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RSST011 - ANALYSIS OF VEGETATIVE COMMUNITY STRUCTURE AND DIVERSITY OF UiTM KUALA PILAH FOREST

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ABSTRACT

Secondary tropical forests are critical for biodiversity conservation and ecological resilience in Malaysia, yet their structural complexity and recovery potential remain under documented. A lack of detailed data on community composition and forest dynamic limits effective monitoring and sustainable management. This study aims to evaluate the vegetative community structure and diversity of the UiTM Kuala Pilah Forest, a secondary lowland dipterocarp forest. Using stratified random sampling, a 50m x 10m plot was established and subdivided into five 10m x10m subplots. Vegetation data were collected for all trees with a diameter at breast height (DBH) ≥ 10cm. A total of 27 individual trees were recorded, representing 17 genera. Key structural parameters analysed, including genus frequency, basal area, size class distribution, Importance Value Index (IVI), and species diversity using Shannon-Weiner Index and Simpson's Index. Results show that *Shorea* sp. and *Dysoxylum* sp. are the most frequent genera (60%) and share the highest relative density (0.0080 indiv/m²). *Shorea* sp. recorded the highest IVI (44.40), suggesting ecological dominance, while *Cinnamomum* sp. exhibited structural dominance with the largest basal area (0.2068 m²). tree size class distribution showed dominance in the 10.0-14.9 cm class (n=12), forming a reverse-J curve indicative of active regeneration. The Shannon-Weiner Index value of H'= 2.80 reflects moderate to high diversity consistent with other secondary dipterocarp forests, while Simpson's Index (1-D= 0.894) shows high heterogeneity and low dominance among genera. These findings suggest that the UiTM Kuala Pilah Forest supports a structurally heterogeneous and ecologically functional community, highlighting its importance in biodiversity conservation and forest recovery assessment.

Keywords – Vegetative structure, species diversity, lowland dipterocarp forest, basal area, regeneration

INTRODUCTION

Tropical rainforests are among the most biodiverse and ecologically significant ecosystems, sustaining about 60% of global biodiversity (Foo & Numata, 2019; Laurance et al., 2012). Lowland dipterocarp rainforests, dominant in Malaysia, are characterized by emergent trees, multiple canopy layers, and exceptional species diversity (Ariff et al., 2022). Despite their ecological importance, these forests face rapid degradation from logging, agricultural expansion, and habitat fragmentation, particularly in Southeast Asia

(Botterill-James et al., 2024). Between 2005 and 2015, Malaysia contributed 16.6% of forest area loss and 17.4% of aboveground carbon stock loss in the region (Estoque et al., 2019). Even protected forests face indirect threats. For example, Endau-Rompin National Park maintained >97% forest cover, but surrounding buffer zones suffered severe deforestation due to oil palm expansion, reducing ecological connectivity ("leakage effect") (Foo & Numata, 2019).

This highlights the need for conservation strategies that extend beyond formal protection boundaries. The UiTM Kuala Pilah Forest Reserve, a secondary lowland dipterocarp forest in Negeri Sembilan under UiTM management, is under-researched despite its potential as an ecological buffer and research site. The absence of baseline data on species composition, diversity, and vegetative structure hinders evaluation of forest health, monitoring of changes, and informed management decisions. This study provides essential baseline data on the vegetation community structure and diversity of UiTM Kuala Pilah Forest to support ecological monitoring, comparisons with other forests, and informed conservation planning.

OBJECTIVE

The objectives of this study are:

i. To determine the community structure of vegetation in UiTM Kuala Pilah Forest.
ii. To determine the diversity indices of vegetation in UiTM Kuala Pilah Forest.

METHODOLOGY

The study was conducted in UiTM Kuala Pilah Forest, Negeri Sembilan, Malaysia (2.7890° N, 102.2180° E), a 405.41 ha secondary lowland dipterocarp forest formerly part of Pelangai Forest Reserve (Abdullah & Azmir, 2021). The site experiences tropical rainforest conditions with temperatures of 23–32°C and year-round rainfall (Hazir et al., 2019).

A 50 m × 10 m plot was established in the lowland area using stratified random sampling and subdivided into five 10 m × 10 m subplots for systematic data collection. All trees with DBH ≥ 10 cm were measured and identified to genus level using standard botanical references (Whitmore, 1972) and field guides. Unidentified or rare specimens were collected as voucher samples, tagged, pressed, dried, and authenticated.

Data analysis included calculating Shannon-Wiener Diversity Index (H′) and Simpson's Index (1-D) to assess species diversity and categorizing diversity levels based on Fernando (1998) and Baliton et al. (2020). Vegetative parameters such as species density, relative density, frequency, relative frequency, basal area, relative dominance, and Importance Value Index (IVI) were determined using established formulas (Curtis & McIntosh, 1951; Yeom & Kim, 2011).

RESULTS AND DISCUSSION

A total of 27 individual trees from 17 genera were recorded across five sample plots, representing a moderately diverse lowland dipterocarp forest community at early to mid-

successional stages. *Shorea* and *Dysoxylum* were the most frequent genera (60% occurrence), followed by *Syzygium*, *Litsea*, and *Palaquium* (40%). Less frequent genera such as *Xylopia*, *Mallotus*, and *Scaphium* suggest microhabitat specialization and spatial heterogeneity.

The DBH range (10–51.3 cm) indicated a multi-aged structure with both regenerating understory and mature canopy trees. *Cinnamomum* contributed the highest basal area (0.2068 m²) despite low frequency, demonstrating that dominance can be influenced by individual tree size. Size-class distribution followed a reverse-J pattern, with most individuals in the smallest class (10.0–14.9 cm), indicating active regeneration. The absence of certain intermediate classes suggests possible past disturbances or natural mortality. Species density was highest for *Shorea* and *Dysoxylum* (0.0080 indiv/m²), reflecting their structural and ecological prominence. Importance Value Index (IVI) analysis confirmed *Shorea* as the dominant genus (IVI = 44.40), followed by *Dysoxylum* (34.98) and *Cinnamomum* (30.89).

The Shannon-Wiener Index (H′= 2.802) indicated moderate to high diversity, comparable to other secondary lowland dipterocarp forests but lower than pristine sites such as Pasoh and Bukit Panchor. High index of heterogeneity and low dominance were demonstrated by the Simpson's Index (1-D = 0.894) of the forest community. A combination of these metrics implies that UiTM Kuala Pilah Forest is a relatively stable and well-balanced community of vegetation. Dominant genera played key ecological roles: *Shorea* in canopy structure and carbon storage; *Dysoxylum* in mid-storey stratification and seed dispersal; and *Cinnamomum* as an emergent species influencing microclimate and nutrient cycling. Genera like *Xylopia*, *Palaquium*, and *Syzygium* contributed to fruit production, vertical diversity, and shade-tolerant understory layers, supporting biodiversity and long-term forest resilience.

Table 1: Summary of vegetative structure parameters and Importance Value Index (IVI) of tree genera in UiTM Kuala Pilah forest

Genus Name	No. of Individuals	Species Density (indiv/m²)	Frequency (%)	Total Basal Area (m²)	Relative Dominance (%)	IVI Value
Shorea	4	0.0016	60	0.14565	15.95081	44.40198
Dysoxylum	4	0.0016	60	0.05964	6.531453	34.98262
Syzygium	3	0.0012	40	0.03427	3.753066	23.95509
Diospyrus	2	0.0008	20	0.03324	3.640266	15.59313
Dyera	2	0.0008	20	0.01705	1.867224	13.82009
Palaqium	2	0.0008	40	0.02389	2.616305	19.11462
Cinnamomum	1	0.0004	20	0.20677	22.64434	30.8935
Dillenia	1	0.0004	20	0.00894	0.979061	9.22822
Litsea	2	0.0008	40	0.0379	4.150605	16.94522
Endospermum	1	0.0004	20	0.00785	0.85969	9.108849
Xylopia	1	0.0004	20	0.10519	11.51984	19.769

Scaphium	1	0.0004	20	0.04104	4.49448	12.74364
Lithocarpus	1	0.0004	20	0.09931	10.8759	19.12506
Mallotus	1	0.0004	20	0.08301	9.09081	17.33997
Madhuca	1	0.0004	20	0.00937	1.026152	9.275311
Total	**27**			**0.86829**		

CONCLUSION

UiTM Kuala Pilah Forest demonstrates the structural and compositional attributes of a functioning lowland dipterocarp ecosystem, with evidence of active regeneration and ecological stability. The dominance of *Shorea* and the presence of varied DBH classes reflect healthy successional processes typical of such forests in Peninsular Malaysia. The combination of Shannon-Wiener and Simpson's indices emphasized that the forest exhibits resilience and ecological stability. Despite the limited sampling area and genus-level identification, the findings highlight the forest's ecological value for biodiversity conservation, carbon storage, and habitat provision. Expanding the sampling scope and conducting species-level identification in future studies would provide a more comprehensive understanding of its biodiversity and ecological dynamics.

REFERENCES

Abdullah, N. N. H., & Azmir, N. I. A. (2021). A pictorial key for the identification of beetle (Order: Coleoptera) and diversity study in selected area within Pelangai Forest Reserve, Negeri Sembilan, Malaysia. *Biodiversitas Journal of Biological Diversity*, *22*(2). https://doi.org/10.13057/biodiv/d220250

Ariff, E. A. R. E., Ahmad Fitri, Z., Kusin, M., Nik Hazlan, N. H., Sarmin, S. N., Hashim, T. T. M. Z., … Latiff, A. (2022). Floristic Composition of Trees in the Lowland Dipterocarp Forest of Kuala Keniam, Taman Negara, Pahang, Peninsular Malaysia. In *IOP Conference Series: Earth and Environmental Science* (Vol. 1019). Institute of Physics. https://doi.org/10.1088/1755-1315/1019/1/012034

Baliton, R., Landicho, L., Cabahug, R. E., Paelmo, N. R. F., Laruan, K., Rodriguez, R., Visco, N. R. G., & Castillo, N. a. K. A. (2020). Ecological services of agroforestry systems in selected upland farming communities in the Philippines. *Biodiversitas Journal of Biological Diversity*, *21*(2). https://doi.org/10.13057/biodiv/d210237

Botterill-James, T., Yates, L. A., Buettel, J. C., & Brook, B. W. (2024). The future of Southeast Asia's biodiversity: A crisis with a hopeful alternative. *Biological Conservation*, *296*, 110641. https://doi.org/10.1016/j.biocon.2024.110641

Estoque, R. C., Ooba, M., Avitabile, V., Hijioka, Y., DasGupta, R., Togawa, T., & Murayama, Y. (2019). The future of Southeast Asia's forests. *Nature Communications*, *10*(1). https://doi.org/10.1038/s41467-019-09646-4

Fernando, E. S. (2008). Forest Formations of the Philippines. South Korea: ASEAN-Korea Environmental Cooperation Unit.

Foo, Y. S., & Numata, S. (2019b). Deforestation and forest fragmentation in and around Endau-Rompin National Park, Peninsular Malaysia. *Tropics*, *28*(2), 23–37. https://doi.org/10.3759/tropics.ms18-16

Hazir, M. H. M., Kadir, R. A., Gloor, E., & Galbraith, D. (2019). Effect of agroclimatic variability on land suitability for cultivating rubber (Hevea brasiliensis) and growth

performance assessment in the tropical rainforest climate of Peninsular Malaysia. *Climate Risk Management*, *27*, 100203. https://doi.org/10.1016/j.crm.2019.100203

Yeom, D., & Kim, J. H. (2011). Comparative evaluation of species diversity indices in the natural deciduous forest of Mt. Jeombong. *Forest Science and Technology*, *7*(2), 68 – 74. https://doi.org/10.1080/21580103.2011.573940

Whitmore, T. C. (1972). Tree Flora of Malaya (Volumes 1–4). Longman.