

Biodiversity of
Tropical
Peat Swamp
Forests
of SARAWAK

EDITORS
JAYASILAN MOHD-AZLAN
INDRANEIL DAS

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Universiti Malaysia Sarawak
Kota Samarahan

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PREFACE

With the largest proportion of Malaysian peat swamp forest located in Sarawak, and their continued exploitation for a variety of purposes the need for substantial research on these threatened habitats and ecosystems has never been more urgent. Many of us here in Universiti Malaysia Sarawak continue to stride into peat swamp forests, especially the one within our campus, in our attempt to increase knowledge on its natural history. The results of some of these efforts have been compiled in the chapters of the volume that you hold in your hands.

As will be evident to the readership, a variety of approaches have been taken by the authors of the book. Jason Hon and J. Mohd-Azlan's essay extols the virtue of peat swamp forests, emphasizing their conservation importance. Siong Fong Sim presents results of her investigations of humic substances and the chemistry of humic substances of the tropical peat. Wong Sin Yeng provides a description of the Araceae portion of the peat swamp flora. Awang Ahmad Sallehin Awang Husaini, Mohd Hasnain Md Hussain and Hairul Azman Roslan propose the use of sago palm (*Metroxylon sagu*) as a starch, to bolster national food security. Within the zoological sciences, separate

contributions include investigations on endohelminth parasites of frogs at a degraded forest, by Ramlah Zainudin, Farliana Zulkifli and Fatimah Abang; ichthyological communities and their relationship with water quality in blackwater environments by Lee Nyanti, Ella Michael Dosi, Jongkar Grinang, Ling Teck-Yee and Khalid Haron; description of the avifaunal diversity of such forests by Mohamad Fizl Sidq Ramji, Mustafa Abdul Rahman, Andrew Alek Tuen, Bettycopa Amit and Khalid Haron and finally, an essay on wildlife conservation, with emphasis of its megafauna, by the editors.

In producing this volume, we are grateful to the authors for their contribution and to the following reviewers: Datuk Seri Lim Chong Keat, Anthony Sebastian, Lim Chan Koon, Abdullah bin Samat, Khairul Adha Abd Rahim, Kopli Bujang, Murtedza Mohamed and Andrew Alek Tuen. Finally, we thank our colleague, Jongkar Grinang for the image used on the front cover of this work. This book greatly benefited from the Niche Research Grant Scheme awarded to Universiti Malaysia Sarawak (NRGS/1087/2013/(01)).

This modest volume commemorates the 23rd year of establishment of Sarawak's first university.

J. Mohd-Azlan and Indraneil Das

Kota Samarahan, 26 January 2016

CONTENTS

PREFACE	vii
1 PEAT SWAMP FORESTS AND THEIR CONSERVATION IMPORTANCE	
• Jason Hon & J. Mohd-Azlan	1
2 HUMIC SUBSTANCES AND THE CHEMISTRY OF TROPICAL PEAT	
• Siong Fong Sim	17
3 ARACEAE OF PEAT SWAMP FORESTS	
• Wong Sin Yeng	35
4 SAGO PALM (<i>METROXYLON SAGU</i> ROTTB.) - A POTENTIAL SOURCE OF STARCH FOR FOOD SECURITY	
• Awang Ahmad Sallehin Awang Husaini, Mohd Hasnain Md Hussain and Hairul Azman Roslan	87
5 ENDOHELMINTH PARASITES OF FROGS AT A DEGRADED PEAT SWAMP FOREST	
• Ramlah Zainudin, Farliana Zulkifli and Fatimah Abang	121

6 FISH FAUNA AND WATER QUALITY OF BLACKWATER HABITATS IN MALUDAM NATIONAL PARK	
• Lee Nyanti, Ella Michael Dosi, Jongkar Grinang, Ling Teck-Yee and Khalid Haron	149
7 DIVERSITY OF AVIFAUNA IN PEAT SWAMP FORESTS	
• Mohamad Fizl Sidq Ramji, Mustafa Abdul Rahman, Andrew Alek Tuen, Bettycopa Amit and Khalid Haron	179
8 WILDLIFE CONSERVATION IN PEAT SWAMP FORESTS	
• J. Mohd-Azlan and Indraneil Das	209
INDEX	229

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PEAT SWAMP FORESTS AND THEIR CONSERVATION IMPORTANCE

Jason Hon and J. Mohd-Azlan

INTRODUCTION

How well do we know about peat swamp forests? Arguably, the name combination itself has equated these forests to 'wet', 'smelly', 'dirty' and 'mosquito-infested' places that are unfit for humans. These are some of the common perceptions that are conceived by many, including researchers, and consequently, peat swamp forests are one of the least known of the lowland ecosystems in the tropics.

Globally, peatlands (areas with peat substance) cover an estimated 400 million hectares or three per cent of the earth's land surface (Strack, 2008). About 11 per cent of tropical peatlands are found in Malaysia, which is second to Indonesia that had till the recent past, 80 per cent coverage of tropical peatlands (Rieley *et al.*, 1996; Page *et al.*, 2006). In Malaysia, peat swamp forests form the largest of all wetland areas, accounting for 75 per cent of the total areas (UNDP, 2006). Within Malaysia, Sarawak comes out top with the largest peat

swamp forest coverage, accounting for about 64 per cent of the total 2.6 million hectares in Malaysia (Hon, 2011). The peat swamp forests of Sarawak are distributed widely in the deltaic plains, and stretches along the Samarahan-Sadong, Lupar-Saribas, Rajang, Baram and Limbang river systems (Sawal, 2004) and the lowland and coastal plains of Mukah. Collectively, these areas account for about 60 per cent of the total peatlands in Sarawak (Sime Darby Services, 1999).

A WORLD OF UNIQUE RICHNESS

Extensive studies on the peat swamp forests of Sarawak were conducted by the British botanist, J. A. R. Anderson in the early 1960s. He recorded six phasic plant communities in a mature peat swamp forest, which form concentric zones of plant communities that intergrade and then slowly replace each other from the perimeter to the centre of the swamp (Anderson, 1960). Peat swamp forests (Figure 1) contain over 240 plant species with endemics such as *Eugenia nemestrina* and *Garcinia eugenaefolia* (Rieley and Ahmad-Shah, 1996; Rieley, 1992).



Figure 1. Peat swamp forest of Logan Bunut NP with large stands of *Alan* (*Shorea albida*)

Some of the most unique and rare fauna species occur in peat swamp forests, such as the red-banded langur (*Presbytis chrysomelas cruciger*), (Figure 2), of which about 300 remaining individuals are found in the Maludam National Park (Hon and Gumal, 2004; 2005). The park also contains populations of the Bornean endemic proboscis monkey (*Nasalis larvatus*).

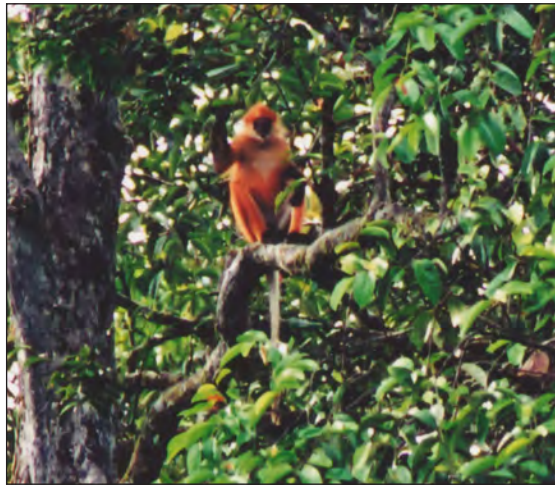


Figure 2. The only viable population of red banded langur (*Presbytis chrysomelas cruciger*) is only found in Maludam NP in Sarawak



Figure 3. The Bornean endemic proboscis monkey (*Nasalis larvatus*)

The largest colonies of flying foxes (*Pteropus vampyrus*), numbering over 20,000 can be found in the peat swamp forests of Loagan Bunut National Park (Gumal *et al.*, 2008) and also Sedilu National Park. The peat swamp forests of Sedilu National Park and Ulu Sebuyau National Park harbour significant populations of the endangered orang-utan (*Pongo pygmaeus pygmaeus*). In Sarawak, the only sightings of Storm's stork (*Cicornia stormi*) *Pongo pygmaeus pygmaeus* and masked finfoot (*Heliopais personata*) were made in peat swamp forest (Hon, 2011) and the only known breeding colony of Oriental darter (*Anhinga melanogaster*) and little cormorant (*Phalacrocorax niger*) were recorded in Loagan Bunut, but both species have since disappeared from this area due to over-harvesting of eggs and chicks (Aonyx, 2012).

ECOLOGICAL IMPORTANCE OF PEAT SWAMP FOREST

The unique chemical, physical and biological attributes make peat swamp forests different from all other terrestrial and wetland areas. Briefly, peat swamp forests perform crucial functions in flood prevention, nutrient storage and carbon sink, to name a few.

Peat domes are higher than surrounding areas and are characterised by high soil absorbency and water-retention ability. Generally, peat acts like a sponge, absorbing most excess water during heavy rainfall events, thereby reducing flood peaks and mitigating floods. Absorbed water is released slowly during drier periods, thereby mitigating droughts in adjacent areas. Peat domes serve as reservoirs of water for many of Sarawak's coastal areas, which would otherwise suffer water shortages during droughts (Sawal, 2004). Clearing of peat swamp forests directly affect water catchments areas, and consequently, the livelihoods of people (Ong and Yogeswaran, 1992; Shakeran, 1999).

Peat swamp forests play important roles in maintaining carbon balance, at a capacity 10 times more efficient than other forest types (ASEAN Peatland Forests Project, 2010). Worldwide, peatlands store about 20 per cent of all the carbon in the soil, with 50 billion tonnes found in south-east Asia alone (Maltby, 1997). These figures show how important peatlands and peat swamp forests are, especially in Sarawak, which has extensive peat swamps.

THREATS

Peat swamp forests in Sarawak are imperiled, their loss driven by economic demands to open land for agricultural expansion. Many of the potential threats to peat swamp forest derive from agricultural conversion and conversion to other land uses.

The forest industry sector plays an important part in Sarawak's economy, as well as in that of Malaysia as whole. The rate of deforestation in Sarawak is higher than in Sabah and Peninsular Malaysia: a conservative estimation of timber exports reveals that Sarawak exports more logs than Peninsular Malaysia and Sabah put together (Mohd-Azlan and Lawes, 2011).

In Sarawak, selective logging system was introduced in the lowland peat swamp forest areas in the early 1950s and continued until the early 1970s (Sawal, 2004). In fact, commercial logging began in the peat swamp forests, where the high valued *Aln*, *Shorea albida*, were found in abundance in former times.

In more recent years, logged-over peat swamp forests in the coastal areas were and continue to be excised from state land and permanent forest estates to make way for oil palm plantations, forest plantation,

pineapple, sago, paddy, field crops and other land development projects. Research and development carried out in recent years have made it possible to maximise economic returns utilizing land once considered marginal, such as peat swamp forests areas (Sawal, 2004).

Between 1959–2011, oil palm in Malaysia expanded from 51,053 hectares to 5,229,739 hectares (Department of Statistics Malaysia, 2010; MPOB, 2014). In Sarawak alone, the acceleration to plantation economy, particularly oil palm, was driven by the exhaustion of land bank in Peninsular Malaysia. Both Malaysia and Indonesia have been the world's major exporter of oil palm, accounting for more than 85% of global export (FAO, 2012).

To maintain its production and position as a major world exporter, the oil palm industry expanded to Sarawak, notably under the Third National Agriculture Policy (1998–2010) (MOA, 1998). Since then, oil palm planting has intensified in Sarawak, increasing at an average 10.5% from 2002–2011 (Hon and Shibata, 2013), the highest for all states in Malaysia. The development and intensification of the oil palm industry in Sarawak under the said policy targeted 1.12 million hectares of land, of which 27 per cent was situated within peat swamp forests (Drahman, 1999).

The conversion of peat swamp forest and peatlands into other land use, notably agriculture, is occurring at a fast pace. Since the 1980s, over a million hectares of peatlands in Malaysia have been converted for agricultural purposes (GEF, 2006). In Sarawak, the increase in planted area for oil palm was largely at the expense of peat swamp forests that are situated in the low lying coastal plains (Hon, 2011).

Peat swamp forests are particularly vulnerable to fires, especially during the dry season. Drained peat swamp forests are highly flammable, and once burned, may take months or years before they are put out (Yule, 2010). Peat fires typically burn underground as well as above, not only eliminating the seedbank but also destroy the soil (Hogan and Caley, 2008). In 1997, the great peat swamp fires in Indonesia and Malaysia burnt for months and destroyed over 5 million hectares of forests (Butler, 2006).

Additionally degraded peat swamp forests are frequently invaded by pioneer secondary forest type plant species such as *Colocasia* sp., *Macaranga* sp., *Melicope* sp. and *Melastoma* sp., most of them non-merchantable timber species and rarely harvested or utilized by the local communities. The succession will not only permanently alter the species composition, structure, ecology and dynamics, but will render these economically useless.

Pollutants discharged from surrounding areas into peat swamp forests affect severely the forests' water quality, through acidification of local and downstream water-bodies with increased river water biological oxygen demand and turbidity (Sawal, 2004). Water-quality monitoring carried out by the Natural Resource and Environmental Board (NREB) of Sarawak, on activities prescribed under the Natural Resource and Environment Ordinance 1993 indicate that major agricultural, non-point source pollution is due to activities such as livestock farming, agro-chemical application, irrigation, planting and harvesting, as they emit or discharge sediments, nutrients, pathogens, pesticides and salts (Sawal and Mamit, 1998). Therefore, managing point of source of pollution from agricultural lands is important in order to minimize the impacts of the surrounding natural ecosystems. This is particularly

crucial for long term conservation of peat swamp forests, largely because they are regarded as fragile ecosystems, and are likely to lie adjacent to large scale agricultural lands such as oil palm plantations. The Loagan Bunut National Park is a suitable example of peat swamp forest under threats from the surrounding anthropogenic activities, notably logging and oil palm planting in the upstream.

CONSERVING PEAT SWAMP FORESTS

In Sarawak, a protected area system is in place to safeguard some of the unique ecosystems and their wildlife. However, the total coverage is small, being slightly over 0.6 million hectare of land area, out of a total land area of over 12 million hectares, implying that about 4.9 per cent of its land is granted full protection. Of the 48 currently gazetted national parks, wildlife sanctuaries and nature reserves, only four are predominantly peat swamp forests-Loagan Bunut NP, Maludam NP, Sedilu NP and Ulu Sebuyau NP. These parks collectively account for about 13 per cent of the total protected land area.

The total area under peatlands in Sarawak, including peat swamp forests is about 1.7 million hectares (SPU, 2011). Taken into account the total coverage of 78,481 hectares, peatlands with protection status represent a conservative value of less than 5 per cent of the total peatlands in Sarawak. Thus, a huge proportion of peatlands and peat swamp forests in Sarawak are not protected, much of which are under threats from conversion for other land uses.

The future of protected peat swamp forests in Sarawak is not secured unless the surrounding areas are managed sustainably. The long-term existence of Loagan Bunut is at risk, whereby the lake

inside the park predicted to dry up permanently in less than 60 years if upstream activities are not curbed. Additionally, logging and expansion of oil palm plantations surround the park (Sayok *et al.*, 2007) have deteriorated water quality, caused higher surface run-off and increase of suspended solids in the water (Lau *et al.*, 2006; Noweg *et al.*, 2006), which, in turn, deposit huge amount of silt into the park. The hydrological properties of Maludam is also at risk from land use change surrounding the park, whereby forests are being cleared and drained to make way for establishment of agricultural plots and human settlements. The hydrological properties of Maludam itself will be affected by the surrounding land development, which, in turn, may adversely affect its unique flora (remaining stands of *Alnus*, *Shorea albida*) and fauna communities (population of red-banded langur). Insufficient enforcement personnel in many of these parks may leave these protected areas defenseless against human encroachment.

STRINGENT POLICY ON LAND USE

The Malaysian government, and the Sarawak State in particular, should emphasise the importance of conserving peat swamp forests, notably changing its agriculture policy and discouraging the large conversion exercise of remaining peat swamp forests. Sarawak, being home to extensive swathes of peat swamp forests, should take a bold move in intensifying research and increasing understanding of the unique plant and animal communities of these forests. Apart from the floral and faunal characteristics of peat swamp forests, the social aspects, notably the livelihoods of people living within and adjacent to peat swamp forests, should be given attention. Most peat swamp forests in Sarawak are closely associated with coastal belts, with large urban

and sub-urban communities. There is an urgent need to protect more peat swamp forests in Sarawak, and to leave them in their natural state.

As required under Article 3 of the Natural Resources and Environment (Prescribed Activities) Order 1997, development of an oil palm plantation or forest harvesting exceeding 500 hectares falls within the order's prescribed activities, thereby warranting an environmental impact assessment approval before commencement of project implementation (Sawal, 2004). The prescribed activities include logging, industrial mining, establishment of commercial golf courses and housing estates.

There is an urgent need to set aside sufficient areas of peat swamps forests, pristine and otherwise, to ensure that the ecosystem, species and genetic diversity are preserved. Therefore, resources and attention should be focused on conserving peat swamp forest patches that are left, with similar effort expended on rehabilitation of degraded or logged over forests.

In areas that are already protected, the relevant agencies, such as the Sarawak Forestry Corporation and the Forest Department of Sarawak, as custodians to all protected areas in the State, must ensure permanent presence of enforcement and park management personnel to safeguard the areas against illegal activities. The government can and should support through increasing the operation budget for park management and to improve staff capacity to properly manage our protected areas.

Sarawak is the proud custodian of the largest peat swamp forests in Malaysia, which also contain unique as well as rare floral and faunal