



UNIVERSITI PUTRA MALAYSIA

***HABITAT OCCUPANCY PATTERNS AND ACTIVITY RATE OF NATIVE
MAMMALS IN TROPICAL FRAGMENTED PEAT SWAMP FORESTS***

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By

SASIDHRAN S/O SELVADURAI

**Thesis Submitted to the School of Graduate Studies, Universiti Putra
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Science**

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Abstract of the thesis presented to the Senate of Universiti Putra Malaysia
in fulfillment of the requirement for the degree of Master of Science

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September 2016

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The North Selangor Peat Swamp Forest (NSPSF) is the second largest remaining peatland fragment in Peninsular Malaysia. Although the NSPSF is recognized as a biodiversity hotspot area in the region, this peat swamp forest is rapidly shrinking mainly due to the expansion of industrial oil palm cultivation. More than 87% of the NSPSF was designated as forest reserves, but in reality, this current status is not really similar to a protected area. This peat swamp forest is still under constant threats from forest conversions, forest fires, and road constructions. Faunal biodiversity loss is likely to happen in the NSPSF unless drastic action is taken by stakeholders. To determine the habitat occupancy and activity rate of various mammals, camera-trap survey was conducted at 45 points located within the NSPSF. From a total survey effort of 2,565 trap nights in an area of 778 km², 16 mammal species were recorded. However, there were no records of Sumatran rhinoceros (*Dicerorhinus sumatrensis*) and Malayan tiger (*Panthera tigris*) or indirect sightings such as footprints, suggesting possibility of being locally extinct at this peat swamp forest. The mammal activity rate responded differently to *in situ* habitat quality and landscape factors according to their feeding guild or diet. The data from camera trap sampling provides vital information on the occurrence of high conservation wildlife species in the NSPSF. It is recommended that conservation agencies to consistently monitor clearance of the forest, create a blueprint to mitigate the post-clearance effects and develop a camera-trapping survey to monitor the mammal populations. Government stakeholders should focus on prohibiting further conversion of peat swamp forests and emphasize on the conversion of the NSPSF status from a forest reserve to a protected area.

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CORAK PENGGUNAAN HABITAT DAN KADAR AKTIVITI MAMALIA ASAL DI HUTAN PAYA GAMBUT

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Hutan Paya Gambut Selangor Utara (NSPSF) merupakan hutan paya gambut kedua terbesar yang mengalami fragmentasi di Semenanjung Malaysia. Walaupun NSPSF dikenali sebagai kawasan *hotspot* biodiversiti di rantau ini, hutan paya gambut ini semakin berkurang disebabkan oleh perkembangan industri penanaman kelapa sawit. Lebih kurang 87% daripada NSPSF telah ditetapkan sebagai hutan simpan, namun secara realitinya, status NSPSF sekarang bukanlah seperti kawasan perlindungan. Hutan paya gambut ini masih dalam keadaan terancam yang berterusan dari penukaran hutan, pembakaran hutan dan pembinaan jalan. Kehilangan biodiversiti fauna sering terjadi di NSPSF melainkan tindakan drastik diambil oleh pihak berkepentingan. Bagi menentukan penghunian habitat dan kadar aktiviti beberapa mamalia, kaji selidik kamera perangkap dijalankan pada 45 lokasi di dalam NSPSF. Hasil usaha kaji selidik ini mendapati 2, 565 perangkap malam di kawasan 778 km², 16 spesies mamalia telah direkodkan. Walau bagaimanapun, Badak Sumatra (*Dicerorhinus sumatrensis*) dan Harimau (*Panthera tigris*) atau penemuan secara tidak langsung seperti tapak kaki tidak direkodkan dan dianggarkan berkemungkinan species ini telah pupus di kawasan hutan paya gambut ini. Hasil kajian ini juga mendapati, kadar aktiviti mamalia dipengaruhi oleh perbezaan kualiti habitat *in situ* dan faktor landskap mengikut panduan pemakanan dan diet mereka. Data dari persampelan kamera perangkap menyediakan maklumat penting terhadap spesies yang mempunyai nilai pemeliharaan yang tinggi dalam NSPSF. Di NSPSF, adalah perlu untuk memantau kehilangan hutan, mewujudkan satu pelan tindakan untuk mengurangkan kesan selepas pelepasan dan membangunkan kaji selidik penggunaan kamera perangkap bagi memantau populasi mamalia. Pihak berkepentingan kerajaan perlu memberi fokus terhadap larangan penukaran hutan paya gambut pada masa akan datang dan penekanan terhadap penukaran NSPSF dari hutan simpan tanpa jaminan kepada kawasan yang dilindungi.

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I certify that a Thesis Examination Committee has met on 8 September 2016 to conduct the final examination of Sasidhran a/l Selvadurai on his thesis entitled "Habitat Occupancy Patterns and Activity Rate of Native Mammals in Tropical Fragmented Peat Swamp Forests" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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CHAPTER 1

INTRODUCTION

1.1 General Review

Agricultural activities have been one of the most controversial land uses around the world for much of the past 30 years (Lindenmayer & Franklin, 2003; Angelstam, 1996; Yaffee, 1994). Rapid agricultural expansion has been replacing forest and poses a serious threat to many natural ecosystems in the next 50 years (Tilman *et al.*, 2001). Tropical rainforests of Southeast Asia are disappearing as predicted at an alarming rate from conversion into oil palm plantations (Lambert & Collar 2002; Linkie *et al.*, 2003; Fitzherbert *et al.*, 2008; Danielsen *et al.*, 2009). Land modification by humans, such as industrial oil palm expansion, is by far the primary cause of habitat loss and habitat fragmentation, affecting biodiversity worldwide (Primack, 2001; Kerr & Deguise, 2004). Despite being considered by environmental NGOs as a serious threat to forest biodiversity, oil palm cultivation continues to expand (Rudel *et al.*, 2009; Sodhi *et al.*, 2004; Sodhi & Brook, 2006) and it has become a key driver of tropical peat swamp forest clearance (Carlson *et al.*, 2012).

Between 1990 and 2005, the oil palm plantations in Malaysia have expanded by a total of 1.87 million ha (MPOB, 2007) and as of 2013, a total area of 5.22 million ha of the country has been covered with oil palms (MPOB, 2013). At this rate, the impacts of industrial oil palm expansion on tropical forests and biodiversity in the region are a major conservation concern (Koh & Wilcove, 2007; Scharlemann & Laurance, 2008). To date, only little research has focused on the actual impacts of oil palm expansion on forest biodiversity (Fitzherbert *et al.*, 2008; Foster *et al.*, 2011). Among tropical forest habitats in Malaysia, peat swamp forests are the most severely affected ecosystem resulted from oil palm expansion.

The protection and restoration of peat swamp forests are conservation priorities that require urgent action because peat swamp forests are more vulnerable to human disturbances than other forest ecosystems (Posa *et al.*, 2011). It is considered to be an important lowland habitat, not only for birds (Adul *et al.*, 2015), but also for the future of mammals in the fragmented North Selangor Peat Swamp Forest. Peat swamp forests are critical for biodiversity conservation and support many specialized species and unique ecosystem types and can provide a refuge for species that are extirpated from non-peat swamp areas affected by degradation and climate change (Parish *et al.*, 2008). Despite the significance of habitat loss as a key threatening process, few studies in conservation biology specifically focused on habitat loss (Fazey *et al.*, 2005).

Habitat fragmentation has degraded remaining forests to a level where it can no longer support viable populations of threatened species (Sodhi *et al.*, 2009;

Bennett, 2011). Mammals have been a focus of human attention for a long time and continue to serve as the traditional focus of government spending on wildlife conservation (Redford *et al.*, 2011). In Malaysia, out of 336 mammal species recorded, a total of 71 species are threatened (IUCN, 2014; Vié *et al.*, 2009). The survival of species is strongly influenced by habitat conservation. Apparently, some natural habitats such as peat swamp forest are rarely monitored by government agencies. The most significant species recorded (Prentice & Aikanathan, 1989) at the North Selangor Peat Swamp Forest (NSPSF), the Sumatran Rhinoceros, was not captured or sighted since 1994 (Tan, 2003).

Deforestation often affects large-bodied mammals, because of their large activity range requirements (Kinnaird *et al.*, 2003). Extinction risk is still determined by human population density, even though human exploitations such as direct persecution and destruction of habitats and prey bases are the main causes of population decline (Cardillo *et al.*, 2004). Larger mammals, especially carnivores risk highest extinction rate because they are more vulnerable to human activities, such as habitat destruction and fragmentation (Forero-Medina *et al.*, 2009). Retaining forest fragments could maintain landscape-scale connectivity by acting as “stepping stones” between contiguous areas of forest (Laurance *et al.*, 2008; Lee & Peres, 2009).

Recent trends in using camera trap devices in wildlife research have provided insights into the ecology of many secretive and cryptic mammals (Rowcliffe & Carbone, 2008; Matsubayashi *et al.*, 2011; Bernard *et al.*, 2012). Camera trapping is very useful in obtaining biological data such as diversity, relative abundances, activity patterns and also presence of species (Kawanishi *et al.*, 1999; Srbek-Araujo & Chiarello, 2005; De Luca & Rovero, 2006; Grassman *et al.*, 2006; Linkie *et al.*, 2007). Also, camera traps are rapidly becoming one of the most important tools in the conservation especially in occupancy estimation studies (Linkie *et al.*, 2007). This will be very useful to study activities of wildlife because photos of different species will also indirectly provide relevant information such as relationship between predator-prey (Kawanishi & Sunquist, 2003; Azlan & Davidson, 2006).

Arthropods have long been considered as an integral part of biodiversity as it provide immense ecological functions and represent more than 80% of total faunal species diversity (Dial *et al.*, 2006; Basset, 2001; Wilson 1992). Arthropods, microbes, and other small organisms maintain stability of various ecosystems including tropical forests, temperate woodlands, urban parks and agricultural farmlands (Pimentel *et al.*, 1992). As part of their ecological functions, majority of arthropods can act as natural enemies that provide biological control of insect pests (Letourneau *et al.*, 2009). They are also essential to the survival of many plant species as insects serve a major role in pollination (Delaplane *et al.*, 2000; Braack, 1997; Bawa, 1990).

Studies showed that insect pollinators such as bees, butterflies, and ants act as important pollinators for flowering plants in rainforests as well as farmlands such

as oil palm plantations (Ramirez *et al.*, 2010; Klein *et al.*, 2007; Thiele, 2005). Pollinating insects are an important constituent of biodiversity (Kevan, 1999). Recent research in oil palm plantations studied insects such as ants (Fayley *et al.*, 2012; Yusah *et al.*, 2012; Klimes *et al.*, 2012), butterflies (Barlow *et al.*, 2007; Fitzherbert *et al.*, 2006; Hamer *et al.*, 2005), orchid bees (Livingston *et al.*, 2013) and other arthropods (Dial *et al.*, 2006; Wettstein & Schmid, 1999) in order to investigate the detrimental effects of deforestation for agricultural expansion.

1.2 Problem Statement

Rate of deforestation in the tropics globally seems to be increasing despite efforts to slow deforestation (Archard *et al.*, 2002). This includes the fragmented largest patch of peat swamp in Peninsular Malaysia. The NSPSF is being threatened by intense oil palm expansion surrounding the forest. This is solely due to the demand of local agencies for profit-making purposes. For an area consisting of several peat swamp reserves, scientific publications on the NSPSF are very scarce, especially on the diversity of wildlife existing in this habitat. The forest complex is vulnerable to future forest clearance that will contribute to the shrinkage of forest area and further affects the wildlife especially the large mammals. There is no substantial data with reference to the availability of flora and fauna in the NSPSF.

North Selangor Peat Swamp Forest is the second largest “intact” peat swamp forest reserve after the South-East Pahang peat complex (Selangor State Forestry Department, 2014). NSPSF consist of few forest reserves including the Sungai Dusun Wildlife Reserve, where now functions as a rehabilitation center for Malayan Tapirs (*Tapirus indicus*). Sungai Dusun Wildlife Reserve is managed by Department of Wildlife and National Parks (PERHILITAN). The NSPSF has the potential to be integrated into ecotourism perspective as this is the closest large forest to the capital of Malaysia, Kuala Lumpur. Thus, understanding of the ecology and the wildlife present in the NSPSF is essential to establish NSPSF as an ecotourism site.

The occurrence of deforestation and subsequent establishment of oil palm plantations triggered few researches to take place in the NSPSF. Early studies acknowledged the importance of the NSPSF as the only peat swamp forest in Peninsular Malaysia that has not been fully studied in terms of biological diversity (Prentice & Aikanathan, 1989). For instance, blackwater fish’s studies indicates that the NSPSF is a unique habitat of exclusive species of certain endemic fishes (Ng *et al.*, 1992; Ng *et al.*, 1994). It has been more than a decade and there has not been a follow-up research on the blackwater fishes.

As for mammals, the response of mammals to selective forest clearance is distinct since degradation may be unfavourable to mammals, as it is typically the initial step for entire clearance of the peat swamp, either through illegal clearance or large-scale commercial agriculture (Linkie *et al.*, 2004). Loss and fragmentation of habitat are a major threat to wildlife, especially carnivorous

mammals that require large home range relative to their body (Woodroffe and Ginsberg, 1998). Recently, Malaysia officials announced the loss of critical endangered Sumatran rhinoceros (*Dicerorhinus sumatrensis*) (Lee, 2015). Sumatran rhinoceros, last seen in 1994 (Tan, 2003) used to roam the NSPSF. This is an example of things went wrong, therefore it is crucial to carry out more significant researches in the NSPSF as it is the largest peat swamp in western coast of Peninsular Malaysia

1.3 Objectives

This study had the following objectives:

1. To estimate the habitat occupancy for various species of peat swamp mammals.
2. To determine the conservation status of native mammals in the NSPSF.
3. To investigate the roles played by *in situ* habitat quality and landscape metrics in animal activity in the NSPSF.

In addition to above objectives, observations were done to gather the baseline information as imminent threats from human activities have increased recently. Besides oil palm expansion, new road construction in the NSPSF, such as recent Ijok-Teluk Intan highway, would have adverse impact on various wildlife species (Bissonette, 2002; Laurance *et al.*, 2008). Since 2002, about 592 ha has been lost to fire (Parish *et al.*, 2014) which may have an impact on species in the area. Also, anthropogenic threats including plantations and cattle grazing is becoming more common nowadays in the NSPSF. These would cause animal-wildlife conflicts and extinction of wide-ranging carnivores in large protected areas (Woodroffe & Ginsberg, 1998).

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