



Effects of peat swamp logging and agricultural expansion on species richness of native mammals in Peninsular Malaysia

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Abstract

The biodiversity inhabiting tropical peat swamp forests in Southeast Asia is currently threatened by commercial logging and agricultural expansion. The occurrence of mammals in such forests is often poorly known and the factors influencing their occurrence in these ecosystems have rarely been quantified. We aim to determine the key habitat and landscape drivers of mammal species richness in fragmented peat swamp reserves. We conducted camera trap surveys in the North Selangor Peat Swamp Forest (NSPSF), the last remaining area of peat swamp forest on the west coast of Peninsular Malaysia. We also measured vegetation structure and landscape metrics to investigate the relationship between these factors and mammal richness. We recorded a total of 16 mammal species from 45 sampling sites using camera traps located in peat swamp forest reserves. Mammal species richness increased with the abundance of large trees and distance away from roads. Species richness decreased significantly with canopy cover and height, the abundance of fallen trees, the abundance of forest palms and saplings, distance away from rivers, and a measure of landscape compositional heterogeneity. Our findings underscore the high conservation value of logged peat swamp forests and the urgent need to halt further deforestation. We recommend: (1) protecting riparian habitat; (2) avoiding further forest conversion particularly areas supporting large trees into oil palm plantations; and (3) limiting road development within and around the NSPSF.

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Introduction

Tropical peat swamp forest in Southeast Asia covers 25 million hectares and is globally important for biodiversity conservation (Parish et al. 2014). The annual loss

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of approximately 5.2 million hectares of tropical forests worldwide between 2000 and 2010, including those in Southeast Asia (FAO 2010), has adversely affected more than 50% of vertebrate animal species, particularly forest taxa (Brooks et al. 2002; Wilcove, Giam, Edwards, Fisher, & Koh 2013). Southeast Asia's tropical peat swamp forests are under enormous threat from logging, fire, habitat fragmentation, and land conversion to establish oil palm plantations and smallholdings. However, the value of the peat swamp forest ecosystem for biodiversity remains poorly understood (Sheil et al. 2009; Sodhi et al. 2010; Koh, Miettinen, Liew, & Ghazoul 2011; Miettinen, Shi, & Liew 2011a, 2011b; Posa, Wijedasa, & Corlett 2011).<

Previous studies have indicated that tropical peat swamp forests are important habitat for mammals (Morrogh-Bernard, Husson, Page, & Rieley 2003; Felton, Engström, Felton, & Knott 2003; Cheyne, Husson, Chadwick, Macdonald, & Hutan 2010; Cheyne & Macdonald, 2011). However, mammals in peat swamp forests are understudied compared to those in other forest types, such as lowland and hill dipterocarp forests (Posa et al. 2011). This is an important knowledge gap because actions to promote the conservation of species depends on understanding where species occur, as well as the quantification of the factors influencing why they occur where they do (Mackey & Lindenmayer 2001; Elith & Graham 2009). We addressed this knowledge gap in this study through an intensive camera trap study of the mammal fauna in the North Selangor Peat Swamp Forest (NSPSF) located on the west coast of Peninsular Malaysia. This area is one of the most important and largest remaining peat swamp forests of its kind (Azhar et al. 2011).

To date, camera trap-based sampling has not been conducted to investigate the diversity and habitat preferences of wildlife species in the NSPSF. Prentice and Aikanathan (1989) reported the presence of 20 mammal species in the NSPSF,

including the Sumatran Rhinoceros (*Dicerorhinus sumatrensis*) and Malayan Tiger (*Panthera tigris*). Their surveys were based on sightings and tracks, as well as indirectly through information from local inhabitants (e.g. loggers, farmers and fishermen), and revealed that the Asian Elephant (*Elephas maximus*) was locally extinct in the NSPSF at that time (Prentice & Aikanathan 1989).

We gathered baseline data on mammal species richness, with the exception of small rodents and bats, in the NSPSF, and quantified the influence on species richness of multiple anthropogenic factors, such as past logging activities, forest fragmentation, and oil palm expansion. We also quantified relationships between mammal species richness and local-level factors. The results of this study are important to determine which species occur in the NSPF and where they occur.

Knowledge of faunal biodiversity in tropical peat swamp forests is far from complete and these forests are disappearing rapidly (Yule 2010). Given that tropical peat swamp forests are more vulnerable than other forest ecosystems in Southeast Asia, protecting the forests and peat swamp biodiversity are conservation priorities that require urgent action (Posa et al. 2011; Hawa, Azhar, Top, & Zubaid 2016).

Materials and methods

Study site

We conducted this study at the North Selangor Peat Swamp Forest (NSPSF) (between 3°40'26.56"N, 101°4'29.52"E and 3°32'4.40"N, 101°27'33.36"E), situated in the state of Selangor, on the west coast of Peninsular Malaysia (Fig. 1). The forest covers 81,304 ha and comprises three forest reserves, namely Raja Musa Forest Reserve (36,938 ha), Sungai Karang Forest Reserve (36,654 ha), Sungai Dusun Wildlife Reserve

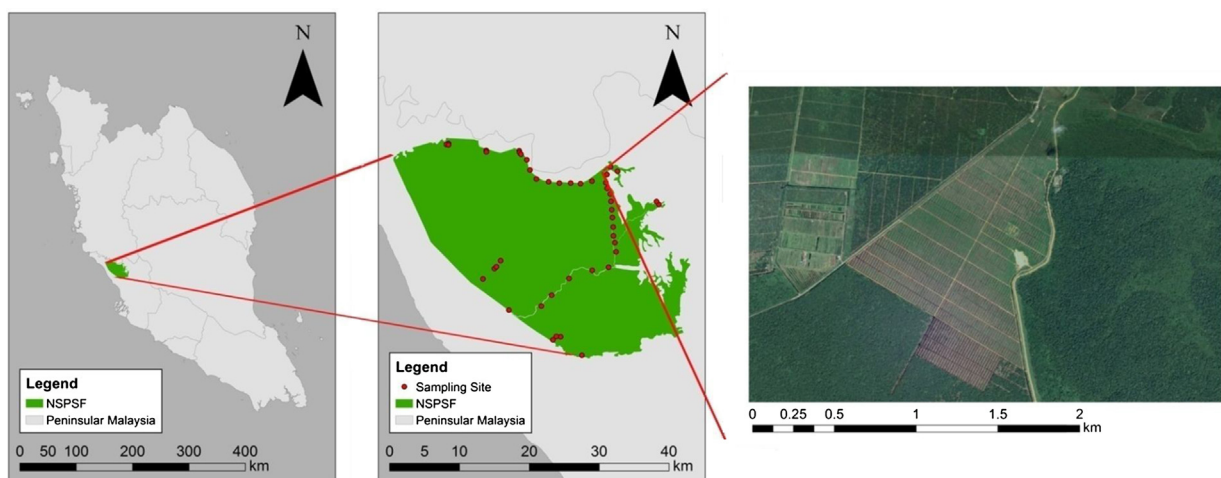


Fig. 1. Map of the study area. (A) Location of study area in Selangor, Peninsular Malaysia; (B) location of sampling sites; (C) deforestation in the NSPSF to establish 370 ha of oil palm monocultures in 2013.

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