A TREE SPECIES INVENTORY IN A ONE-HECTARE PLOT AT THE BATANG GADIS NATIONAL PARK, NORTH SUMATRA, INDONESIA

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ABSTRACT
KARTAWINATA, KUSWATA; SAMSOEDIN, ISMAYADI; HERIYANTO, M. AND AFRIASTINI, J. J. 2004. A tree species inventory in a one-hectare plot at the Batang Gadis National Park, North Sumatra, Indonesia. Reinwardtia 12 (2): 145 – 157. The results of the inventory of trees with DBH ≥ 10 cm shows that 184 species in 41 families, represented by 583 individuals with the total basal areas of 40.56 m² occurred in the one-hectare plot sampled. Together with the saplings and shrubs the number of species was 240 belonging to 47 families. The forest is richer in tree species than other lowland forests in North Sumatra, but poorer than those in Borneo and the Malay Peninsula. Dipterocarps constituted 18.42 % of total species with basal area of 18.99 m² or 46.82 % of the total basal area in the plot. The most prominent species was Shorea gibbosa. Hopea nigra, reported to be rare in Bangka and Belitung, occurred here as one of the ten leading species. The species-area curve shows that a considerable number of additional species was encountered more or less steadily up to one hectare and there was no indication of levelling off. A simulated profile diagram shows the forest may be stratified into five layers: (1) emergent layer, (2) upper canopy, (3) middle canopy, (4) lower canopy and (5) ground canopy. Dipterocarps were leading species in the emergent layer, upper canopy and middle canopy. Only 82 species were regenerating as represented by their presence in the sapling stage ranging from 5 to 50 plants/hectare. Macaranga lowii King ex Hook. f. dominated the section which seemed to be previously occupied by gaps.

Key words: Inventory, forest, species richness, dipterocarps, structure, regeneration, North Sumatra.

ABSTRAK
KARTAWINATA, KUSWATA; SAMSOEDIN, ISMAYADI; HERIYANTO, M. AND AFRIASTINI, J.J. 2004. Inventarisasi jenis-jenis pohon pada plot satu hektar di Taman Nasional Batang Gadis, Sumatra Utara, Indonesia. Reinwardtia 12 (2): 145 – 157. Hasil inventarisasi pohon dengan diameter setinggi dada ≥ 10 cm menunjukkan bahwa 184 jenis dalam 41 suku, yang diwakili oleh 583 pohon dengan luas bidang dasar total 40.56 m² terdapat dalam plot satu hektar yang dicukup. Bersama-sama dengan belda dan perdu tercatat 240 jenis yang termasuk 47 suku. Jenis-jenis pohon di hutan ini lebih kaya daripada di hutan pamah lain di Sumatera Utara, tetapi lebih miskin daripada di Borneo dan Semenanjung Malaya. Jenis-jenis Dipterocarpaceae mencakup 18.42 % dari semua jenis dengan luas bidang dasar 18.99 m² atau 46.82 % dari luas bidang dasar total dalam plot. Jenis yang menonjong adalah Shorea gibbosa. Hopea nigra yang dilaporkan jarang dan hanya tercatat di Bangka dan Belitung termasuk salah satu dari 10 jenis utama di sini. Kurva jenis-luas menunjukkan bahwa penambahan jenis yang cukup tinggi dapat dilihat sampai luas satu hektar dan tidak menunjukkan tanda-tanda mulai mendatar. Berdasarkan diagram profil simulasi dapat dibuat stratifikasi hutan sebagai berikut: (1) lapisan mencuat, (2) kanopi atas, (3) kanopi

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tengah, (4) kanopi bawah dan (5) kanopi dasar. Jenis-jenis Dipterocarpaceae menonjol pada lapisan mencuat, kanopi atas dan kanopi tengah. Regenerasi hanya terdapat pada 82 jenis seperti ditunjukkan oleh kehadirannya dalam fase bela yang berkisar dari 5 sampai 50 tumbuhan/hektar. Macaranga lowii King ex Hook. f. mendominasi bagian plot yang tampaknya sebelumnya berupa rumpang.

Kata kunci: Inventarisasi, hutan, kekayaan jenis, Dipterocarpaceae, struktur, regenerasi, Sumatera Utara.

INTRODUCTION

Only a relatively few studies on tree species composition of forests have been undertaken in North Sumatra, Indonesia. Some of them have been published including those of Abdulhadi (1991) and Abdulhadi et al. (1984, 1987, 1989a, 1989b, 1991). The present study was conducted in February and March of 2004 as part of biological inventories in the Batang Gadis National Park. The purpose of the present paper is to provide information about tree species richness, frequency, density dominance based on a one-hectare sample in a portion of the park not previously reported in this fashion.

STUDY SITE AND METHOD

The Batang Gadis National Park was established on 29 April 2004 by the decree of the Minister of Forestry No. SK.126/Menhut-II/2004, based on the wish of the local community and the local government. It covers a total area of 108,000 ha in the District of the Mandailing-Natal (Madina), the Province of North Sumatra. It is located between 99°12'45" and 99°47'45" East and between 0°27'15" and 1°01'57" North at the altitude between 300 and 2,145 m a.s.l. (above sea level) with the highest point at the top of the volcanic Mount Sorik Merapi (Sulistiowati & Perbatakusumah 2004). The area is partly mountainous with about 50% are slopes of more than 40% and covers also lowland, swamps, and alluvial fans. Figure 1 shows the map of the National Park and its surrounding area. Geologically the area consists of the pre-tertiary Kuantan formation, which comprised metamorphic rocks and alluvial deposits dominated by sand and gravels (M. N. S Rock cited by Perbatakusumah, unpublished). The nearest rainfall stations (Table 1) showed at Muara Soma the mean annual rainfall of 4004 mm with the highest in November (463 mm) and the lowest in June (178 mm), at Kotanopan 2374 mm with the highest in April (256 mm) and the lowest in July (96 mm) and at Panyabungan (222 m a.s.l.) 1553 mm with the highest in November (191 mm) and the lowest in June (65 mm) and July (65 mm), which were based on long-term observations ranging from 27 to 60 years (Berlage 1949).

The one-hectare plot sampled was in the form of a 100 x 100 m quadrat and was selected because it was far from any particular settlement so that it is not disturbed by the cutting of trees or collecting of non-timber forest products such as rattans. The plot was established in a primary forest with a canopy cover of about 70-80% at Aek Nangali on a sloping convex ridge at 99°27’23” East and 0°36’94” N and altitude of 660 m a.s.l. The plot was divided into 25 subplots of 20 x 20 m each, where the data on frequency of species were derived, trees with a DBH of 10 cm and greater were marked and enumerated, measured for their diameters and heights and identified. Voucher specimens which were mostly sterile were collected for further identification at the Herbarium Bogoriense at Bogor. Nomenclature followed Whitmore & Tantra (1986) and Steenis et al. (1949 – 2004). Plants with diameters of 5 – 9.99 cm were considered saplings or shrubs (those with clumped stems) and were enumerated, measured and identified in five randomly selected subplots.
Table 1. The mean monthly rainfall (January to December) and mean annual rainfall at Muara Soma, Kotanopan and Panyabungan, Mandailing-Natal District.

| Locality                  | Mean Monthly Rainfall (mm) | Mean Annual Rainfall (mm) |
|---------------------------|----------------------------|---------------------------|
| Muara Soma (500 m a.s.l.) | J 303 F 289 M 347 A 442 M 253 J 178 A 203 J 302 | A 363 S 441 O 463 N 414 D 4004 |
| Kotanopan (433 m a.s.l.)  | J 220 F 184 M 218 A 256 M 167 J 114 A 96 J 161 | A 190 S 272 O 246 N 250 D 2374 |
| Panyabungan (222 m a.s.l.)| J 141 F 103 M 150 A 149 M 110 J 65 A 65 J 110 | A 138 S 178 O 191 N 153 D 1553 |

Source: (Berlage 1949)

**RESULTS AND DISCUSSION**

**Composition**

The results of the inventory of trees with DBH of 10 cm and greater shows that 184 species in 41 families, represented by 583 individuals with the total basal areas of 40.56 m² occurred in the one-hectare plot sampled. Of these 184 species, 150 were identified down to specific level, 30 to generic level, three to family level and one was unidentified even to family level. Together with the saplings and shrubs the number of species was 240 belonging to 47 families. Appendix 1 lists all species of trees with DBH ≥ 10 cm by family and shows densities, relative densities, frequencies, relative frequencies, basal areas, relative basal areas and Importance Values (IV). They were calculated following the standard procedure as discussed by Mueller-Dombois and Ellenberg (1974). The Total Species Important Values for a Family (TSIVF) indicate the family importance value, based on the sum of IVs of all species for in a family, which is different from the Family Importance Value of Mori et al. (1983) those in Borneo and the Malay Peninsula; while tree densities were higher than those in Ketambe (North Sumatra), Bukit Lagong and Sungai Menyala (the Malay Peninsula), and Ladan and Belalong (Brunei), but lower than those in Malinau and Sebulu (East Kalimantan), Gunung Mulu (Sarawak) and Andulau (Brunei).

Table 2. Compositional and structural characteristics of a one-hectare plot of a lowland forest at the Batang Gadis National Park

| Forest characteristics | Dipterocarp | Non Dipterocarp |
|------------------------|-------------|-----------------|
| Number of species      | 16 (8.70 %) | 168 (91.30 %)   |
| Density                | 122 (20.93 %) | 461 (79.07 %)   |
| Basal area (m²)        | 18.99 (46.82 %) | 21.57 (53.18 %)  |
| Importance Value       | 84.24 (28.08 %) | 215.76 (71.92 %)  |

Table 3. Comparison of densities and number of species in the present studies with those conducted in Sumatra, Malay Peninsula and Borneo.

| Locality                  | Alt (m) | Plot size (ha) | Mean Density (tree/ha) | No of species | Source                  |
|---------------------------|---------|----------------|------------------------|--------------|-------------------------|
| East Kalimantan           |         |                |                        |              |                         |
| Malinau                   |         |                |                        |              |                         |
| Sebulu                    |         |                |                        |              |                         |
| Ketambe 1                 | 100     | 1.0            | 759                    | 221          | Kartawinata (unpublished)|
| Ketambe 2                 | 100     | 1.0            | 640                    | 211          | Ismayadi (unpublished)   |
| Ketambe 3                 | 70      | 1.0            | 592                    | 276          | Sukardjo et al. (1990)  |
| North Sumatra             |         |                |                        |              |                         |
| Ketambe 1                 | 250     | 1.0            | 550                    | 231          | Poulsen et al. (1996)   |
| Ketambe 2                 | 70      | 0.96           | 480                    | 194          | Davies & Becker (1996)  |
| Ketambe 3                 | 60      | 0.96           | 396                    | 256          | Davies & Becker (1996)  |
| Batang Gadis              | 460-550 | 2              | 494                    | 232          | Manokaran & Swaine (1994) |
| Sungai Menyala            | 30      | 2              | 476.5                  | 232          | Manokaran & Swaine (1994) |

Table 4. Ten most common families according to the Total Species Importance Values for Families (TSIV) in a one-hectare plot of a lowland forest at the Batang Gadis National Park

| No. | Family            | TSIV |
|-----|-------------------|------|
| 1   | Dipterocarpaceae  | 84.24|
| 2   | Euphorbiaceae     | 31.97|
| 3   | Burseraceae       | 24.11|
| 4   | Myrtaceae         | 15.89|
| 5   | Fabaceae          | 13.72|
| 6   | Lauraceae         | 11.62|
| 7   | Sapotaceae        | 11.51|
| 8   | Myristicaceae     | 9.73 |
| 9   | Moraceae          | 9.09 |
| 10  | Clusiaceae        | 7.44 |

Total 219.32 (73.11 %)
Table 4 indicates ten most common families according to the Total Species Important Values for Families (TSIVF). It can be noted that the *Dipterocarpaceae* was dominant showing TSIVF of 84.24 or 28.08 % of the total and Basal Area of 21.57 m² or 53.18 % of the total (Table 2, Table 4 and Appendix 1). Table 4 reveals ten leading species indicating also the prominence of the dipterocarp species. Altogether 16 species of dipterocarps were recorded in the one hectare plot with the density of 122 and basal area of 18.99 m² (Table 2, Appendix 1). It is interesting to note that *Hopea nigra*, which was reported to occur only Bangka and Belitung (Ashton 1982) was relatively common here with density of 14 trees/ha and frequency of 44 % and was well represented in the sapling stage also (Table 7, 9).

**Table 5. Ten leading tree species based on Importance Value (IV) in a one-hectare plot of a lowland forest at the Batang Gadis National Park.**

| No. | Species                  | IV    |
|-----|--------------------------|-------|
| 1   | *Shorea gibbosa*         | 30.29 |
| 2   | *Hopea beccariana*       | 12.84 |
| 3   | *Santiria laevigata*     | 10.84 |
| 4   | *Shorea acuminata*       | 8.44  |
| 5   | *Shorea parvifolia*      | 8.12  |
| 6   | *Artocarpus nitidus*     | 7.20  |
| 7   | *Macaranga lowii*        | 6.70  |
| 8   | *Hopea nigra*            | 5.89  |
| 9   | *Dipterocarpus palembanicus* | 5.55 |
| 10  | *Santiria tomentosa*     | 5.45  |

Total 101.38 (33.79 %)

Table 6. Ten leading tree species according to the basal area (BA) in a one-hectare plot of a lowland forest at the Batang Gadis National Park.

| No. | Species                  | BA (m²) |
|-----|--------------------------|---------|
| 1   | *Shorea gibbosa*         | 9.36    |
| 2   | *Santiria laevigata*     | 2.89    |
| 3   | *Hopea beccariana*       | 2.65    |
| 4   | *Shorea parvifolia*      | 1.83    |
| 5   | *Dipterocarpus palembanicus* | 1.35 |
| 6   | *Shorea acuminata*       | 1.13    |
| 7   | *Artocarpus nitidus*     | 1.03    |
| 8   | *Santiria tomentosa*     | 0.78    |
| 9   | *Shorea* sp.             | 0.65    |
| 10  | *Litsea* sp. 4           | 0.56    |

Total 22.22 (54.78 %)

In order to determine whether the 184 species recorded in the one-hectare plot represent the total number of species in the area studied, a species-area curve was constructed (Figure 2). The 25 subplots of 20x20 m each were examine to determine the number of additional species recorded each time a subplot was added. It shows that a considerable number of additional species was encountered more or less steadily up to one hectare and there was no indication of levelling off, which may be implied that a one-hectare plot does not represent a minimum area for this forest. This is comparable to situations in the tropical forest elsewhere in Borneo and the Malay Peninsula as reported by various authors (Kartawinata *et al.* 1981, Sist & Saridan 1999, Riswan 1982, Wyatt-Smith 1966, etc.).

**Structure**

The total basal area (BA) of 40.56 m² (Table 2, Appendix 1) represented that of 583 trees, thus giving a mean basal area/tree of 0.07 m². It should be noted that 18.99 m² or 46.82 % of this total was occupied by dipterocarps. Table 6 shows the basal areas of ten leading species that amounted to 22.22 m² or 54.78 % of the total. It is clear also that six of the species were dipterocarp and *Shorea gibbosa* was the most prominent species with the basal rea of 9.36 m². Table 7 shows ten leading species according to the tree density with total of 163 trees /ha or 27.96 % of the total density in the plot (583 trees/ha). Again here dipterocarps are the most prominent species.

**Table 7. Ten leading species according to the density in one-hectare plot of a lowland forest at the Batang Gadis National Park**

| No. | Species | Density |
|-----|---------|---------|
| 1   | *Shorea gibbosa* | 122     |
| 2   | *Hopea* | 14      |
| 3   | *Santiria tomentosa* | 14     |
| 4   | *Artocarpus* | 14      |
| 5   | *Macaranga* | 14      |
| 6   | *Santiria* | 14      |
| 7   | *Hopea* | 14      |
| 8   | *Shorea* | 14      |
| 9   | *Dipterocarpus* | 14     |
| 10  | *Shorea* | 14      |

Total 163 (27.96 %)

The diameter class distribution of trees in one-hectare plot is presented in Figure 3, which shows more or less a typical size class graph of a tropical undisturbed primary forest. It reveals that...
78.6 % of the trees were less than 30 cm DBH (59.2 % in the 10-19.9 cm and 19.4 % in the 20-29.9 cm size class). Only 21.4 % occurred in the diameters greater than 30 cm. It is interesting to note that the trees with large DBH were mainly dipterocarps. Five species were recorded in the 70-80 size class with basal area of 2.53 m², comprising three non-dipterocarps [Cratoxylon arborescens, Mezettea parvifolia and Pouteria malaccensis] and two dipterocarps (Hopea beccariana and Shorea gibbosa), whose basal area was 1.25 m² or 50 % of the basal in the group. There were no trees with DBH of 80–89.9 cm. In the 90-99.9 cm DBH there were seven trees of five species comprising one non-dipterocarp (Santiria laevigata) with a basal area of 0.74 m² and three dipterocarps (Hopea beccariana, Shorea gibbosa and Shorea sp.) with the basal area of 4.8 m². The 100-160 cm DBH was entirely occupied by three trees of a single species of dipterocarp (Shorea gibbosa) with a basal area of 4.85 m².

Table 7. Ten leading species according to the density (D) of trees in a one-hectare plot of a lowland forest in the Batang Gadis National Park.

| No. | Species          | Density |
|-----|------------------|---------|
| 1   | Shorea gibbosa   | 24      |
| 2   | Shorea acuminata | 21      |
| 3   | Hopea beccariana | 20      |
| 4   | Macaranga lowii  | 19      |
| 5   | Shorea parvifolia| 15      |
| 6   | Hopea nigra      | 14      |
| 7   | Artocarpus nitidus| 14     |
| 8   | Santiria laevigata| 12     |
| 9   | Lithocarpus lucidus| 12     |
| 10  | Aporusa antennifera| 12     |
|     | Total            | 163 (27.96 %) |

Figure 4 and Table 8 show the height class distribution and density of the trees with DBH of 10 cm and greater in the one-hectare plot. It is evident that the majority of the trees were mainly less than 30 m high, totalling 461 trees or 71.9 % of the total number of trees in the plot. Only 101 trees or 17.3 % were in the middle and upper canopy. Trees with height of 50-55 m were only three and all were a dipterocarp, Shorea gibbosa, which can be considered as the emergent. In the height class of 40-49.9 m, 28 trees were recorded, of which 17 trees or 60.7 % were dipterocarps. They were 16 species in this group and seven of them were dipterocarps (Dipterocarpus palembanicus, Hopea beccariana, Shorea acuminata, S. execlliptic, S. gibbosa, S. parvifolia and Fatica micranta), where again S. gibbosa was the most prominent. In the height group of 30-39.9, of 69 trees recorded only 25 trees or 36.2 % were dipterocarps. They consisted of 40 species, including eight species of dipterocarps (Anisoptera costat, D. palembanicus, H. beccariana, S. acuminata, S. gibbosa, S. parvifolia and two Shorea spp.). The 10-29.9 cm height class contained 461 trees including 72 trees dipterocarps. Species diversity was high in this height class, where 167 species were recorded,
trees and saplings which are described below. The stratum (E) or the ground canopy consisted mainly of shrubs, small trees and and shrubs and the most common species were Macaranga lowii, Santiria laevigata, S. tomentosa, Shorea acuminata, S. gibbosa and Swintonia glauca.

Figure 5 shows a simulated profile diagram constructed by plotting the data on tree heights and tree numbers reflecting the sequence of field recording positioned in a linear row. Based on this diagram, the forest canopy (sensu Whitmore 1984) may be stratified into five strata: (A) the emergent representing the uppermost layer (50-55 m), (B) upper canopy (30 – 50 m), (C) middle canopy (20-30 m), (D) lower canopy (10-20 m) and (E) ground canopy (0-10 m). The major species composition for strata (A) to (D) were described above. The stratum (E) or the ground canopy consisted mainly of shrubs, small trees and saplings which are described below.

Saplings

Only 82 species were regenerating as represented by their presence in the sapling stage ranging from 5 to 50 plants/hectare. Table 9 shows the species with good regeneration with densities of 25 – 120 saplings/hectare or more than 1 % of the total saplings in the plot, which was 2265. Macaranga lowii had the highest density of 120 saplings/hectare. It was regenerating well in the disturbed part occurring on one corner of the plot where a gap was at one time formed and now has developed into a building phase of the forest. In the tree stage it was represented by 19 trees/ha which occurred rather widespread as indicated by a frequency of 48 %. Other species of Macaranga were Macaranga gigantea, Macaranga hosei and Macaranga hypoleuca. Apparently they occurred in areas previously occupied by gaps. It should be noted that only five species of dipterocarps had a relatively good regeneration with densities of 25-65 saplings/hectare.

Table 9. Saplings of tree species with density of more than 1 % of the total saplings in the plot

| No. | Species              | Density (Plants/Ha) | Frequency (%) |
|-----|----------------------|---------------------|---------------|
| 1   | Macaranga lowii      | 120                 | 80            |
| 2   | Syzygium cymosa      | 80                  | 80            |
| 3   | Gonystylus forbesii  | 80                  | 80            |
| 4   | Shorea sp. 1         | 65                  | 80            |
| 5   | Syzygium racemosum   | 55                  | 80            |
| 6   | Hopea beccariana     | 45                  | 80            |
| 7   | Syzygium confertum   | 45                  | 80            |
| 8   | Chionanthus nitens   | 45                  | 80            |
| 9   | Santiria laevigata   | 45                  | 40            |
| 10  | Shorea acuminata     | 45                  | 60            |
| 11  | Hopea nigra          | 45                  | 80            |
| 12  | Beilschmiedia madang | 40                  | 40            |
| 13  | Drypetes longifolia  | 35                  | 60            |
| 14  | Vatica micrantha     | 35                  | 60            |
| 15  | Prunus grisea        | 30                  | 80            |
| 16  | Mallotus penangensis | 30                  | 60            |
| 17  | Litsea resinosa      | 30                  | 60            |
| 18  | Santiria tomentosa   | 25                  | 60            |
| 19  | Syzygium sp. 2       | 25                  | 60            |
| 20  | Knema laurina        | 25                  | 60            |

Ninety nine species of trees had no representation in the sapling stages, 11 dipterocarp species, i.e., Anisoptera costata, Dipterocarpus palembanicus, Shorea exceltippica, Shorea gibbosa, Shorea parvifolia, Shorea platyclados, three Shorea spp. Vatica mangachapoi and Vatica perakensis. There were 55 species were present entirely in the sapling stage (Appendix 2). These were mainly small trees and and shrubs and the most common with densities of 25-50 plants/ha were Ardisia sanguinolenta, Cinannomomum cuspidatum, Ixora pseudo-javanica, Saprosma arboresum, Saururu pendula and Urophyllum glabrum. Some main canopy trees were represented with low densities and frequencies, such as Dacryodes incurvata, Dialium indum, Podocarpus nerifolius and Lithocarpus spp.

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Appendix 1. Density (D = trees/ha), Relative Density (RD), Frequency (F=%), Relative Frequency (RF), Basal Area (BA = m²), Relative Basal Area (RBA) and Importance Value (IV) of species and families in a one-hectare plot of lowland forest at the Batang Gadis National Park, North Sumatra.

| No. | Family and Species | D   | RD | F   | RF  | BA  | RBA | IV  |
|-----|--------------------|-----|----|-----|-----|-----|-----|-----|
| 1   | 1. Alangiaceae     |     |    |     |     |     |     |     |
| 1   | *Alangium javanicum* | 1   | 0.17 | 4.00 | 0.21 | 0.008 | 0.02 | 0.40 |
|     | Family total       |     | 0.008 |     |     |     |     |     |
| 2   | 2. Anacardiace      |     |    |     |     |     |     |     |
| 2   | *Buchanania sessilifolia* | 2 | 0.34 | 4.00 | 0.41 | 0.066 | 0.16 | 0.92 |
| 3   | *Mangifera cf. swintonioides* | 1 | 0.17 | 4.00 | 0.21 | 0.029 | 0.07 | 0.45 |
| 4   | *Mangifera laurina* | 4   | 0.69 | 16.00 | 0.82 | 0.282 | 0.69 | 2.21 |
| 5   | *Melanochyla caesia* | 2   | 0.34 | 8.00 | 0.41 | 0.036 | 0.09 | 0.84 |
| 6   | *Melanochyla bracteata* | 1 | 0.17 | 4.00 | 0.21 | 0.034 | 0.08 | 0.46 |
| 7   | *Swintonia glauca* | 8   | 1.37 | 28.00 | 1.44 | 0.372 | 0.92 | 3.73 |
|     | Family total       |     | 18  |     |     |     |     |     |
| 3   | 3. Annonaceae       |     |    |     |     |     |     |     |
| 8   | *Annonaceae*        |     |     |     |     |     |     |     |
| 9   | *Annonaceae (t. daun)* |     |     |     |     |     |     |     |
| 10  | *Cyathocalyx biovulatus* | 13 | 2.23 | 48.00 | 2.47 | 0.325 | 0.80 | 5.50 |
| 11  | *Cyathocalyx sp.1* | 1   | 0.17 | 4.00 | 0.21 | 0.040 | 0.10 | 0.48 |
| 12  | *Melodorum kentii* | 1   | 0.17 | 4.00 | 0.21 | 0.012 | 0.03 | 0.41 |
| 13  | *Mezzetia parvifloraee.* | 1 | 0.17 | 4.00 | 0.21 | 0.424 | 1.05 | 1.42 |
| 14  | *Polyalthia cauliflora* | 1 | 0.17 | 4.00 | 0.21 | 0.015 | 0.04 | 0.42 |
| 15  | *Polyalthia lateriflora* | 2 | 0.34 | 8.00 | 0.41 | 0.050 | 0.12 | 0.88 |
| 16  | *Polyalthia sumatrana* | 1 | 0.17 | 4.00 | 0.21 | 0.019 | 0.05 | 0.42 |
| 17  | *Sageraea lanceolata* | 1 | 0.17 | 4.00 | 0.21 | 0.033 | 0.08 | 0.46 |
| 18  | *Xylopia malayana* | 6   | 1.03 | 24.00 | 1.24 | 0.321 | 0.79 | 3.06 |
|     | Family total       |     | 28  |     |     |     |     |     |
| 4   | 4. Arecaceae        |     |    |     |     |     |     |     |
| 19  | *Oncosperma horridum* | 1 | 0.17 | 4.00 | 0.21 | 0.027 | 0.07 | 0.44 |
|     | Family total       |     | 1   |     |     |     |     |     |
| 5   | 5. Asteraceae       |     |    |     |     |     |     |     |
| 20  | *Vernonia arborea* | 1   | 0.17 | 4.00 | 0.21 | 0.010 | 0.03 | 0.40 |
|     | Family total       |     | 1   |     |     |     |     |     |
| 6   | 6. Bombacaceae      |     |    |     |     |     |     |     |
| 21  | *Durio malaccensis* | 2   | 0.34 | 8.00 | 0.41 | 0.062 | 0.15 | 0.91 |
| 22  | *Durio oxleyanus* | 1   | 0.17 | 4.00 | 0.21 | 0.017 | 0.04 | 0.42 |
| 23  | *Durio zibethinus* | 1   | 0.17 | 4.00 | 0.21 | 0.023 | 0.06 | 0.43 |
| 24  | *Neesia alissima* | 1   | 0.17 | 4.00 | 0.21 | 0.166 | 0.41 | 0.79 |
|     | Family total       |     | 5   |     |     |     |     |     |
| 7   | 7. Burseraceae      |     |    |     |     |     |     |     |
| 25  | *Canarium littorale* | 1   | 0.17 | 4.00 | 0.21 | 0.020 | 0.05 | 0.43 |
| 26  | *Canarium patentinervium* | 7 | 1.20 | 24.00 | 1.24 | 0.130 | 0.32 | 2.76 |
| 27  | *Dacryodes laxa* | 2   | 0.34 | 8.00 | 0.41 | 0.330 | 0.81 | 1.57 |
| 28  | *Dacryodes rostrata* | 5 | 0.86 | 20.00 | 1.03 | 0.142 | 0.35 | 2.24 |
| 29  | *Dacryodes sp.1* | 1   | 0.17 | 4.00 | 0.21 | 0.011 | 0.03 | 0.41 |
| 30  | *Santiria apiculata* | 1 | 0.17 | 4.00 | 0.21 | 0.020 | 0.05 | 0.43 |
| 31  | *Santiria laevigata* | 12 | 2.06 | 32.00 | 1.65 | 2.894 | 7.13 | 10.84 |
| 32  | *Santiria tomentosa* | 11 | 1.89 | 32.00 | 1.65 | 0.775 | 1.91 | 5.45 |
|     | Family total       |     | 40  |     |     |     |     |     |

*Note: D = Density (trees/ha), RD = Relative Density (%), F = Frequency (%), RF = Relative Frequency (%), BA = Basal Area (m²), RBA = Relative Basal Area (%), IV = Importance Value.*
| No. | Family and Species | D | RD | F | RF | BA | RBA | IV |
|-----|-------------------|---|----|---|----|----|-----|----|
| 8. Celastraceae | | | | | | | |
| 33 | Kokoona littoralis | 4 | 0.69 | 16.00 | 0.82 | 0.157 | 0.39 | 1.90 |
|   | Family total | 4 | 0.157 | 0.39 | 1.90 |
| 9. Clusiaceae | | | | | | | |
| 34 | Calophyllum rigidum | 1 | 0.17 | 4.00 | 0.21 | 0.024 | 0.06 | 0.44 |
| 35 | Cratoxylon arborescens | 4 | 0.69 | 16.00 | 0.82 | 0.556 | 1.37 | 2.88 |
| 36 | Garcinia gauchichaudi | 1 | 0.17 | 4.00 | 0.21 | 0.011 | 0.03 | 0.41 |
| 37 | Garcinia havilandii | 1 | 0.17 | 4.00 | 0.21 | 0.030 | 0.07 | 0.45 |
| 38 | Garcinia parvifolia | 1 | 0.17 | 4.00 | 0.21 | 0.018 | 0.04 | 0.42 |
| 39 | Garcinia sp. 1 | 1 | 0.17 | 4.00 | 0.21 | 0.010 | 0.02 | 0.40 |
| 40 | Mesua coriacea | 5 | 0.86 | 20.00 | 1.03 | 0.152 | 0.37 | 2.26 |
| 41 | Mesua fereea | 1 | 0.17 | 4.00 | 0.21 | 0.102 | 0.25 | 0.63 |
|   | Family total | 15 | 0.903 | 7.89 |
| 10. Cornaceae | | | | | | | |
| 42 | Mastixia trichotoma | 5 | 0.86 | 20.00 | 1.03 | 0.178 | 0.44 | 2.33 |
|   | Family total | 5 | 0.178 | 2.33 |
| 11. Dipterocarpaceae | | | | | | | |
| 43 | Anisoptera costata | 1 | 0.17 | 4.00 | 0.21 | 0.274 | 0.67 | 1.05 |
| 44 | Dipterocarpus palembanicus | 7 | 1.20 | 20.00 | 1.03 | 1.347 | 3.32 | 5.55 |
| 45 | Hopea beccariana | 20 | 3.43 | 56.00 | 2.89 | 2.647 | 6.53 | 12.84 |
| 46 | Hopea nigra | 14 | 2.40 | 44.00 | 2.27 | 0.496 | 1.22 | 5.89 |
| 47 | Shorea acuminata | 21 | 3.60 | 40.00 | 2.06 | 1.126 | 2.78 | 8.44 |
| 48 | Shorea exelliptica | 1 | 0.17 | 4.00 | 0.21 | 0.072 | 0.18 | 0.55 |
| 49 | Shorea gibbosa | 24 | 4.12 | 60.00 | 3.09 | 9.361 | 23.08 | 30.29 |
| 50 | Shorea parvifolia | 15 | 2.57 | 20.00 | 1.03 | 1.832 | 4.52 | 8.12 |
| 51 | Shorea platyclados | 1 | 0.17 | 4.00 | 0.21 | 0.035 | 0.09 | 0.46 |
| 52 | Shorea sp. | 1 | 0.17 | 4.00 | 0.21 | 0.651 | 1.60 | 1.98 |
| 53 | Shorea sp. 1 | 2 | 0.34 | 8.00 | 0.41 | 0.243 | 0.60 | 1.35 |
| 54 | Shorea sp. 2 | 4 | 0.69 | 16.00 | 0.82 | 0.081 | 0.20 | 1.71 |
| 55 | Shorea sp.3 | 1 | 0.17 | 4.00 | 0.21 | 0.246 | 0.61 | 0.99 |
| 56 | Vatica mangachapoi | 2 | 0.34 | 8.00 | 0.41 | 0.028 | 0.07 | 0.83 |
| 57 | Vatica micrantha | 6 | 1.03 | 20.00 | 1.03 | 0.482 | 1.19 | 3.25 |
| 58 | Vatica perakensis | 2 | 0.34 | 8.00 | 0.41 | 0.070 | 0.17 | 0.93 |
|   | Family total | 122 | 18.991 | 84.24 |
| 12. Ebenaceae | | | | | | | |
| 59 | Diospyros pseudo-malabarica | 1 | 0.17 | 4.00 | 0.21 | 0.009 | 0.02 | 0.40 |
| 60 | Diospyros sp. 1 | 1 | 0.17 | 4.00 | 0.21 | 0.010 | 0.03 | 0.40 |
| 61 | Diospyros sp. 2 | 2 | 0.34 | 8.00 | 0.41 | 0.017 | 0.04 | 0.80 |
| 62 | Diospyros sumatranae. | 1 | 0.17 | 4.00 | 0.21 | 0.010 | 0.03 | 0.40 |
|   | Family total | 5 | 0.046 | 2.00 |
| 13. Elaeocarpaceae | | | | | | | |
| 63 | Elaeocarpus mastersii | 1 | 0.17 | 4.00 | 0.21 | 0.086 | 0.21 | 0.59 |
| 64 | Elaeocarpus parvifolius | 1 | 0.17 | 4.00 | 0.21 | 0.043 | 0.11 | 0.48 |
|   | Family total | 2 | 0.129 | 1.07 |
| 14. Euphorbiaceae | | | | | | | |
| 65 | Aporusa antennifera | 12 | 2.06 | 40.00 | 2.06 | 0.220 | 0.54 | 4.66 |
| 66 | Aporusa falcifera | 3 | 0.51 | 8.00 | 0.41 | 0.111 | 0.27 | 1.20 |
| 67 | Aporusa grandistipula | 2 | 0.34 | 8.00 | 0.41 | 0.023 | 0.06 | 0.81 |
| No. | Family and Species | D  | RD   | F    | RF   | BA   | RBA  | IV   |
|-----|--------------------|----|------|------|------|------|------|------|
| 68  | Aporusa maingayi    | 1  | 0.17 | 4.00 | 0.21 | 0.013| 0.03 | 0.41 |
| 69  | Aporusa symplocoides| 1  | 0.17 | 4.00 | 0.21 | 0.010| 0.02 | 0.40 |
| 70  | Baccaurea brevipes  | 1  | 0.17 | 4.00 | 0.21 | 0.024| 0.03 | 0.44 |
| 71  | Baccaurea dulcis    | 1  | 0.17 | 4.00 | 0.21 | 0.075| 0.18 | 0.56 |
| 72  | Baccaurea multiflora| 3  | 0.51 | 8.00 | 0.41 | 0.065| 0.16 | 1.09 |
| 73  | Blumeodendron tokbrai|4 | 0.69 | 12.00| 0.62 | 0.184| 0.45 | 1.76 |
| 74  | Drypetes longifolia | 3  | 0.51 | 12.00| 0.62 | 0.035| 0.09 | 1.22 |
| 75  | Macaranga gigantea  | 3  | 0.51 | 8.00 | 0.41 | 0.125| 0.31 | 1.24 |
| 76  | Macaranga hosei     | 1  | 0.17 | 4.00 | 0.21 | 0.126| 0.31 | 0.69 |
| 77  | Macaranga hypoleuca | 4  | 0.69 | 12.00| 0.62 | 0.232| 0.57 | 1.88 |
| 78  | Macaranga lowii     | 19 | 3.26 | 48.00| 2.47 | 0.393| 0.97 | 6.70 |
| 79  | Mallotus penangensis| 9  | 1.54 | 36.00| 1.86 | 0.222| 0.55 | 3.95 |
| 80  | Neoscortechinia kingii|2 | 0.34 | 8.00 | 0.41 | 0.038| 0.09 | 0.85 |
| 81  | Pimeleodendron griffithianum|5 | 0.86 | 20.00| 1.03 | 0.132| 0.33 | 2.21 |
| 82  | Ptychophyxis kingii | 1  | 0.17 | 4.00 | 0.21 | 0.057| 0.14 | 0.52 |
| 83  | Sapium baccatum     | 2  | 0.34 | 8.00 | 0.41 | 0.260| 0.64 | 1.40 |
|     | Family total        | 77 |      |      |      |      |      |      |
|     |                    |    | 2.343|      |      |      |      | 31.97|
| 15. | Fabaceae            |    |      |      |      |      |      |      |
| 84  | Archidendon sp. 1   | 1  | 0.17 | 4.00 | 0.21 | 0.012| 0.03 | 0.41 |
| 85  | Archidendron bubalinum|2 | 0.34 | 8.00 | 0.41 | 0.066| 0.16 | 0.92 |
| 86  | Fabaceae            | 2  | 0.34 | 4.00 | 0.21 | 0.028| 0.07 | 0.62 |
| 87  | Koompassia malaccensis|9 | 1.54 | 28.00| 1.44 | 0.517| 1.27 | 4.26 |
| 88  | Ormosia sumatrana   | 1  | 0.17 | 4.00 | 0.21 | 0.008| 0.02 | 0.40 |
| 89  | Parkia speciosa     | 1  | 0.17 | 4.00 | 0.21 | 0.049| 0.12 | 0.50 |
|     | Family total        | 16 |      |      |      | 0.680|      | 7.10 |
| 16. | Fagaceae            |    |      |      |      |      |      |      |
| 90  | Castanopsis sp. 1   | 3  | 0.51 | 8.00 | 0.41 | 0.094| 0.23 | 1.16 |
| 91  | Castanopsis sp. 2   | 1  | 0.17 | 4.00 | 0.21 | 0.045| 0.11 | 0.49 |
| 92  | Lithocarpus bennetii| 1  | 0.17 | 4.00 | 0.21 | 0.018| 0.04 | 0.42 |
| 93  | Lithocarpus cyclophorus|1 | 0.17 | 4.00 | 0.21 | 0.163| 0.40 | 0.78 |
| 94  | Lithocarpus elegans | 1  | 0.17 | 4.00 | 0.21 | 0.017| 0.04 | 0.42 |
| 95  | Lithocarpus hystrix | 2  | 0.34 | 8.00 | 0.41 | 0.045| 0.11 | 0.87 |
| 96  | Lithocarpus lucidus  | 12 | 2.06 | 36.00| 1.86 | 0.268| 0.66 | 4.57 |
| 97  | Lithocarpus sp. 1   | 1  | 0.17 | 4.00 | 0.21 | 0.035| 0.09 | 0.46 |
| 98  | Quercus argentina    | 4  | 0.69 | 12.00| 0.62 | 0.239| 0.59 | 1.89 |
| 99  | Quercus gemelliflora | 1  | 0.17 | 4.00 | 0.21 | 0.284| 0.70 | 1.08 |
| 100 | Quercus subericea    | 2  | 0.34 | 8.00 | 0.41 | 0.333| 0.82 | 1.58 |
|     | Family total        | 29 |      |      | 1.540|      | 13.72|
| 17. | Flacourtiaceae      |    |      |      |      |      |      |      |
| 101 | Ryparosa caesia      | 4  | 0.69 | 16.00| 0.82 | 0.185| 0.46 | 1.97 |
|     | Family total        | 4  |      |      | 0.185|      | 1.97 |
| 18. | Icacinaceae         |    |      |      |      |      |      |      |
| 102 | Platea excelsa      | 1  | 0.17 | 4.00 | 0.21 | 0.042| 0.10 | 0.48 |
|     | Family total        | 1  |      |      | 0.042|      | 0.48 |
| 19. | Lauraceae           |    |      |      |      |      |      |      |
| 103 | Alseodaphne peduncularis|1 | 0.17 | 4.00 | 0.21 | 0.011| 0.03 | 0.41 |
| 104 | Beilschmiedia dictyoneura|1 | 0.17 | 4.00 | 0.21 | 0.027| 0.07 | 0.44 |
| No. | Family and Species          | D  | RD | F  | RF | BA  | RBA | IV  |
|-----|---------------------------|----|----|----|----|-----|-----|-----|
| 105 | Beilschmiedia madang      | 2  | 0.34 | 4.00 | 0.21 | 0.104 | 0.26 | 0.81 |
| 106 | Cryptocarya ferrea         | 1  | 0.17 | 4.00 | 0.21 | 0.010 | 0.02 | 0.40 |
| 107 | Cryptocarya sp. 1          | 2  | 0.34 | 4.00 | 0.21 | 0.036 | 0.09 | 0.64 |
| 108 | Litsea firma               | 1  | 0.17 | 4.00 | 0.21 | 0.088 | 0.22 | 0.60 |
| 109 | Litsea odorifera           | 5  | 0.86 | 16.00 | 0.82 | 0.334 | 0.82 | 2.51 |
| 110 | Litsea resinosa            | 2  | 0.34 | 4.00 | 0.21 | 0.021 | 0.05 | 0.60 |
| 111 | Litsea sp.                 | 1  | 0.17 | 4.00 | 0.21 | 0.008 | 0.02 | 0.40 |
| 112 | Litsea sp. 1               | 1  | 0.17 | 4.00 | 0.21 | 0.088 | 0.22 | 0.60 |
| 113 | Litsea sp. 2               | 1  | 0.17 | 4.00 | 0.21 | 0.020 | 0.05 | 0.43 |
| 114 | Litsea sp. 3               | 2  | 0.34 | 8.00 | 0.41 | 0.216 | 0.53 | 1.29 |
| 115 | Litsea sp. 4               | 3  | 0.51 | 12.00 | 0.62 | 0.559 | 1.38 | 2.51 |
|     | Family total               | 23 | 1.523 | 11.62 |       |      |      |     |
| 20  | Melastomataceae            |           |       |       |       |      |      |     |
| 116 | Memecylon oligoneurum      | 2  | 0.34 | 8.00 | 0.41 | 0.093 | 0.23 | 0.99 |
| 117 | Pterandra cordata          | 1  | 0.17 | 4.00 | 0.21 | 0.008 | 0.02 | 0.40 |
| 118 | Pterandra rostrata         | 3  | 0.51 | 12.00 | 0.62 | 0.034 | 0.08 | 1.22 |
| 119 | Pterandra sp. 1            | 1  | 0.17 | 4.00 | 0.21 | 0.009 | 0.02 | 0.40 |
|     | Family total               | 7  | 0.144 | 3.00  |       |      |      |     |
| 21  | Meliaceae                  |           |       |       |       |      |      |     |
| 120 | Aglaia ganggo              | 1  | 0.17 | 4.00 | 0.21 | 0.038 | 0.09 | 0.47 |
| 121 | Aglaia odoratissima        | 1  | 0.17 | 4.00 | 0.21 | 0.038 | 0.09 | 0.47 |
| 122 | Aglaia sp. 1               | 1  | 0.17 | 4.00 | 0.21 | 0.008 | 0.02 | 0.40 |
| 123 | Chisocheton patens         | 1  | 0.17 | 4.00 | 0.21 | 0.017 | 0.04 | 0.42 |
| 124 | Dysoxylum cauliflorum      | 9  | 1.54 | 28.00 | 1.44 | 0.178 | 0.44 | 3.43 |
| 125 | Dysoxylum sp.              | 1  | 0.17 | 4.00 | 0.21 | 0.011 | 0.03 | 0.41 |
| 126 | Sandoricum koetjape        | 1  | 0.17 | 4.00 | 0.21 | 0.035 | 0.09 | 0.46 |
|     | Family total               | 15 | 0.325 | 6.05  |       |      |      |     |
| 22  | Moraceae                   |           |       |       |       |      |      |     |
| 127 | Artocarpus kemando         | 2  | 0.34 | 4.00 | 0.21 | 0.067 | 0.17 | 0.71 |
| 128 | Artocarpus nitida          | 14 | 2.40 | 44.00 | 2.27 | 1.025 | 2.53 | 7.20 |
| 129 | Ficus drupacea             | 2  | 0.34 | 8.00 | 0.41 | 0.172 | 0.43 | 1.18 |
|     | Family total               | 18 | 1.265 | 9.09  |       |      |      |     |
| 23  | Myristicaceae              |           |       |       |       |      |      |     |
| 130 | Horsfieldia polyspherula   | 9  | 1.54 | 36.00 | 1.86 | 0.354 | 0.87 | 4.27 |
| 131 | Knema cinerea              | 9  | 1.54 | 28.00 | 1.44 | 0.135 | 0.33 | 3.32 |
| 132 | Knema latericia            | 2  | 0.34 | 8.00 | 0.41 | 0.041 | 0.10 | 0.86 |
| 133 | Knema laurina              | 1  | 0.17 | 4.00 | 0.21 | 0.010 | 0.03 | 0.40 |
| 134 | Myristica iners            | 2  | 0.34 | 8.00 | 0.41 | 0.048 | 0.12 | 0.87 |
|     | Family total               | 23 | 0.588 | 9.73  |       |      |      |     |
| 24  | Myrsinaceae                |           |       |       |       |      |      |     |
| 135 | Embelia sp. 1              | 1  | 0.17 | 4.00 | 0.21 | 0.017 | 0.04 | 0.42 |
|     | Family total               | 1  | 0.017 | 0.42  |       |      |      |     |
| 25  | Myrtaceae                  |           |       |       |       |      |      |     |
| 136 | Syzygium acuminatum        | 3  | 0.51 | 12.00 | 0.62 | 0.133 | 0.33 | 1.46 |
| 137 | Syzygium antiseppticum     | 5  | 0.86 | 16.00 | 0.82 | 0.227 | 0.56 | 2.24 |
| 138 | Syzygium chloranthum       | 3  | 0.51 | 8.00 | 0.41 | 0.197 | 0.49 | 1.41 |
| 139 | Syzygium confertum         | 5  | 0.86 | 12.00 | 0.62 | 0.062 | 0.15 | 1.63 |
| 140 | Syzygium cymosum           | 2  | 0.34 | 8.00 | 0.41 | 0.067 | 0.17 | 0.92 |
| No. | Family and Species            | D  | RD  | F  | RF  | BA  | RBA | IV |
|-----|------------------------------|----|-----|----|-----|-----|-----|----|
| 141 | *Syzygium fastigiatum*       | 2  | 0.34| 8.00| 0.41| 0.041| 0.10| 0.86|
| 142 | *Syzygium flosculifera*      | 3  | 0.51| 12.00| 0.62| 0.037| 0.09| 1.22|
| 143 | *Syzygium griffithii*        | 1  | 0.17| 4.00| 0.21| 0.036| 0.09| 0.47|
| 144 | *Syzygium racemosum*         | 4  | 0.69| 16.00| 0.82| 0.090| 0.22| 1.73|
| 145 | *Syzygium sp. 1*             | 1  | 0.17| 4.00| 0.21| 0.048| 0.12| 0.50|
| 146 | *Syzygium sp. 2*             | 1  | 0.17| 4.00| 0.21| 0.026| 0.06| 0.44|
| 147 | *Syzygium sp. 3*             | 1  | 0.17| 4.00| 0.21| 0.283| 0.70| 1.08|
| 148 | *Syzygium sp. 4*             | 1  | 0.17| 4.00| 0.21| 0.059| 0.15| 0.52|
| 149 | *Syzygium sp. 5*             | 1  | 0.17| 4.00| 0.21| 0.011| 0.03| 0.41|
| 150 | *Tristaniopsis whiteana*     | 1  | 0.17| 4.00| 0.21| 0.071| 0.17| 0.55|
|     | *Family total*               | 754|     |     |     | 58.593| 397.09|    |
| 26  | Olacaceae                    |    |     |     |     |     |     |    |
| 151 | *Strombosis ceylanica*       | 3  | 0.51| 12.00| 0.62| 0.031| 0.08| 1.21|
|     | *Family total*               | 3  |     |     |     | 0.031| 1.21|    |
| 27  | Oleaceae                     |    |     |     |     |     |     |    |
| 152 | *Chionanthus nitens*         | 5  | 0.86| 20.00| 1.03| 0.058| 0.14| 2.03|
|     | *Family total*               | 5  |     |     |     | 0.058| 2.03|    |
| 28  | Polygalaceae                 |    |     |     |     |     |     |    |
| 153 | *Xanthophyllum rufum*        | 7  | 1.20| 24.00| 1.24| 0.291| 0.72| 3.15|
|     | *Family total*               | 7  |     |     |     | 0.291| 3.15|    |
| 29  | Proteaceae                   |    |     |     |     |     |     |    |
| 154 | *Helicia serrata*            | 1  | 0.17| 4.00| 0.21| 0.012| 0.03| 0.41|
|     | *Family total*               | 1  |     |     |     | 0.012| 0.41|    |
| 30  | Rosaceae                     |    |     |     |     |     |     |    |
| 155 | *Atuna racemosa*             | 2  | 0.34| 8.00| 0.41| 0.077| 0.19| 0.95|
| 156 | *Prunus arboarea*            | 1  | 0.17| 4.00| 0.21| 0.064| 0.16| 0.54|
| 157 | *Prunus grisea*              | 1  | 0.17| 4.00| 0.21| 0.013| 0.03| 0.41|
|     | *Family total*               | 4  |     |     |     | 0.154| 1.89|    |
| 31  | Rubiaceae                    |    |     |     |     |     |     |    |
| 158 | *Aidia racemosa*             | 1  | 0.17| 4.00| 0.21| 0.009| 0.02| 0.40|
| 159 | *Canthium glabrum*           | 1  | 0.17| 4.00| 0.21| 0.009| 0.02| 0.40|
| 160 | *Tricalysia singularis*      | 2  | 0.34| 8.00| 0.41| 0.022| 0.06| 0.81|
|     | *Family total*               | 4  |     |     |     | 0.040| 1.61|    |
| 32  | Santalaceae                  |    |     |     |     |     |     |    |
| 161 | *Scleropyrum wallichianum*   | 1  | 0.17| 4.00| 0.21| 0.010| 0.02| 0.40|
|     | *Family total*               | 1  |     |     |     | 0.010| 0.40|    |
| 33  | Sapindaceae                  |    |     |     |     |     |     |    |
| 162 | *Nephelium chrysemum*        | 6  | 1.03| 24.00| 1.24| 0.135| 0.33| 2.60|
| 163 | *Nephelium cuspidatum*       | 2  | 0.34| 8.00| 0.41| 0.043| 0.11| 0.86|
| 164 | *Nephelium lappaceum*        | 1  | 0.17| 4.00| 0.21| 0.022| 0.05| 0.43|
| 165 | *Xerospermum laevigatum*     | 1  | 0.17| 4.00| 0.21| 0.011| 0.03| 0.41|
|     | *Family total*               | 10 |     |     |     | 0.211| 4.30|    |
| 34  | Sapotaceae                   |    |     |     |     |     |     |    |
| 166 | *Palaquium gutta*            | 2  | 0.34| 8.00| 0.41| 0.044| 0.11| 0.86|
| 167 | *Palaquium hexandrum*        | 7  | 1.20| 24.00| 1.24| 0.237| 0.58| 3.02|
| 168 | *Palaquium quercifolium*     | 1  | 0.17| 4.00| 0.21| 0.091| 0.22| 0.60|
| 169 | *Palaquium rostratum*        | 1  | 0.17| 4.00| 0.21| 0.302| 0.74| 1.12|
| No. | Family and Species          | D  | RD  | F   | RF  | BA  | RBA | IV  |
|-----|----------------------------|----|-----|-----|-----|-----|-----|-----|
| 170 | Payena leerii              | 8  | 1.37| 24.00| 1.24| 0.427| 1.05| 3.66|
| 171 | Planchonella nitida        | 1  | 0.17| 4.00 | 0.21| 0.012| 0.03| 0.41|
| 172 | Pouteria malaccensis       | 2  | 0.34| 8.00 | 0.41| 0.438| 1.08| 1.83|
|     | Family total               | 22 |     |      |     | 1.550|    | 11.51|
|     | **35. Sterculiaceae**      |    |     |      |     |     |     |     |
| 173 | Heritiera sumatrana        | 3  | 0.51| 12.00| 0.62| 0.081| 0.20| 1.33|
| 174 | Sterculia arceolata        | 1  | 0.17| 4.00 | 0.21| 0.012| 0.03| 0.41|
|     | Family total               | 4  |     |      |     | 0.093|    | 1.74|
|     | **36. Stryraceae**         |    |     |      |     |     |     |     |
| 175 | Stryx paralleneurus        | 6  | 1.03| 16.00| 0.82| 0.393| 0.97| 2.82|
|     | Family total               | 6  |     |      |     | 0.393|    | 2.82|
|     | **37. Symplolocaceae**     |    |     |      |     |     |     |     |
| 176 | Symlocos sp. 1             | 1  | 0.17| 4.00 | 0.21| 0.020| 0.05| 0.43|
|     | Family total               | 1  |     |      |     | 0.020|    | 0.43|
|     | **38. Theaceae**           |    |     |      |     |     |     |     |
| 177 | Gordonia singaporoiana     | 3  | 0.51| 12.00| 0.62| 0.028| 0.07| 1.20|
| 178 | Pyrrenaria serrata         | 3  | 0.51| 8.00 | 0.41| 0.200| 0.49| 1.42|
| 179 | Thea sp. 1                 | 2  | 0.34| 8.00 | 0.41| 0.032| 0.08| 0.83|
|     | Family total               | 8  |     |      |     | 0.260|    | 3.46|
|     | **39. Thymelaeaceae**      |    |     |      |     |     |     |     |
| 180 | Aquilaria malaccensis      | 1  | 0.17| 4.00 | 0.21| 0.013| 0.03| 0.41|
| 182 | Gonystylus forbesii        | 7  | 1.20| 24.00| 1.24| 0.102| 0.25| 2.69|
|     | Family total               | 8  |     |      |     | 0.114|    | 3.10|
|     | **40. Verbenaceae**        |    |     |      |     |     |     |     |
| 183 | Vitex quinata              | 1  | 0.17| 4.00 | 0.21| 0.013| 0.03| 0.41|
|     | Family total               | 1  |     |      |     | 0.013|    | 0.41|
|     | **41. Unidentified family**|    |     |      |     |     |     |     |
| 184 | Unidentified               | 2  | 0.34| 2.00 | 0.41| 0.093| 0.23| 0.98|
|     | Family total               | 2  |     |      |     | 0.093|    | 0.98|
|     | **TOTAL**                  | 583| 100.0| 1,930.00| 100.0| 40.56| 100.0| 300.0|

Note: The followings are the list of species of shrubs, small trees and saplings which are not listed above.

- **Actinidiaceae**: Saurania pendula; **Anacardiaceae**: Buchanania sessilifolia; **Annonaceae**: Unidentified; Polyalthia sp.1, Polyalthia sp. 2; Polyalthia subcordata, Popowia pisocarpa, Sageraeea elliptica; **Apocynaceae**: Alstonia angustiloba; **Arecaceae**: Pinanga sp.; **Burseraceae**: Dacryodes incurvata; **Clusiaceae**: Calophyllum sp., Mesua sp.; **Convolvulaceae**: Erycibe sp.; **Crypteroniaceae**: Crypteronia sp.; **Ebenaceae**: Diospyros frutescens; **Euphorbiaceae**: Aporusa cf. prauniana, Baccaurea javanica, Baccaurea miniatiflora, Glocidion sp., Mallotus macrostachys, Saururus rhamnoides, Trigonostemon serratus; **Fabaceae**: Dialium indum; **Fagaceae**: Lithocarpus sp. 1, Lithocarpus sp. 2; **Lauraceae**: Actinodaphne sp., Cinnamomum caudatum, Linderia caesia, Litsea lanceolata., Litsea oppositifolia, Litsea pedunculata; **Melastomataceae**: Piernandra azurea; **Meliaceae**: Aglaia palembanica, Aglaia sp., Lansium domesticum, Reinwardtiodendron humile; **Moraceae**: Ficus sp., Ficus uncinulata; **Myrsinaceae**: Ardisia nagelii, Ardisia sanguinolenta; **Myrtaceae**: Rhodamnia cinerea, Syzygium spicatum; **Podocarpaceae**: Podocarpus nerifolius; **Polygalaceae**: Xanthophyllum affine; **Rubiaceae**: Canthium glabrum, Ixora pseudovirginalis, Lasianthus stipularis, Saprosma arboreum, Unidentified, Urophylum glabrum; **Rutaceae**: Euodia glabra; **Theaceae**: Ternstroemia sp., Adinandra dasyantha; **Tiliaceae**: Microcos crassifolia.
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