DRIVERS OF AVIAN BIODIVERSITY IN TROPICAL AGRICULTURAL LANDSCAPES

ABU HASSAN DIN BIN AMIRUDDIN

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By
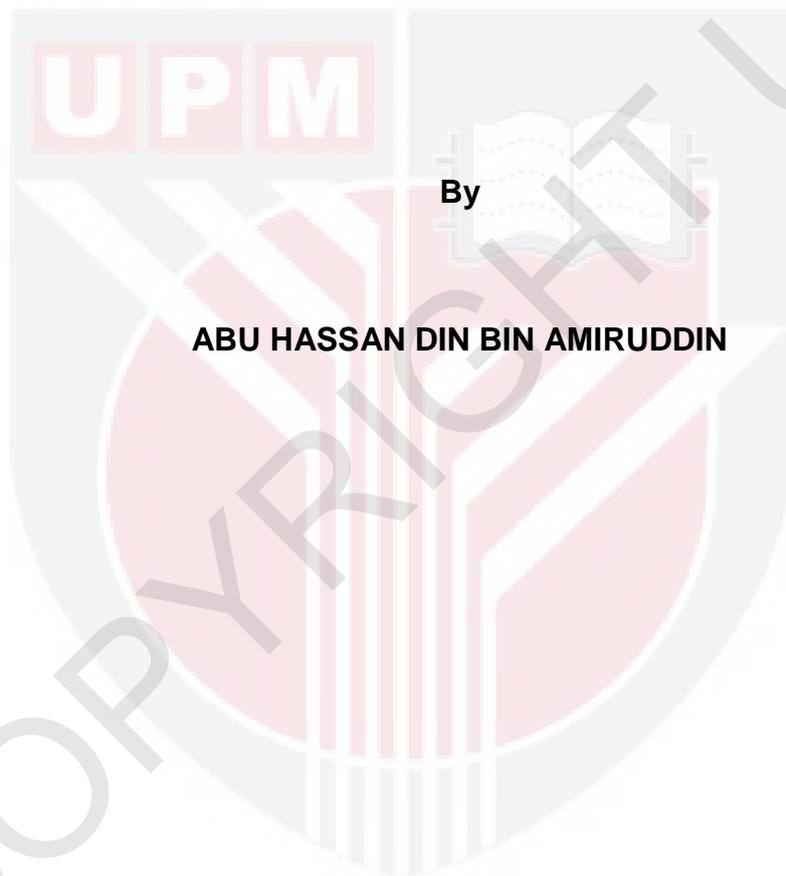
ABU HASSAN DIN BIN AMIRUDDIN

**A Project Report Submitted in Partial Fulfillment of the Requirements
for the Degree of Bachelor of Forestry Science in the
Faculty of Forestry
Universiti Putra Malaysia**

2018

DEDICATION

For my beloved family:

Haji Amiruddin Bin Haji Nordin

Razilah Binti Mohd Jadi

Suriani Binti Abdul Rani

Siti Noraisyah Binti Zohari

Also my siblings.

To all my friends,

Kuala Lumpur Kepong Plantation and Sg. Lalah residents

Thank you for your encouragements supports

and the facilities that given during this research.

Thank you for everything. May Allah Bless All of us.

ABSTRACT

Conversion of forest area to agriculture land is rapidly occurring in Malaysia. This landscape transformation affects biodiversity including flora and fauna. The purpose of this research was to determine the drivers of avian biodiversity in tropical agricultural landscapes such as oil palm plantation, fruit orchard and rubber tree plantation. This study had proved that the highest bird species richness was found in oil palm plantation and fruit orchard compared to rubber tree plantations. Altogether, 72 individual birds from 24 species with 15 families were found in tropical agriculture landscapes. Interestingly, the species richness of the bird was influenced by canopy coverage, light intensity and the density of tree. The drivers that influence avian species richness was canopy cover, light intensity and tree density. However, there was a significant difference in bird species richness between the oil palm plantation and rubber tree plantation as well as the fruit orchard and rubber tree plantation but there was no significance difference between the oil palm plantation and fruit orchard. Further research is required to date of the tropical agriculture landscapes for supporting biodiversity in future.

ABSTRAK

Kebanyakan hutan di Malaysia telah ditukar untuk menjadi kawasan pertanian. Oleh yang demikian, fenomena ini akan memberikan impak yang besar terhadap biodiversiti di sesuatu kawasan. Dalam kajian ini, perhatian diberikan tentang apakah faktor yang dapat menarik burung untuk menjadikan kawasan pertanian ini sebagai habitat. Hasil dapatan kajian ini membuktikan ladang kelapa sawit dan kebun getah merekodkan jumlah spesies yang tinggi berbanding bilangan spesies di ladang pokok getah. 72 jumlah individu burung daripada 24 spesies dapat direkodkan dalam landskap pertanian. Kehadiran burung ini di pengaruhi oleh pelbagai faktor antara yang utama adalah litupan silara pokok, keamatan cahaya dan kepadatan pokok di kawasan berkenaan. Justeru itu, ladang kelapa sawit dan dusun buah tiada perbezaan yang ketara antara bilangan spesies yang direkodkan berbanding ladang pokok getah. Kajian lanjutan perlu dijalankan agar dapat memastikan kawasan pertanian dapat menampung kepelbagaian hidupan terutama burung pada masa akan datang.

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Finally, to my parents and siblings, special thanks are given to them. To all my friends, thank you for understanding and encouragement in my moment of crisis. Your friendship makes my life a wonderful experience. This thesis is only a beginning of my journey to explore in this field.

APPROVAL SHEET

I certify that this research project report entitled Drivers of avian biodiversity in tropical agricultural landscape ‖ by Abu Hassan Din Bin Amiruddin has been examined and approved as a partial fulfilment of the requirements for the Degree of Bachelor of Forestry Science in the Faculty of Forestry, Univeristi Putra Malaysia.

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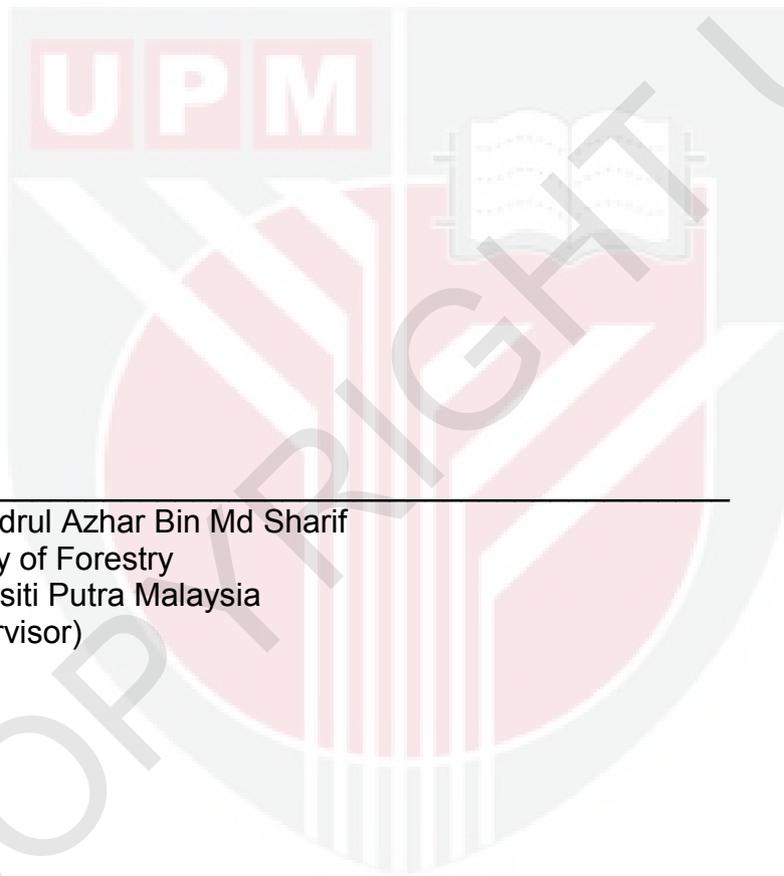
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Date: June 2017

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UNFCC   United Nations Framework Convention on Climate Change

FAO   Food and Agriculture Organization

ANOSIM   Analysis of Similarities

GLMs   Generalized Linear Models

CHAPTER ONE

INTRODUCTION

1.1 Background

Deforestation is the activity of clearing the stand of trees or the forest area is converted into urban area, dam and for agricultural purpose. According to the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, the overwhelming direct cause of deforestation is agriculture. Agriculture is intensifying and expanding rapidly, threatening the substantial biodiversity that persists in agriculture practices management (Tilman *et al.* 2011; Fischer *et al.* 2008; Philpott *et al.* 2008; Perfecto *et al.* 2009; Karp *et al.* 2011; Melo *et al.* 2013).

Conversion pressure is mainly great in the tropics, which comprise much of the world's plant and vertebrate multiplicity (Lambin et al., 2003; Gibson et al., 2011; Bhagwat et al., 2008). This could be achieved by adopting best practices methods for plantation management leading to more extensive agricultural areas, or more intensive agriculture with the aim of conserving larger tracts of natural forest. (Radford and Bennett, 2007; Lindenmayer et al., 2008; Gardner et al., 2009; Phalan et al., 2011; Kamp et al., 2015; Lamb et al., 2016).

Lowland tropical forest ecosystems consist of the main levels of species endemism and biological diversity worldwide (Sodhi NS et al. 2004; Fitzherbert *et al.* 2008). However, large area of tropical lowland forests was converted into oil palm (*Elaeis guineensis*) which drives biodiversity loss (Fitzherbert *et al.* 2008) and compromises forest functioning and maintenance of vital ecosystem services (Brown et al. 2011). According to the Food and Agriculture Organization of the United Nations (FAO) in year 2012 over 17.1 million hectares of enduring cultivated cropland worldwide was covered of oil palm agriculture compared with 9.97 million hectares in the year 2000. Oil palm establishment continues to increase within lowland areas of Malaysia and Indonesia, the two dominant producing countries in Southern Asia (Gilbert N. 2012).

Over the past 35 years, landscape lowland rainforests have been replaced by monoculture plantations of Brazilian rubber trees (*Hevea brasiliensis*) (Li HM. *et al.* 2007). This crop species has led to the deforestation in changes of agricultural landscapes. In Malaysia, the rubber plantation is the source of economic for society and country. Rubber plantations had the lowest species richness in our non-breeding habitat surveys and no species used rubber plantation sites as breeding habitat and get their food source because the monoculture system. This massive land conversion has caused the remaining lowland rainforests to experience significant fragmentation involving a decrease in mean patch size and an increase in inter patch distance, with 74% of the patches being less than 500 ha and on average

253 m apart (Li HM, *et al.* 2009). Forest habitat patches in this region are small and isolated within vast stretches of rubber plantations.

Traditional orchards or fruit orchards are established by small holders. These traditional practices planting of fruit species tree and well manage by smallholding. This orchard system has heterogeneity structure compare to plantation method this is because vegetative structure have different canopy layer height, more bushes and produce fruit to attract the present of avifauna to get their food also the suitable place for breeding. For example, There is growing interest in avian functional diversity in tropical forests and agro ecosystems, especially in tree-dominated agroforestry systems such as shade coffee and cacao plantations that have higher bird diversity than open agricultural systems with few or no trees (Thiollay 1995; Greenberg et al. 1997, 2000b; Wang and Young 2003; Perfecto et al. 2004; Waltert et al. 2005; Marsden et al. 2006; Clough et al. 2009; Tscharntke et al. 2008).

Gaston K.J (2008) stated that conservation of biodiversity in human-modified landscapes is necessary to protect rare and common species of aesthetic and cultural interest and to maintain ecosystem services, which are ensured by high species diversity. The change of forest structure to tropical agricultural landscape will affect the environment structure. The management practices will affect wildlife habitat. Habitat is the place of the wildlife to get their necessary such as shelter, food and breeding. Habitat quality is wildlife habitats have a diversity of plant species including shrubs, trees, grasses,

and forbs, Plant reproduction, or the presence of seedlings and new growth are an indication of healthy plants and habitats. Wildlife species use the various types of plants to meet their daily needs. While encounter is a steady component of the habitat, fruit tree species and grasses greatly enhance the quality of food and cover resources for all wildlife. Such as most important factors governing diversity gradients are contemporary factors such as ambient energy, water availability and productivity, area, biotic interactions and environmental heterogeneity, and factors related to historical processes such as phylogenetic niche conservatism and geological or climatic history (Currie 1991; Hawkins *et al.* 2003; Kreft & Jetz 2007; Field *et al.* 2009)

Tropical agricultural landscape scales had shown the declines pattern in species diversity due to agricultural intensification have been documented for birds (Donald et al. 2001). This is because the lack of research that related to species of avian with the tropical agricultural landscape quality for a being the habitat. Avian also had choose in this research because, they play important roles as predators, prey, seed dispersers and pollinators in the maintenance of ecological processes (Pimm, 1986). Second, they are easy to sample and are sensitive to habitat changes, making them useful environmental indicators (Johns, 1992).

This study aimed to identify the key habitat quality characteristics in tropical agricultural landscape that influenced birds. To date, little is known about the avian biodiversity in different agriculture landscape and the vegetation

structure such as the traditional orchard, oil palm plantation and rubber plantation.

1.2 Research questions

I. Do avian richness and abundance differ between fruit orchard, oil palm plantation and rubber plantation?

II. What are the key habitat quality variables that influence birds species richness?

III. Is there any difference in habitat quality between fruit orchard, oil palm plantation and rubber plantation?

1.3   Objectives

I.   To determine number of total bird capture into avian communities in fruit orchard, rubber tree plantation and oil palm plantation

II.   To compare avian species composition between fruit orchard, rubber tree plantation and oil palm plantation.

III.   To determine key environmental factors that drive avian species richness in agricultural landscapes.
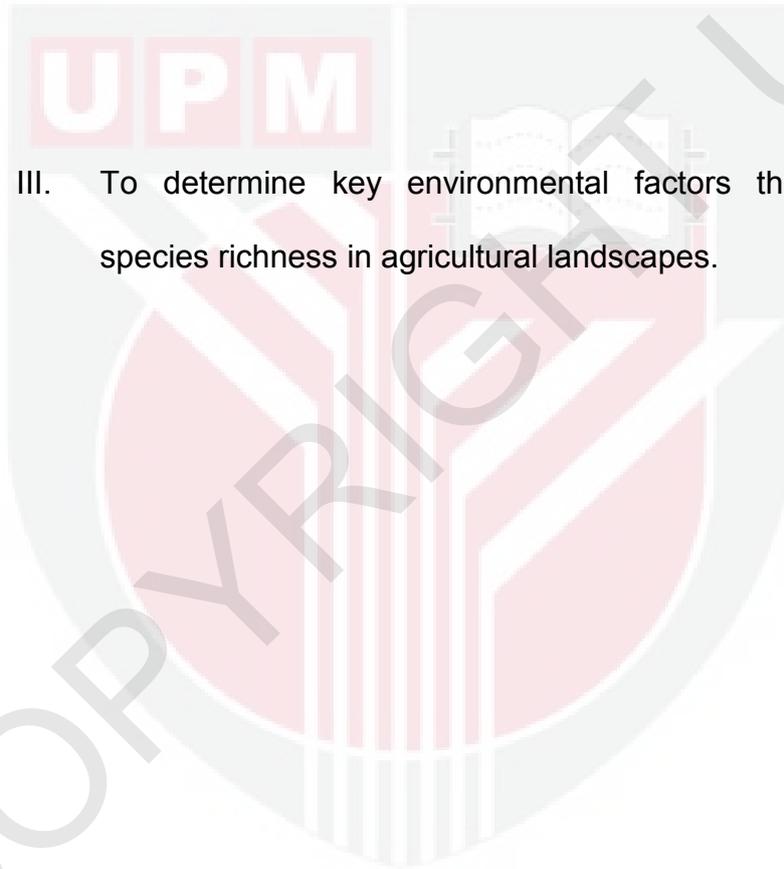
1.4   Hypothesis

I.   Frugivores are more abundant in fruit orchards compared to other agricultural landscapes

II.   Avian species composition is more diverse in fruit orchards compared to other agricultural landscapes.

III.   Vegetation structure characteristics increase or decrease avian species richness.

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