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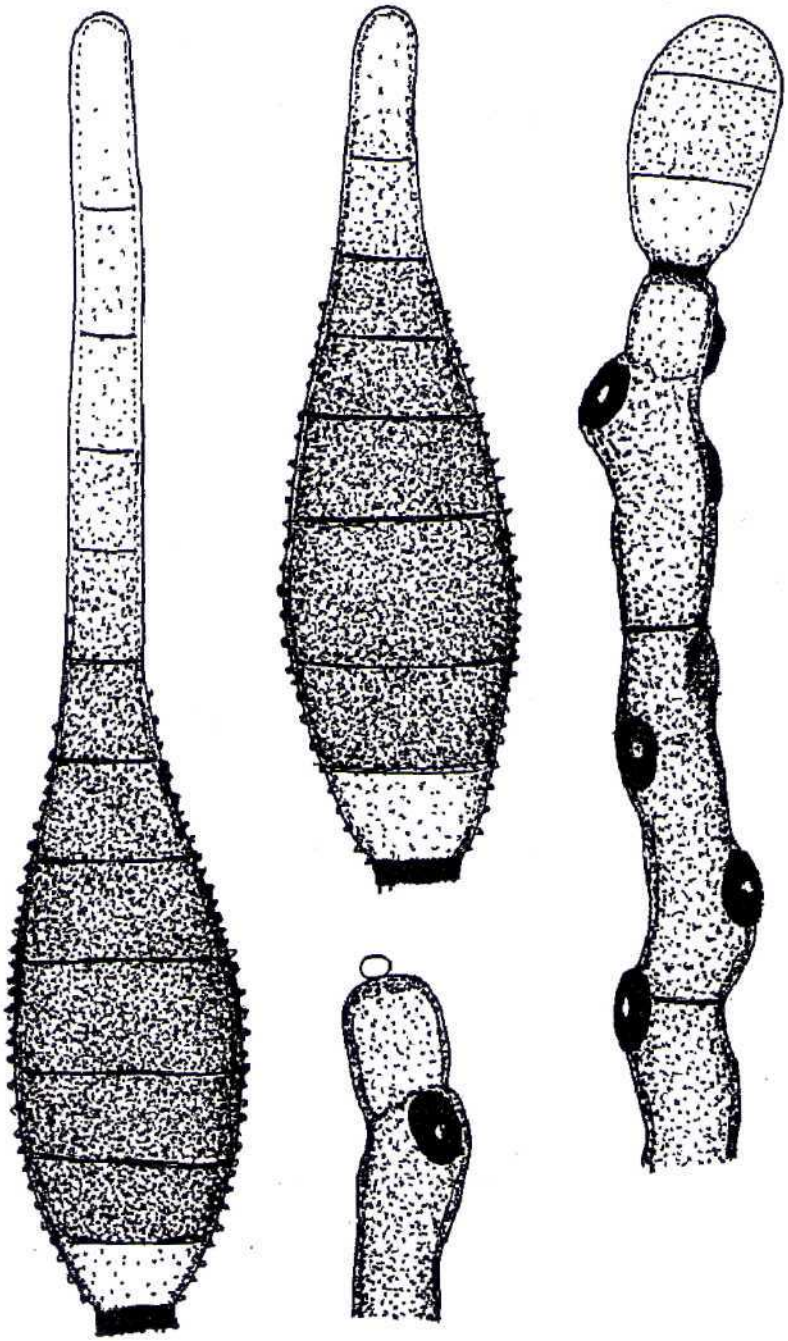

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FLORISTICS AND STRUCTURE OF A LOWLAND DIPTEROCARP FOREST AT WANARISET SAMBOJA, EAST KALIMANTAN, INDONESIA

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ABSTRACT.
KARTAWINATA, K., PURWANINGSIH, PARTOMIHARDJO, T., YUSUF, R., ABDULHADI, R. & RISWAN, S. 2008. Floristics and structure of a lowland dipterocarp forest at Wanariset Samboja, East Kalimantan, Indonesia. *Reinwardtia* 12(4): 301−323. — The results of a floristic inventory of trees with DBH ≤ 10 cm in a lowland dipterocarp forest in East Kalimantan show that 553 species of 192 genera in 62 families, represented by 5847 individuals, with the total basal area of 350.01 m^2 occurred in the plot of 10.5 hectare sampled. The two leading families in terms of number of species were *Myrtaceae* and *Lauraceae* while according to the total sum of importance values for families were *Dipterocarpaceae* and *Euphorbiaceae*. The forest had the second highest species richness in Indonesia. We recorded 25 species of dipterocarps , constituting 4.53 % of total species with basal area of 85.53 m^2. or 24.44 % of the total basal area in the plot. *Shorea laevis* (a diptererocarp) and *Pholidocarpus majadum,* (a palm) were the most prominent species occurring here and were two of the ten leading species. The species-area curve rose steadily even up to an area of 10.5 hectare, with a very slight indication of levelling off at about five hectares, indicating high heterogeneity of the forest. Three largest trees were *Shorea pauciflora* (DBH = 196.50 cm) *Dipterocarpus cornutus* (DBH = 170.90 cm), and *Alstonia scholaris* (DBH = 170.00 cm) , Some species could be identified as fruit trees and medicinal plants.

Key words: Composition, structure, dipterocarp forest, species richness, East Kalimantan

KARTAWINATA, K., PURWANINGSIH, PARTOMIHARDJO, T., YUSUF, R., ABDULHADI, R. & RISWAN, S. 2008. Floristik dan struktur hutan pamah dipterocarpa di Wanariset Samboja, Kalimantan , Indonesia. *Reinwardtia* 12(4): 301−323. — Hasil inventarisasi pohon dengan DBH (diameter setinggi dada) ≥ 10 cm menunjukkan bahwa 553 spesies dari 192 marga dalam 62 suku, yang diwakili oleh 5847 batang pohon dengan luas bidang dasar total 350.01 $m^{2,}$ terdapat dalam plot cuplikan 10.5 hektare. Berdasarkan jumlah spesies dua suku utama adalah *Myrtaceae* dan *Lauraceae*, sedangkan menurut nilai penting suku adalah *Dipterocarpaceae* dan *Euphorbiaceae*. Hutan di sini mempunyai kekayaan spesies pohon tertinggi kedua di Indonesia. Spesies Dipterocarpaceae tercatat 25 spesies atau 4.53 % dari jumlah total spesies dengan luas bidang dasar 85.53 m^2 atau 24.44 % dari luas bidang dasar total seluruh pohon dalam petak *Shorea laevis* (diptererokarpa) dan *Pholidocarpus majadum* (palem) adalah spesies pohon paling menonjol di sini dan merupakan dua dari sepuluh jenis pohon utama. Kurva spesies-luas menanjak tajam bahkan sampai 10.5 hektare, dan agak mendatar pada luasan lima hektare, yang menunjukkan heterogenitas hutan yang tinggi. Tiga pohon terbesar adalah *Shorea pauciflora* (DBH = 196.50 cm) *Dipterocarpus cornutus* (DBH = 170.90 cm), dan *Alstonia scholaris* (DBH = 170.00 cm) Beberapa jenis dapat diidentifikasi sebagai pohon buah-buahan dan tumbuhan obat

Kata kunci: Komposisi, struktur, hutan dipterokarpa, kekayaan jenis, Kalimantan Timur.

INTRODUCTION

Borneo is widely acknowledged as one of the most important centers of plant diversity in the world as well as the center of distribution and species diversity for a large number of families and genera within the Malesian archipelago (Whitmore, 1986; Soepadmo, 1995). The most widespread forest ecosystem in Borneo is the mixed dipterocarp forest, mainly characterised by a 40-60 m tall canopy dominated by an association of species of the *Dipterocarpaceae* family. This forest shows the greatest number of species of any rain forest ecosystem in Malesia (Whitmore, 1986; Philips *et al*., 1994). Mixed dipterocarp forests are also one of the most productive in the tropics and have been extensively logged during the last 30 years. Harvesting rates range from 80 to100 m^3 ha^{-1} whereas in other parts of the tropics they do not exceed 30 to 50 m^3 ha^{-1} (Sist, 2000). In Kalimantan, most of the lowland dipterocarp forests have been heavily logged and now the hill forests of the interior constitute the remaining primary forest and the main source of timber. Current knowledge of the ecology, floristics, structure and species richness of the lowland mixed dipterocarps forests is mainly based on studies carried out in Sabah, Brunei and Sarawak (*e.g*. Burgess,1961; Ashton, 1964; Nicholson, 1965; Bruenig, 1969, 1970, 1973; Proctor *et al.,* 1983; Baillie *et al.,* 1987; Ashton *et al.,* 1992; Newberry *et al*., 1992; Davies & Becker, 1996). For Kalimantan, the studies remain few (Kartawinata *et al*., 1981; Riswan, 1982; Guhardja *et al.,* 2000; Riswan, 1987a & b; Suselo & Riswan, 1987; Partomihardjo *et al*., 1987; Soekardjo *et al*., 1990; Setiadi *et al*., 1996; Soedjito, 1990; Soedjito & Kartawinata, 1995; Sist & Saridan, 1999; Tanuwijaya *et al*., 1996). A floristic analysis of the lowland dipterocarp forests of Borneo found that on a regional scale, diversity is highest in south-east Borneo and central Sarawak with *Dipterocarpaceae* as the most common family followed by *Euphorbiaceae* and several geographically distinct floristic regions could be detected. (Slik *et al.* 2003). Based on data from Northern Borneo, mainly Sarawak, Brunei and Sabah, it was suggested that forests of western Borneo were significantly richer in dipterocarp species than those of eastern Borneo (Ashton, 1989; Davies & Becker, 1996). The richness of the lowland rainforest of Sarawak and Brunei might be linked to the higher climatic stability of North-western Borneo which experiences less dramatic and severe drought periods attributed to El Niño-Southern Oscillation (ENSO) events than the eastern part of the island, especially Sabah (Ashton, 1989; Goldammer *et al.* 1996; Walsh; 1996,) and East Kalimantan (Guhardja *et al.* 2000; Leighton & Wirawan 1986;). However, Sist & Saridan (1999) recently reported that the species richness of the mixed dipterocarp forest of Berau in East Kalimantan, in spite of its eastern location and its proximity to Sabah was much higher than that of the forest of Sabah and similar to that recorded in Sarawak. Similarly, the forest at Wanariset Samboja, was reported to be the richest in Borneo and even in the world (Kartawinata *et al.* 1981, Whitmore 1986). These facts clearly show that our knowledge of the floristic richness and variability of the mixed dipterocarp forest of Kalimantan is still limited. During the last two decades, the forest of Kalimantan has been depleted and is disappearing at an alarming rate. The main causes are intensive and uncontrolled logging, and conversion into industrial plantations. Successive fires following land clearing affected million of hectares during El Nino events (Sunderlin and Resosudarmo, 1996; Dennis, 1999). Regeneration after fires in East Kalimantan was mainly through seedbank germination in lowland dipterocarp forest and through repsrouting in *kerangas* (Riswan 1982; Riswan & Kartawinata 1988a, 1989) and dipterocarp forests. The regeneration developed better in the twice-burnt area than that in the area burnt once and the density of young trees was higher and even exceeded that of primary forest (Eichhorn 2006). Furthermore, in the burnt forest, the survival and sprouting capacity of primary forest trees and seedling establishment of pioneer trees and shrubs suppressed the establishment of non-forest species and post fire vegetation was found to be less resilient than it was presumed (Nieuwstadt 2002; Nieuwstadts *et al*. 2001,). Fires resulted in changes of forest structure and composition, loss of tree species diversity and invasion of pioneer species. In sum, forest recovery was not only affected by burning but also by environmental changes resulting from fire (Simbolon *et al.* 2005)

A better knowledge of basic ecological information, including floristic composition and structure of the forest, are necessary for development of a sustainable forest management scheme. To date, there are still very few detailed descriptions and quantitative assessments of forest floristics and structure from a huge area of the Malesian rain forests (Whitmore & Sidiyasa 1986) and for Indonesia. Kartawinata (2005) reviewed the state of quantitative vegetation studies from 1960's

onwards and recommended a list of future actions on the subject. The *Lembaga Biologi Nasional* (National Biological Institute), now known as *Pusat Penelitian Biologi* (Research Center for Biology) noted such needs and in the mid 1970s initiated and integrated the vegetation analysis project into its overall biological research program (Kartawinata 2005). The present study was a part of this program presenting a basic descriptive account of the structure and floristic composition of a 10.5 ha permanent plot set up in a lowland mixed ditperocarp forest in Wanariset Samboja in East Kalimantan. It was intended for use by various future studies in order to provide a permanent basis for long-term study of forest dynamics and floristic changes. In this paper, analysis of the species inventory data collected in the plots will be limited to the description of the forest in terms of the main structural parameters (basal area and density), species richness, pattern of relative abundance and family composition, integrating also data from a 1.6 ha section of this plot reported earlier by Kartawinata *et al.* (1981) and on forest gaps by Partomihardjo et al. (1987).

STUDY SITE AND METHODS

The study area is located within a 500-ha research forest managed by the Wanariset (Field Research Station) of the Forest Research and Development Agency (FORDA) of the Ministry of Forestry of Indonesia at Samboja, District of Kutai Kertanegara, East Kalimantan, Indonesia at 0^{o} 59' Lat. and 116^{o} 57' Long, about 38 km north of Balikpapan (Figure 1). The physiography is undulating to flat. The forest is lowland dipterocarp forest on dryland with small patches of seasonally swampy ground. The elevation varies between 3 to about 50 m above sea level. The climate is everwet and belongs to the rainfall type A with the ratio between dry and wet months (Q) of 4.4 (Schmidt and Ferguson, 1951). The mean annual rainfall recorded at the nearest meteorological station (Balikpapan BP (Woods and Bower, 1982)) was 2425 mm for the period of 1927-1980. The mean monthly rainfall ranged from126 mm in October to 236 mm in March (Figure 1) and the mean annual number of raindays was 145 with the mean number of monthly raindays ranging from 9 to 14. The forest is situated on the Red Yellow Podsolic Soil and occurs on an alluvial plain of upper Miocene sedimentary rocks (Soeprapto-hardjo, 1972).

A block of 150m x 700 m was set up in 1979 in an undisturbed location within a lowland dipterocarp forest about 50 m to the north of Km 1.6 of the now Semboja-Semoi-Sepaku road. It was constructed by sequentially placing a series of 10 m x 10 m plots, first along the width of the block, thus forming a 150 m x 10 m transect consisting of 15 plots; with the surface of each plot was parallel to the ground. The second, third ….. and 70^{th} transects were laid down adjacent to one another along the 700-m length of the block Thus 1050 plots were established . The 700-m length of the plot stretched roughly South to North and the 150-m width from East to West. The habitat of each plot with reference to topography, whether it is located on a swampy site, a flat dry land, a slope or a ridge was noted qualitatively. In each plot, all the trees with DBH (Diameter at Breast Height) $\geq$ 10 cm were mapped, numbered with aluminum tags, identified, and measured for DBH. Important features of the forest were also recorded qualitatively. The gaps within the plot were mapped and a profile diagram of a 15 x 60 m^2 subplot was made as reported by Partomihardjo (1987). Voucher specimens or fallen leaves (if a leafy twig was not accessible) from each tree was collected for identification at the Herbarium Bogoriense, Bogor. The authority of botanical names of plants in the plot followed Whitmore *et al*. (1989, 1990), Keßler & Sidiyasa (1994) and Keßler *et al.* (2000) The inventory was carried out between 1979 and 1981.

RESULTS AND DISCUSSION

Floristic characteristics and diversity

The results of the inventory of trees with DBH $\geq$ 10 cm showed that 553 species of 192 genera in 62 families, represented by 5847 individuals, with the total basal area of 350.01 m^2 (Table 1) occurred in the 10.5 hectare plot. Of 550 species recorded, we were able to name 425 species. Appendix 1 lists all species of trees with DBH $\geq$ 10 cm by family and reports absolute densities, relative densities, frequencies, relative frequencies, basal areas, relative basal areas and Importance Values (IV). These parameters were calculated following the standard procedure as discussed by Mueller-Dombois & Ellenberg (1974). The Total Species Importance Values for a Family (TSIVF) indicates the family importance value based on the sum of IVs of all species in a family (Kartawinata *et al.*

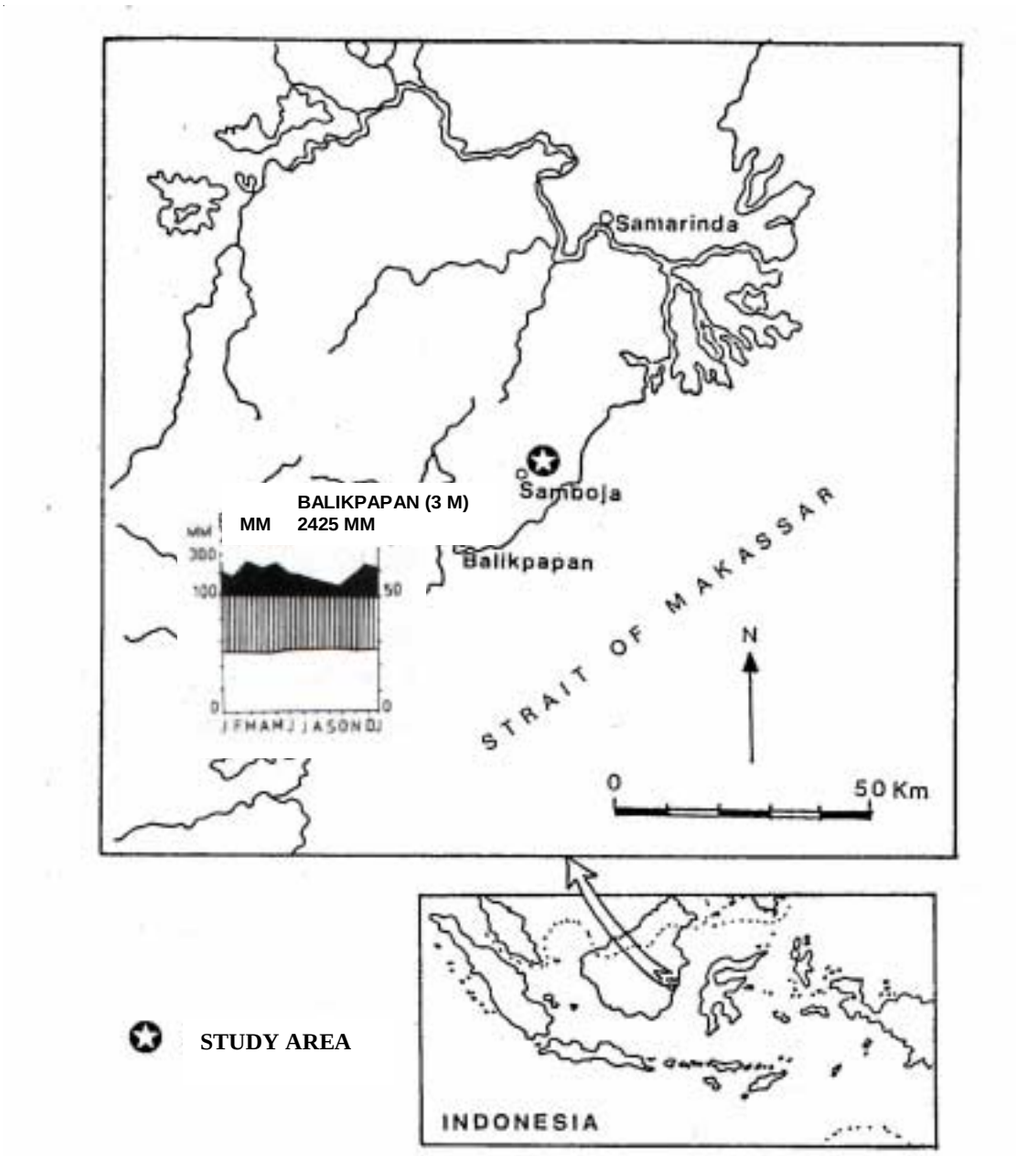

Figure 1. The location of the study area at Wanariset Samboja, East Kalimantan

2004). It is evident that the forest had a high species richness compared to other areas within the region. No single species was dominant, instead dominance was shared by several common species. The forest was characterized by uneven species composition, certain species were represented by large number of individuals, while the majority of species were represented by only a few individuals and often only by one specimen. (Appendix 1).

The ten richest families in terms of number of species are shown in Table 3. Ranked by number of species present, Myrtaceae, Lauraceae, Euphorbiaceae and Myristicaceae were the top four families and Dipterocarpaceae occupied the 5th ranking. In small plots in Borneo and Sumatra, *Lauraceae* constitutes one of the top three most common families (Whitmore & Sidiyasa 1986). In the lowland forests of West Malesia, Euphorbiaceae is by far the richest family (cf Abdulhadi 1991, Davies & Becker 1996, Poore 1968, Riswan 1982, Sist & Saridan1999, Suselo & Riswan 1987, Whitmore 1986, Whitmore & Sidiyasa 1986). As in the present study, *Annonaceae*, *Burseraceae*, *Dipterocarpaceae*, *Moraceae*, *Myristicaceae* and *Rubiaceae* are also in the top ten families ranked by species richness in Borneo and Sumatra (Kartawinata et al. 1981, Table 1). In terms of the Total Sum of Important Values for Families (TSIVF), the ten most important amilies show different order. *Dipterocarpaceae* and *Euphor-*

biaceae had the first and second highest values (Table 3). The high value for *Dipterocarpaceae* was attributed to the presence of large trees in the plots (Annex 1). It is interesting to note that although it contains only three species, *Arecaceae* had a high TSIVF value, resulting from the high number of individuals of *Pholidocarpus majadum* and *Borassodendron borneensis*. In order to determine whether the 550 species recorded in the 10.5-ha plot represent the total number of species in the area studied, a species-area curve was constructed (Figure 2). The 1050 subplots of 10x10 m each were examined to determine the number of additional species recorded each time a subplot was added. A considerable number of additional and it continued to rise steeply even up to 10.5 hectare. There was a very slight indication of leveling off at about five hectares. This implies that a minimum area can not be determined for this forest. This is similar to lowland tropical rain forests elsewhere in Borneo and the Malay Peninsula as reported by various authors (Kartawinata 2006, Kartawinata *et al*. 1981; Sist & Saridan 1999, Riswan 1982; Whitmore 1986; Wyatt-Smith 1966, etc.), but it is less dramatic compared to lowland forests of Sulawesi (Kartawinata 2005; Whitmore & Sidiyasa 1986).

Table 1. Floristic and structural characteristics

Stand Characteristics	Dipterocarps	Non- Dipterocarps	Total
Number of Species	25 (4.53 %)	527 (95.47 %)	552
Number of trees	575 (9.83)	5272 (90.17 %)	5847
Mean Density (Trees/Ha)	54.76	502.10	556.86
Basal area (M^2)	85.53 (24.44 %)	264.48 (75.56 %)	350.01
Mean Basal Area/Ha (M^2)	8.48	25.19	33.33

Table 2. Density and number of species of trees with DBH $\geq$ 10 cm in selected plots of different forest types in Kalimantan, Sumatra and Sulawesi (Extracted from Kartawinata 2006)

Locality	Alt. (m)	Plot size (ha)	Mean Density (Trees/ha)	Number of Species	Reference
EAST KALIMANTAN					
Wanariset Samboja	< 100	10.5	557	552	Present Study
Malinau 1	100	2 x1.0	413	240	Yusuf (2003)
Malinau 2	100	4 x 1.0	759	404	Samsoedin (2005)
Malinau 3	<100	1,0	567	225	Kartawinata (unpublished)
Berau	<100	3 x 4.0	521	538	Sist & Saridan (1999)
Lempake	<100	1.6	445	209	Riswan, (1987a
Bukit Bangkirai	110	1.0	445	141	Simbolon *et al.* (2005)
NORTH SUMATRA					
Leuser National Park	450-670	1.6	538	116	Abdulhadi *et al.* (1989)
Ketambe 1	350-450	1.6	420	94	Abdulhadi (1991)
Ketambe 2	350-450	1.6	475	127	Abdulhadi *et al.* (1991)
Ketambe 3					
Batang Gadis National Park Aek Nauli	660	1.0	583	182	Kartawinata *et al.* (2004)
RIAU					
Bukit Tigapuluh National Park Bukit Lawang	297	1.0	453	216	Polosakan (2001)

Table 3. Ten important families in terms of the Total Sum of Importance Values (TSIVF) and number of species arranged in descending order indicating the rank

Order	Family	No of species	Order	Family	TSIVF (%)
1	*Myrtaceae*	59	1	*Dipterocarpaceae*	44.272
2	*Lauraceae*	51	2	*Euphorbiaceae*	29.277
3	*Euphorbiaceae*	45	3	*Myrtaceae*	18.592
4	*Myristicaceae*	33	4	*Lauraceae*	17.999
5	*Dipterocarpaceae*	25	5	*Myristicaceae*	17.982
6	*Annonaceae*	24	6	*Arecaceae*	16.608
7	*Rubiaceae*	22	7	*Sapotaceae*	15.336
8	*Burseraceae*	21	8	*Annonaceae*	13.061
9	*Moraceae*	21	9	*Ebenaceae*	12.164
10	*Fabaceae*	19	10	*Burseraceae*	9.316

The forest of the present study is the second most species rich in East Kalimantan after that in Malinau, which constitutes the richest forest in Indonesia (Kartawinata 2005). It can be seen from Table 2 that if the number of species in one hectare is extrapolated from the number in 10.5 ha plot, as is shown also in the species-area curve (Figure 2, and see also data of Abdulhadi *et al.* 1981), the total species richness may be comparable to that of Lempake (E. Kalimantan), Gunung Mulu (Sarawak) Belalong and Andulau (Brunei), Bukit Lawang (Riau), Bukit Lagong (Penisular Malaysia), and higher than that of Aek Nauli and Ketambe (Sumatra) and Toraut (Sulawesi). The species richness was however lower than at Malinau 3 (East Kalimantan), at least partly due to different plot design.

The calculation of species frequencies was based on the species data from the 70 transects, each consisting of 15 subplots with the total area of 1500 m^2. The majority of species had frequencies of less than 50 % and species with frequencies greater than 50 % are shown in Table 5. Interestingly, among dipterocarps only *Shorea ovalis* and *S. laevis* howed relatively high frequency, suggesting that most dipterocarps species apparently grow in clumps in this forest.

Simple ordination of the plots did not produce a recognizable pattern of grouping the plots that warrants the separation of swampy habitat on flat lands from dry habitat on slopes and ridges. Field observations concurred that the composition of the forest on swampy sites was not much different from that on dryland, although the following species were

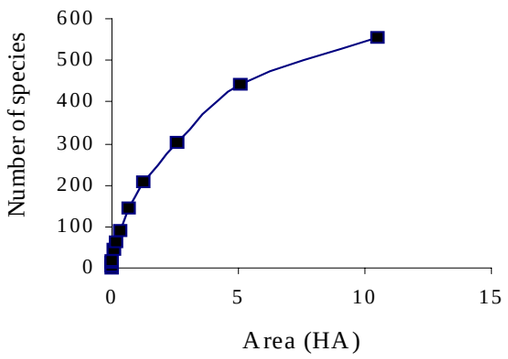

Figure 2. Species-area curve in a lowland dipterocarp forest at Wanariset Samboja, East Kalimantan

Table 4. Ten most important species in decending order of Importance Value (IV)

No.	Species	Family	IV
1	*Shorea laevis*	Dipterocarpaceae	11.941
2	*Pholidocarpus majadum*	Arecaceae	10.656
3	*Diospyros borneensis*	Ebenaceae	6.512
4	*Eusideroxylon zwageri*	Lauraceae	6.139
5	*Scaphium macropodum*	Sterculiaceae	5.800
6	*Polyalthia sumatrana*	Annonaceae	5.190
7	*Ganua motleyana*	Sapotaceae	5.071
8	*Borassodendron borneensis*	Arecaceae	4.918
9	*Dipterocarpus cornutus*	Dipterocarpaceae	4.568
10	*Shorea ovalis*	Dipterocarpaceae	4.155

mostly found in or were restricted to the swampy sites:*Actynodaphne procera, Cratoxylum laevifolius, Dialium hydnocarpoides, Diospyros elliptica, D. laevifolia, D. maingayi, D. pentaphylla, D. sumatrana, Elipanthus beccarii, Elmerillia tsiampacca, Eugenia accuminatissima, E. beccarii, E. densiflora, E. densinervia, E. lineata, E. oleosa, Ganua motleyana, Horsfieldia crassifolia, Litsea noronhae, Mammea*

obovata , *Urophyllum corymbosum* and *Xanthophyllum adenotum.* Three species of tree palms were prominent in the forest and two of them, *Oncosperma horridum* and *Pholydocarpus majadum,* mainly occurred on swampy habitats, while the other, *Borassodendron borneensis,* was present mainly on dryland. Certain other species which occurred at lower densities were also characteristic of swampy habitats: *Anthocephalus cadamba, Knema laurina, Neesia altissima* and *Pometia pinnata*.. The total number of individuals recorded is indicated in Appendix. 1. The area of the swampy sites was difficult to quantify precisely because they were patchy, but they occurred mainly on the northern part of the plot and there was no ambiguity in assigning trees to this habitat type.

Table 5. Ten species with highest frequency

No.	*Species*	Family	Frequency (%)
1	*Diospyros borneensis*	Eben	87.14
2	*Polyalthia sumatrana*	Anno	87.14
3	*Eusideroxylon zwageri*	Laur	78.57
4	*Borassodendron borneensis*	Arec	74.29
5	*Pholidocarpus majadum*	Arec	67.14
6	*Madhuca sericea*	Sapo	62.86
7	*Mallotus leptophyllus*	Euph	61.43
8	*Shorea laevis*	Dipt	60.00
9	*Dacryodes rugosa*	Burs	60.00
10	*Shorea ovalis*	Dipt	57.14

Some species could be identified as (potential) fruit trees and medicinal plants, including the followings:

(1) Fruit trees: Anacardiaceae (*Bouea macrophylla, Mangifera caesia, M. foetida, M. pajang)*. Bombacaceae (*Durio acutifolius, D. dulcis, D. graveolens, D. kutejensis, D. lanceolatus, D.* oxleyanus), Burseraaceae (*Canarium dichotomum, C. denticulatum, D. littorale, D. patentinervium, D. pilosum, D. rugosum*), Clusiaceae (*Garcinia celebica, G. littorale, G. nervosa*), Euphorbiaceae (*Baccaurea deflexa, B. kunstleri, B. racemosa, B. rumphii, B. sumatrana*), Fabaceae (*Parkia roxburghii, P. speciosa*), Meliaceae (*Sandoricum borneensis*) and Sapindaceae (*Nephelium lappaceum, Pometia pinnata*) , and (2) Medicinal plants: Apocynaceae (*Alstonia angustifolia, A. scholaris, Dyera costulata),* Thymelaeaceae *(Aquilaria malacensis)* and Annonaceae (*Cananga odorata*).

Structure

The basal area of each tree recorded in the plot was calculated. Appendix 1 shows these data grouped by family, as well as for individual species, along with other measures. The total basal area of trees recorded in the plot was 350.01 m^2, resulting in a mean basal area of 33.33 m^2/ha (Table 1). Ten species with the highest basal areas are presented in Table 4, in which *Shorea laevis, Pholidocarpus adum* and *Scaphium macropodum* were the most prominent. It was also evident that ten dipterocarp species were prevalent, with a total basal area of 53.86 m^2 (46.74%) As a whole, the dipterocarps were the largest trees and dominated the forest with 25 species (representing 4.47% of the total species richness) occupying a total basal area of 85.53 m^2 (24.96 %). Most species had basal areas of less than 1.0 m^2 and only 71 species (12.90 %) had basal areas greater than 1.0 m^2, of which the highest basal areas of 10-31 m^2 were shared by three species (Figure 3), *i.,e. Shorea laevis, Pholidocarpus majadum* and *Scaphium macropodum* (Table 6).

Table 6. Ten species with highest BA in a 10.5-ha plot

No.	Species	Family	BA (M2)
1	*Shorea laevis*	Dipt	30.455
2	*Pholidocarpus majadum*	Arec	16.534
3	*Scaphium macropodum*	Ster	16.500
4	*Anthocephalus cadamba*	Rubi	9.734
5	*Eusideroxylon zwageri*	Laur	9.379
6	*Dipterocarpus cornutus*	Dipt	9.315
7	*Ganua motleyana*	Sapo	9.223
8	*Shorea parvifolia*	Dipt	7.242
9	*Shorea ovalis*	Dipt	6.844
10	*Shorea pauciflora*	Dipt	6.499
			121.725

Figure 4 shows the diameter class distribution of trees with DBH $\geq$ 10 cm in the 10.5-ha plot. The data show more or less a typical size class distribution of tropical undisturbed primary forest. This reveals that 79.13% of the total trees had DBH of less than 30 cm and only 20.87 % occurred in the diameter class greater than 30 cm. The trees with large DBH were mainly dipterocarps. Three largest tree species were *Shorea pauciflora* (DBH =196.50 cm), *Dipterocarpus cornutus* (170.90 cm) and *Alstonia scholaris* (170.0 cm). It is interesting to note that a pioneer species, *Anthocephalus cadamba,* developed well in this forest, where trees were distributed in all diameter classes and reached a maximum DBH of 128 cm. In contrast, *Alstonia scholaris,* another pioneer species, demonstrated a disjunct size distribution (Table 7)

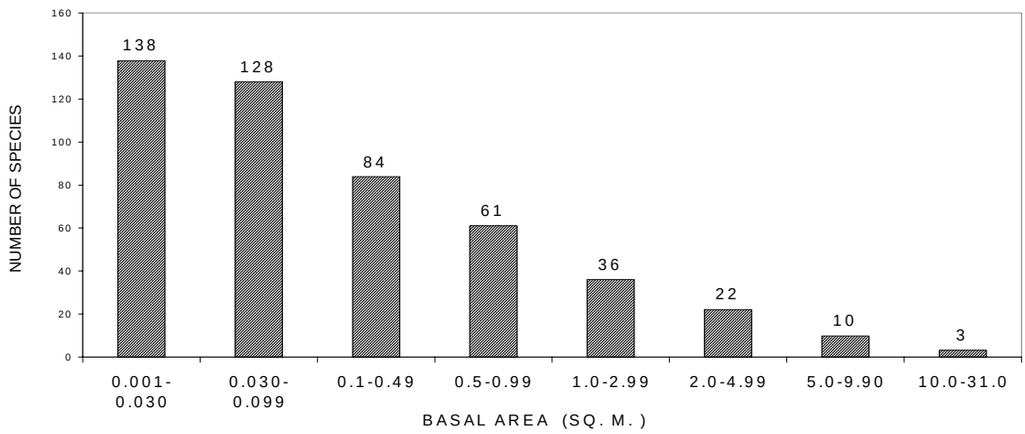

Figure 3. Basal area class distribution and number of tree species with DBH ≥ 10 cm in a 10.5-ha plot in a lowland dipterocarp forest at Wanariset Samboja, E. Kalimantan

disjunct size distribution (Table 7) with only two large individuals of DBH 140 cm and 170 cm (Appendix 1). *A. cadamba* is a light-demanding species (Whitmore 1986) and, in this study, had a large number of individuals with big diameters and a low number of small individuals. This pattern contrasts that of shade-demanding species, such as *Dipterocarpus cornutus*, which had a higher number of individuals of small sizes (Figure 5). Other secondary forest species present in a relatively high number of individuals in the plot are shown in Table 7, but none were as large as *A. cadamba* and *Alstonia scholaris*. These species appeared to occur on sites previously occupied by gaps. An earlier study on this plot (Partomihardjo *et al.* 1987) (Figure 6) reported that gaps covered a total area of 17, 399 m^2 (16.6 % of the canopy) and gap formation was estimated to be 1,187 m^2 (1.05 % of the canopy opening annually) and the recovery rate was about 16 years. Meanwhile, a man-made gap of 0.5 ha in a lowland dipterocarp forest at Lempake, about 100 km north east of Wanariset Samboja (Riswan 1982; Riswan & Kartawinata 1989) was immediately occupied by secondary forest species after clearing. The primary forest species arrived later and achieved a 50% proportion of all species after 18 months. The primary forest arrivals included dipterocarps, *Hopea rudiformis*, *Shorea parvifolia* and *Shorea leprosula*, which were present also in the present study (Appendix 1) and have been reported to behave like pioneer species (Riswan 1982; Riswan & Kartawinata 1989, 1991). Furthermore, in a 35 year old 0.8-ha gap at Lempake the large trees were dominated by secondary forest species, primarily *Macaranga* spp. (Riswan 1982; Riswan &Kartawinata 1988a).

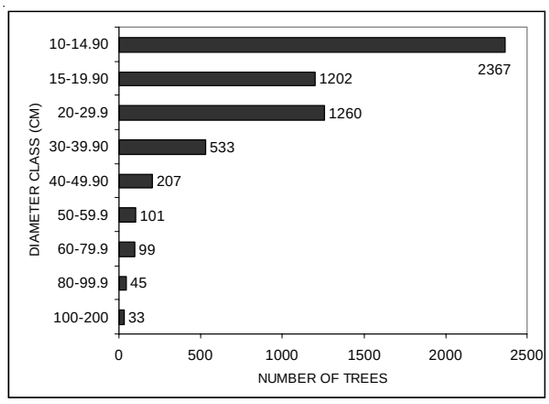

Figure 4. Diameter class distribution and number of tree species with DBH ≥ 10 cm in a 10.5-ha plot in a lowland dipterocarp forest at Wanariset Samboja, E. Kalimantan.

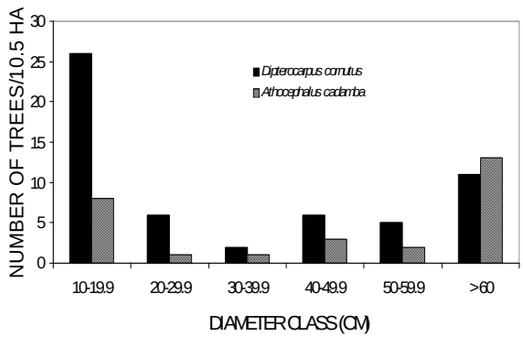

Figure 5. Number of individuals of a light-demander (*Anthocephalus cadamba)* and shade-demander (*Dipterocarpus cornutus*) according to diameter-class in a 10.5-ha plot of a lowland dipterocarp forest at Wanariset Samboja, Kalimantan Timur

Table 7. Number of trees of major secondary forest species according to diameter class in the 10.5-ha plot of lowland dipterocarp forest at Wanariset Samboja, East Kalimantan.

SPECIES	DIAMETER CLASS											
	10-19.9	20-29.9	30-39.9	40-49.9	50-59.9	60-69.9	70-79.9	80-89.9	90.99.9	100-109.9	110-129.9	130-170
Anthocephalus cadamba	8	1	1	3	2	3	3	2		3	2	
Alstonia scholaris	5	3	1									2
Alstonia angustifolia	4	2	1									
Artocarpus anisophyllus	12	2	2	1								
Artocarpus rigidus	13	2	1									
Buchanania sessifolia	3	12	7									
Dillenia excelsa	15	2	3	1								
Endospermum diadenum	2	1	1									
Porterandia anisophylla	8	1										
Macaranga gigantea	2	3	2	2								
Macaranga hypoleuca	4	1										
Macaranga tanarius	14		1									
Parinari oblongifolia	7	1	3	1	1	2						
Schima wallichii	2		2		1							

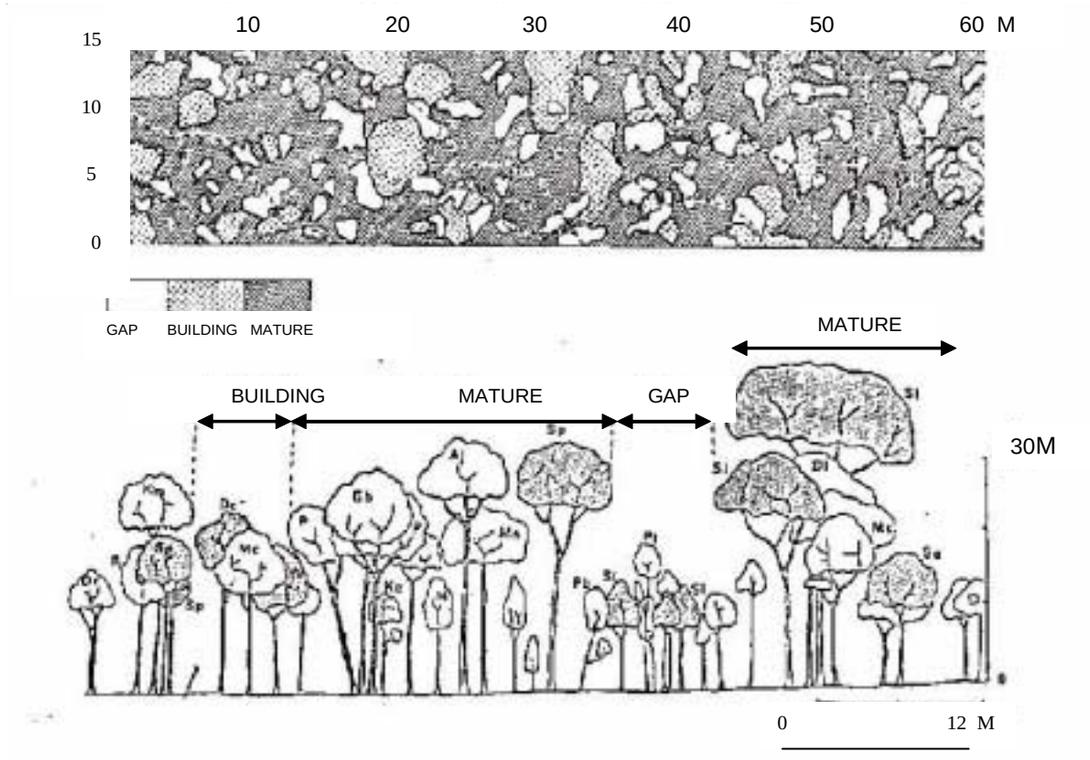

Figure 6. Canopy phases and a profile diagram of a portion of the 10.5-ha plot within a lowland dipterocarp forest at Wanariset Samboja, East Kalimantan. D – *Dysoxylum sp.*, Dl – *Drypetes laevis*, Dr – *Dacryodes rostrata*, Gb – *Gonystylus bancanus*, H – *Horsfieldia* sp., Kc – *Knema cinerea*, Km – *Koompasia malaccensis*, *Madhuca* sp., Mc – *Microcos crassifolia*, Ml – *Mallotus leptophyllus*, Ms – *Madhuca sericea*, Nk – *Neoscortechinia kingii*, P – *Polyalthia* sp., Pl – *Polyalthia rumphii*, Sl – *Shorea laevis*, So – *Shorea ovalis*, Sp – *Shorea parvifolia*, Vu – *Vatica umbonata*. (After Partomihardjo *et al.* 1987)

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Appendix 1. Number of Species in a Family (in parenthesis), Number of occurrence, Frequency (%), Number of trees, Basal Area (cm2), Relative Basal Area (%), Relative Frequency (%), Relative Density (%,) Importance Value in a 10.5 ha plot of lowland dipterocarp forest at Wanariset Semboja, East Kalimantan, Indonesia. The Family Importance Value is the Total Spesies Importance Values for a Family (TSIVF).

No.	Family and Species	Number of Occurrence in plots	Frequency (%)	Number of Trees (in 10.5 Ha)	Basal Area (Cm2)	Relative Basal Area (%)	Relative Frequency (%)	Relative Density (%)	Importance Value
1	**Actinidiaceae (2 spp.)**								
1	*Saurauia* sp. 1	1	1.43	1	132.73	0.004	0.027	0.017	0.048
2	*Saurauia* sp. 2	1	1.43	1	196.07	0.006	0.027	0.017	0.050
	Family Importance Value								0.098
2	**Alangiaceae (1 sp.)**								
3	*Alangium ebenaceum*	20	28.57	26	6,899.50	0.201	0.538	0.446	1.186
	Family Importance Value								1.186
3	**Anacardiaceae (15)**								
4	*Bouea oppositifolia*	7	10.00	8	2,910.34	0.085	0.188	0.137	0.411
5	*Buchanania sessifolia*	17	24.29	23	6,344.42	0.185	0.457	0.395	1.037
6	*Campnosperma coriaceum*	2	2.86	2	1,005.31	0.029	0.054	0.034	0.117
7	*Koordersiodendron pinnatum*	1	1.43	1	426.38	0.012	0.027	0.017	0.057
8	*Mangifera caesia*	10	14.29	10	9,984.09	0.291	0.269	0.172	0.732
9	*Mangifera foetida* .	9	12.86	10	2,646.81	0.077	0.242	0.172	0.491
10	*Mangifera indica*	1	1.43	1	84.95	0.002	0.027	0.017	0.047
11	*Mangifera macrocarpa*	1	1.43	1	343.07	0.010	0.027	0.017	0.054
12	*Mangifera pajang*	4	5.71	4	4,616.66	0.135	0.108	0.069	0.311
13	*Melanochyla bracteata*	4	5.71	4	716.21	0.021	0.108	0.069	0.197
14	*Melanochyla fulvinervis*	7	10.00	8	1,873.00	0.055	0.188	0.137	0.380
15	*Parishia maingayi*	2	2.86	2	7,853.05	0.229	0.054	0.034	0.317
16	*Semecarpus bunburyanus*	1	1.43	1	271.72	0.008	0.027	0.017	0.052
17	*Semecarpus forstenii*	3	4.29	3	1,740.21	0.051	0.081	0.051	0.183
18	*Semecarpus glauca*	1	1.43	1	4,185.39	0.122	0.027	0.017	0.166
	Family Importance Value								4.552
4	**Annonaceae (24)**								
19	*Cananga odorata*	5	7.14	6	8,079.85	0.236	0.134	0.103	0.473
20	*Cyathocalyx sumatrana*	1	1.43	3	1,359.32	0.040	0.027	0.051	0.118
21	*Goniothalamus macrophylla*	4	5.71	4	637.27	0.019	0.108	0.069	0.195
22	*Meiogyne virgata*	5	7.14	5	1,111.89	0.032	0.134	0.086	0.253
23	*Mitrephora polypyrena*	1	1.43	1	132.73	0.004	0.027	0.017	0.048
24	*Monocarpia marginalis*	9	12.86	13	7,056.34	0.206	0.242	0.223	0.671
25	*Oxymitra* sp.	1	1.43	1	122.72	0.004	0.027	0.017	0.048
26	*Polyalthia lateritica*	2	2.86	2	753.94	0.022	0.054	0.034	0.110
27	*Polyalthia glauca*	1	1.43	1	109.36	0.003	0.027	0.017	0.047
28	*Polyalthia lateriflora*	31	44.29	78	29,839.03	0.871	0.834	1.339	3.043
29	*Polyalthia rumphii*	19	27.14	26	6,745.95	0.197	0.511	0.446	1.154
30	*Polyalthia* sp. 1	1	1.43	1	426.38	0.012	0.027	0.017	0.057
31	*Polyalthia* sp. 2	1	1.43	1	124.69	0.004	0.027	0.017	0.048
32	*Polyalthia* sp. 3	1	1.43	1	116.90	0.003	0.027	0.017	0.047
33	*Polyalthia* sp. 4	1	1.43	1	692.79	0.020	0.027	0.017	0.064
34	*Polyalthia* sp. 5	1	1.43	1	829.58	0.024	0.027	0.017	0.068
35	*Polyalthia sumatrana*	61	87.14	143	37,494.99	1.094	1.641	2.455	5.189
36	*Popowia hirta*	6	8.57	6	1,025.05	0.030	0.161	0.103	0.294
37	*Popowia* sp. 1	1	1.43	1	162.86	0.005	0.027	0.017	0.049
38	*Popowia* sp. 2	1	1.43	1	95.03	0.003	0.027	0.017	0.047
39	*Popowia tomentosa*	2	2.86	2	276.78	0.008	0.054	0.034	0.096
40	*Xylopia ferruginea*	2	2.86	2	979.93	0.029	0.054	0.034	0.117
41	*Xylopia malayana*	13	18.57	16	5,242.90	0.153	0.350	0.275	0.777
42	*Xylopia* sp. 1	1	1.43	1	86.59	0.003	0.027	0.017	0.047
	Family Importance Value								13.061
5	**Apocynaceae (5)**								
43	*Alstonia angustifolia*	6	8.57	7	2,778.12	0.081	0.161	0.120	0.363
44	*Alstonia scholaris*	11	15.71	11	41,046.72	1.198	0.296	0.189	1.683
45	*Dyera* sp.	1	1.43	1	1,231.63	0.036	0.027	0.017	0.080

No.	Family and Species	Number of Occurrence in plots	Frequency (%)	Number of Trees (in 10.5 Ha)	Basal Area (Cm2)	Relative Basal Area (%)	Relative Frequency (%)	Relative Density (%)	Importance Value
46	*Dyera lowii*	1	1.43	1	1,063.62	0.031	0.027	0.017	0.075
47	*Willughbeia firma*	3	4.29	4	3,277.67	0.096	0.081	0.069	0.245
	Family Importance Value								2.445
6	**Aquifoliaceae (1)**								
48	*Ilex cymosa*	4	5.71	4	17,262.70	0.504	0.108	0.069	0.680
	Family Importance Value								0.680
7	**Arecaceae (3)**								
49	*Borassodendron borneensis*	52	74.29	120	49,993.30	1.459	1.399	2.060	4.917
50	*Oncosperma horridum*	13	18.57	25	8,783.28	0.256	0.350	0.429	1.035
51	*Pholidocarpus majadum*	47	67.14	266	165,336.91	4.825	1.264	4.566	10.655
	Family Importance Value								16.608
8	**Bombacaceae (7)**								
52	*Durio acutifolius*	17	24.29	28	13,674.62	0.399	0.457	0.481	1.337
53	*Durio dulcis*	9	12.86	9	27,197.65	0.794	0.242	0.154	1.190
54	*Durio graveolens*	16	22.86	17	7,520.90	0.220	0.430	0.292	0.942
55	*Durio kutejensis*	1	1.43	1	314.16	0.009	0.027	0.017	0.053
56	*Durio lanceolatus*	12	17.14	16	3,490.79	0.102	0.323	0.275	0.699
57	*Durio oxleyanus*	17	24.29	22	11,462.90	0.335	0.457	0.378	1.169
58	*Neesia synandra*	12	17.14	13	12,072.47	0.352	0.323	0.223	0.898
	Family Importance Value								6.289
9	**Burseraceae (21)**								
59	*Canarium decumanum*	1	1.43	1	143.14	0.004	0.027	0.017	0.048
60	*Canarium denticulatum*	1	1.43	1	224.32	0.007	0.027	0.017	0.051
61	*Canarium dichotomum*	3	4.29	4	765.21	0.022	0.081	0.069	0.172
62	*Canarium hirsutum*	6	8.57	6	1,248.98	0.036	0.161	0.103	0.301
63	*Canarium littorale*	6	8.57	6	965.46	0.028	0.161	0.103	0.293
64	*Canarium patentinervum*	1	1.43	1	232.35	0.007	0.027	0.017	0.051
65	*Canarium pilosum*	3	4.29	5	1,618.41	0.047	0.081	0.086	0.214
66	*Dacryodes laxa*	1	1.43	1	193.59	0.006	0.027	0.017	0.050
67	*Dacryodes rostrata*	39	55.71	62	21,663.10	0.632	1.049	1.064	2.745
68	*Dacryodes rubiginosa*	1	1.43	1	535.02	0.016	0.027	0.017	0.060
69	*Dacryodes rugosa*	42	60.00	66	17,259.69	0.504	1.130	1.133	2.766
70	*Haplolobus moluccanus*	7	10.00	7	1,833.09	0.053	0.188	0.120	0.362
71	*Santiria griffithii*	14	20.00	19	5,495.28	0.160	0.377	0.326	0.863
72	*Santiria laevigata*	1	1.43	1	3,067.96	0.090	0.027	0.017	0.134
73	*Santiria megaphylla*	6	8.57	6	1,003.10	0.029	0.161	0.103	0.294
74	*Santiria* sp. 1	1	1.43	1	502.73	0.015	0.027	0.017	0.059
75	*Santiria* sp. 2	1	1.43	1	730.62	0.021	0.027	0.017	0.065
76	*Santiria* sp. 3	1	1.43	1	165.13	0.005	0.027	0.017	0.049
77	*Santiria* sp. 4	1	1.43	1	103.87	0.003	0.027	0.017	0.047
78	*Santiria tomentosa*	7	10.00	7	2,042.89	0.060	0.188	0.120	0.368
79	*Trioma malaccensis*	6	8.57	7	1,540.18	0.045	0.161	0.120	0.326
	Family IV								9.316
10	**Celastraceae (3)**								
80	*Bhesa paniculata*	16	22.86	22	6,563.37	0.192	0.430	0.378	1.000
81	*Euonymus javanicus*	2	2.86	2	460.45	0.013	0.054	0.034	0.102
82	*Lophopetalum javanicum*	1	1.43	1	91.61	0.003	0.027	0.017	0.047
	Family Importance Value								1.148
11	**Chrysobalanaceae (6)**								
83	*Atuna racemosa* ssp. *excelsa*	7	10.00	7	7,044.01	0.206	0.188	0.120	0.514
84	*Licania splendens*	19	27.14	27	27,448.19	0.801	0.511	0.463	1.776
85	*Maranthes corymbosa*	2	2.86	3	1,596.52	0.047	0.054	0.051	0.152
86	*Parastemon urophyllus*	4	5.71	4	4,844.15	0.141	0.108	0.069	0.318
87	*Parinari oblongifolia*	13	18.57	15	15,568.71	0.454	0.350	0.257	1.061
88	*Parinari* sp.	1	1.43	1	84.95	0.002	0.027	0.017	0.047
	Family Importance Value								3.867
12	**Clusiaceae (19)**								
89	*Calophyllum pulcherrimum*	3	4.29	3	1,347.71	0.039	0.081	0.051	0.172
90	*Calophyllum soulattri*	11	15.71	11	42,461.00	1.239	0.296	0.189	1.724
91	*Garcinia celebica*	8	11.43	10	6,005.72	0.175	0.215	0.172	0.562

No.	Family and Species	Number of Occurrence in plots	Frequency (%)	Number of Trees (in 10.5 Ha)	Basal Area (Cm2)	Relative Basal Area (%)	Relative Frequency (%)	Relative Density (%)	Importance Value
92	*Garcinia dioica*	2	2.86	2	642.71	0.019	0.054	0.034	0.107
93	*Garcinia lateriflora*	1	1.43	1	114.99	0.003	0.027	0.017	0.047
94	*Garcinia nervosa*	4	5.71	4	1,002.63	0.029	0.108	0.069	0.206
95	*Garcinia parvifolia*	2	2.86	2	3,808.13	0.111	0.054	0.034	0.199
96	*Garcinia rigida*	2	2.86	2	1,093.09	0.032	0.054	0.034	0.120
97	*Garcinia* sp. 1	3	4.29	3	1,589.75	0.046	0.081	0.051	0.179
98	*Garcinia* sp. 2	2	2.86	2	569.29	0.017	0.054	0.034	0.105
99	*Garcinia* sp. 3	2	2.86	2	1,328.64	0.039	0.054	0.034	0.127
100	*Garcinia* sp. 4	1	1.43	1	390.57	0.011	0.027	0.017	0.055
101	*Garcinia tetrandra*	4	5.71	4	538.77	0.016	0.108	0.069	0.192
102	*Kayea macrantha*	11	15.71	14	4,794.23	0.140	0.296	0.240	0.676
103	*Mammea acuminata*	1	1.43	1	143.14	0.004	0.027	0.017	0.048
104	*Mesua borneensis*	1	1.43	1	320.63	0.009	0.027	0.017	0.053
105	*Mesua caroidea*	1	1.43	1	298.50	0.009	0.027	0.017	0.053
106	*Mesua* sp. 1	1	1.43	1	102.07	0.003	0.027	0.017	0.047
107	*Mesua* sp. 2	1	1.43	1	95.03	0.003	0.027	0.017	0.047
	Family Importance Value								4.719
13	**Combretaceae (3)**								
108	*Terminalia foetidissima*	4	5.71	4	1,342.12	0.039	0.108	0.069	0.215
109	*Ellipanthus beccarii*	1	1.43	1	314.16	0.009	0.027	0.017	0.053
110	*Mastixia tricholoma*	3	4.29	4	689.22	0.020	0.081	0.069	0.169
	Family Importance Value								0.438
14	**Crypteroniaceae (1)**								
111	*Crypteronia cumingii*	13	18.57	15	59,833.97	1.746	0.350	0.257	2.353
	Family Importance Value								2.353
15	**Ctenolophonaceae (1)**								
112	*Ctenolophon parviflorus*	3	4.29	2	495.60	0.014	0.081	0.034	0.129
	Family Importance Value								0.129
16	**Dilleniaceae (4)**								
113	*Dillenia excelsa*	18	25.71	21	7,974.88	0.233	0.484	0.360	1.077
114	*Dillenia grandiflora*	12	17.14	13	5,501.57	0.161	0.323	0.223	0.706
115	*Dillenia obovata* .	6	8.57	7	8,360.12	0.244	0.161	0.120	0.526
116	*Dillenia pentagyna*	1	1.43	1	116.90	0.003	0.027	0.017	0.047
	Family Importance Value								2.357
17	**Dipterocarpaceae (25)**								
117	*Anisoptera costata*	1	1.43	1	3,903.63	0.114	0.027	0.017	0.158
118	*Dipterocarpus cornutus*	33	47.14	56	93,147.45	2.719	0.888	0.961	4.567
119	*Dipterocarpus gracilis*	15	21.43	18	22,960.57	0.670	0.403	0.309	1.383
120	*Dipterocarpus humeratus*	8	11.43	9	2,949.50	0.086	0.215	0.154	0.456
121	*Hopea dryobalanoides*	10	14.29	11	1,602.06	0.047	0.269	0.189	0.505
122	*Hopea mengerawan*	9	12.86	24	9,409.26	0.275	0.242	0.412	0.929
123	*Hopea rudiformis*	1	1.43	1	1,320.25	0.039	0.027	0.017	0.083
124	*Parashorea malaanonan*	5	7.14	6	2,822.65	0.082	0.134	0.103	0.320
125	*Shorea acuminatissima*	2	2.86	2	2,255.07	0.066	0.054	0.034	0.154
126	*Shorea almon*	7	10.00	11	8,868.85	0.259	0.188	0.189	0.636
127	*Shorea gibbosa*	6	8.57	6	4,801.37	0.140	0.161	0.103	0.404
128	*Shorea johorensis*	1	1.43	1	226.98	0.007	0.027	0.017	0.051
129	*Shorea kunstleri*	1	1.43	1	555.71	0.016	0.027	0.017	0.060
130	*Shorea laevis*	42	60.00	112	304,547.17	8.888	1.130	1.922	11.940
131	*Shorea lamellata*	20	28.57	26	64,794.59	1.891	0.538	0.446	2.875
132	*Shorea leprosula*	17	24.29	29	27,590.48	0.805	0.457	0.498	1.760
133	*Shorea ovalis*	40	57.14	63	68,438.42	1.997	1.076	1.081	4.155
134	*Shorea palembanica*	8	11.43	8	5,381.47	0.157	0.215	0.137	0.510
135	*Shorea parvifolia*	29	41.43	42	72,416.11	2.114	0.780	0.721	3.614
136	*Shorea pauciflora*	5	7.14	7	64,986.79	1.897	0.134	0.120	2.151
137	*Shorea smithiana* .	17	24.29	18	38,451.69	1.122	0.457	0.309	1.888
138	*Upuna borneensis*	1	1.43	1	615.75	0.018	0.027	0.017	0.062
139	*Vatica macrantha*	22	31.43	48	20,564.74	0.600	0.592	0.824	2.016
140	*Vatica rassak* .	12	17.14	18	10,256.16	0.299	0.323	0.309	0.931
141	*Vatica umbonata*	39	55.71	56	22,428.86	0.655	1.049	0.961	2.665
	Family Importance Value								44.272

No.	Family and Species	Number of Occurrence in plots	Frequency (%)	Number of Trees (in 10.5 Ha)	Basal Area (Cm2)	Relative Basal Area (%)	Relative Frequency (%)	Relative Density (%)	Importance Value
18	**Ebenaceae (12)**								
142	*Diospyros borneensis*	61	87.14	195	52,219.17	1.524	1.641	3.347	6.512
143	*Diospyros buxifolia*	2	2.86	2	1,755.56	0.051	0.054	0.034	0.139
144	*Diospyros elliptica*	5	7.14	8	11,884.09	0.347	0.134	0.137	0.619
145	*Diospyros macrocarpa*	12	17.14	18	7,307.95	0.213	0.323	0.309	0.845
146	*Diospyros maingayi*	19	27.14	48	20,940.24	0.611	0.511	0.824	1.946
147	*Diospyros malayana*	1	1.43	1	510.71	0.015	0.027	0.017	0.059
148	*Diospyros oblonga*	15	21.43	26	5,646.10	0.165	0.403	0.446	1.015
149	*Diospyros* sp 1	1	1.43	1	111.22	0.003	0.027	0.017	0.047
150	*Diospyros* sp. 2	1	1.43	1	191.18	0.006	0.027	0.017	0.050
151	*Diospyros* sp. 3	2	2.86	3	287.15	0.008	0.054	0.051	0.114
152	*Diospyros sumatrana*	5	7.14	6	677.98	0.020	0.134	0.103	0.257
153	*Diospyros wallichii*	8	11.43	12	4,804.86	0.140	0.215	0.206	0.561
	Family Importance Value								12.164
19	**Elaeocarpaceae (5)**								
154	*Elaeocarpus glaber*	12	17.14	12	6,224.44	0.182	0.323	0.206	0.710
155	*Elaeocarpus obtusus*	2	2.86	2	701.87	0.020	0.054	0.034	0.109
156	*Elaeocarpus oxypyrens*	1	1.43	2	545.17	0.016	0.027	0.034	0.077
157	*Elaeocarpus polystachyus*	9	12.86	11	6,417.47	0.187	0.242	0.189	0.618
158	*Sloanea javanica*	1	1.43	1	346.36	0.010	0.027	0.017	0.054
	Family Importance Value								1.568
20	**Euphorbiaceae (45)**								
159	*Antidesma neurocarpum*	1	1.43	1	706.86	0.021	0.030	0.017	0.068
160	*Aporusa elmeri*	27	38.57	29	5,017.06	0.146	0.726	0.498	1.370
161	*Aporusa falcifera*	16	22.86	24	5,683.79	0.166	0.430	0.412	1.008
162	*Aporusa lucida*	5	7.14	6	2,450.46	0.072	0.134	0.103	0.309
163	*Aporusa lunata*	2	2.86	2	478.95	0.014	0.054	0.034	0.102
164	*Aporusa maingayi*	4	5.71	5	2,271.45	0.066	0.108	0.086	0.260
165	*Aporusa nitida*	1	1.43	2	184.92	0.005	0.027	0.034	0.067
166	*Aporusa sp.*	8	11.43	8	1,368.64	0.040	0.215	0.137	0.392
167	*Aporusa sphaeridophora*	8	11.43	8	1,368.64	0.040	0.215	0.137	0.392
168	*Baccaurea costulata*	18	25.71	23	5,928.13	0.173	0.484	0.395	1.052
169	*Baccaurea kunstleri*	3	4.29	3	493.87	0.014	0.081	0.051	0.147
170	*Baccaurea macrocarpa*	28	40.00	42	13,486.93	0.394	0.753	0.721	1.868
171	*Baccaurea minor*	4	5.71	4	553.61	0.016	0.108	0.069	0.192
172	*Baccaurea parviflora*	1	1.43	1	113.10	0.003	0.027	0.017	0.047
173	*Baccaurea racemosa*	7	10.00	7	12,883.86	0.376	0.188	0.120	0.684
174	*Baccaurea* sp. 1	1	1.43	1	615.75	0.018	0.027	0.017	0.062
175	*Baccaurea* sp. 2	1	1.43	1	136.85	0.004	0.027	0.017	0.048
176	*Baccaurea* sp. 3	1	1.43	1	188.69	0.006	0.027	0.017	0.050
177	*Baccaurea* sp. 4	1	1.43	1	408.28	0.012	0.027	0.017	0.056
178	*Baccaurea* sp. 5	1	1.43	3	436.76	0.013	0.027	0.051	0.091
179	*Baccaurea sumatrana*	9	12.86	9	1,814.82	0.053	0.242	0.154	0.450
180	*Blumeodendron elatriospermur*	3	4.29	3	488.67	0.014	0.081	0.051	0.146
181	*Blumeodendron tokbrai*	3	4.29	3	1,188.70	0.035	0.081	0.051	0.167
182	*Chaetocarpus castanocarpus*	21	30.00	25	14,811.69	0.432	0.565	0.429	1.426
183	*Cleistanthus maingayi*	1	1.43	1	95.03	0.003	0.027	0.017	0.047
184	*Croton oblongus*	16	22.86	24	4,227.28	0.123	0.430	0.412	0.966
185	*Drypetes crassipes*	3	4.29	1	900.26	0.026	0.081	0.017	0.124
186	*Drypetes laevis*	33	47.14	78	56,120.60	1.638	0.888	1.339	3.864
187	*Drypetes littoralis*	1	1.43	1	95.03	0.003	0.027	0.017	0.047
188	*Drypetes longifolia*	8	11.43	11	3,770.41	0.110	0.215	0.189	0.514
189	*Drypetes minahasae*	22	31.43	38	17,926.66	0.523	0.592	0.652	1.767
190	*Drypetes* sp.	1	1.43	1	201.06	0.006	0.027	0.017	0.050
191	*Endospermum diadenum*	3	4.29	4	1,701.44	0.050	0.081	0.069	0.199
192	*Fahrenheitia pendula*	6	8.57	6	1,317.20	0.038	0.161	0.103	0.303
193	*Glochidion philippicum*	7	10.00	7	1,510.91	0.044	0.188	0.120	0.353
194	*Glochidion rubrum*	4	5.71	5	1,294.68	0.038	0.108	0.086	0.231
195	*Macaranga gigantea*	8	11.43	9	6,069.00	0.177	0.215	0.154	0.547
196	*Macaranga hypoleuca*	5	7.14	5	1,181.77	0.034	0.134	0.086	0.255
197	*Macaranga lowii*	3	4.29	5	669.15	0.020	0.081	0.086	0.186
198	*Macaranga tanarius*	12	17.14	15	2,836.33	0.083	0.323	0.257	0.663
199	*Macaranga winkleri*	2	2.86	2	250.65	0.007	0.054	0.034	0.095
200	*Mallotus penangensis*	38	54.29	69	12,328.46	0.360	1.022	1.184	2.566
201	*Mallotus leptophyllus*	43	61.43	104	15,928.22	0.465	1.157	1.785	3.407
202	*Neoscortechinia kingii*	30	42.86	39	10,504.88	0.307	0.807	0.669	1.783

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203	*Pimeleodendron griffithianum*	23	32.86	28	8,699.46	0.254	0.619	0.481	1.353
204	*Ptychopyxis bacciformis*	1	1.43	1	201.06	0.006	0.027	0.017	0.050
	Family Importance Value								29.824
21	**Fabaceae (19)**								
205	*Archidendron clypearia*	5	7.14	5	1,420.93	0.041	0.134	0.086	0.262
206	*Archidendron microcarpum*	5	7.14	5	6,417.90	0.187	0.134	0.086	0.408
207	*Crudia reticulata*	2	2.86	2	168.27	0.005	0.054	0.034	0.093
208	*Crudia ripicola*	1	1.43	1	962.11	0.028	0.027	0.017	0.072
209	*Dialium hydnocarpoides*	1	1.43	1	547.39	0.016	0.027	0.017	0.060
210	*Dialium indum*	7	10.00	9	2,909.06	0.085	0.188	0.154	0.428
211	*Dialium platysepalum*	5	7.14	5	3,675.24	0.107	0.134	0.086	0.328
212	*Dialium* sp.	1	1.43	1	2,436.69	0.071	0.027	0.017	0.115
213	*Koompassia excelsa*	13	18.57	15	14,019.13	0.409	0.350	0.257	1.016
214	*Koompassia malaccensis*	32	45.71	76	42,828.62	1.250	0.861	1.304	3.415
215	*Milletia sericea*	2	2.86	2	193.22	0.006	0.054	0.034	0.094
216	*Parkia speciosa*	1	1.43	2	4,964.70	0.145	0.027	0.034	0.206
217	*Parkia timoriana .*	5	7.14	5	29,722.22	0.867	0.134	0.086	1.088
218	*Phitecelobium* sp.	1	1.43	1	141.03	0.004	0.027	0.017	0.048
219	*Pithecellobium microcarpum*	3	4.29	3	988.22	0.029	0.081	0.051	0.161
220	*Saraca declinata*	3	4.29	3	431.36	0.013	0.081	0.051	0.145
221	*Sindora leiocarpa*	2	2.86	2	254.63	0.007	0.054	0.034	0.096
222	*Sindora velutina*	12	17.14	17	8,645.59	0.252	0.323	0.292	0.867
223	*Uittienia modesta*	2	2.86	2	228.97	0.007	0.054	0.034	0.095
	Family Importance Value								8.995
22	**Fagaceae 12)**								
224	*Castanopsis costata*	2	2.86	2	995.29	0.029	0.054	0.034	0.117
225	*Castanopsis javanica*	1	1.43	1	1,116.28	0.033	0.027	0.017	0.077
226	*Castanopsis lucida*	1	1.43	2	732.57	0.021	0.027	0.034	0.083
227	*Castanopsis* sp.	1	1.43	1	452.39	0.013	0.027	0.017	0.057
228	*Lithocarpus blumeanus*	18	25.71	29	15,863.89	0.463	0.484	0.498	1.445
229	*Lithocarpus conocarpus*	5	7.14	5	1,545.08	0.045	0.134	0.086	0.265
230	*Lithocarpus hystrix*	2	2.86	2	2,133.34	0.062	0.054	0.034	0.150
231	*Lithocarpus* sp. 1	1	1.43	1	186.27	0.005	0.027	0.017	0.049
232	*Lithocarpus* sp. 2	1	1.43	1	769.45	0.022	0.027	0.017	0.067
233	*Lithocarpus sundaicus*	4	5.71	4	3,680.77	0.107	0.108	0.069	0.284
234	*Quercus argentata*	8	11.43	10	7,462.50	0.218	0.215	0.172	0.605
235	*Quercus gemelliflora*	2	2.86	2	475.36	0.014	0.054	0.034	0.102
	Family Importance Value								3.301
23	**Flacourtiaceae (1)**								
236	*Hydnocarpus polypetala*	23	32.86	32	5,820.27	0.170	0.619	0.549	1.338
	Family Importance Value								1.338
24	**Hypericaceae (2)**								
237	*Cratoxylon cochinchinense*	1	1.43	1	1,075.21	0.031	0.027	0.017	0.075
238	*Cratoxylon hypericinum*	5	7.14	5	4,156.45	0.121	0.134	0.086	0.342
	Family Importance Value								0.417
26	**Icacinaceae (1)**								
239	*Stemonurus* sp.	1	1.43	1	229.66	0.007	0.027	0.017	0.051
	Family Importance Value								0.051
27	**Lauraceae (51)**								
240	*Actinodaphne glomerata*	1	1.43	1	283.53	0.008	0.027	0.017	0.052
241	*Actinodaphne procera*	4	5.71	6	1,347.67	0.039	0.108	0.103	0.250
242	*Alseodaphne* sp. 1	1	1.43	1	138.93	0.004	0.027	0.017	0.048
243	*Alseodaphne* sp. 2	8	11.43	9	4,093.17	0.119	0.215	0.154	0.489
244	*Alseodaphne oblanceolata*	9	12.86	11	4,027.09	0.118	0.242	0.189	0.548
245	*Alseodaphne umbelliflora*	9	12.86	9	8,616.86	0.251	0.242	0.154	0.648
246	*Beilschmiedia glabra*	7	10.00	7	1,734.66	0.051	0.188	0.120	0.359
247	*Beilschmiedia maingayi*	20	28.57	24	5,837.79	0.170	0.538	0.412	1.120
248	*Beilschmiedia* sp. 1	1	1.43	1	349.67	0.010	0.027	0.017	0.054
249	*Beilschmiedia sp. 2*	1	1.43	1	206.12	0.006	0.027	0.017	0.050
250	*Cryptocarya crassifolia*	1	1.43	1	314.16	0.009	0.027	0.017	0.053
251	*Cryptocarya crassinervia*	3	4.29	3	892.88	0.026	0.081	0.051	0.158
252	*Cryptocarya cumingii*	1	1.43	1	193.59	0.006	0.027	0.017	0.050
253	*Cryptocarya ferrea*	1	1.43	1	219.04	0.006	0.027	0.017	0.050

No.	Family and Species	Number of Occurrence in plots	Frequency (%)	Number of Trees (in 10.5 Ha)	Basal Area (Cm2)	Relative Basal Area (%)	Relative Frequency (%)	Relative Density (%)	Importance Value
254	*Dehaasia borneensis*	1	1.43	1	444.88	0.013	0.027	0.017	0.057
255	*Dehaasia caesia*	5	7.14	5	3,377.01	0.099	0.134	0.086	0.319
256	*Dehaasia firma*	1	1.43	1	136.85	0.004	0.027	0.017	0.048
257	*Dehaasia incrassata*	2	2.86	2	255.64	0.007	0.054	0.034	0.096
258	*Dehaasia* sp.	1	1.43	1	404.71	0.012	0.027	0.017	0.056
259	*Endiandra beccariana*	5	7.14	6	1,140.00	0.033	0.134	0.103	0.271
260	*Endiandra rubescens*	18	25.71	19	7,708.87	0.225	0.484	0.326	1.035
261	*Eusideroxylon zwageri*	55	78.57	112	93,791.11	2.737	1.479	1.922	6.139
262	*Litsea accendens*	2	2.86	2	487.39	0.014	0.054	0.034	0.102
263	*Litsea angulata*	1	1.43	1	397.61	0.012	0.027	0.017	0.056
264	*Litsea crassifolia*	1	1.43	1	459.96	0.013	0.027	0.017	0.057
265	*Litsea elliptica*	11	15.71	13	6,147.83	0.179	0.296	0.223	0.698
266	*Litsea ferruginea*	10	14.29	12	8,534.30	0.249	0.269	0.206	0.724
267	*Litsea firma*	2	2.86	2	712.37	0.021	0.054	0.034	0.109
268	*Litsea grandis*	9	12.86	10	3,329.13	0.097	0.242	0.172	0.511
269	*Litsea lancifolia*	2	2.86	2	308.14	0.009	0.054	0.034	0.097
270	*Litsea mappacea*	1	1.43	1	390.57	0.011	0.027	0.017	0.055
271	*Litsea noronhae*	4	5.71	4	1,672.54	0.049	0.108	0.069	0.225
272	*Litsea resinosa*	11	15.71	16	10,845.73	0.317	0.296	0.275	0.887
273	*Litsea robusta*	1	1.43	1	314.16	0.009	0.027	0.017	0.053
274	*Litsea* sp. 1	1	1.43	1	346.36	0.010	0.027	0.017	0.054
275	*Litsea* sp. 2	1	1.43	1	637.94	0.019	0.027	0.017	0.063
276	*Litsea* sp. 3	1	1.43	1	89.92	0.003	0.027	0.017	0.047
277	*Litsea* sp. 4	1	1.43	1	102.07	0.003	0.027	0.017	0.047
278	*Litsea* sp. 5	1	1.43	1	118.82	0.003	0.027	0.017	0.048
279	*Litsea* sp. 6	1	1.43	1	183.85	0.005	0.027	0.017	0.049
280	*Litsea* sp. 7	1	1.43	1	452.39	0.013	0.027	0.017	0.057
281	*Litsea* sp. 8	1	1.43	1	471.44	0.014	0.027	0.017	0.058
282	*Litsea* sp. 9	1	1.43	1	539.13	0.016	0.027	0.017	0.060
283	*Litsea* sp. 10	1	1.43	1	725.83	0.021	0.027	0.017	0.065
284	*Litsea* sp. 11	1	1.43	1	1,152.09	0.034	0.027	0.017	0.078
285	*Litsea tomentosa*	1	1.43	1	98.52	0.003	0.027	0.017	0.047
286	*Litsea wallichii*	1	1.43	1	84.95	0.002	0.027	0.017	0.047
287	*Neolitsea cesiaefolia*	4	5.71	4	505.50	0.015	0.108	0.069	0.191
288	*Notaphoebe* sp.	1	1.43	1	237.79	0.007	0.027	0.017	0.051
289	*Notaphoebe umbelliflora*	8	11.43	10	10,307.36	0.301	0.215	0.172	0.688
290	*Phoebe laevis*	4	5.71	4	1,922.09	0.056	0.108	0.069	0.232
	Family Importance Value								17.408
28	**Lecythidaceae (5)**								
291	*Barringtonia acutangula*	1	1.43	1	286.52	0.008	0.027	0.017	0.052
292	*Barringtonia lanceolata*	7	10.00	9	4,867.72	0.142	0.188	0.154	0.485
293	*Barringtonia macrostachya*	15	21.43	19	5,246.79	0.153	0.403	0.326	0.883
294	*Barringtonia* sp.	1	1.43	1	95.03	0.003	0.027	0.017	0.047
295	*Planchonia valida*	3	4.29	3	1,047.29	0.031	0.081	0.051	0.163
	Family Importance Value								1.630
29	**Loganiaceae (1)**								
296	*Strychnos lucida*	1	1.43	1	188.69	0.006	0.027	0.017	0.050
	Family Importance Value								0.050
30	**Lythraceae (1)**								
297	*Lagerstroemia floribunda*	6	8.57	9	6,505.05	0.190	0.161	0.154	0.506
	Family Importance Value								0.506
31	**Magnoliaceae (4)**								
298	*Elmerillia tsiampacca*	2	2.86	3	430.96	0.013	0.054	0.051	0.118
299	*Magnolia candollii*	1	1.43	1	122.72	0.004	0.027	0.017	0.048
300	*Magnolia elegans*	2	2.86	2	367.57	0.011	0.054	0.034	0.099
301	*Magnolia* sp.	4	5.71	4	663.21	0.019	0.108	0.069	0.196
	Family Importance Value								0.460
32	**Melastomataceae (14)**								
302	*Memecylon beccarianum*	6	8.57	6	2,593.09	0.076	0.161	0.103	0.340
303	*Memecylon costatum*	2	2.86	2	320.27	0.009	0.054	0.034	0.097
304	*Memecylon lilacinum*	7	10.00	8	2,081.88	0.061	0.188	0.137	0.386
305	*Memecylon ovatum*	6	8.57	8	1,263.34	0.037	0.161	0.137	0.336
306	*Pternandra azurea*	3	4.29	3	357.79	0.010	0.081	0.051	0.143
307	*Pternandra caerulescens*	32	45.71	60	11,172.08	0.326	0.861	1.030	2.217

No.	Family and Species	Number of Occurrence in plots	Frequency (%)	Number of Trees (in 10.5 Ha)	Basal Area (Cm2)	Relative Basal Area (%)	Relative Frequency (%)	Relative Density (%)	Importance Value
308	*Pternandra cordata*	26	37.14	57	10,460.75	0.305	0.699	0.978	1.983
309	*Pternandra galeata*	21	30.00	25	4,376.10	0.128	0.565	0.429	1.122
310	*Pternandra latifolia*	2	2.86	2	254.01	0.007	0.054	0.034	0.096
311	*Pternandra rostrata*	14	20.00	21	2,786.40	0.081	0.377	0.360	0.818
312	*Pternandra* sp. 1	1	1.43	1	130.70	0.004	0.027	0.017	0.048
313	*Pternandra* sp. 2	1	1.43	1	86.59	0.003	0.027	0.017	0.047
314	*Pternandra* sp. 3	1	1.43	1	186.27	0.005	0.027	0.017	0.049
315	*Pternandra* sp. 4	1	1.43	1	136.85	0.004	0.027	0.017	0.048
	Family Importance Value								3.519
33	**Meliaceae (17)**								
316	*Aglaia macrocarpa*	6	8.57	13	2,514.29	0.073	0.161	0.223	0.458
317	*Aglaia odorata*	2	2.86	2	221.24	0.006	0.054	0.034	0.095
318	*Aglaia silvestris*	26	37.14	32	6,969.66	0.203	0.699	0.549	1.452
319	*Aglaia* sp.	1	1.43	1	109.36	0.003	0.027	0.017	0.047
320	*Aphanamixis polystachya*	12	17.14	15	4,866.39	0.142	0.323	0.257	0.722
321	*Chisocheton cumingianus*	1	1.43	1	143.14	0.004	0.027	0.017	0.048
322	*Chisocheton medusae*	5	7.14	6	2,331.40	0.068	0.134	0.103	0.306
323	*Chisocheton* sp.	5	7.14	1	246.06	0.007	0.134	0.017	0.159
324	*Chisocheton patens*	1	1.43	1	86.59	0.003	0.027	0.017	0.047
325	*Dysoxylum arborescens*	1	1.43	1	881.41	0.026	0.027	0.017	0.070
326	*Dysoxylum densiflorum*	2	2.86	2	364.57	0.011	0.054	0.034	0.099
327	*Dysoxyllum excelsum*	16	22.86	25	5,843.87	0.171	0.430	0.429	1.030
328	*Dysoxylum macrocarpum*	4	5.71	4	3,081.34	0.090	0.108	0.069	0.266
329	*Dysoxylum pachyrache*	4	5.71	4	598.12	0.017	0.108	0.069	0.194
330	*Kokoona littoralis*	3	4.29	3	1,641.02	0.048	0.081	0.051	0.180
331	*Lansium domesticum*	21	30.00	21	4,071.20	0.119	0.565	0.360	1.044
332	*Sandoricum borneense*	6	8.57	7	2,706.12	0.079	0.161	0.120	0.361
	Family Importance Value								6.576
34	**Monimiaceae (1)**								
333	*Kibara coriacea*	4	5.71	4	670.89	0.020	0.108	0.069	0.196
	Family Importance Value								0.196
35	**Moraceae (21)**								
334	*Artocarpus altilis*	6	8.57	6	2,939.32	0.086	0.161	0.103	0.350
335	*Artocarpus anisophyllus*	13	18.57	17	6,330.02	0.185	0.350	0.292	0.826
336	*Artocarpus champeden*	1	1.43	2	1,719.72	0.050	0.027	0.034	0.111
337	*Artocarpus dadah*	5	7.14	14	5,363.16	0.157	0.134	0.240	0.531
338	*Artocarpus kemando*	6	8.57	9	3,150.37	0.092	0.161	0.154	0.408
339	*Artocarpus longifolius*	1	1.43	1	235.06	0.007	0.027	0.017	0.051
340	*Artocarpus nitidus*	27	38.57	38	11,924.51	0.348	0.726	0.652	1.726
341	*Artocarpus rigidus*	12	17.14	16	3,729.70	0.109	0.323	0.275	0.706
342	*Artocarpus* sp. 1	8	11.43	9	7,243.06	0.211	0.215	0.154	0.581
343	*Artocarpus* sp.2	1	1.43	1	174.37	0.005	0.027	0.017	0.049
344	*Artocarpus tamara*	1	1.43	1	664.10	0.019	0.027	0.017	0.063
345	*Ficus ampelas*	1	1.43	1	130.70	0.004	0.027	0.017	0.048
346	*Ficus aurata*	2	2.86	2	211.76	0.006	0.054	0.034	0.094
347	*Ficus crassiramica*	1	1.43	1	136.85	0.004	0.027	0.017	0.048
348	*Ficus* sp. 1	2	2.86	2	295.98	0.009	0.054	0.034	0.097
349	*Ficus* sp. 2	2	2.86	2	463.40	0.014	0.054	0.034	0.102
350	*Ficus sumatrana*	3	4.29	3	327.63	0.010	0.081	0.051	0.142
351	*Ficus sundaica*	2	2.86	2	335.08	0.010	0.054	0.034	0.098
352	*Ficus variegata*	1	1.43	1	160.61	0.005	0.027	0.017	0.049
353	*Ficus xanthophylla*	4	5.71	4	3,609.92	0.105	0.108	0.069	0.282
	Family Importance Value								6.363
36	**Myristicaceae (33)**								
354	*Gymnacranthera contracta*	36	51.43	69	21,616.58	0.631	0.968	1.184	2.784
355	*Gymnacranthera* sp. 1	1	1.43	1	363.05	0.011	0.027	0.017	0.055
356	*Gymnacranthera* sp. 2	1	1.43	1	498.76	0.015	0.027	0.017	0.059
357	*Gymnacranthera* sp. 3	1	1.43	1	257.30	0.008	0.027	0.017	0.052
358	*Horsfieldia bracteosa*	18	25.71	27	10,393.08	0.303	0.484	0.463	1.251
359	*Horsfieldia crassifolia*	1	1.43	1	2,463.01	0.072	0.027	0.017	0.116
360	*Horsfieldia glabra*	20	28.57	32	14,414.24	0.421	0.538	0.549	1.508
361	*Horsfieldia grandis*	10	14.29	12	1,783.58	0.052	0.269	0.206	0.527
362	*Horsfieldia irya*	2	2.86	4	1,863.20	0.054	0.054	0.069	0.177
363	*Horsfieldia punctatifolia*	13	18.57	25	9,126.34	0.266	0.350	0.429	1.045

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364	*Horsfieldia* sp. 1	1	1.43	1	254.47	0.007	0.027	0.017	0.051
365	*Horsfieldia* sp. 2	1	1.43	1	206.12	0.006	0.027	0.017	0.050
366	*Horsfieldia* sp. 3	1	1.43	1	153.94	0.004	0.027	0.017	0.049
367	*Horsfieldia* sp. 4	1	1.43	1	176.71	0.005	0.027	0.017	0.049
368	*Knema cinerea*	28	40.00	72	21,642.47	0.632	0.753	1.236	2.621
369	*Knema conferta*	24	34.29	42	10,594.10	0.309	0.646	0.721	1.676
370	*Knema latericia*	19	27.14	24	5,754.04	0.168	0.511	0.412	1.091
371	*Knema latifolia*	4	5.71	6	1,248.47	0.036	0.108	0.103	0.247
372	*Knema laurina*	9	12.86	13	2,643.36	0.077	0.242	0.223	0.542
373	*Knema lunduensis*	23	32.86	29	7,643.17	0.223	0.619	0.498	1.339
374	*Knema percoriacea*	8	11.43	13	2,975.00	0.087	0.215	0.223	0.525
375	*Knema* sp. 1	1	1.43	1	283.53	0.008	0.027	0.017	0.052
376	*Knema* sp. 2	1	1.43	1	467.59	0.014	0.027	0.017	0.058
377	*Knema* sp. 3	1	1.43	1	514.72	0.015	0.027	0.017	0.059
378	*Knema* sp. 4	1	1.43	1	376.68	0.011	0.027	0.017	0.055
379	*Knema* sp. 5	1	1.43	1	452.39	0.013	0.027	0.017	0.057
380	*Knema* sp. 6	1	1.43	1	174.37	0.005	0.027	0.017	0.049
381	*Myristica gaulterifolia*	19	27.14	25	10,447.70	0.305	0.511	0.429	1.245
382	*Myristica iners*	2	2.86	2	286.07	0.008	0.054	0.034	0.096
383	*Myristica lanceifolia*	1	1.43	1	339.79	0.010	0.027	0.017	0.054
384	*Myristica maxima*	4	5.71	5	1,198.73	0.035	0.108	0.086	0.228
385	*Myristica* sp.	1	1.43	1	176.71	0.005	0.027	0.017	0.049
386	*Myristica villosa*	3	4.29	4	583.19	0.017	0.081	0.069	0.166
	Family Importance Value								7.572
37	**Myrsinaceae (1)**								
387	*Ardisia* sp.	1	1.43	1	105.68	0.003	0.027	0.017	0.047
	Family Importance Value								0.047
38	**Myrtaceae (59)**								
388	*Cleistocalyx operculata*	1	1.43	1	441.15	0.013	0.027	0.017	0.057
389	*Eugenia acuminatissima*	7	10.00	12	3,825.07	0.112	0.188	0.206	0.506
390	*Eugenia acutangula*	35	50.00	62	22,772.72	0.665	0.941	1.064	2.670
391	*Eugenia albidiramea*	10	14.29	15	9,549.71	0.279	0.269	0.257	0.805
392	*Eugenia aquea*	3	4.29	4	884.95	0.026	0.081	0.069	0.175
393	*Eugenia beccarii*	2	2.86	2	2,140.21	0.062	0.054	0.034	0.151
394	*Eugenia boerlagei*	6	8.57	9	4,743.91	0.138	0.161	0.154	0.454
395	*Eugenia bruneorhamea*	5	7.14	6	1,066.18	0.031	0.134	0.103	0.269
396	*Eugenia corymbosa*	21	30.00	38	15,267.54	0.446	0.565	0.652	1.663
397	*Eugenia decipiens*	4	5.71	8	2,846.91	0.083	0.108	0.137	0.328
398	*Eugenia densiflora*	1	1.43	1	176.71	0.005	0.027	0.017	0.049
399	*Eugenia densinervia*	2	2.86	2	745.47	0.022	0.054	0.034	0.110
400	*Eugenia excelsa*	1	1.43	1	706.86	0.021	0.027	0.017	0.065
401	*Eugenia fastigiata*	25	35.71	40	17,213.92	0.502	0.672	0.687	1.861
402	*Eugenia jamboloides*	8	11.43	9	4,955.50	0.145	0.215	0.154	0.514
403	*Eugenia lanceolata*	1	1.43	1	191.18	0.006	0.027	0.017	0.050
404	*Eugenia lineata*	7	10.00	7	1,151.49	0.034	0.188	0.120	0.342
405	*Eugenia ochneocarpa*	17	24.29	25	10,150.70	0.296	0.457	0.429	1.183
406	*Eugenia oleosa* F. Muell.	9	12.86	20	11,454.01	0.334	0.242	0.343	0.920
407	*Eugenia opaca* K. & V.	13	18.57	16	5,807.38	0.169	0.350	0.275	0.794
408	*Eugenia operculata*	1	1.43	1	441.15	0.013	0.027	0.017	0.057
409	*Eugenia rostrata* Bedd. *ex* Dut	2	2.86	2	617.52	0.018	0.054	0.034	0.106
410	*Eugenia* sp. 1	4	5.71	4	854.31	0.025	0.108	0.069	0.201
411	*Eugenia* sp. 2	3	4.29	6	2,111.62	0.062	0.081	0.103	0.245
412	*Eugenia sp.* 3	7	10.00	10	5,842.20	0.171	0.188	0.172	0.530
413	*Eugenia sp.* 4	1	1.43	2	465.31	0.014	0.027	0.034	0.075
414	*Eugenia sp.* 5	4	5.71	1	394.28	0.012	0.108	0.017	0.136
415	*Eugenia* sp. 6	1	1.43	1	83.32	0.002	0.027	0.017	0.046
416	*Eugenia* sp. 7	1	1.43	1	98.52	0.003	0.027	0.017	0.047
417	*Eugenia* sp. 8	1	1.43	1	109.36	0.003	0.027	0.017	0.047
418	*Eugenia* sp. 9	1	1.43	1	124.69	0.004	0.027	0.017	0.048
419	*Eugenia* sp. 10	1	1.43	1	136.85	0.004	0.027	0.017	0.048
420	*Eugenia* sp. 11	1	1.43	1	143.14	0.004	0.027	0.017	0.048
421	*Eugenia* sp. 12	1	1.43	1	151.75	0.004	0.027	0.017	0.048
422	*Eugenia* sp. 13	1	1.43	1	206.12	0.006	0.027	0.017	0.050
423	*Eugenia* sp. 14	1	1.43	1	268.80	0.008	0.027	0.017	0.052
424	*Eugenia* sp. 15	1	1.43	1	352.99	0.010	0.027	0.017	0.054
425	*Eugenia* sp. 16	1	1.43	1	397.61	0.012	0.027	0.017	0.056
426	*Eugenia* sp. 17	1	1.43	1	452.39	0.013	0.027	0.017	0.057

No.	Family and Species	Number of Occurrence in plots	Frequency (%)	Number of Trees (in 10.5 Ha)	Basal Area (Cm2)	Relative Basal Area (%)	Relative Frequency (%)	Relative Density (%)	Importance Value
427	*Eugenia* sp. 18	1	1.43	1	530.93	0.015	0.027	0.017	0.060
428	*Eugenia* sp. 19	1	1.43	1	660.52	0.019	0.027	0.017	0.063
429	*Eugenia* sp. 20	1	1.43	1	730.62	0.021	0.027	0.017	0.065
430	*Eugenia* sp. 21	1	1.43	1	764.54	0.022	0.027	0.017	0.066
431	*Eugenia* sp. 22	1	1.43	1	907.92	0.026	0.027	0.017	0.071
432	*Eugenia* sp. 23	1	1.43	1	907.92	0.026	0.027	0.017	0.071
433	*Eugenia* sp. 24	1	1.43	1	951.15	0.028	0.027	0.017	0.072
434	*Eugenia* sp. 25	1	1.43	1	1,029.22	0.030	0.027	0.017	0.074
435	*Eugenia* sp. 26	1	1.43	1	1,640.30	0.048	0.027	0.017	0.092
436	*Eugenia sp.* 27	1	1.43	1	83.32	0.002	0.027	0.017	0.046
437	*Eugenia sp.* 28	1	1.43	1	98.52	0.003	0.027	0.017	0.047
438	*Eugenia sp.* 29	1	1.43	1	109.36	0.003	0.027	0.017	0.047
439	*Eugenia* sp. 30	1	1.43	1	124.69	0.004	0.027	0.017	0.048
440	*Eugenia suringariana*	19	27.14	43	22,042.61	0.643	0.511	0.738	1.892
441	*Rhodamnia cinerea*	7	10.00	8	3,765.40	0.110	0.188	0.137	0.435
442	*Rhodamnia* sp. 1	1	1.43	1	172.03	0.005	0.027	0.017	0.049
443	*Syzygium aqueum*	1	1.43	1	114.99	0.003	0.027	0.017	0.047
444	*Syzygium corymbosum*	1	1.43	1	226.98	0.007	0.027	0.017	0.051
445	*Tristaniopsis obovata*	1	1.43	1	260.16	0.008	0.027	0.017	0.052
446	*Tristanopsis whiteana*	4	5.71	7	3,347.54	0.098	0.108	0.120	0.325
	Family Importance Value								14.918
38	**Ochnaceae (1)**								
447	*Gomphia serrata*	3	4.29	4	3,252.70	0.095	0.081	0.069	0.244
	Family Importance Value								0.244
39	**Olacaceae (5)**								
448	*Anacolosa frutescens*	1	1.43	1	201.06	0.006	0.027	0.017	0.050
449	*Ochanostachys amentacea*	40	57.14	72	25,596.86	0.747	1.076	1.236	3.059
450	*Scorodacarpus borneensis*	12	17.14	17	7,612.93	0.222	0.323	0.292	0.837
451	*Strombosia ceylanica*	2	2.86	2	535.05	0.016	0.054	0.034	0.104
452	*Strombosia javanica*	4	5.71	4	1,298.09	0.038	0.108	0.069	0.214
	Family Importance Value								4.263
40	**Oxalidaceae (1)**								
453	*Sarcotheca glauca*	1	1.43	1	498.76	0.015	0.027	0.017	0.059
	Family Importance Value								0.059
41	**Podocarpaceae (1)**								
454	*Nageia wallichiana*	3	4.29	4	1,208.91	0.035	0.081	0.069	0.185
	Family Importance Value								0.185
42	**Polygalaceae (8)**								
455	*Xanthophyllum adenotus*	1	1.43	1	263.02	0.008	0.027	0.017	0.052
456	*Xanthophyllum affine*	2	2.86	2	571.78	0.017	0.054	0.034	0.105
457	*Xanthophyllum scortechinii*	10	14.29	12	7,025.07	0.205	0.269	0.206	0.680
458	*Xanthophyllum* sp.1	1	1.43	1	1,562.28	0.046	0.027	0.017	0.090
459	*Xanthophyllum* sp. 2	1	1.43	1	143.14	0.004	0.027	0.017	0.048
460	*Xanthophyllum* sp. 3	1	1.43	1	598.28	0.017	0.027	0.017	0.062
461	*Xanthophyllum* sp. 4	1	1.43	1	3,631.68	0.106	0.027	0.017	0.150
462	*Xanthophyllum stipitatum*	11	15.71	13	4,704.18	0.137	0.296	0.223	0.656
	Family Importance Value								1.842
43	**Proteaceae (2)**								
463	*Helicia robusta*	1	1.43	1	224.32	0.007	0.027	0.017	0.051
464	*Heliciopsis incisa*	1	1.43	1	229.66	0.007	0.027	0.017	0.051
	Family Importance Value								0.101
44	**Rhamnaceae (1)**								
465	*Zizyphus angustifolius*	4	5.71	4	4,146.51	0.121	0.108	0.069	0.297
	Family Importance Value								0.297
45	**Rhizophoraceae (3)**								
466	*Carallia brachiata*	6	8.57	8	7,184.41	0.210	0.161	0.137	0.508
467	*Pelacalyx axilaris*	4	5.71	5	3,632.48	0.106	0.108	0.086	0.299
468	*Pellacalyx lobbii*	5	7.14	1	804.25	0.023	0.134	0.017	0.175
	Family Importance Value								0.983

No.	Family and Species	Number of Occurrence in plots	Frequency (%)	Number of Trees (in 10.5 Ha)	Basal Area (Cm2)	Relative Basal Area (%)	Relative Frequency (%)	Relative Density (%)	Importance Value
46	**Rosaceae (4)**								
469	*Licania splendens*	27	38.57	27	27,448.19	0.801	0.726	0.463	1.991
470	*Prunus arborea*	10	14.29	10	4,280.74	0.125	0.269	0.172	0.566
471	*Prunus beccarii*	13	18.57	15	3,070.82	0.090	0.350	0.257	0.697
472	*Prunus* sp. 1	1	1.43		240.53	0.007	0.027	0.000	0.034
473	*Prunus* sp. 2	1	1.43	1	3,216.99	0.094	0.027	0.017	0.138
	Family Importance Value						-		1.434
47	**Rubiaceae (22)**								
474	*Adina minutiflora*	5	7.14	5	6,614.45	0.193	0.134	0.086	0.413
475	*Anthocephalus cadamba*	20	28.57	28	98,044.19	2.861	0.538	0.481	3.880
476	*Gardenia forsteniana*	4	5.71	4	1,163.60	0.034	0.108	0.069	0.210
477	*Gardenia* sp.	1	1.43	1	349.67	0.010	0.027	0.017	0.054
478	*Gardenia tubifera* .	1	1.43	1	268.80	0.008	0.027	0.017	0.052
479	*Ixora .grandifolia*	3	4.29	4	395.95	0.012	0.081	0.069	0.161
480	*Lasianthus* sp.	1	1.43	1	145.27	0.004	0.027	0.017	0.048
481	*Nauclea junghuhnii*	2	2.86	2	516.50	0.015	0.054	0.034	0.103
482	*Nauclea* sp.	1	1.43	1	201.06	0.006	0.027	0.017	0.050
483	*Nauclea subdita*	1	1.43	2	714.43	0.021	0.027	0.034	0.082
484	*Petunga* sp.	1	1.43	1	196.07	0.006	0.027	0.017	0.050
485	*Porterandia anisophylla* .	10	14.29	10	2,952.47	0.086	0.269	0.172	0.527
486	*Randia* sp.	1	1.43	1	314.16	0.009	0.027	0.017	0.053
487	*Tarenna winkleri*	3	4.29	3	1,075.01	0.031	0.081	0.051	0.164
488	*Timonius flavescens*	7	10.00	7	1,664.09	0.049	0.188	0.120	0.357
489	*Timonius sericeus*	2	2.86	2	1,082.48	0.032	0.054	0.034	0.120
490	*Tricalysia malaccensis*	1	1.43	1	93.31	0.003	0.027	0.017	0.047
491	*Tricalysia singularis*	3	4.29	3	320.17	0.009	0.081	0.051	0.142
492	*Urophyllum arboreum*	5	7.14	5	1,119.94	0.033	0.134	0.086	0.253
493	*Urophyllum borneensis*	2	2.86	2	282.03	0.008	0.054	0.034	0.096
494	*Urophyllum corymbosum*	2	2.86	2	268.05	0.008	0.054	0.034	0.096
495	*Urophyllum polyneurum*	12	17.14	23	2,867.25	0.084	0.323	0.395	0.801
	Family Importance Value								7.759
48	**Sabaiaceae (1)**								
496	*Meliosma sumatrana*	5	7.14	5	2,767.26	0.081	0.134	0.086	0.301
	Family Importance Value								0.301
49	**Santalaceae (1)**								
497	*Scleropyrum wallichianum*	5	7.14	5	1,237.81	0.036	0.134	0.086	0.256
	Family Importance Value								0.256
50	**Sapindaceae (13)**								
498	*Allophylus cobe*	1	1.43	1	162.86	0.005	0.027	0.017	0.049
499	*Didymocarpus* sp.	1	1.43	1	226.98	0.007	0.027	0.017	0.051
500	*Didymocarpus longan*	7	10.00	7	930.20	0.027	0.188	0.120	0.336
501	*Guioa* sp.	1	1.43	1	183.85	0.005	0.027	0.017	0.049
502	*Nephelium cuspidatum*	4	5.71	4	539.34	0.016	0.108	0.069	0.192
503	*Nephelium lappaceum*	4	5.71	4	635.56	0.019	0.108	0.069	0.195
504	*Nephelium maingayi*	1	1.43	1	122.72	0.004	0.027	0.017	0.048
505	*Nephelium ramboutan-ake*	5	7.14	5	2,089.81	0.061	0.134	0.086	0.281
506	*Paranephelium* sp.	1	1.43	1	141.03	0.004	0.027	0.017	0.048
507	*Pometia pinnata*	14	20.00	17	3,697.80	0.108	0.377	0.292	0.776
508	*Rhysotoechia acuminata*	1	1.43	1	543.25	0.016	0.027	0.017	0.060
509	*Xerospermum laevigatum*	2	2.86	2	613.26	0.018	0.054	0.034	0.106
510	*Xerospermum xanthophyllum*	3	4.29	4	1,460.11	0.043	0.081	0.069	0.192
	Family Importance Value								2.383
51	**Sapotaceae (16)**								
511	*Chrysophyllum lanceolatum*	1	1.43	1	576.80	0.017	0.027	0.017	0.061
512	*Ganua motleyana*	24	34.29	101	92,233.50	2.692	0.646	1.734	5.071
513	*Madhuca ligulata*	1	1.43	2	2,116.49	0.062	0.027	0.034	0.123
514	*Madhuca magnifolia*	6	8.57	7	8,087.12	0.236	0.161	0.120	0.518
515	*Madhuca malaccensis* (	1	1.43	3	1,620.98	0.047	0.027	0.051	0.126
516	*Madhuca motleyana*	3	4.29	4	3,721.56	0.109	0.081	0.069	0.258
517	*Madhuca sericea*	44	62.86	80	21,007.02	0.613	1.183	1.373	3.170
518	*Madhuca sessiliflora*	1	1.43	1	130.70	0.004	0.027	0.017	0.048
519	*Palaquium calophyllum*	10	14.29	14	6,978.71	0.204	0.269	0.240	0.713
520	*Palaquium dasyphyllum*	22	31.43	32	9,954.55	0.291	0.592	0.549	1.432
521	*Palaquium ferox*	10	14.29	12	9,806.05	0.286	0.269	0.206	0.761

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522	*Palaquium rostratum*	26	37.14	41	12,565.50	0.367	0.699	0.704	1.770
523	*Palaquium sericeum*	3	4.29	3	413.71	0.012	0.081	0.051	0.144
524	*Palaquium* sp.	1	1.43	1	1,590.43	0.046	0.027	0.017	0.090
525	*Payena lucida*	15	21.43	20	8,807.83	0.257	0.403	0.343	1.004
526	*Payena sericea*	1	1.43	1	107.51	0.003	0.027	0.017	0.047
	Family Importance Value								15.335
52	**Simarubaceae (1)**								
527	*Irvingia malayana*	5	7.14	5	4,917.83	0.144	0.134	0.086	0.364
	Family Importance Value								
53	**Sonneratiaceae (1)**								
528	*Duabanga moluccana*	1	1.43	1	122.72	0.004	0.027	0.017	0.048
	Family Importance Value								0.048
54	**Sterculiaceae (9)**								
529	*Heritiera javanica*	1	1.43	1	176.71	0.005	0.027	0.017	0.049
530	*Heritiera littoralis*	8	11.43	8	3,001.48	0.088	0.215	0.137	0.440
531	*Heritiera simplicifolia*	6	8.57	6	3,826.99	0.112	0.161	0.103	0.376
532	*Pterocymbium tubulatum*	8	11.43	8	1,943.91	0.057	0.215	0.137	0.409
533	*Pterygota* sp.	2	2.86	2	3,079.08	0.090	0.054	0.034	0.178
534	*Scaphium macropodum*	20	28.57	26	165,001.32	4.816	0.538	0.446	5.800
535	*Sterculia gilva*	4	5.71	5	2,058.76	0.060	0.108	0.086	0.253
536	*Sterculia rubiginosa*	7	10.00	7	2,062.43	0.060	0.188	0.120	0.369
537	*Sterculia* sp.1	1	1.43	1	136.85	0.004	0.027	0.017	0.048
	Family Importance Value								7.923
55	**Symplocaceae (1)**								
538	*Symplocos odorartissima*	1	1.43	1	100.29	0.003	0.027	0.017	0.047
	Family Importance Value								0.047
56	**Theaceae (3)**								
539	*Schima wallichii*	5	7.14	5	4,723.370	0.138	0.134	0.086	0.358
540	*Tetramerista glabra*	8	11.43	11	18,722.63	0.546	0.215	0.189	0.950
541	*Thea* sp.	1	1.43	1	80.12	0.002	0.027	0.017	0.046
	Family Importance Value								1.309
57	**Thymelaeaceae (4)**								
542	*Aquilaria malaccensis*	22	31.43	30	18,030.69	0.526	0.592	0.515	1.633
543	*Gonystylus forbesii*	1	1.43	1	113.10	0.003	0.027	0.017	0.047
544	*Gonystylus macrophyllus*	7	10.00	7	1,530.18	0.045	0.188	0.120	0.353
545	*Gonystylus velutinus*	4	5.71	4	1,242.89	0.036	0.108	0.069	0.213
	Family Importance Value								2.246
58	**Tiliaceae (4)**								
546	*Microcos crassifolia*	3	4.29	3	403.18	0.012	0.081	0.051	0.144
547	*Microcos hirsuta*	2	2.86	2	202.39	0.006	0.054	0.034	0.094
548	*Pentace laxiflora*	21	30.00	30	9,843.85	0.287	0.565	0.515	1.367
549	*Pentace triptera*	1	1.43	1	174.37	0.005	0.027	0.017	0.049
	Family Importance Value								1.654
59	**Ulmaceae (2)**								
550	*Gironniera nervosa*	26	37.14	54	19,101.88	0.557	0.699	0.927	2.184
551	*Gironniera subaequalis*	1	1.43	1	237.79	0.007	0.027	0.017	0.051
	Family Importance Value								2.235
		1	1.43	1	298.65	0.009	0.027	0.017	0.053
60	***Urticaceae*** **(1)**								
552	*Poikilospermum suaveolens*	1	143.00	1	298.65	0.009	0.027	0.017	0.053
	Family Importance Value								0.053
61	**Verbenaceae (2)**								
553	*Teijsmanniodendron bogoriense*	2	2.86	2	4,183.23	0.122	0.054	0.034	0.210
554	*Teijsmanniodendron coriaceum*	1	1.43	1	81.71	0.002	0.027	0.017	0.046
	Family Importance Value								0.257
62	**Violaceae (1)**								
555	*Rinorea benghalensis*	17	24.29	28	13,946.90	0.407	0.457	0.481	1.345
	Family Importance Value								1.345
	TOTAL	3,762	5,515.86	5,848	3,500,424.54	102.162	101.187	100.378	303.726

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