



**ASSESSMENT OF HABITAT CHARACTERISTICS ON WILD BOAR
DETECTION IN SELECTED FOREST RESERVES IN PENINSULAR
MALAYSIA**

By

KU NOOR KHALIDAH BINTI KU HALIM

**Thesis Submitted to the School of Graduate Studies, Universiti Putra
Malaysia, in Fulfilment of the Requirements for the Degree of Master
of Science**

November 2021

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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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Wild boar (*Sus scrofa*) populations have increased remarkably worldwide. In predominantly Muslim region such as Peninsular Malaysia, wild boars have thrived, in part, because Muslims do not hunt them as they are prohibited from consuming pork. This is complicated by the decline of predators such as Malayan Tigers. We examined the relationship between the number of wild boar detections, with vegetation structure characteristics, and landscape metrics in 12 forest reserves in Peninsular Malaysia. Camera-trapping was used to record wild boar detections. At each camera trap location, the site-level characteristics and landscape metrics were measured. We found that the number of wild boar detections was 2.5 times higher in Peat Swamp Forest compared to Lowland Dipterocarp Forest. In contrast, the number of wild boar detections was six times lower in Montane Forest compared to Lowland Dipterocarp Forest. The data further revealed that the number of wild boar detections was positively related to the number of trees with diameter at breast height (DBH) > 45 cm, number of fallen trees, number of palms, number of saplings, and elevation. However, the number of wild boar detections was negatively influenced by the number of trees with DBH < 45 cm, canopy cover, distance from nearest paved and unpaved roads. Surprisingly, wild boar populations were not affected by forest fragmentation and logging. The data indicated that site-level characteristics, particularly vegetation structure, supersede landscape-level characteristics in terms of driving the number of wild boar detections in the forest reserves. The high detection numbers of wild boar may influenced by five landscape-level characteristics which are number of trees with DBH > 45cm, number of dead fallen trees, number of palms, number of saplings and elevation. Generally, our findings suggest that wild boars can thrive in tropical fragmented landscapes with favourable site-level characteristics and lower bushmeat hunting pressure.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan ijazah Master Sains

PENILAIAN CIRI-CIRI HABITAT TERHADAP PENGESANAN BABI HUTAN DI HUTAN SIMPAN YANG TERPILIH DI SEMENANJUNG MALAYSIA

Oleh

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Populasi babi hutan telah meningkat secara luar biasa di seluruh dunia. Di wilayah yang didominasi oleh Muslim seperti Semenanjung Malaysia, babi hutan telah berkembang maju di sesetengah bahagian kerana Muslim tidak memburu babi hutan kerana mereka dilarang untuk memakan daging babi. Ini dirumitkan dengan pemangsa seperti Harimau Malaya yang semakin berkurangan. Kami telah mengkaji hubungan antara bilangan babi hutan yang dikesan dengan ciri-ciri struktur tumbuh-tumbuhan dan metrik landskap di 12 hutan simpan di Semenanjung Malaysia. Kamera perangkap telah digunakan untuk mencatat bilangan babi hutan yang dikesan. Di setiap lokasi kamera perangkap, kami telah mengukur ciri-ciri struktur tumbuh-tumbuhan dan metrik landskap. Kami mendapati bahawa bilangan babi hutan yang dikesan adalah 2.5 kali lebih tinggi di hutan paya gambut berbanding dengan hutan Dipterokarp tanah rendah. Berbeza pula bilangan babi hutan yang dikesan adalah enam kali lebih rendah di hutan Dipterokarp tanah tinggi berbanding di hutan Dipterokarp tanah rendah. Data kami telah mendedahkan bahawa babi hutan yang dikesan adalah berkorelasi positif dengan bilangan pokok yang mempunyai diameter paras dada >45 cm, bilangan pokok tumbang, bilangan pokok palma, bilangan anak pokok, dan ketinggian. Berbeza pula, bilangan babi hutan yang dikesan adalah berkorelasi negatif dengan bilangan pokok yang mempunyai diameter paras dada < 45 cm, penutup kanopi, jarak dari jalan berturap dan jarak dari jalan tidak berturap. Lebih mengejutkan, populasi babi hutan adalah tidak terkesan dengan pemecahan hutan dan pembalakan. Data kami menunjukkan bahawa ciri-ciri struktur tumbuh-tumbuhan, struktur vegetasi menggantikan tahap ciri landskap dari segi mendorong pengesanan babi hutan di dalam hutan simpan. Bilangan pengesanan babi hutan yang tinggi mungkin dipengaruhi oleh lima ciri metrik landskap iaitu bilangan pokok dengan diameter paras dada melebihi 45cm, bilangan pokok tumbang mati, bilangan pokok palma, bilangan anak pokok dan ketinggian. Secara umumnya, penemuan kami mencadangkan bahawa babi hutan boleh berkembang maju di landskap pemecahan hutan

tropika diikuti beberapa ciri-ciri tahap tapak yang baik dan penurunan tekanan terhadap daging buruan.



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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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LIST OF ABBREVIATIONS

DBH	Diameter at breast height
IUCN	International Union of Conservation for Nature
PFR	Pasoh Forest Reserve
DNA	Deoxyribonucleic Acid
Ma	Million years ago
ASF	African Swine Fever
KFR	Kenaboi Forest Reserve
SMFR	Sungai Menyala Forest Reserve
SLFR	Sungai Lalang Forest Reserve
NSPSF	North Selangor Peat Swamp Forest
AHFR	Ayer Hitam Forest Reserve
BCFR	Bukit Cherakah Forest Reserve
BFR	Bangi Forest Reserve
TFR	Terla Forest Reserve
BGFR	Batu Gangan Forest Reserve
BBFR	Bukit Bertam Forest Reserve
BJFR	Bukit Jerut Forest Reserve

CHAPTER 1

INTRODUCTION

1.1 Background of study

There is broad agreement that setting aside protected areas as reserves is one of the important strategies to protect wildlife habitats and their ecological functions (Bruner *et al.*, 2001; Peres, 2005). While Southeast Asia's protected area system covers approximately 13.8% of the land (UNEP-WCMC & IUCN, 2011), the biodiversity of this region is under specific threat, with the highest recorded rate of decline (about 1.5% between 2000 and 2005) and the highest percentage of endangered vertebrates in all tropical regions (Sodhi *et al.*, 1997). Among mammals, the ungulate family such as wild boars (*S. scrofa*) responds to protection within a reserve system (Caro *et al.*, 2000), and is peculiarly sensitive to decline (Mace & Balmford, 2000; Laliberte & Ripple, 2004).

Forest fragmentation, habitat destruction, and degradation from environmental factors are the driving forces of biodiversity loss. These factors have adverse effects on ecological processes and the provision of ecosystem services (Crooks *et al.*, 2017; Tee *et al.*, 2018). Moreover, population density is closely linked with both habitat fragmentation (Chiarello, 2000; Michalski & Peres, 2007), and hunting pressure (Peres & Palacios, 2007), especially for large-bodied animals. Deforestation affects terrestrial biodiversity through habitat loss and the effects of fragmentation (per se) such as patch loss and enhanced edge effects (Bernard *et al.*, 2009; Melo *et al.*, 2013). Nevertheless, high-intensity and large-scale disturbances, which are prevalent in several increasingly logged forests may have negative effects on a group of species (Sist *et al.*, 2003). Such adverse effects are also present in lowered-impact logging, although the process may mimic large, naturally occurring tree-fall gaps (Sist *et al.*, 2003).

The population size of tropical forest mammals depends heavily on elevation, net primary productivity, climatic factors (rainfall, temperature), and floristic composition (Galetti *et al.*, 2009). The effects of habitat productivity and climate variables on the biodiversity of tropical wildlife populations have been investigated by a few authors (Bellard *et al.*, 2012; Crist *et al.*, 2017). However, the relationship between environmental factors and anthropogenic disruptions are yet to be elucidated, particularly in complex human-dominated biomes (Galetti *et al.*, 2009). By conducting mammal surveys, the details on the occurrence of species in a specific group can be better understood (Leite *et al.*, 2016). Other important benefits of mammal surveys include enhanced awareness of the structure of animals at a given time and location (Leite *et al.*, 2016). The remains of native vegetation, the development of actions for their recovery, and the assessment and development of effective management plans of disturbed areas are important for the protection of mammals (Leite *et al.*, 2016). Preserved habitats of natural vegetation and overlapping corridors

significantly contribute to the conservation of mammalian biodiversity and create a healthy habitat for existing populations of wild animals in an area (Leite *et al.*, 2016).

The rising numbers of wild boar (*S. scrofa*) have made them the most widely distributed ungulate (Gortazar *et al.*, 2000; Massei & Genov, 2004). Wild boar populations are increasing worldwide due to ecological and social-economic changes (Snow *et al.*, 2017) thus, resulting in several impacts. These impacts are majorly experienced in forest habitats (Gomez, *et al.*, 2003) and areas where wild boars have been introduced (Cushman *et al.*, 2004; Mitchell *et al.*, 2007). Other researchers reported that wild boars also caused agricultural damages (Herrero *et al.*, 2006), health risks (Gortazar *et al.*, 2007), traffic accidents (Lagos *et al.*, 2012) and conservation problems (Bueno *et al.*, 2009).

Wild boar is a species known to adjust its pattern of action depending on the level of human activity, and such behavioural versatility may affect the outcome of behaviour (Ohashi *et al.*, 2013). Although the impact of direct and indirect human activities on the pattern of activity of wild boars has been previously acknowledged, an indirect observation is considered difficult due to their diligent behaviour and preference for habitats with dense thickets (Ohashi *et al.*, 2013). Camera traps are mainly applied to minimise the influence of human activity when studying wildlife activity.

Hence, using the camera trapping method, this study aimed to, 1) study the relationship between the number of detection of wild boar and vegetation structure and, 2) the effects of logging activities and habitat fragmentation on the presence of wild boar in forest reserves in Peninsular Malaysia.

1.2 Problem statement

Previous studies revealed a decline of species richness and abundance in fragmented tropical rainforests (Goodman & Rakotondravony, 2000). Socio-economic and ecological changes such as translocation, limited hunting, natural forest regeneration, logging, forest fragmentation, and increased anthropogenic food affect wild boar populations as a result of demographic and geographical influences (Snow *et al.*, 2017). Since the implications on forest fragmentation may differ between species (Malcolm, 1997), it is pertinent to study the effects of forest fragmentation on wild boars in Malaysian tropical rainforests.

Due to the increasing population of wild boars, they were reported to alter the natural environment by overturning the soil; thereby, affecting the process of natural regeneration of forests, destroying native plants, and compete with native species for food in forestry landscapes (Massei & Genov, 2004; Hegel & Marini, 2013). One of the reasons for the negative impact of wild boar on the regeneration and vegetation of forests and native plants is nest-building (Ickes

et al., 2005). Apart from that, Ickes *et al.* (2001) also highlighted the important role of wild boar in plant dynamics in Malaysian rainforests as the animals influenced growth, mortality, stem density, and species richness.

Specific factors are responsible for influencing the attraction of an animal to visit, forage, and inhabit a certain area. These factors may differ between different species. Wild boars have been recognised to cause positive and negative impacts on forest ecosystems, however, the factors influencing their attraction to such environment have not been investigated. Thus, this study aims to determine the environmental and habitat characteristics that influence the presence of wild boar in the forest reserves in Peninsular Malaysia. From this research, the findings and results can be used by stakeholders, small holders and farmers in agricultural sector to avoid and protect their crops from being damaged by pest mainly by wild boars.

In forest reserves in Peninsular Malaysia, field studies are needed to study the wild boar populations as baseline information on wild boar ecology is currently lacking. A previous study conducted by Ickes *et al.*, (2001) reported Pasoh Forest Reserves (PFR) had the highest density of wild boar. The finding corroborated earlier data from two different studies (Diong, 1973; Laidlaw, 1994) as PFR recorded a higher density of wild boar population than elsewhere. Besides, due to the increasing number of wild boar in PFR, it reflects that the natural predator of wild boar such as the Malayan tiger may be absent in the forest reserve. To date, there is little information to support and guide the conservation of wild boar populations in the wild. It is also unknown how wild boar populations respond to habitat fragmentation in the region.

The hypothesis for this study is site level such as canopy cover, number of saplings and number of palms which lead to high dense vegetation are more likely to attract the presence of wild boars than landscape levels characteristics and human activities such as logging have a negative effect on the number of detection of wild boar.

1.3 Research objectives

This study aims to investigate the environmental and anthropogenic factors (e.g. vegetation structure, habitat fragmentation and logging) that influence the presence of wild boars in forest reserves in Peninsular Malaysia.

The main objectives of this study were:

- i) To assess the influence of site-level characteristics such as vegetation structure on the number of wild boar detections.
- ii) To evaluate the effect of landscape-level characteristics on the number of wild boar detections.
- iii) To provide management and conservation recommendations based on the findings.

- iv) To identify the logging impact on the number of detection of wild boar in the selected forest.

1.4 Research hypothesis

Hypothesis 1:

H₀: Site-level and landscape-level characteristics have no effect on the number of detection of wild boars in selected forest reserves.

H₁: Site-level and landscape-level characteristics have positive effect on the number of detection of wild boars in selected forest reserves.

Hypothesis 2:

H₀: Logging activities have no effect on the number of detection of wild boars in selected forest reserves.

H₁: Logging activities do influence the number of detection of wild boars in selected forest reserves.

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