

UNIVERSITI TEKNOLOGI MARA

**ECOLOGICAL LINKAGES
BETWEEN UNDERSTORY
VEGETATION, INSECT
COMMUNITIES, AND SOIL
CHEMICAL PROPERTIES IN
DIFFERENT OIL PALM
PLANTATIONS**

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Thesis submitted in fulfilment
of the requirements for the degree of
**Master of Science
(Biology)**

Faculty of Applied Sciences

September 2025

ABSTRACT

The ecological sustainability in oil palm plantations depends on the complex relationship between biodiversity and soil health. This study investigated the influence of plantation management practices which are different planting spacing of oil palm trees and different method of collecting oil palm fruit bunch on the diversity and abundance of understory vegetation, insect communities and soil chemical properties in two oil palm plantations in Selangor. The diversity and abundance of understory vegetation and insects inhabiting the understory in plantations were quantified using a quadrat, sweep net and handpicking. Soil quality was assessed by comparing the pH levels, electrical conductivity, organic matter (OM), and organic carbon (OC) content at both plantations. A total of 45 understory vegetation species and nine genera were identified from both plantations. Plantation 1 recorded 31 species and five genera with a total of 1630 individuals while Plantation 2 recorded 17 species and four genera with 1248 individuals. *Nephrolepis* spp. were among the most abundant vegetation species identified from both plantations. The differences in the number of understory vegetation between the plantations were significant as higher planting spacing and traditional methods of oil palm crop collection support more plant richness and abundance. Furthermore, Plantation 1 recorded 1238 insect individuals while Plantation 2 recorded 1160 individuals. Insects from this study were classified into 15 orders and 80 families, with 13 orders and 57 families recorded from Plantation 1 and 11 orders and 59 families in Plantation 2. Ants or the family Formicidae was the predominant insect family collected. The number of insects between plantations did not differ significantly as $P > 0.05$. Variations in the number of understory vegetation and insects between the areas and plantations were attributed to the differences in human and agricultural activities, resource availability, and plantation management. Regression analyses revealed insignificant relationships between the number of understory vegetation and the number of insects in both plantations. Soil chemical properties (pH, EC, OM and OC) also showed no significant difference with the number of understory vegetation and insects from both plantations except for the number of insects and EC in Plantation 2. These results were suspected primarily due to the human activities, and plantation management. These findings highlighted the vital role of plantation management practices in promoting biodiversity and their potential positive influence on soil quality. The results underscored the importance of sustainable management approaches in enhancing the ecosystem within oil palm plantations in conjunction with the national agenda in SDG goals.

ACKNOWLEDGEMENT

First of all, I would like to thank the Almighty Allah for bestowing upon me the opportunity to embark on this remarkable journey and granting me resilience and patience that sustained me throughout the entire research journey. There are no words that can describe how profoundly thankful I am for my supervisor, Dr. Siti Khairiyah Mohd Hatta, for her unwavering support, scholarly insights, invaluable guidance and enduring patience which have been the pillars of strength throughout my research process. Her expertise and constructive feedback were very impactful in shaping the trajectory of this thesis. Beyond academia, dedication and commitment displayed by her have been a huge encouragement for me to complete this research. My sincere gratitude also extends to my co-supervisors, Dr. Nur Nadiah binti Md.Yusof and Prof. Dr. Salmah Binti Yaakop for their valuable advice and assistance. Not to forget, I am very grateful to Universiti Teknologi MARA and the Ministry of Higher Education Malaysia for providing accessible facilities and funding for this research. Last but not least, words could never be enough to express my gratitude to and Ibrahim Abd Latip for their sacrifices, support and prayers that eased my journey in completing this research. I also extend my warmest thanks to my research colleague, Nurul Fathiah Khairudin for her constant assistance and being a great source of reference for many aspects of this research. I would also like to thank my friends, lab mates and lab staff in UiTM Shah Alam for all the assistance they have provided. May Allah, in His infinite mercy, reward all those who have played a part in my journey with His abundant blessings and gratitude.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Oil palm (*Elaeis guineensis*) is one of the most important crops in Malaysia. Malaysia's economic development depends mainly on oil palm trees, originally introduced by the British in 1871 (Awalludin et al., 2015). The oil palm industry in Malaysia, Indonesia, and Thailand maintains to produce over 88% of the world's palm oil, making that region a significant economic contributor (Murphy et al., 2021). Malaysia currently dominates the oil palm industry market trade globally with 45% of the market share (Lai et al., 2015).

Oil palm trees are able to produce various by-products and uses including wood production from its trunk, energy production, source of organic material for fertilization, biomedicine and biotechnology properties, textile for the fashion industry, design and architecture materials and food applications (El-Mously, 2019). Employment in the oil palm industry has also been proven to ameliorate specific households (Hervas & Isakson, 2020). Many people are employed in Malaysia's oil palm industry, which makes up a significant portion of the country's gross domestic product or GDP. Harun & Laksito (2022) in their analysis stated that agriculture contributed 7.3% of Malaysia's GDP with oil palm largely accounting for 37.9% of the agricultural GDP and furthermore highlighted statistically significant cointegration relationship between GDP and 3 key variables (labor force, palm fruit production, and palm oil exports).

Domination of the oil palm plantations to the land across Malaysia has been affecting the flora and fauna of the local habitat. As of 2015, 27% of peatlands in Peninsular Malaysia, Sumatra and Borneo were covered by the plantation industry with 73% of it from oil palm plantations (Miettinen et al., 2016). According to Murphy et al. (2021), tropical peatlands in Asia are affected by the oil palm conversion causing the loss of plants and animals in their natural habitats. Endangered animals such as