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**Research Article**

**Woody Plants of Ulu Muda Forest Reserve Kedah, Malaysia**

**Zakaria RAHMAD<sup>1</sup>, Rusly ROSAZLINA<sup>1</sup> and Gbenga Festus AKOMOLAFE<sup>1,2,3\*</sup>**

<sup>1</sup>School of Biological Sciences, Universiti Sains Malaysia, 11800 Pulau Pinang.

<sup>2</sup>Department of Plant Science and Biotechnology, Federal University of Lafia, Nigeria.

<sup>3</sup>Department of Plant & Soil Sciences, University of Pretoria, South Africa.

\*Corresponding author email address: [gfakomolafe@yahoo.com](mailto:gfakomolafe@yahoo.com)

Received 08 February 2023 | Accepted 02 January 2024 | Published 20 August 2024

Doi: <https://doi.org/10.51200/jtbc.v21i.5356>

**ABSTRACT**

The woody plants species inventory and diversity of primary, old secondary and secondary forest patches of Ulu Muda Forest Reserve (UMFR), Kedah, Peninsular Malaysia were assessed in this study. This was done to understand the current status of the forest towards ensuring proper conservation plans. Plants with diameter at breast height of not less than 10 were identified and enumerated within 10m radius (both left and right) of a 1500m transect laid at each site. Two hundred and thirty-five (235) plant species belonging to 56 families and 144 genera were enumerated in all the sites. The percentage composition of lianas (14.53%) was found to be very minimal to tree species (76.49%) which denotes the health status of the forest. *Polyalthia jenkinsii*, *Spondias cytherea* and *Intsia palembanica* were the most common plants in the three sites. The Shannon diversity index of all the sites was observed to be greater than 2, which shows the high diverse nature of the forest despite some past disturbances. The old secondary forest patch was reported to have recuperated over the years due to its highest diversity indices.

**Keyword:** Conservation; Dipterocarp; Euphorbiaceae; Forest; Kedah.

**INTRODUCTION**

Tropical forests globally are known to be highly valuable due to the ecosystem services they provide such as controlling soil erosion and serving as habitats to both plants and animals (Anbarashan & Parthasarathy, 2013). These tropical forests are threatened severely by anthropogenic influences and require specific interventions towards the management and maintenance of their overall carbon productivity, biodiversity and sustainability (Kumar et al., 2006). To ensure the management and sustainability of forest ecosystems, it is important to understand their tree species composition and structures (Kacholi, 2014). The knowledge of the forests' structure, tree species richness, and their characteristics is a useful tool towards an effective long-term conservation of the forests (Ifo et al., 2015). The main anthropogenic threat faced by tropical forests globally is the issue of logging and this has gotten the attention of most ecologists in studying how these forests have reacted to the threat (Saiful & Latiff, 2014). This makes it more expedient for tropical forests to be protected to conserve biodiversity and mitigate climate change (Berry et al., 2010). Consequently, most tropical countries have now adopted a more sustainable way of scrutinizing logging activities in their forests through closed supervision (Sadeghi et al., 2014).

Similarly, Malaysian forests are known to be highly diverse in plant species and are economically useful to the country. About 44.7% of the total land mass in Peninsular Malaysia is composed of forests (Ghollasimood, 2011). Based on the elevation and soil types ranging from coastal areas to the hills, about 16 different types of forests have been classified across the world (Whitmore & Sayer, 1992). The Ulu Muda Forest Reserve (UMFR) can be described as a dipterocarp forest (Mardan et al., 2013). Both primary and secondary forests have to be protected due to their importance in maintaining balance in the environment (Berry et al., 2010).

Over the years, there has been a consistent decrease in the number of plant species at the UMFR due to logging activities (Saiful et al., 2008). This is why there is need for continuous assessment of the plant species diversity in the forest so as to guide effective conservation planning and management. This study aims to produce an inventory of the richness and diversity of plant species (mainly angiosperms) found at the Ulu Muda Forest Reserve (UMFR), Kedah, Malaysia. This is to give an updated record of the plant species diversity of this forest which was lacking in previous studies (Mardan et al., 2013).

## METHODOLOGY

### Study area

Ulu Muda Forest Reserve (UMFR) which has an average size of about 160,000 ha is located in Kedah, Northwest of Peninsular Malaysia. The city where this forest is located has an average annual rainfall of about 2000mm with the peak in October. This forest comprises both hill and lowland dipterocarp forest vegetations. It also houses other vegetation types such as limestone and riparian vegetations. Due to the proximity of the forest to Southern Thailand, a few Thailand flora are found in this forest (Sukswan, 2008). Apart from these, the forest serves a lot of economical uses such as water supply, recreation and logging to the natives of Kedah and neighbouring states (Mariana et al., 2008). Consequently, it has remained threatened by these anthropogenic activities. The most prevalent threats on the UMFR are the legal and illegal unsustainable logging activities.

### Sampling technique and data analysis

The forest was divided into three (3) study sites namely secondary forest (site 1), old secondary forest (site 2), and primary forest (site 3). The geographic coordinates of the sites are presented in Table 1.

Sampling was done using a 1,500m line transect laid at each site. Plants particularly with diameter at breast height (dbh) of not less than 10cm, found along the transect and within the radius of 10m to the right and left of the transects were identified. Plant identification was done on-site and only those with uncertain identities were collected and identified at the herbarium of Universiti Sains Malaysia, Penang.

**Table 1:** Location of the study sites.

Site	Latitude (N)	Longitude (E)	Altitude	Forest type
1	6° 6'47.03"	100°57'52.59"	130 m	Secondary Forest
2	6° 5'48.92"	100°58'27.19"	185 m	Old Secondary Forest
3	6° 6'21.12"	100°58'16.39"	210 m	Primary Forest

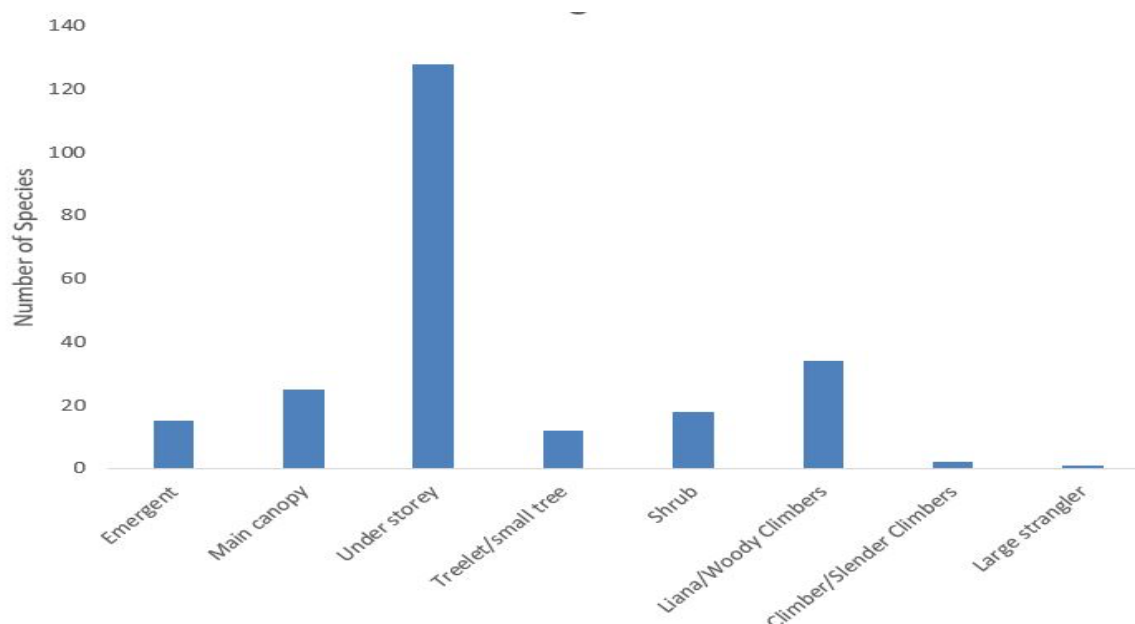
The diversity indices such as Simpson index, Shannon index, species evenness and Margalef index were estimated using the PAST 3.0 software. Rarefaction analysis was done to determine the species richness using the Biodiversity Pro software. The similarity in plant species between the studied forests was assessed using a Sorensen similarity index as calculated using the equation below:

$$Sc = (2W/a) \times 100\% \text{ (Sorensen, 1948)}$$

*Sc* represents the similarity coefficient. *W* symbolized the number of plant species found common to all the sites. Also, *a* is the sum of the total number of plants species recorded at each of the sites.

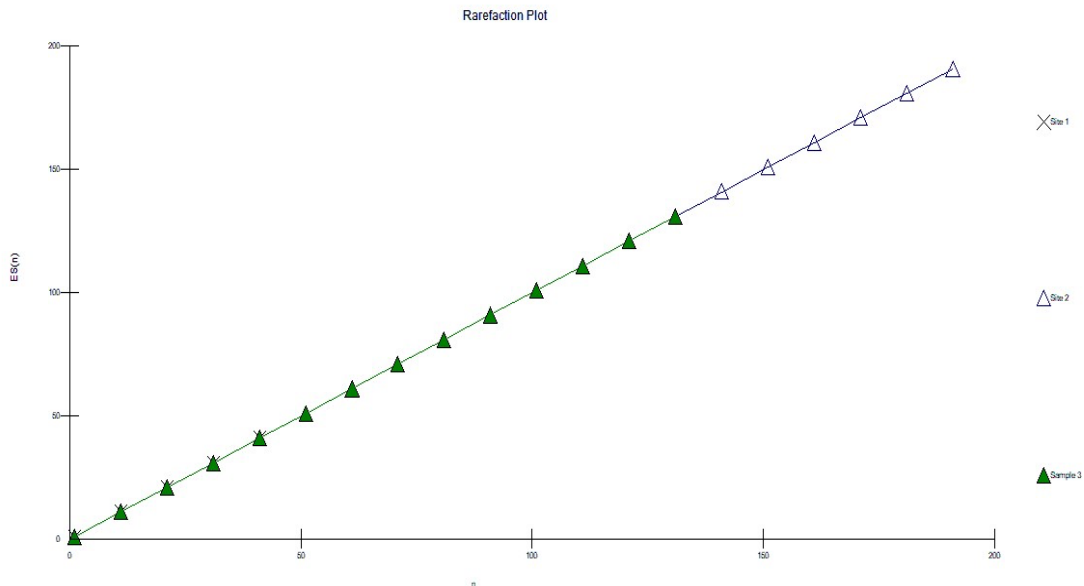
## RESULTS AND DISCUSSION

A total of 235 plant species comprising the following plant types; 15 emergent, 25 main canopy, 128 understory, 12 treelets, 18 shrubs, 34 lianas, 2 slender climbers and 1 large strangler were identified at all the sites in this forest (Fig. 1). These 235 plant species belong to 56 families and 144 genera (Appendix 1).



**Figure 1:** The plant types and the corresponding number of species.

Sites 1, 2 and 3 have 46, 199, and 135 plant species respectively. The rarefaction curve shows that site 2 has the highest plant species richness, followed by site 3, while site 1 has the lowest (Fig. 2).



**Figure 2:** Rarefaction plot showing the species richness of the sample sites.

In this analysis, the estimated species richness for each site was very close to the observed species richness. The lianas have 14.53% composition as compared with the 76.49% of trees (emergent, main canopy, understory and treelets) in these forests. This low liana composition indicates that the forests are less disturbed and more stable in terms of tree richness and diversity (Villagra et al., 2013). Abundance of lianas in tropical forests has been reported to be positively correlated with high disturbance and also interfere with tree diversity (Addo-Fordjour & Rahmad, 2015; García León et al., 2018).

Euphorbiaceae, Annonaceae, and Meliaceae are the most common families having 22, 18, and 14 number of species respectively. These same plant families have been reported to be dominant in many other tropical forests (Françoso et al., 2016; Rahmad et al., 2018). A previous study at the hill dipterocarp forest of UMFR also confirmed that Euphorbiaceae was the most important family in the forest (Sadeghi et al., 2014). However, this could have been due to the removal of some Dipterocarpaceae members during past logging (Saiful et al., 2008). In site 1, *Polyalthia jenkinsii*, *Spondias cytherea* and *Pterocymbium javanicum* were the most common species. In site 2, *Lagerstromia speciosa*, *Polyalthia jenkinsii*, and *Spondias cytherea* were the most common species. However, in site 3, *Intsia palembanica*, *Spondias cytherea*, and *Bombax valetonii* were the most common species. This then made *Polyalthia jenkinsii*, *Spondias cytherea*, and *Intsia palembanica* to overall be highly distributed species in all the three sites.

Site 2 which is an old secondary forest, was observed to have the highest Simpson (0.995), Shannon (5.288) and Margalef (37.25) indices, followed by site 3 which is a primary forest. Site 1 was the one with the least of all the diversity indices estimated. This is very

understandable due to the recent level of disturbance (logging) faced by site 1, being a secondary forest. None of the studied forests had a Shannon index that less than two. This shows that they are all highly diverse and stable in plant species (Barbour et al., 1999). The Sorenson similarity index coefficient between the three study sites is 8.97%. This is very low and it indicates that there is very little similarity between the study sites in terms of plant species. The three forests are different in level of disturbance. This could explain the reason for the low similarity index between them.

**Table 2:** The diversity indices of plants species at the Ulu Muda Forest, Kedah.

	Site 1	Site 2	Site 3
Number of species	46	198	135
Simpson index	0.978	0.995 <sup>b</sup>	0.993 <sup>b</sup>
Shannon index	3.829 <sup>a</sup>	5.288 <sup>d</sup>	4.905 <sup>b</sup>
Species evenness	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>
Margalef index	11.75 <sup>c</sup>	37.25 <sup>d</sup>	27.32 <sup>e</sup>

The inventory and diversity of plants reported in this study could be a useful tool for the conservation of these forests in future (Jayakumar et al., 2011). Generally, tropical forests to which UMFR belongs, are described as very rich in species diversity and are providers of important ecosystem services including sources of timber and non-timber forest products (NTFPs), carbon stock and sequestration etc. (Bradon, 2014). As done in this study, it is important to periodically ascertain the status of forests which are known to provide lots of ecosystem services that are very essential to the survival of life on earth (Cardinale et al., 2012; Steur et al., 2020). This will aid in implementing appropriate conservation measures by policy makers or conservationists in the forests whose ecosystem services have been identified to be threatened (IPBES, 2019). There is a direct positive relationship between forest biodiversity richness and ecosystem services (Harrison et al., 2014). This means that conservation of forest biodiversity will also aid in the preservation of its ecosystem services (Steur et al., 2020). Specifically, higher plant diversity of a forest is expected to lead to a higher ecosystem service since the plants are the primary producers in such forest (Quijas et al., 2010).

## CONCLUSIONS

This study has revealed that the old secondary forest (site 2) has undergone fast recuperation over the years and has become richer and more diverse in plant species as compared with the primary forest (site 3) at the UMFR. This shows that the efforts made by the government in conserving this forest reserve is yielding positive results and it is commended. The current level of supervised logging activities should be maintained or further minimized so as to keep the forest more stable in the provision of ecosystem services and diverse in plant species.

## ACKNOWLEDGEMENTS

We acknowledge the School of Biological Sciences, Universiti Sains Malaysia for providing the opportunity to conduct this study. Special thanks to Mr. Abu Husin Harun for assisting in the plant identification in the field and providing valuable guidance in the forest survey.

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Appendix 1: List of plants identified at Ulu Muda Forest, Kedah

S/N	Family	Species	Local name	Plant type	Site 1	Site 2	Site 3
1	Actinidiaceae	<i>Saurauia pentapetala</i>	Sauraya	T	0	1	0
2	Alangiaceae	<i>Alangium griffithii</i>	Mentulang	U	0	1	0
3	Alangiaceae	<i>Alangium ridleyi</i>	Mentulang	U	0	1	0
4	Anacardiaceae	<i>Bouea macrophylla</i>	Kundang daun besar	U	0	1	0
5	Anacardiaceae	<i>Bouea oppositifolia</i>	Kundang rumenia	U	1	0	1
6	Anacardiaceae	<i>Dracontomelon dao</i>	Sengkuang	U	1	0	1
7	Anacardiaceae	<i>Mangifera macrocarpa</i>	Macang hutan	U	0	0	1
8	Anacardiaceae	<i>Mangifera sp.1</i>	Macang hutan	U	0	0	1
9	Anacardiaceae	<i>Spondias cytherea</i>	Umrah/Amra	E	1	1	1
10	Annonaceae	<i>Cananga odorata</i>	Kenanga hutan	U	1	0	0
11	Annonaceae	<i>Desmos chinensis</i>	Akar mempisang	L	0	1	1
12	Annonaceae	<i>Desmos cochinchinensis</i>	Akar mempisang	L	0	1	1
13	Annonaceae	<i>Desmos dumosa</i>	Akar mempisang	L	0	1	0
14	Annonaceae	<i>Fissistigma mambratum</i>	Larak	L	1	1	1
15	Annonaceae	<i>Goniothalamus tenuifolius</i>	Seteru putih	S	0	1	1
16	Annonaceae	<i>Goniothalamus tortilipetalus</i>	Seteru hitam	S	0	1	1
17	Annonaceae	<i>Mitrella kentii</i>	Akar mempisang	L	1	1	1
18	Annonaceae	<i>Polyalthia clavigera</i>	Mempisang	U	0	1	0
19	Annonaceae	<i>Polyalthia jenkinsii</i>	Mempisang	U	1	1	1
20	Annonaceae	<i>Polyalthia lateriflora</i>	Mempisang	U	0	0	1
21	Annonaceae	<i>Polyalthia rumphii</i>	Mempisang	U	0	1	1
22	Annonaceae	<i>Polyalthia sclerophylla</i>	Mempisang	U	0	0	1
23	Annonaceae	<i>Popowia pisocarpa</i>	Mempisang	U	0	1	1
24	Annonaceae	<i>Pyramidanthe prismatica</i>	Akar mempisang	L	0	1	0
25	Annonaceae	<i>Trivahvaria macrophylla</i>	Mempisang	U	0	1	1
26	Annonaceae	<i>Uvaria pauci-ovulata</i>	Akar mempisang	L	0	1	0
27	Annonaceae	<i>Xylopiya magna</i>	Banit kijang	U	0	1	0
28	Apocynaceae	<i>Tabernaemontana corymbosa</i>	Jelutong badak	U	0	1	0
29	Apocynaceae	<i>Tabernaemontana pauciflora</i>	Jelutong kecil	U	0	1	0
30	Araliaceae	<i>Arthropphyllum diversifolium</i>	Susun pelepah	U	0	1	0



S/N	Family	Species	Local name	Plant type	Site 1	Site 2	Site 3
31	Araliaceae	<i>Macropanax maingayi</i>	None	C	0	1	0
32	Araliaceae	<i>Schefflera heterophylla</i>	None	U	0	1	0
33	Araliaceae	<i>Trevesia burckii</i>	Jari hantu	S	0	1	1
34	Bignoniaceae	<i>Diplanthea bancana</i>	Cenderu	C	1	0	0
35	Bombacaceae	<i>Bombax vuletonii</i>	Kekabu hutan	E	0	1	1
36	Bombacaceae	<i>Durio singaporensis</i>	Durian hutan	C	0	1	0
37	Burseraceae	<i>Santiria laevigata</i>	Kedondong kerantai licin	C	0	1	1
38	Burseraceae	<i>Santiria tomentosa</i>	Kedondong kerantai bulu	C	1	0	0
39	Burseraceae	<i>Trioma malaccensis</i>	Kedondong kijal	C	0	1	1
40	Cecropiaceae	<i>Poikilospermum suaveolens</i>	Akar tumpang	L	0	1	0
41	Chloranthaceae	<i>Chloranthus erectus</i>	None	S	1	1	0
42	Combretaceae	<i>Terminalia citrina</i>	Jelawai belang rimau	C	0	0	1
43	Compositae	<i>Vernonia arborea</i>	None	U	0	1	0
44	Connaraceae	<i>Rourea emarginata</i>	None	L	0	1	0
45	Connaraceae	<i>Rourea memosoides</i>	None	L	0	1	0
46	Connaraceae	<i>Rourea minor</i>	None	L	0	1	0
47	Connaraceae	<i>Rourea rugosa</i>	None	L	0	1	1
48	Dilleniaceae	<i>Dillenia reticulata</i>	Simpoh gajah	C	0	1	0
49	Dilleniaceae	<i>Tetracera akara</i>	Akar mempelas	L	0	1	0
50	Dilleniaceae	<i>Tetracera macrophylla</i>	Akar mempelas	L	0	1	0
51	Dilleniaceae	<i>Tetracera maingayi</i>	Akar mempelas	L	0	1	0
52	Dipterocarpaceae	<i>Anisoptera costata</i>	Mersawa kesat	E	0	1	0
53	Dipterocarpaceae	<i>Dipterocarpus costulatus</i>	Keruing kipas	E	0	1	1
54	Dipterocarpaceae	<i>Dipterocarpus fagineus</i>	Keruing bukit	E	0	1	0
55	Dipterocarpaceae	<i>Dipterocarpus hasseltii</i>	Keruing ropol	E	0	1	0
56	Dipterocarpaceae	<i>Hopea mengarawan</i>	Merawan penak	E	0	1	0
57	Dipterocarpaceae	<i>Shorea guiso</i>	Balau membatu	E	0	1	1
58	Dipterocarpaceae	<i>Shorea leprosula</i>	Meranti tembaga	E	0	1	1
59	Dipterocarpaceae	<i>Shorea parvifolia</i>	Meranti sarang punai	E	0	0	1
60	Dipterocarpaceae	<i>Vatica pauciflora</i>	Resak laru	E	1	0	0
61	Ebenaceae	<i>Diospyros andamanica</i>	Kayu arang	U	0	1	1

S/N	Family	Species	Local name	Plant type	Site 1	Site 2	Site 3
62	Ebenaceae	<i>Diospyros buxifolia</i>	Meribut	U	0	1	0
63	Ebenaceae	<i>Diospyros pendula</i>	Kayu arang	U	0	1	0
64	Ebenaceae	<i>Diospyros singaporensis</i>	Kayu arang	U	0	1	1
65	Ebenaceae	<i>Diospyros sumatrana</i>	Kayu arang	U	0	1	1
66	Elaeocarpaceae	<i>Elaeocarpus stipularis</i>	Mendung	U	0	1	0
67	Euphorbiaceae	<i>Alchornea rhodophylla</i>	Julong jantan	T	0	1	0
68	Euphorbiaceae	<i>Aporosa arborea</i>	Sebasah	U	1	1	1
69	Euphorbiaceae	<i>Aporosa aurea</i>	Sebasah	U	0	1	1
70	Euphorbiaceae	<i>Aporosa confusus</i>	Sebasah	U	0	1	0
71	Euphorbiaceae	<i>Baccaurea brevipes</i>	Rambai hutan	U	1	1	1
72	Euphorbiaceae	<i>Baccaurea kunstleri</i>	Tampoi	U	0	0	1
73	Euphorbiaceae	<i>Baccaurea parviflora</i>	Setambun tahi	U	0	1	1
74	Euphorbiaceae	<i>Baccaurea racemosa</i>	Setambun jantan	U	0	0	1
75	Euphorbiaceae	<i>Croton erythrostachys</i>	Hujan panas	U	1	1	1
76	Euphorbiaceae	<i>Elateriospermum tapos</i>	Perah	C	0	1	1
77	Euphorbiaceae	<i>Endospermum diadenum</i>	Sesenduk	C	1	1	0
78	Euphorbiaceae	<i>Erismanthus obliquus</i>	None	T	0	1	1
79	Euphorbiaceae	<i>Glochidion glomeratum</i>	Ubah	U	1	0	0
80	Euphorbiaceae	<i>Glochidion sericeum</i>	Ubah	U	0	1	0
81	Euphorbiaceae	<i>Macaranga diepenhorstii</i>	Mahang	U	1	1	1
82	Euphorbiaceae	<i>Macaranga gigantea</i>	Mahang gajah	U	1	1	0
83	Euphorbiaceae	<i>Macaranga hosei</i>	Mahang	U	0	1	0
84	Euphorbiaceae	<i>Macaranga hypoleuca</i>	Mahang tumu putih	U	0	1	0
85	Euphorbiaceae	<i>Macaranga lowii</i>	Mahang hutan	U	0	1	0
86	Euphorbiaceae	<i>Mallotus griffithianus</i>	Balik angin	U	0	1	0
87	Euphorbiaceae	<i>Sapium baccatum</i>	Ludai	U	1	1	0
88	Euphorbiaceae	<i>Sauropus androgynus</i>	Pucuk manis hutan	S	0	1	1
89	Fagaceae	<i>Castanopsis curtisii</i>	Berangan	C	0	1	0
90	Fagaceae	<i>Castanopsis lucida</i>	Berangan	C	0	1	1
91	Fagaceae	<i>Lithocarpus rassa</i>	Mempening	C	1	1	1
92	Flacourtiaceae	<i>Casearia sp.2</i>	None	T	0	1	1

S/N	Family	Species	Local name	Plant type	Site 1	Site 2	Site 3
93	Flacourtiaceae	<i>Casearia tuberculata</i>	None	T	0	1	1
94	Flacourtiaceae	<i>Flacourtia rukam</i>	Rukam hutan	T	0	0	1
95	Flacourtiaceae	<i>Hydnocarpus castanea</i>	Setumpol	U	0	1	1
96	Flacourtiaceae	<i>Hydnocarpus woodii</i>	Setumpol	U	0	1	1
97	Flacourtiaceae	<i>Ryparosa fasciculata</i>	Duku hutan	U	0	1	1
98	Flacourtiaceae	<i>Ryparosa kunstleri</i>	Duku hutan	U	0	1	1
99	Flacourtiaceae	<i>Scolopia spinosa</i>	Telusuk ayam	U	0	1	1
100	Gnetaceae	<i>Gnetum macrostachyum</i>	Akar meninjau	T	0	1	0
101	Guttiferae	<i>Garcinia nervosa</i>	Kandis beruang	U	0	1	1
102	Guttiferae	<i>Garcinia parvifolia</i>	Kandis	U	0	1	1
103	Icacinaceae	<i>Stemonurus malaccensis</i>	Sampul keris	U	0	1	1
104	Irvingiaceae	<i>Irvingia malayana</i>	Pauh kijang	E	0	0	1
		<i>Actinodaphne sesquipetalis</i>					
105	Lauraceae	<i>var. sesquipetalis</i>	Medang payung	U	1	0	0
106	Lauraceae	<i>Cryptocarya infectoria</i>	Medang kunyit	U	0	1	1
107	Lauraceae	<i>Dehasia incrassata</i>	Medang	U	0	1	1
108	Lauraceae	<i>Litsea elliptica</i>	Medang	U	0	1	0
109	Lauraceae	<i>Litsea grandis</i>	Medang	U	0	0	1
110	Vitaceae	<i>Leea indica</i>	Memali	S	1	1	0
111	Leguminosae	<i>Albizia splendens</i>	Batai hutan	C	0	1	0
112	Leguminosae	<i>Bauhinia bidentata</i>	Tapak kuda	L	0	1	1
113	Leguminosae	<i>Caesalpinia andamanica</i>	Gorek	L	0	1	1
114	Leguminosae	<i>Caesalpinia sumatrana</i>	Gorek	L	0	1	1
115	Leguminosae	<i>Calyera atropurpurea</i>	Tulang daing	C	0	1	1
116	Leguminosae	<i>Crudia curtisii</i>	Merbau nera	U	1	0	0
117	Leguminosae	<i>Derris malaccensis</i>	None	L	1	0	0
118	Leguminosae	<i>Dialium platysepalum</i>	Keranji	C	0	0	1
119	Leguminosae	<i>Intsia palembanica</i>	Merbau	E	0	1	1
120	Leguminosae	<i>Parkia timoriana</i>	Petai kerayong	C	0	1	0
121	Leguminosae	<i>Saraca declinata</i>	Gapis	U	0	1	1
122	Leguminosae	<i>Sindora coriacea</i>	Sepetir licin	C	0	0	1

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123	Leguminosae	<i>Spatolobus ferrugineus</i>	None	L	1	1	1
124	Loganiaceae	<i>Strychnos flavescens</i>	Tarik gajah	L	0	1	1
125	Loganiaceae	<i>Strychnos ignatii</i>	Tarik gajah	L	0	1	1
126	Lytracae	<i>Lagerstromia speciosa</i>	Bungor	E	1	1	1
127	Magnoliaceae	<i>Magnolia elegans</i>	Cempaka hutan	U	0	1	0
128	Magnoliaceae	<i>Magnolia lilifera var. lilifera</i>	Cempaka hutan	U	0	1	0
129	Malvaceae	<i>Hibiscus macrophyllus</i>	Tutor	C	0	1	1
130	Melastomataceae	<i>Clidemia hirta</i>	Kelentit nyamuk	S	1	1	0
131	Melastomataceae	<i>Oxydora bullata</i>	Senduduk gajah	S	0	1	0
132	Melastomataceae	<i>Oxydora hirta</i>	Senduduk gajah	S	0	1	0
133	Melastomataceae	<i>Phyllagatis hirta</i>	Tapak sulaiman	S	0	1	1
134	Melastomataceae	<i>Phyllagatis magnifica</i>	Tapak sulaiman	S	0	1	1
135	Melastomataceae	<i>Pternandra coeruleascens</i>	Sial menahun	U	0	1	0
136	Melastomataceae	<i>Pternandra echinata</i>	Sial menahun	U	0	1	0
137	Meliaceae	<i>Aglaia argentea</i>	Bekak	U	0	1	1
138	Meliaceae	<i>Aglaia crassinervia</i>	Bekak	U	1	0	0
139	Meliaceae	<i>Aglaia elliptica</i>	Bekak	U	0	1	0
140	Meliaceae	<i>Aglaia grandis</i>	Bekak	U	0	1	1
141	Meliaceae	<i>Aglaia lavii ssp. oligocarpa</i>	Bekak	U	1	0	0
142	Meliaceae	<i>Aglaia leucophylla</i>	Bekak	U	0	1	0
143	Meliaceae	<i>Aglaia macrocarpa</i>	Bekak	U	0	1	1
144	Meliaceae	<i>Aglaia pachyphylla</i>	Bekak	U	0	0	1
145	Meliaceae	<i>Aglaia palembanica</i>	Bekak	U	0	1	1
146	Meliaceae	<i>Aglaia tenuicaulis</i>	Bekak	U	0	1	1
147	Meliaceae	<i>Aphanamixis polystachya</i>	Kulim burung	U	1	0	1
148	Meliaceae	<i>Aphanamixis sumatrana</i>	Kulim burung	U	1	1	0
149	Meliaceae	<i>Chisocheton ceramicus</i>	Pasak lingga	U	0	1	0
150	Meliaceae	<i>Lansium domesticum</i>	Langsat hutan	U	1	1	1
151	Memecylaceae	<i>Memecylon dichotomum</i>	Nipis kulit	U	0	1	1
152	Memecylaceae	<i>Memecylon megacarpum</i>	Nipis kulit	U	0	1	1
153	Memecylaceae	<i>Memecylon oleifolium</i>	Nipis kulit	U	0	0	1

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154	Memecylaceae	<i>Memecylon pubescens</i>	Nipis kulit	U	0	1	1
155	Menispermaceae	<i>Coscinium fenestratum</i>	Mengkunyit	U	1	1	1
156	Moraceae	<i>Artocarpus elasticus</i>	Terap nasi	L	0	1	1
157	Moraceae	<i>Artocarpus fubicortex</i>	Keledang bulu	C	0	0	1
158	Moraceae	<i>Ficus kerkhovenii</i>	Ara	LS	0	1	1
159	Moraceae	<i>Ficus lepiciparpa</i>	Ara	U	0	1	0
160	Moraceae	<i>Ficus scortechinii</i>	Ara	S	0	1	0
161	Myristicaceae	<i>Horsfieldia polyspherula var. sumatrana</i>	Penarahan	U	0	1	1
162	Myristicaceae	<i>Horsfieldia sucosa</i>	Penarahan	U	0	1	1
163	Myristicaceae	<i>Knema curtisii</i>	Penarahan	U	1	1	0
164	Myristicaceae	<i>Knema furfuracea</i>	Penarahan	U	0	1	1
165	Myristicaceae	<i>Knema hookeriana</i>	Penarahan	U	0	1	1
166	Myristicaceae	<i>Knema lamellaria</i>	Penarahan	U	1	0	1
167	Myristicaceae	<i>Knema scortechinii</i>	Penarahan	U	1	1	1
168	Myristicaceae	<i>Myristica malaccensis</i>	Penarahan arang	U	1	0	0
169	Myrsinaceae	<i>Ardisia chlorantha</i>	Mata pelanduk	T	0	1	1
170	Myrsinaceae	<i>Ardisia fulva</i>	Mata pelanduk	S	0	1	0
171	Myrsinaceae	<i>Ardisia korthalsiana</i>	Mata pelanduk	T	0	1	1
172	Myrsinaceae	<i>Ardisia pachysandra</i>	Mata pelanduk	T	0	1	1
173	Myrtaceae	<i>Syzygium cinereum</i>	Kelat	U	0	1	1
174	Myrtaceae	<i>Syzygium griffithii</i>	Kelat	U	0	1	1
175	Myrtaceae	<i>Syzygium polyalthum</i>	Kelat	U	1	1	0
176	Myrtaceae	<i>Syzygium scortechinii</i>	Kelat	U	0	1	1
177	Myrtaceae	<i>Syzygium sp. 6</i>	Kelat	U	0	1	1
178	Oleaceae	<i>Ochanostachys amentacea</i>	Petaling	U	0	1	0
179	Oleaceae	<i>Strombosia javanica</i>	Dedali	U	0	1	0
180	Ophiliaceae	<i>Champereia manillana</i>	Chemperai	T	0	1	1
181	Pandaceae	<i>Galearia fulva</i>	Ekor tupai	T	0	1	1
182	Polygalaceae	<i>Xantophyllum ellipticum</i>	Minyak berok	U	1	0	0
183	Polygalaceae	<i>Xantophyllum eurynchum</i>	Minyak berok	U	0	1	1

S/N	Family	Species	Local name	Plant type	Site 1	Site 2	Site 3
184	Rhamnaceae	<i>Ziziphus affinis</i>	Bidara hutan	L	0	1	1
185	Rhamnaceae	<i>Ziziphus calophylla</i>	Bidara hutan	L	0	1	1
186	Rhamnaceae	<i>Ziziphus kunstleri</i>	Bidara hutan	L	0	1	1
187	Rhamnaceae	<i>Ziziphus oenoplia</i>	Bidara hutan	L	0	1	1
188	Rhamnaceae	<i>Ziziphus permytoides</i>	Bidara hutan	L	0	1	1
189	Rubiaceae	<i>Aidia densiflora</i>	Mentebang	U	0	1	0
190	Rubiaceae	<i>Canthium horridum</i>	Akar kait kecil	L	0	1	1
191	Rubiaceae	<i>Chasalia culviflora</i>	Puding hutan	S	0	1	0
192	Rubiaceae	<i>Coptosapelta tomentosa</i>	None	L	0	1	1
193	Rubiaceae	<i>Diplospora malaccensis</i>	Gading-gading	U	0	1	1
194	Rubiaceae	<i>Fagerlindia fasciculata</i>	None	L	0	1	1
195	Rubiaceae	<i>Greenea corymbosa</i>	None	U	0	1	0
196	Rubiaceae	<i>Lasianthus griffithii</i>	None	S	0	1	1
197	Rubiaceae	<i>Lasianthus inaequalis</i>	None	S	0	1	1
198	Rubiaceae	<i>Lasianthus oblongus</i>	None	S	0	1	1
199	Rubiaceae	<i>Lasianthus sp.6</i>	None	S	0	1	0
200	Rubiaceae	<i>Nauclea officinalis</i>	Mengkal	U	0	1	0
201	Rubiaceae	<i>Uncaria attenuata</i>	Akar kait-kait	L	0	1	1
202	Sapindaceae	<i>Lepisanthes senegalensis</i>	Rambututan hutan	U	0	1	0
203	Sapindaceae	<i>Nephelium maingayi</i>	Redan	U	0	0	1
204	Sapindaceae	<i>Paranephelium macrophyllum</i>	Rambututan hutan	U	1	1	1
205	Sapindaceae	<i>Pometia pinnata</i>	Kasai daun besar	U	1	1	1
206	Sapotaceae	<i>Madhuca kunstleri</i>	Nyatoh	U	0	0	1
207	Sapotaceae	<i>Palaquium maingayi</i>	Nyatoh tembaga	U	0	1	1
208	Sapotaceae	<i>Payena maingayi</i>	Nyatoh durian	U	0	1	1
209	Smilacaceae	<i>Smilax lanceifolia</i>	Ubi jaga	CL	1	1	0
210	Smilacaceae	<i>Smilax setosa</i>	Ubi jaga	CL	0	1	0
211	Sterculiaceae	<i>Pterocymbium javanicum</i>	Menglembu	C	1	1	1
212	Sterculiaceae	<i>Pterospermum javanicum</i>	Bayur	C	0	1	1
213	Sterculiaceae	<i>Pterygota alata</i>	Kasah	C	1	1	0

S/N	Family	Species	Local name	Plant type	Site 1	Site 2	Site 3
214	Sterculiaceae	<i>Scaphium linearicarpum</i>	Kembang semangkuk bulat	U	0	1	0
215	Sterculiaceae	<i>Sterculia macrophylla</i>	Kelumpang	U	0	1	0
216	Symplocaceae	<i>Symplocos ophirensis</i>	Jirak	U	0	1	1
217	Tetramelaceae	<i>Tetrameles nudiflora</i>	Mengkundur	E	0	1	1
218	Theaceae	<i>Gordonia multinervis</i>	Samak pulut	U	0	1	0
219	Tiliaceae	<i>Grewia laevigata</i>	Akar cenderai	L	0	1	1
220	Tiliaceae	<i>Microcos hirsuta</i>	Cenderai	U	0	1	1
221	Tiliaceae	<i>Microcos latifolia</i>	Cenderai	U	0	1	1
222	Tiliaceae	<i>Microcos latistipulata</i>	Cenderai	U	0	1	0
223	Tiliaceae	<i>Microcos laurifolia</i>	Cenderai	U	0	1	1
224	Tiliaceae	<i>Microcos tomentosa</i>	Cenderai	U	1	0	0
225	Tiliaceae	<i>Schoutenia furfuracea</i>	Bayur	U	1	1	0
226	Ulmaceae	<i>Celtis philippinensis</i>	Kaum hampas tebu	C	0	1	0
227	Ulmaceae	<i>Celtis rigescens</i>	Kaum hampas tebu	C	0	1	0
228	Ulmaceae	<i>Girardinia nervosa</i>	Hampas tebu	U	0	1	1
229	Verbenaceae	<i>Callicarpa maingayi</i>	Tampang besi	U	0	1	1
230	Verbenaceae	<i>Sphenodesma pentandra var. pentandra</i>	Akar leban	L	0	1	1
231	Verbenaceae	<i>Teijsmanniodendron pteropodium</i>	Entapuluh	U	0	1	0
232	Verbenaceae	<i>Vitex gamosepala</i>	Leban	U	0	1	0
233	Verbenaceae	<i>Vitex pinnata</i>	Leban	U	0	1	0
234	Verbenaceae	<i>Vitex vestita</i>	Leban	U	0	1	0

**Key:** 1 - present; 0 - absent; E - emergent; C - main canopy; U - understory; T - treelet / small tree; S -shrub; L - liana; CL - slender climbers; LS - large strangler.