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Vascular plant species inventory of a Philippine lowland rain forest and its conservation value

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Abstract. The Philippines are one of the most important biodiveristy hotspots on earth. Due to the extraordinary rate of environmental destruction, leaving only 3% of the land with primary forest, this biodiversity is at high risk. Despite that situation information on Philippine forest vegetation is fragmentary and focused on trees. This study aimed at analysing forest remnants in the Leyte Cordillera on the Island of Leyte, and at evaluating their role as refuge to the largely destroyed lowland forest vegetation. A total of 49 plots (100 m^2 each) between 55 and 520 m a.s.l. were studied. All vascular plant species except epiphytes were included. Records include 685 taxa from 289 genera and 111 families, representing nearly 8% of the known Philippine vascular plant species. More than half (52%) of the species are Philippine endemics. A number of 41 tree species, or 6% of all taxa recorded, are included in the IUCN red list, either as vulnerable, endangered, or critically endangered. Life form composition was dominated by phanerophytes (65.3%), followed by lianas and chamaephytes (17.1 and 16.9%, respectively). The most common families were the Rubiaceae with 35 and the Euphorbiaceae with 32 species. All five Philippine dipterocarp forest types as well as the molave forest type were represented by typical tree species. The area provides an important gene bank of the highly threatened Philippine lowland forest vegetation and is of high value for biodiversity conservation. Additionally, it can play an important role as seed source of valuable tree species for the increasing initiatives to rehabilitate and reforest degraded land with native species.

Introduction

The destruction of tropical rain forests is still continuing at high rates (FAO 2003). This process, especially threatens the earth's biodiversity hotspots such as the Philippines (Myers et al. 2000; Brooks et al. 2002). Despite this, there are only very few studies worldwide which aimed at the documentation of the total plant species richness of such sites. Most inventories were restriced to selected life forms such as ground herbs (e.g. Kiew 1987; Poulsen and Balslev 1991; Poulsen 1996) or trees of a defined minimum diameter (e.g. Valencia et al. 1994; Lieberman et al. 1996; Newbery et al. 1996; Rennolls and Laumonier 2000; Slik et al. 2003). Vascular plant species composition of tropical lowland forests was studied in Ghana on 0.5- and 1-ha plots by Hall and Swaine (1981), in Amazonia on 0.02-ha plots by Takeuchi (1960) and on 10 non-contiguous plots of 0.1 ha by Duivenvoorden

(1994), in Ecuador on 0.1-ha plots of three lowland forest types by Gentry and Dodson (1987), and in stratified plots with a total area of about 2 ha in Puerto Rico by Smith (1970). In Southeast Asia, Kochummen et al. (1992) studied the trees and shrubs (> 1 cm diameter at breast height (dbh)) in a 50-ha plot in the Pasoh Forest Reserve in Malaysia. The most comprehensive study including all vascular plants as well as mosses was conducted by Whitmore et al. (1985) on a single 100-m^2 plot in the lowland rain forest of Costa Rica. However, no study representing a complete inventory of vascular plant species richness of any site of lowland rain forest in Southeast Asia was found.

The Philippines are among the most seriously depleted tropical countries with only 3% of the land area still covered by primary forest (Myers et al. 2000). From 1990 to 2000, the Philippines lost 1.4%, or 89,000 ha, of the forest area annually (FAO 2003). At the same time, the Philippine archipelago is one of the most important biodiversity hotspots on earth (Myers et al. 2000) with high proportions of endemic plant and animal species (Heaney and Regalado 1998). The endemism rate of plants was estimated to be 39% (Davis et al. 1995), but for certain taxa, it can be much higher. For example, 11 of 12 species of pitcher plants (*Nepenthes* spp.) known from the Philippines are endemic (Cheek and Jebb 2001). Similarly, there are high rates of endemism among the fauna. Referring to terrestrial vertebrates, 64% of the archipelago's land mammals are endemic, as well as 44% of the breeding land birds, 68% of the reptiles, and ca. 78% of the amphibians (Heaney and Regalado 1998). Most of them depend on forest ecosystems.

Despite the ecological uniqueness on the one hand and the extensive destruction on the other, the study of Philippine forest vegetation has been neglected (Tan and Rojo 1989; Kartawinata 1990; Soerianegara and Lemmens 1994). Much of the current knowledge is still based on studies conducted in the early 20th century (Whitford 1906; Whitford 1911; Brown and Mathews 1914; Brown 1919), which were mainly dealing with timber trees under economical aspects. Recent studies focused on the vegetation of montane and submontane forest types on different islands. However, in most cases (Aragones 1991; Pipoly and Madulid 1998; Proctor et al. 1998; Hamann et al. 1999) these were largely restricted to trees of a defined size, which usually is ≥10 cm dbh. Buot and Okitsu (1997) only considered woody plants higher than 1.3 m, and Ingle (2003) those of at least 5 cm dbh. The only data without size limitations are provided by Gonzales-Salcedo (2001) from Mt. Amuyao, Luzon, at elevations of 1600–1800 a.s.l. and by Gruezo (1998) from the highly degraded vegetation of Pagbilao Grande Island. No study dealing with lowland forest vegetation was found in the literature.

In order to provide more substantial information on species richness and composition of Philippine lowland forests, we analysed forest remnants in the rugged foothills of the Leyte Cordillera. The island of Leyte is located in the central part of the Philippine archipelago and represents a typical example of the environmental situation in the Philippines. In 1987, the remaining forest cover of Leyte was 12%, and in 1994 only 2% of the island's area have been estimated to be primary forest (Dargantes and Koch 1994). More recent data (DENR 1998) show that about 40% of the land area of Leyte is covered by grassland and barren land, resulting from abandoned cultivation and grazing land that marginalised in productivity through erosion and leaching. Another 40% of the island's area is under coconut plantations. The remaining area is composed of settlements, agricultural land and forest. In the view of this situation, the objectives of this study were (a) to analyse the vascular plant species composition and diversity of selected plots of mature primary forest and (b) to evaluate the role of the study area as refuge to lowland forest vegetation and its significance for conservation and as a gene bank.

Material and methods

Study area

The Island of Leyte (Figure 1) belongs to the biogeographic region of the Eastern Visayas (DENR and UNEP 1997). It is located between 9°55′ N–11°48′ N and 124°17′ E–125°18′ E, with an extension of 214 km from north to south. Located offshore the northeastern part of Leyte is the island of Samar. The southern part of Leyte is exposed to the Pacific Ocean (Leyte Gulf).

Leyte is characterised by the north–south running Leyte Cordillera which is part of the Philippine Fault Line. The Cordillera reaches a maximum elevation of ca. 1350 m (Mt. Lobi) in the northern part of the island. As geologically young volcanic mountain range, it shows a typical rugged topography of narrow ridges and steep slopes, where landslides are common (Bremer 1995, 1999; Walsh 1996). In its foothills, patches of primary forest without discernible human interference can still be found although the island is densely populated (ca. 262 inhabitants/km^2 as calculated after: NSCB RU-8 2001). The coastal plains have already been deforested in the first half of the last century (Barrera et al. 1954).

The study area is located in the western part of the Leyte Cordillera, ca. 8 km north of the provincial capital of Baybay, in the foothills of Mt. Pangasugan (1150 m, 10°46′ N, 124°50′ E). In this part of the island, the Cordillera reaches close to the coast. Large parts of the mountain's western range are extremely steep and are free from trees of this reason. In the eastern part of the Cordillera, the slope has a lower gradient.

Primary forest can be found from about 250 m a.s.l. up to the mountain's summit at 1150 m a.s.l. In hillsides below this elevation, the forests has largely been replaced by coconut plantations and slash and burn agriculture. Only along the small creeks, near natural vegetation can still be found at these lower elevations. Above ca. 600 m a.s.l., the lowland forest formation changes into mossy forest, with its stunted trees and a rich epiphyte community.

Within the study area, no recent logging was observed, although forest clearing continues at other localities of the mountain. This can be explained by the area's status as Forest Reserve of the Leyte State University. Despite this, rattan collection and hunting was observed within the Forest Reserve.

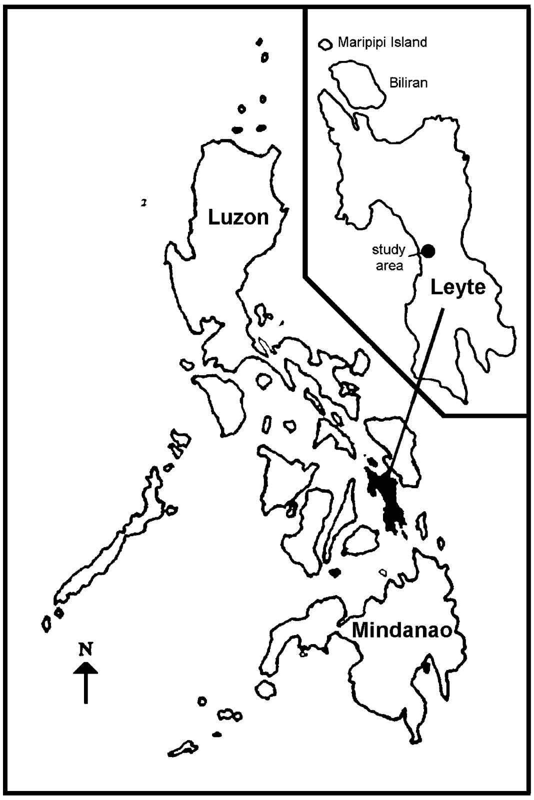

Figure 1. The Philippine archipelago, the Island of Leyte, and the location of the study area.

Geology and soils

The soil type in the primary forest between 370 and 520 m a.s.l. is a haplic Andosol with rudic phase (FAO/UNESCO 1988) overlying basaltic and andesitic breccia (Zikeli 1998). The soil at lower elevations (100 m a.s.l.) has been classified as haplic Alisol (FAO/UNESCO 1988) over basalt (Asio 1996).

Climate

According to the climatic classification of the 'Modified Corona's System', Leyte is climatically divided (Kintanar 1984). Southern Leyte belongs to the climatic type II (i.e. no pronounced dry season), but exhibits a distinct rainfall peak in December and January as a result of the northeast monsoon. The northern part of Leyte which includes the study area has been assigned to climatic type IV, showing a more or less even rainfall distribution throughout the year. The standardization of the rainfall pattern in northern Leyte compared to that of southern Leyte might be explained by the protective effect of the Island of Samar off the northeast-coast of Leyte, although Samar's mountains are lower than those of Leyte (ca. 850 m a.s.l.).

Local climatic conditions have been analysed from a 23-years period (1976–1998) of record by using data from the PAGASA (Philippine Atmospheric, Geophysical and Astronomical Services Administration) weather station on the campus of the Leyte State University (7 m a.s.l.), ca. 1–3 km west of the study plots. The annual average temperature is 27.4 °C and the average annual precipitation is 2586 mm. Highest precipitation occurs during November to January. Lowest rainfall is observed between March and May. On average, all months receive at least 100 mm precipitation, i.e. there is no dry month according to the definition of Walsh (1996). However, drought periods (i.e. less than 50 mm of monthly precipitation according to Walsh 1996) of up to 4 months have been recorded during El Niño Southern Oscillation events. The general rainfall patterns and the climatic conditions measured at the PAGASA station are more similar to climatic type II with its clear impact of the northeast monsoon than to climatic type IV, implying that neither the mountains of Samar nor the Leyte Cordillera itself causes a distinct rain shadow west of Mt. Pangasugan.

Orographic rainfalls are an important factor in the Leyte Cordillera, especially in the vicinity of the mountain summits. The summit of Mt. Pangasugan is often observed being cloud covered, and during field work heavy rainfalls have been experienced, while the coastal plain did not receive any precipitation.

An important climatic feature of the area are typhoons. Leyte lies at the southern margin of the typhoon tracks entering the Philippines, and is hit at a rate of five typhoons in three years, mainly during the summer months (Parong 1984; cited in Kintanar 1984).

Vegetation analysis

Field studies were conducted in 1997 and 1998. The attempt to identify a minimum area in mature primary forest failed due to the heterogeneity of the vegetation. A plot size allowing a reasonable number of replications proved to be 100 m^2. Where relief conditions and homogeneity of the vegetation allowed, plots were arranged along a catena from ridge to river bank. The 100-m^2 plots were generally designed as quadrats, but on narrow ridges and river banks, other rectangular design was used due to relief constraints. A total of 49 plots was established, with 15 on the ridge, 21 on slopes, and 11 on riverbanks. Two plots were established in ca. 6-year-old land slide successions, with one of them located ca. 2 km south of the main study area.

The vegetation analysis procedure was based on a 'nested quadrat design' (Kent and Coker 1992). All plants >2.5 m were identified from the total plots (100 m^2). On central subplots of 25 m^2, all plants ≤ 2.5 m as well as the lianas were considered. Records included epiphytic and climbing plants on the stem bases of trees up to a height of 2.5 m. Crown epiphytes were not included in the analysis, but epiphytes found on the ground were identified and added to the species lists. From species which could not be identified in the field, voucher specimens were collected. Tall trees were sampled with the help of a tree climber. However, no samples were taken from erect and climbing palms (rattans), because this would have been destructive and the chance of identification was very low due to the lack of fertile specimens. Therefore, most palms had to be distinguished as morphospecies.

Taxa were assigned to life forms on the base of field observations, or with the help of literature information in the case of juveniles. Life form classification followed Ellenberg and Mueller-Dombois (1967). Plant samples collected in this study were deposited at the Department of Plant Breeding, Herbarium, Leyte State University, ViSCA, Baybay, Leyte, 6521A, Philippines.

Species identification and nomenclature

Identification of specimens was conducted with the help of literature and specialists. Publications referring to the Philippine flora included de Guzman et al. (1986), Merrill (1912), Pancho (1983), Santos et al. (1986), van Steenis (1950-ongoing), and Zamora and Co 1986). Sources referring to neighbouring countries, which also include many Philippine taxa, were used in addition (Henderson 1974a, b; Ng 1978, 1989; Keng 1983, 1990; Whitmore 1983a, b; Corner 1988; Anonymous 1993, 1994, 1996; Soepadmo and Wong 1995; Soepadmo et al. 1996). Identification of seedlings, infertile and juvenile plants was not possible in all cases. For pre-identification of taxa and delimitation of morphospecies, field characters were very important. Besides the description of such characters in the above mentioned literature, the specific publications by van Balgooy (1997a, b) and Keller (1996) were used. Tree seedlings were identified with help of Ng (1991) and Burger (1972).

In addition, plants were identified by taxonomists from the Philippine National Herbarium, Manila, the National Herbarium of the Netherlands, Leiden Branch, and collaboratively during meetings of the Philippine Native Plant Group. Nomenclature followed various sources as cited above. However, priority was given to the Flora Malesiana (van Steenis 1950-ongoing), whenever possible. The legumes were assigned to the traditional family of Leguminosae. Scientific names were not derived from the translation of local names in any case.

Data analysis

Species richness, diversity and evenness were determined for each of the 49 plots. Only those plants rooting within the plots were considered in the analysis. The Shannon-Index (H′) was used as a robust and simple diversity measure (Magurran 1988). For the analysis of species dominance patterns, Evenness (E) based on the Shannon-Index was calculated for each of the plots.

To assess the area's value as a refuge to Philippine tree species, the characterization of forest types by Whitford (1911) was used. His classification and characterization is based on the occurrence of typical tree species and tree species combinations. He often used vernacular names or typical families or genera as e.g. 'Apitong' for *Dipterocarpus* spp. to characterise his forest types. For many of these vernacular names a scientific species could not be assigned with certainty, and therefore, were not used for comparisons. Whitford (1911) pointed out that the description of his forest types was based on a still fragmentary knowledge of Philippine forests. Most of his 'typical' tree species – with few exceptions such as mangroves – occur in the other forest types as well. For example, many species of the dipterocarp forest types occur at wet localities in the Molave forest (limestone forest). On the other hand, the typical Molave forest species also exist in the dipterocarp forest types, especially on dry sites. Of such reasons, Whitford's (1911) forest types are primarily related to the major habitat conditions in the Philippines and do not represent real plant associations. The comparison of the species recorded in this study with Whitford's (1911) forest types merely demonstrates the diverse habitat conditions in the present study area. Unfortunately, not much work has been conducted so far to improve Whitford's system, and information on species composition of the undergrowth vegetation, which might be especially valuable to characterise habitat conditions (Schulze and Whitacre 1999), is still missing.

Results

From the 49 plots, a total of 685 taxa was recorded. Of these, 58.3% were identified to species level, 86.2% to genus level, and 96.7% to family level. The remaining 3.3% of the taxa could only be assigned to higher taxonomic levels. All taxa identified to species level are listed in the Appendix. Species inventory was clearly dominated by angiosperms, accounting for 92.1% of all species. The pteridophytes represented 7.5% of the species. Only three species of gymnosperms (*Podocarpus rumphii*, *Gnetum gnemon*, *G. latifolium*) were found (Table 1).

More than half (52%) of all species identified are endemic to the Philippines, including one endemic genus (*Greeniopsis*, Rubiaceae). The most common families were the Rubiaceae (35 species) and the Euphorbiaceae (32 species), followed by the herbaceous family of Araceae and the erect and climbing palms (Arecaceae) with 28 species each. The Meliaceae and Moraceae included 27 species each (Figure 2). The ratio between the number of genera and the number of species ranged between 1:1.5 (Anacardiaceae) and 1:6.7 (Moraceae).

The frequency of taxa was low. Nearly half (48.5%) of all taxa were recorded from only one of the 49 plots, and nearly one third (30.5%) of the taxa were

Table 1. Taxonomic composition of 49 non-contiguous plots (100 m^2 each) in lowland forest remnants of the study area in the foothills of Leyte Cordilliera.

	Spermatophytes (%)		Pteridophytes (%)	Total (%)
	Gymnosperms	Angiosperms		
Families	2 (1.8)	94 (84.7)	15 (13.5)	111 (100)
Genera	2 (0.7)	261 (90.3)	26 (9)	289 (100)
Species	3 (0.4)	631 (92.1)	51 (7.5)	685 (100)

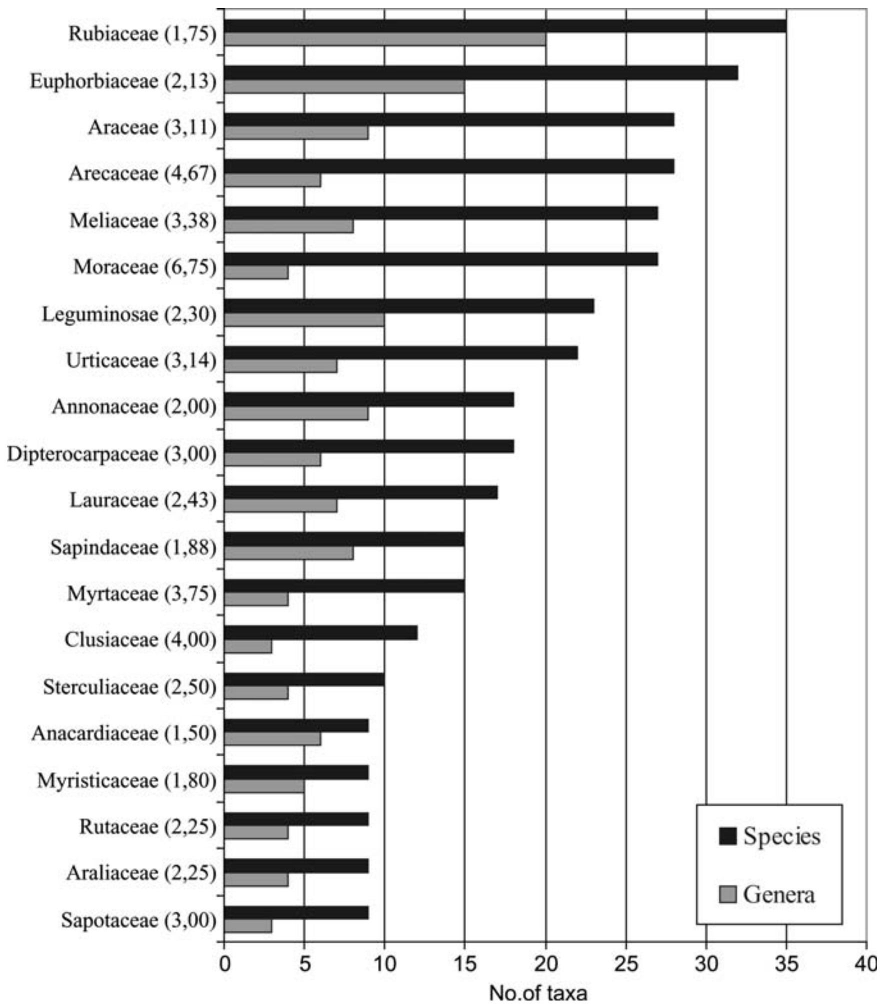

Figure 2. The 20 most common plant families recorded from 49 plots (100 m^2 each) in the study area. Figures in brackets indicate the ratio between the number of genera and the number of species.

represented by only one single individual. Very few species showed high frequencies as e.g. the two tree species, *Calophyllum blancoi* (present in 32 plots) and *Dacryodes rostrata* (present in 31 plots), which was due to a high rate of juveniles.

The average number of species per plot was 47 and ranged between 17 and 80. Shannon diversity (H′) reached values between 2.2 and 3.9, and evenness (E) ranged between 0.64 and 0.98. The species–area curve for all plots shows a steady increase of species numbers with only a weak tendency to level off (Figure 3). The flattening of the curve at its beginning is the result of the river bank vegetation which was comparatively species poor and homogenous. The species–area curve starts to rise again with the addition of the slope plots.

Life form composition is clearly dominated by phanerophytes (65.3% of all taxa), followed by lianas (17.1%) and chamaephytes (16.9%). Geophytes were rare (0.7%) and largely represented by few ground orchids. Hemicryptophytes and therophytes were absent (Figure 4). Epiphytes were not the focus of this study and are therefore not included in the calculation of life form composition. A rough estimate of epiphyte contribution to the area's species inventory is ca. 10%. The most conspicuous epiphytic plant group observed were orchids. Many of the vegetation clusters observed in the tree crowns were composed of the accumulation of orchid bulbs belonging to a single species (e.g. *Grammatophyllum multiflorum*).

The following taxa occurring in the study plots have been classified by Soepadmo (1995) as endangered and economically important lowland forest genera in SE Asia: *Anisoptera*, *Dipterocarpus*, *Parashorea*, *Shorea*, *Vatica* (Dipterocarpaceae), *Artocarpus* (Moraceae), *Mangifera* (Anacardiaceae), and *Calamus* (Arecaceae). Additionally, 41 of the tree species recorded are listed as endangered for the Philippines by IUCN (2000). Of these, 23 are classified as vulnerable, one as endangered, and 17 as critically endangered (see Appendix).

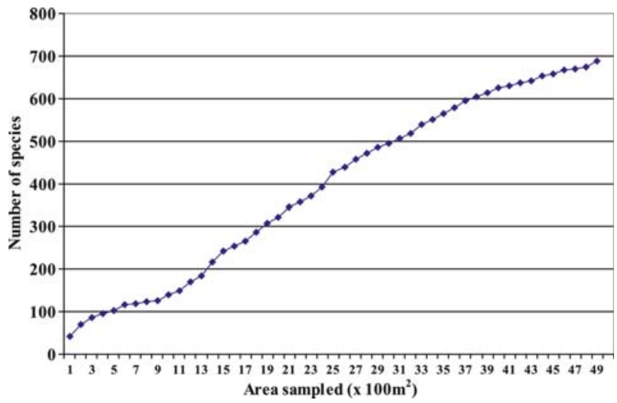

Figure 3. Species–area curve for 49 plots (100 m^2 each) in the study area.

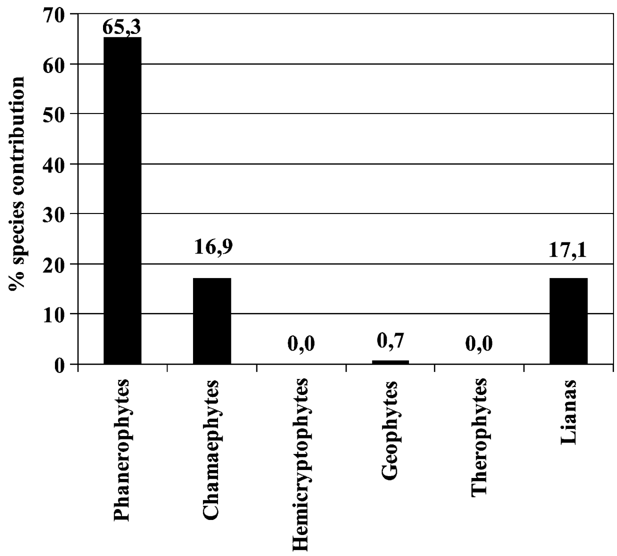

Figure 4. Life form spectrum (after Ellenberg and Müller-Dombois 1967) of species recorded from 49 plots (100 m^2 each) in the study area.

Discussion

The 685 taxa recorded from the 49 plots account for nearly 8% of the ca. 8900 vascular plant species so far described for the Philippines (Davis et al. 1995). Although the plots were not contiguous and species numbers can therefore be expected to be higher than in contiguous plots (Whitmore 1985) this figure is high, considering the small overall study area (4900 m^2 in total). Only very few datasets cover tropical lowland forest vegetation comprehensively and are therefore suitable for comparison. The only study using the same plot size was conducted by Whitmore et al. (1985) in the tropical lowland rain forest of Costa Rica, who analysed a plot of 100 m^2, considering all vascular plants. They recorded a total of 233 species, including 59 (25%) epiphyte species. In the present study, the highest number of species recorded from a single 100-m^2 plot was 80 and thus much lower than the number found by Whitmore et al. (1985). However, in the present study the vegetation up to 2.5 m tall as well as the lianas were collected from subplots of 25 m^2, and crown epiphytes were excluded. Despite this, the maximum number of vascular plant species on 100-m^2 plots in the study area can expected to be clearly lower than the number of 233 species recorded by Whitmore et al. (1985).

An estimate of the overall vascular plant species richness of Mt. Pangasugan area, including mossy forest as well as the different stages of succession, results in 1500–2000 species. This estimate is based on the very conservative assumption that 50% of the lowland forest species was recorded in this study, and that the mossy forest has a similar species richness as a 1-ha plot studied by

Meijer (1959) in a montane rainforest in Indonesia (333 vascular plant species). The numbers of tree species given by Ingle (2001) (100 species ≥5 cm dbh) and Hamann et al. (1999) (92 species ≥10 cm dbh) for 0.75- and 1-ha plots, respectively, in Philippine mountain environments show that the overall species richness including all life forms can be expected to be roughly similar to that of Meijer (1959) in Indonesia.

Representation of taxa

The composition of taxa observed in this study is similar to other areas in Southeast Asia. Differences to such sites are related to the proportions of families and result mainly from different inventory approaches. For trees alone, the dominance of the Dipterocarpaceae and the Euphorbiaceae concerning number of species is well documented (Manokaran and Kochummen 1990; Sist and Saridan 1998; Slik et al. 2003; Wilkie et al. 2004). Sist and Saridan (1998) report that the Dipterocarpaceae represent 70% of all trees ≥ 50 cm dbh in a primary forest in East Kalimantan. In our study, the Dipterocarpaceae were the most common family in the canopy layer (12 of 44 species).

Turner (1994) analysed the vascular flora of Singapore and its main habitat types from herbarium collections.The Orchidaceae are the most speciose family in his taxonomic spectrum. This reflects the large number of orchid species in Malesia (6500 species according to Soepadmo 1995). In our study, however, Orchidaceae are poorly represented because we did not include crown epiphytes. Without considering the orchids in both studies, the pteridophytes are the most speciose group, followed by the Rubiaceae and the Euphorbiaceae in both studies. The other predominant families in terms of species richness listed by Turner (1994) are Annonaceae, Moraceae, Arecaceae/Palmae, Myrtaceae, Melastomataceae and Lauraceae. With exception of the Melastomataceae, these are also the most speciose families in our study (Figure 2).

Representation of forest types

The rugged relief of the study area represents a broad spectrum of Philippine habitats. The comparison of the tree species recorded from our study with the typical tree species composition of the forest types described by Whitford (1911) showed a high degree of correspondence. Many tree species typical of the five dipterocarp forest types as well as the Molave type (Figure 5) were present. From the 18 tree species listed by Whitford (1911) as typical for the Lauán-hagághak, 15 were also present in our study area. Originally, this forest type is established on lowland plains on wet soils (Whitford 1911), but was transformed into rice fields in the study area. However, tree species representing this type of forest still occur on the banks of the small creeks at low

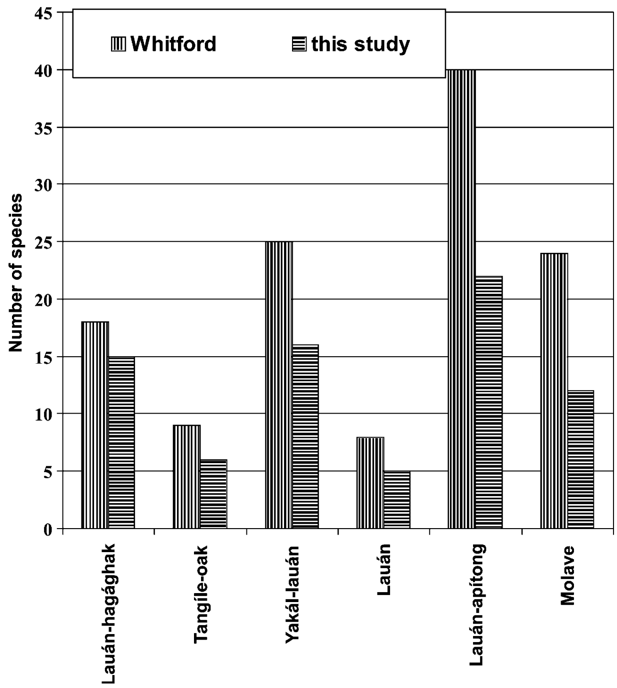

Figure 5. Comparison of the number of characteristic species of the different lowland forest types in the Philippines (after Whitford 1911) with the number of respective species recorded in this study.

elevations. The typical tree species of other forest types were also well represented (Figure 5). The high number of Molave type species (50% of the typical species as mentioned by Whitford 1911) in the study area is remarkable, as this forest represents dry limestone areas (Whitford 1911). This is another indication that the area's vegetation might be strongly influenced by drought periods.

Life form composition

The dominance of trees and phanerophytes is a typical feature of tropical rain forests (Richards 1996). In our study, Phanerophytes account for 65.3% of the species. Richards (1996) provides figures from a rain forest in Guyana, which are based on the Raunkiaer System (Raunkiaer 1934) and cannot be directly compared with our data. We therefore recalculated his data by excluding the lianas from the phanerophytes and excluded the epiphytes in addition. This resulted in a life form composition of 60% phanerophytes, 16% chamaephytes, and 24% lianas. A similar recalculation of figures provided by Cromer and Pryor (1942) for a rain forest in Queensland results in 77.1% phanerophytes, 12.5% chamaephytes, and 10.4% lianas. Figures for a terra firme rain forest in

Brasilia (Cain et al. 1956) are: phanerophytes 74.3%, chamaephytes 0.9%, hemicryptophytes 2.8%, geophytes 0.9%, lianas 12.8%, and epiphytes 8.3%.

Therophytes and hemicryptophytes are usually absent from undisturbed tropical rain forests (Richards 1996). Geophytes are also often absent as in Richards' Guyana study or represented by few species as in the present study (0.7%), where they were mainly made up of ground orchids.

The estimated proportion of epiphyte species of the total number of species in this study (ca. 10%) is clearly lower than the numbers given by Whitmore et al. (1985) (25%) for Costa Rica or by Gentry and Dodson (1987) (35%) for Ecuador.

Conservation value

Kochummen et al. (1992) stated that comparatively small areas might represent high numbers of a regional flora. They found that their 50-ha plot in the Pasoh Forest Reserve (Malaysia) included 25% of all trees and shrubs (≥ 1 cm dbh) of the Malay Peninsula. In our study, an overall sample area of approximately half hectare included ca. 8% of all Philippine vascular plant species. Given the small area considered as well as the fact that neither the successional vegetation nor the mossy forest is included, the representation of Philippine flora in the Mt. Pangasugan area is clearly higher than 8%.

The proportion of 52% endemic taxa recorded in this study is clearly higher than the proportion of 39% stated as an average for the Philippines (Davis et al. 1995). This result agrees with Ashton (1993) who stated that the south-eastern part of the Philippines is especially rich in endemic plants. The area's endemism might be even higher than 52%, as a number of taxa could not be identified. For example, only 3 of the 16 rattan species (Arecaceae) recorded, which generally show a high degree of endemism (Dransfield 1990), could be assigned to a scientific name. Two of them were Philippine endemics.

Another aspect referring to the conservation value of the area is the occurrence of 41 tree species in the red list of IUCN (2000). However, from the species recorded from this study, other than trees are not represented in the red list. Despite this, it can be expected that many of the non-tree taxa recorded are threatened by habitat destruction as well. For example, no rattans are listed by IUCN although this plant group is still heavily exploited and shows high rates of endemism. The IUCN red list seems to have a strong focus on well known and economically important tree species. This is supported by the fact that only dipterocarps are classified as critically endangered, although many other tree species are more rare in the study area. This was e.g. true for the valuable tree species *Heritiera sylvatica* (Sterculiaceae) and *Xanthostemon verdugonianus* (Myrtaceae) which were known by local farmers from only one mature tree each in the entire western foothills of Mt. Pangasugan.

Taken together, the Mt. Pangasugan region on Leyte represents a unique refuge for a high number of species, which are characteristic of all Philippine dipterocarp forest types and the molave type. In view of the large areas of degraded land in the Philippines, the conservation value of the Mt. Pangasugan region is very high and represents an important gene bank of the Philippine forest vegetation.

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Appendix

Species list of the vascular plant species found in 49 plots (100 m^2 each) in the foothills of the Leyte Cordillera at Mt. Pangasugan, Leyte, Philippines.

The list includes only those species which could be identified to species level. Some species recorded outside the plots are provided in addition.

Numbers in brackets following the species name indicate the first voucher specimen collected of this species.

Life form classification of species is based on observations of mature individuals in the study area, or from species descriptions in literature. Life form definitions follow Ellenberg and Mueller-Dombois (1967) with a minor revision by Richter (1997). MacP, Macrophanerophyte (>20–50 m); MesP, Mesophanerophyte (>5–20 m); MiP, Microphanerophyte (>2–5 m); NP, Nanophanerophyte (>1–2 m); NP herb, herbaceous Nanophanerophyte; Ch, Chamaephyte (≤ 1 m); Ch frut, fruticose Chamaephyte; Ch suff, suffruticose Chamaephyte; Ch herb, herbaceous Chamaephyte; G rhiz, rhizome Geophyte; PL, Phanerophytic Liana; r PL, root PL; st PL, winding PL; el PL, tendril PL; d PL, spread climber; E, Epiphyte.

Species classified by IUCN (2000) as endangered are listed along with their status in bold letters. Short definitions of the status are:

CR, critically endangered ('… facing an extremely high risk of extinction in the wild in the immediate future …'); EN, endangered ('… not critically endangered but facing a very high risk of extinction in the wild in the near future …'); VU, vulnerable ('… not critically endangered or endangered but facing high risk of extinction in the wild in the medium-term future …').

For comprehensive definitions and criteria of classification see www.iucnredlist.org/search-basic.html

I.

Spermatophyta	Life form
Aceraceae	
Acer laurinum Hassk. (1221)	MacP
Actinidiaceae	
Saurauia cf. *denticulata* C.B. Rob. (1078)	MiP
Saurauia samarensis Merr. (235)	MiP
Alangiaceae	
***Alangium longiflorum* Merr. (1331) VU**	MesP
Amaranthaceae	
Deeringia polysperma (Roxb.) Moq. (2214)	Ch herb
Anacardiaceae	
Dracontomelon dao (Blco.) Merr. & Rolfe (660)	MacP
Dracontomelon edule (Blco.) Skeels	Mes
Koordersiodendron pinnatum (Blco) Merr. (162)	MacP
***Mangifera altissima* Blco. (971) VU**	MacP
Rhus taitensis Guill. (818)	MesP
Semecarpus cuneiformis Blco. (538)	MiP
Annonaceae	
Alphonsea arborea (Blco.) Merr. (1009)	MesP
Anaxagorea javanica Bl. (1509)	MiP
Artabotrys cf. *rolfei* Vid. (2159)	el PL
Cananga odorata (Lamk.) Hook. f. & Thoms.	MesP
Goniothalamus elmeri Merr. (327)	MiP
Meiogyne virgata (Bl.) Miq.	MesP
Papualthia cf. *lanceolata* (Vid.) Merr. (206)	MesP
Popowia pisocarpa (Bl.) Endl. (1054)	MesP
Apocynaceae	
Alstonia macrophylla Wall. ex. G. Don (1774)	MesP
Alstonia scholaris (L.) R. Br.	MesP
Kibatalia blancoi (Rolfe) Merr. (467)	MesP
Lepiniopsis ternatensis Val. (2220)	MesP
Tabernaemontana pandacaqui Poir. (140)	MicP
Voacanga globosa (Blco.) Merr. (218)	MiP
Araceae	
Alocasia cf. *zebrina* Schott ex van Houtte (1677)	Ch herb
Amorphophallus paeoniifolius (Dennst.) Nicolson (1924)	NP herb
Costus speciosus (J. Konig) Sm	NP herb

Spermatophyta	Life form
Pothos cylindricus Presl (1226)	r PL
Raphidophora korthalsii Schott (881)	d PL
Araliaceae	
Arthrophyllum ahernianum Merr. (1911)	MesP
Osmoxylon trilobatum (Merr.) Philipson (220)	NP
Polyscias nodosa (Bl.) Seem.	MesP
Arecaceae	
Calamus cf. *merrillii* Becc.	d PL
Caryota cf. *cumingii* Lodd. ex Mart	MiP
Caryota cf. *mitis* Lour. (560)	MesP
Daemonorops cf. *mollis* (Blco.) Merr. (593)	PL
Korthalsia laciniosa Mart. (1120)	d PL
Pinanga maculata Porte	MiP
Caryota rumphiana Mart. var. *philippinensis* Becc.	MacP
Aristolochiaceae	
Aristolochia philippinensis Warb. (702)	Ch suff
Asclepiadaceae	
Hoya multiflora Bl. (689)	PL
Asteraceae	
Vernonia arborea Buch.-Ham. (826)	MesP
Bignoniaceae	
Oroxylum indicum (L.) Vent.	MesP
Radermachera pinnata (Blco.) Seem. (1129)	MesP
Burseraceae	
Canarium asperum Benth. (265)	MacP
Canarium denticulatum Bl. (428)	MesP
Canarium euryphyllum Perk. (1265)	MacP
Canarium gracile Engl. (611)	MesP
Canarium hirsutum Willd. (1714)	MesP
Dacryodes rostrata (Bl.) H. J. Lam (247)	MacP
Caprifoliaceae	
Sambucus javanica Reinw. ex Bl.	MiP
Casuarinaceae	
Gymnostoma rumphianum (Miq.) L.A.S. Johnson (1915)	MesP
Cecropiaceae	
Poikilospermum erectum (Blco) Merr. (321)	d PL
Poikilospermum suaveolens (Bl.) Merr. (328)	d PL
Celastraceae	
Bhesa paniculata Arn. (812)	MesP
Euonymus cochinchinensis Pierre (495)	MesP
Euonymus javanicus Bl. (232)	MesP
Lophopetalum javanicum (Zoll.) Turcz. (1127)	MacP
Chloranthaceae	
Chloranthus erectus (Buch.-Ham.) Verdc. (1522)	Ch suff
Sarcandra glabra (Thunb.) Nakai (562)	Ch frut

Spermatophyta	Life form
Chrysobalanaceae	
Maranthes corymbosa Bl. (790)	MacP
Clusiaceae	
Calophyllum blancoi Pl. & Tr. (278)	MesP
Calophyllum soulattri Burm. f. (1250)	MesP
Cratoxylum formosum Benth. & Hook. f. ex Dyer (452)	MesP
Combretaceae	
Terminalia microcarpa Decne. (672)	MacP
Terminalia nitens **Presl (481) VU**	MesP
Commelinaceae	
Floscope scandens Lour.	Ch herb
Forrestia hispida Less. & A. Rich. (423)	Ch herb
Pollia sorzogoniensis (E. Meyer) Steud.	Ch herb
Pollia thyrsiflora (Bl.) Steud.	Ch herb
Rhopalephora cf. *vitiensis* (Seem.) Fader (2102)	Ch herb
Connaraceae	
Agelaea borneensis (Hook. f.) Merr. (491)	st PL
Connarus culionensis Merr. (686)	PL
Connarus semidecandrus Jack (623)	PL
Ellipanthus tomentosus Kurz (396)	MesP
Crypteroniaceae	
Crypteronia cumingii (Planch.) Planch. ex Endl. (1693)	MesP
Cunoniaceae	
Weinmannia cf. *hutchinsonii* Merr. (130)	MesP
Datiscaceae	
Octomeles sumatrana Miq.	MacP
Dilleniaceae	
Dillenia megalantha **Merr. (2007) VU**	MesP
Dillenia philippinensis **Rolfe VU**	MesP
Tetracera fagifolia Bl. (674)	st PL
Dioscoreaceae	
Dioscorea hispida Dennst.	PL
Dipterocarpaceae	
Anisoptera thurifera Foxw. ssp. *thurifera* (353)	MacP
Dipterocarpus gracilis **Bl. (486) CR**	MacP
Dipterocarpus validus **Bl. CR**	MacP
Hopea acuminata **Merr. (292) CR**	MacP
Hopea malibato **Foxw. ex Elm. (20) CR**	MacP
Hopea philippinensis **Dyer (925) CR**	MacP
Hopea plagata **(Blco.) Vid. (305) CR**	MacP
Parashorea malaanonan **(Blco.) Merr. (267) CR**	MacP
Shorea almon **Foxw. (430) CR**	MacP
Shorea assamica **Dyer forma** ***philippinensis*** **(Brandis) Sym. (269) CR**	MacP
Shorea astylosa **Foxw. (1796) CR**	MacP
Shorea cf. hopeifolia **(Heim) Sym. (2110) CR**	MakP
Shorea contorta **Vid. (1001) CR**	MacP

Spermatophyta	Life form
***Shorea falciferoides* Foxw. ssp. *falciferoides* (290) CR**	MacP
***Shorea guiso* (Blco) Bl. (384) CR**	MacP
***Shorea palosapis* (Blco) Merr. (263) CR**	MacP
***Shorea polysperma* (Blco) Merr. (297) CR**	MacP
***Vatica mangachapui* Blco. (528) EN**	MacP
Ebenaceae	
***Diospyros blancoi* A. DC. (163) VU**	MacP
Diospyros cf. *nitida* Merr. (1901)	MiP
Diospyros curranii Merr. (1631)	MesP
Diospyros multibracteata Merr. (598)	MiP
Diospyros pilosanthera Blco.	MesP
Diospyros pyrrhocarpa Miq. (385)	MesP
Elaeagnaceae	
Elaeagnus triflora Roxb. var. *triflora* (412)	dPL frut
Elaeocarpaceae	
Elaeocarpus cumingii Turcz. (1123)	MesP
Euphorbiaceae	
Acalypha amentacea Roxb. (254)	NP
Antidesma digitaliforme Tul. (371)	NP
Antidesma nitidum Tul. (268)	MiP
Antidesma tomentosum Bl. (919)	MicP
Aporosa benthamiana Hook. f. (573)	MiP
Baccaurea tetrandra (Baill.) Müll. Arg. (360)	MesP
Bridelia glauca Bl. (233)	MesP
Claoxylon brachyandrum Pax & K. Hoffm. (379)	MesP
Cleistanthus cf. *glaber* Airy Shaw (628)	MesP
Cleistanthus sumatranus (Miq.) Müll. Arg. (396)	MesP
Codiaeum luzonicum Merr.	MiP
Croton cascarilloides Raeusch. (205)	NP
Drypetes cf. *megacarpa* (Bl.) Pax & Hoffm. (374)	MiP
Drypetes longifolia (Merr.) Pax et Hoffm. (372)	MiP
Glochidion rubrum Bl. (715)	MiP
***Macaranga caudatifolia* Elm. (735) VU**	MiP
***Macaranga grandifolia* (Blcol.) Merr. VU**	MesP
Macaranga hispida (Bl.) Muell.-Arg.	MiP
Macaranga tanarius (L.) Muell.-Arg.	MesP
Mallotus cf. *paniculatus* (Lam.) Muell.-Arg. (330)	MesP
Mallotus floribundus (Bl.) Muell.-Arg. (228)	MesP
Mallotus lackeyi Elm. (1800)	MesP
Mallotus philippensis (Lam.) Muell.-Arg. (302)	MesP
Neotrewia cumingii (Muell.-Arg.) Pax & Hoffm. (343)	MesP
Omalanthus populneus (Geisel.) Pax	MiP
Phyllanthus leytensis Elm. (250)	Ch frut
Suregada glomerulata (Hassk.) Jones (287)	NP
Fagaceae	
Lithocarpus buddii (Merr.) A. Camus (15)	MacP
Lithocarpus caudatifolia (Merr.) Rehd. (555)	MesP
Lithocarpus coopertus (Blco) Rehd. (387)	MesP

Spermatophyta	Life form
Flacourtiaceae	
Casearia cf. *mindanaensis* Merr. (1675)	P
Casearia grewiaefolia Vent. var. *gelonioides* (Bl.) Sleum. (794)	MesP
Flacourtia cf. *indica* (Burm. f.) Merr. (378)	MesP
Osmelia philippina (Turcz.) Benth. (352)	MesP
Flagellariaceae	
Flagellaria indica L. (1128)	el PL
Gesneriaceae	
Cyrtandra angularis Elm. (2212)	Ch herb
Cyrtandra glaucescens Kranzl. (960)	Ch herb
Monophyllaea merrilliana Kranzl. (2027)	Ch herb
Rhynchoglossum obliquum Bl.	Ch herb
Gnetaceae	
Gnetum gnemon L. var. *gnemon* (375)	MesP
Gnetum latifolium Bl.	PL
Hamamelidaceae	
Sycopsis dunnii Hemsl. (739)	MesP
Hernandiaceae	
Illigera megaptera Merr. (721)	PL
Icacinaceae	
Gomphandra cumingiana (Miers) F.-Vill. (1118)	MesP
Gonocaryum calleryanum (Baill.) Becc. (700)	MesP
Miquelia celebica Bl.	PL
Phytocrine macrophylla (Bl.) Bl. var. *macrophylla*	PL
Platea excelsa Bl. var. *borneensis* (Heine) Sleum. (1217)	MesP
Ixonanthaceae	
Ixonanthes petiolaris Bl.	MesP
Juglandaceae	
Engelhardtia serrata Bl. (411)	MacP
Lamiaceae	
Gomphostemma javanicum (Bl.) Bth. (285)	Ch herb
Lauraceae	
Actinodaphne apoensis Merr. (1083)	MesP
Actinodaphne bicolor (Elm.) Merr.	MesP
Actinodaphne cf. *multiflora* Benth. (833)	MesP
Caryodaphnopsis tonkinensis (Lec.) Shaw (441)	MesP
***Cinnamomum mercadoi* Vid. (468) VU**	MacP
Endiandra coriacea Merr. (1883)	MesP
Litsea garciae Vid. (478)	MesP
***Litsea leytensis Merr.* (805) VU**	MesP
***Neolitsea cf. vidallii* Merr. (272) VU**	MiP

Spermatophyta	Life form
Leeaceae	
Leea aculeata Bl. ex Spreng.	Mip
Leea guineensis G. Don (255)	MiP
Leea quadrifida Merr. (546)	MiP
Leguminosae	
***Afzelia rhomboidea* (Blco.) Vid. VU**	MesP
Albizia procera (Roxb.) Benth.	MacP
Albizia saponaria (Lour.) Bl. ex Miq.	MesP
Archidendron clypearia var. *casai* (Blco.) I.C. Nielsen (1082)	MesP
Archidendron pauciflorum (Benth.) Nielsen (1852)	MiP
Archidendron scutiferum (Blco.) I.C. Nielsen (323)	MesP
Bauhinia integrifolia Roxb. ssp. *cumingiana* (Benth.) K. & S.S. Larsen (364)	PL
Dalbergia cf. *mimosella* (Blco) Prain (1435)	MesP
Desmodium laxum DC. (820)	Ch herb
Entada phaseoloides (L.) Merr.	el PL
Erythrina subumbrans (Hassk.) Merr.	MacP
Euchresta horsfieldii (Lesch.) Benn. (847)	Ch herb
Kingiodendron alternifolium (Elm.) Merr. & Rolfe (357)	MacP
Ormosia calavensis Azaola	MesP
***Pterocarpus indicus Willd.* VU**	MesP
Wallaceodendron celebicum Koord. (395)	MacP
Liliaceae	
Dianella ensifolia (L.) DC.	Ch herb
Loganiaceae	
Fagraea auriculata Jack ssp. *auriculata* (851)	st PL
Fagraea racemosa Jack ex Wall.	MiP
Strychnos luzoniensis Elm. (748)	el PL
Magnoliaceae	
Magnolia liliifera (L.) Baill. var. *angatensis* (719)	MesP
Marantaceae	
Donax cannaeformis (Forst. f.) K. Schum. (1006)	MiP
Marattiaceae	
Angiopteris evecta (Forst.) Hoffm. (1188)	NP herb
Marattia pellucida Presl (1444)	Ch herb
Melastomataceae	
Memecylon paniculatum Jack (311)	MiP
Meliaceae	
Aglaia argentea Bl. (642)	MesP
***Aglaia costata* Merr. (275) VU**	MesP
Aglaia elliptica Bl. (1295)	MesP
Aglaia luzoniensis (Vid.) Merr. & Rolfe (511)	MiP
Aphanamixis polystachia (Wall.) R.N. Parker (941)	MesP
Chisocheton ceramicus (Miq.) C. DC.) (1184)	MesP
Chisocheton cumingianus (C. DC.) Harms (211)	MesP
Chisocheton pentandrus (Blco.) Merr. (753)	MesP

Spermatophyta	Life form
Dysoxylum arborescens (Bl.) Miq. (664)	MesP
Dysoxylum cumingianum C. DC. (316)	MesP
Reinwardtiodendron humile (Hassk.) Mabb. (965)	MesP
Toona calantas Merr. & Rolfe (918)	MacP
Vavaea amicorum Benth. (273)	NP
Walsura cf. *pinnata* Hassk. (2082)	MesP
Menispermaceae	
Arcangelisia flava (L.) Merr. (1798)	el PL
Monimiaceae	
Matthaea pubescens Merr. (139)	MiP
Moraceae	
Ficus aurita Bl. (210)	MiP
***Artocarpus blancoi (Elm.)* Merr. (1701) VU**	MacP
Artocarpus elastica Reinw. ex Bl. (697)	MacP
Ficus balete Merr. (v)	MacP
Ficus benjamina L. (1075)	MacP
Ficus cumingii Miq. var. *angustissima* (Merr.) Corner (778)	MesP
Ficus fistulosa Reinw. ex Bl. (1307)	MiP
Ficus heteropoda Miq. (425)	MiP
Ficus odorata (Blco.) Merr.	MesP
Ficus pedunculosa Miq. (1780)	MiP
Ficus pseudopalma Blco.	NP
Ficus punctata Thunb. (406)	r PL
Ficus ribes Reinw. ex Bl. (405)	MiP
Ficus ruficaulis Merr.	MesP
Ficus subulata Bl. (646, 1966)	PL
***Ficus ulmifolia Lam.* (451) VU**	MesP
Maclura cochinchinensis (Lour.) Corner (1417)	d PL
Streblus ilicifolia (Vid.) Corner (1700)	MesP
Streblus macrophyllus Bl. (216, 335, 613)	MesP
Myristicaceae	
Endocomia macrocoma (Miq.) W.J.J. de Wilde subsp. *prainii* (King) W.J.J.de Wilde (479)	MesP
Gymnacranthera farquhariana (Hook. f. & Th) Warb. var. *paniculata* (A. DC.) R. Schouten (541)	MesP
Horsfieldia cf. *costulata* (Miq.) Warb. (2002)	MesP
Knema glomerata (Blco.) Merr. (641)	MesP
Knema stellata Merr. (1481)	MesP
***Myristica cf. frugifera* W. J. J. de Wilde (743) VU**	MesP
***Myristica cf. philippensis* Lam. VU**	MesP
Myristica simiarum A. DC cf ssp. *simiarum* (417)	MesP
Myrsinaceae	
Ardisia pardalina Mez. (815)	Ch frut
***Ardisia squamulosa* Presl (204) VU**	Ch frut
Maesa denticulata Mez (241)	MiP
Myrtaceae	
Acmena acuminatissima (Bl.) Merr. & Perry (503)	MacP

Spermatophyta	Life form
Syzygium cf. *densinervium* (Merr.) Merr. (749)	MesP
Syzygium cf. *xanthophyllum* (C.B. Rob.) Merr.	MesP
Syzygium cumini (L.) Skeel	MesP
***Tristaniopsis decorticata* (Merr.) P.G. Wilson & J.T. Waterh. (142) VU**	MesP
Tristaniopsis micrantha (Merr.) P.G. Wilson & J.T. Waterh. (301)	MesP
***Xanthostemon verdugonianus* Naves (2209) VU**	MacP
Ochnaceae	
Gomphia serrata (Gaertn.) Kanis	MesP
Olacaceae	
Erythropalum scandens Bl. (780)	el PL
Strombosia philippinensis (Baill.) Rolfe (380)	MesP
Oleaceae	
Olea borneensis Boerl. (306)	MesP
Opiliaceae	
Champereia manillana (Bl.) Merr. (100)	MesP
Melientha suavis Pierre ssp. *suavis* (366)	MesP
Orchidaceae	
Calanthe triplicata (Willem.) Ames	G rhiz
Ceratostylis retisquama Rchb. f.B143	E
Cymbidium aliciae Quis. (880)	E
Eulophia zollingeri (Reichb.f.) J.J.Smith	G rhiz
Grammatophyllum multiflorum var. *tigrinum* Lindley.	E
Lepidogyne longifolia (Bl.) Bl.	G rhiz
Liparis wenzelii Ames	G rhiz
Phalaenopsis hieroglyphica (Rchb. f.) Sweet	E
Robiquetia cf. *compressa* Schltr.	E
Trichoglottis latisepala Ames	E
Trichoglottis rosea (Lindl.) Ames (1055)	E
Pandanaceae	
Freycinetia cf. *philippinensis* Hemsl. (1353)	r PL
Freycinetia cumingiana Gaudich. (388, 1234)	r PL
Freycinetia multiflora Merr. (1130)	r PL
Freycinetia vidalii Hemsl. (1352)	r PL
Freycinetia membranifolia Elm. (955)	r PL
Pentaphragmataceae	
Pentaphragma grandiflorum Kurz (457, 458, 1407)	Ch herb
Piperaceae	
Piper abbreviatum Opiz (638)	st PL
Piper halconense C. CD.	st PL
Piper toppingii C. CD. (654, 1143)	st PL
Piper viminale Opiz (1205)	st PL
Pittosporaceae	
Pittosporum resiniferum Hemsl. (448)	Mesp

Spermatophyta	Life form
Poaceae	
Bambusa spinosa Roxb.	MesP
Dinochloa cf. *pubiramea* Gamble	PL
Dinochloa cf. *scandens* (Bl.) O. Ktze.	PL
Podocarpaceae	
Podocarpus rumphii Bl. (1520)	MacP
Polygalaceae	
Polygala venenosa Juss. ex Poir. (284, 2011)	Ch herb
Xanthophyllum vitellinum (Bl.) Dietr. (992)	MesP
Proteaceae	
Helicia graciliflora Merr. (1154)	MiP
Helicia loranthoides Presl. (1079)	MesP
Helicia robusta (Roxb.) R. Br. ex Wall. (588)	MiP
Ranunculaceae	
Clematis javana DC. (159, 1997)	PL
Rhamnaceae	
Ventilago dichotoma (Blco.) Merr. (723)	PL
Ziziphus angustifolius (Miq.) Hatusima ex Steenis (488)	MesP
Ziziphus crebrivenosa C.B. Rob. (492, 661)	d PL
Rhizophoraceae	
Gynotroches axillaris Bl. (1538)	MacP
Rosaceae	
Prunus arborea (Bl.) Kalkm. var. *arborea* (1624)	MesP
Prunus cf. *fragrans* (Elm.) Kalkm. (795)	MesP
Prunus grisea (Bl.) Kalkm. var. *grisea* (71, 490)	MesP
Rubus fraxinifolius Poiret (2017)	d PL suff
Rubiaceae	
Boholia nematostylis Merr. (1919)	Ch herb
Canthium gynochthodes Baill. (563)	MesP
Diodia ocynifolia (Willd.) Brem. (1424)	PL
Diplospora cf. *fasciculiflora* Elm. (663)	MiP
Dolicholobium philippinense Trenteuse (260)	MiP
Greeniopsis multiflora (Elm.) Merr. (279)	MesP
Hedyotis baruensis (Miq.) Val. ex Merr. (329)	Ch herb
Hypobathrum purpureum (Elm.) Merr. (1507)	MesP
Ixora bartlingii Elm. (1060)	Mip
Ixora cf. *cumingiana* Vidal (509)	MiP
Ixora cf. *macrophylla* Bartl. (207)	MiP
Ixora longistipula Merr. (1122)	MiP
Ixora macrophylla Barth.	MiP
Ixora salicifolia (Bl.) DC. (288)	NP
Lasianthus cf. *obliquinerva* Merr. (701)	MiP
Morinda bracteata Roxb. (326)	MiP
Mussaenda philippica A. Rich.	MiP
Mussaenda vidallii Elm. (129)	MiP
Mycetia javanica (Bl.) Korth. (258)	Ch suff
Nauclea subdita (Korth.) Stend. (1958)	MiP

Spermatophyta	Life form
Neonauclea formicaria (Elm.) Merr. (793)	MiP
Neonauclea lanceolata (Bl.) Merr. subsp. *gracilis* (Vidal) Ridsdale (402)	MesP
Praravinia cf. *mindanensis* (Elm.) Brem. (289)	NP
Psychotria cf. *ixoroides* Bartl. ex DC. (515)	st PL
Psychotria membranifolia Bartl. ex DC. (257)	NP
Tarenna cumingiana (Vid.) Elm. (464)	MesP
Tarrenoidea wallichii (Hook. f.) D.D.Tirvengadum & C. Sastre (307)	MesP
Timonius arboreus Merr. (248)	MiP
Uncaria cf. *perrottetii* (A. Rich.) Merr. (325)	el PL
Uncaria lanosa Wall. f. *philippinensis* (Elm.) Ridsd. (900)	el PL
Uncaria longiflora (Poir.) Merr. (1300)	el PL
Wendlandia luzoniensis DC. (444)	MesP
Xanthophytum fruticulosum Reinw. ex Bl. (1005)	NP
Rutaceae	
Clausena anisum–olens (Blco.) Merr. (605)	NP
Lunasia amara Blco. (158)	NP
Micromelum compressum (Blco.) Merr. (771)	NP
Severinia disticha (Blco) Merr. (398)	NP
Sapindaceae	
Allophyllus cobbe (L.) Raeuschel (823)	MesP
Cubilia cubili (Blco.) Adelh. (586)	MacP
Dictyoneura acuminata Bl. ssp. *acuminata* (246)	MesP
Dimocarpus fumatus (Bl.) Leenhouts ssp. *philippinensis* Leenhouts (72)	MesP
Euphorianthus obtusatus Radlk. ex Koord. (1641)	MesP
Ganophyllum falcatum Bl. (1212)	MesP
Guioa cf. *diplopetala* (Hassk.) Radlk. (1104)	MesP
Harpullia cupanioides Roxb. (212)	MesP
Lepisanthes fruticosa (Roxb.) Leenh. (933)	MesP
Nephelium cf. *ramboutan–ake* (Labill.) Leenh. (442)	MesP
Paranephelium cf. *xestophyllum* Miq. (727)	MesP
Pometia pinnata Forst. (578, 1546)	MesP
Sapotaceae	
***Palaquium philippense* (Perr.) C. B. Rob. (443) VU**	MacP
Planchonella mindanaensis Clemens (1126)	MacP
Pouteria firma (Miq.) Baehni (1237)	MacP
Saxifragaceae	
Dichroa philippinensis Schltr.	Ch frut
Polyosma integrifolia Bl. (1219)	NP
Dichroa fibrifuga (807)	
Simaroubaceae	
Picrasma javanica Bl. (218)	MesP
Solanaceae	
Solanum anisophyllum Elm. (225)	Ch herb
Solanum ferox L. (282)	Ch herb
Sonneratiaceae	
Duabanga moluccana Bl.	MacP

Spermatophyta	Life form
Staphyleaceae	
Turpinia borneensis (Merr. & Perry) B.L. Linden (1802)	MesP
Sterculiaceae	
Heritiera sylvatica Vidal (1768)	MesP
Pterocymbium tinctorium (Blco.) Merr. (345)	MacP
Pterospermum diversifolium Bl. (270)	MesP
Pterospermum elongatum Korth. (434)	MesP
Pterospermum obliquum Blco. (120)	MesP
Sterculia multistipularis Elm. (251)	MiP
Sterculia oblongata R. Br. (678)	MesP
Sterculia philippinensis Merr. (1898)	MesP
Sterculia stipulata Korth. var. *jagorii* (Warb.) Tantra	MesP
Symplocaceae	
Symplocos cochinchinensis(Lour.) Moore var. *cochinchinensis* (1954)	MicP
Taccaceae	
Tacca palmata Bl. (303)	G rhiz
Theaceae	
Eurya acuminata DC. (1314)	NP
Ternstroemia philippinensis Merr. var. *philippinensis* (1491)	MesP
Thymelaeaceae	
Aquilaria cumingiana (Decn) Ridl. (300)	NP
Phaleria perrottetiana (Dcne) F.-Vill. (160)	Ch suff
Tiliaceae	
Colona serratifolia Cav. (626)	MesP
***Diplodiscus paniculatus* Turcz. (271) VU**	MesP
Ulmaceae	
Celtis cf. *philippinensis* Blanco	MesP
Gironniera celtidifolia Gaudich. (238)	MiP
Trema orientalis (L.) Bl. (2202)	MesP
Urticaceae	
Cypholophus moluccanus (Bl.) Miq.	Ch frut
Leucosyke capitellata (Poir.) Wedd. (242)	MiP
Maoutia setosa Wedd.	NP
Villebrunea rubescens (Bl.) Bl. (324)	MesP
Villebrunea trinervis Wedd. (733)	MesP
Verbenaceae	
Clerodendrum villosum Bl.	NP
Teijsmanniodendron pteropodum (Miq.) Bakh. (157)	MesP
Vitex parviflora Juss. (1837)	MacP
Vitex turczaninowii Merr. (705)	MacP
Premna odorata Blco. (633)	MesP

II.

Ptaridophyta	Life form
Aspidiaceae	
Didymochlaena cf. *truncatula* (Sw.) J. Sm. (2056)	Ch herb
Aspleniaceae	
Asplenium nidus L. (1902)	Ch herb
Asplenium tenerum Forst. (2096)	Ch herb
Athyriaceae	
Diplazium asperum (Bl.) Milde (1809)	Ch herb
Diplazium esculentum (Retz.) Sw. (1846)	Ch herb
Cyatheaceae	
Cyathea cf. *contaminans* (Hook.) Copel.	MesP
Davalliaceae	
Davallia solida (G. Forst.) Sw. (1462)	Ch herb
Davallia trichomanoides Bl. var. *lorrainii* (Hance) Holttum (222)	Ch herb
Hymenophyllaceae	
Trichomanes javanicum Bl. (1042)	Ch herb
Lindsaeaceae	
Lindsaea lucida Bl. ssp. *lucida* (533)	Ch herb
Sphenomeris chinensis (L.) Maxon	Ch herb
Tapeinidium pinnatum (Cav.) C.Chr. (1267)	Ch herb
Lomariopsidaceae	
Bolbitis cf. *guoyana* (Gaudich.) Ching (2016)	Ch herb
Bolbitis guoyana (Gaudich.) Ching	Ch herb
Bolbitis heteroclita (Presl) Ching (1049)	r PL
Lomogramma cf. *copelandii* Holttum (1851)	r PL
Lomogramma copelandii Holttum	r PL
Teratophyllum arthropteroides (Christ) Holttum (2084)	Ch herb
Teratophyllum cf. *articulatum* (J. Sm. ex Fèe) Mett. (516)	Ch herb
Osmundaceae	
Osmunda banksiaefolia (Pr.) Kuhn (1261, 1392)	Ch herb
Polypodiaceae	
Drynaria quercifolia (L.) J. Sm	E
Leptochilus cf. *decurrens* Bl.	Ch herb
Microsorum cf. *longissimum* J. Sm. ex Fée (964)	Ch herb
Microsorum membranifolium (R. Br.) Ching	Ch herb
Microsorum punctatum (L.) Copel. (1821)	Ch herb
Microsorum scolopendria (Burm. f.) Copel. (1445)	Ch herb
Pyrrosia cf. *lanceolata* (L.) Farwell	PL
Microsorum plukenetii (Presl) M.G. Price (1860)	
Pteridaceae	
Pteris cf. *pellucida* Presl	Ch herb
Pteris ensiformis Burm. f. (1806)	Ch herb
Pteris longipinnula Wall. (334)	Ch herb
Schizaeaceae	
Lygodium auriculatum (Willd.) Alst. et Holtt. (1974)	st PL
Lygodium circinnatum (Burm. f.) Sw. (1603)	st PL

Ptaridophyta	Life form
Selaginellaceae	
Selaginella cf. *involvens* (Sw.) Spring (856)	Ch frut
Selaginella cf. *springiana* Alderw. (1526)	Ch frut
Selaginella cupressina (Willd.) Spring (745)	Ch frut
Selaginella engleri Hieron. (1011)	Ch frut
Taenitidaceae	
Taenitis blechnoides (Willd.) Sw. (1091)	Ch herb
Tectaria group	
Ctenitis cf. *silvatica* Holttum (939)	Ch herb
Cyclopeltis crenata (Fée) C. Chr. (1807)	Ch herb
Pleocnemia cf. *presliana* Holttum (1849)	Ch herb
Pleocnemia irregularis (Presl) Holttum (1007)	Ch herb
Tectaria crenata Cav. (1301)	Ch herb
Thelypteridaceae	
Cyclosorus sumatranus (v. Ald. v. Ros.) Ching	Ch herb
Pneumatopteris laevis (Mett.) Holttum (1812)	Ch herb
Pronephrium × *xiphioides* (Christ) Holttum (498)	Ch herb
Pseudophegopteris paludosa (Bl.) Ching (2093)	Ch herb
Pronephrium granulosum (Presl) Holtt. (997)	Ch herb

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