three decades. Foremost is clear-felling for conversion of forest lands to oil palm plantation, a rather sensitive topic, vis-à-vis with current development planning policies. Fires are also prevalent in peat swamps, especially during the prolonged dry period of El Niño years, and many such events have been recorded in Borneo in the past decade. Their effects on the local wildlife species remain largely undocumented (except for individuals of turtles bearing fire-scars, see Jensen and Das, 2007).

Peat swamp forest adjacent to MDF provides habitat heterogeneity, additional protection as refugium and cover for various terrestrial mammals and potentially for many bird species from adjacent lowland forests, which are under great pressure from logging and development (Yule, 2010). It appears that the surrounding matrix habitats may have an effect on the composition of species in the PSF, this postulation, however, warrants further research. Peat swamp forest surrounded by several matrix types is likely to have different assemblage as structurally complex matrices may provide greater landscape connectivity. With increasing agricultural activities, such as expansion of oil palm plantations around protected areas, inclusion of adjacent mixed dipterocarp forests in the conservation plans for the PSF in Sarawak may be necessary to effectively maintain this habitat type and the diverse life forms it support. The continuing decline in the extent and quality of PSF in Sarawak will increasingly be a concern to the wildlife found in these areas. Consequently, loss of specialist species is likely to have major impacts on ecosystem function, particularly those species which have roles in seed dispersal and as top predators (Yule, 2010).

Our considered response to the peat swamp crisis can be summarized as follows: 1) initiate ecological studies to improve understanding of precise habitat requirements, tolerance of secondary habitats and response to fragmentation, 2) improvement of the management of protected areas that suffer encroachment, and 3) extend boundaries of protected areas with peat swamp forests to include adjacent non-peat habitat types and integrate them in management plans and strategies).

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Biodiversity of Tropical Peat Swamp Forests of Sarawak



Peat swamps historically occupied vast areas of land and water in Sarawak State, East Malaysia. Yet, these environments remain poorly-known in terms of their biodiversity and potential for sustainable use. This volume is a compendium of papers on these topics, including the conservation importance of peat swamp forests; chemistry of humic substances of tropical peat, the Araceae of peat swamps; use of sago palm (*Metroxylon sagu*) to bolster national food security; assessment of infestation by endohelminth parasites of frogs at a degraded forest; the relationship between water quality and fish communities of blackwater environments; bird communities of peat swamp forests, and concludes a review of wildlife conservation, with emphasis of its megafauna, of this important habitat in Borneo.



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