

## VEGETATION TYPES AND THE DECIDUOUS–EVERGREEN FOREST CONTINUUM ALONG AN ELEVATION GRADIENT IN MAE WONG NATIONAL PARK, WESTERN THAILAND

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### ABSTRACT

Four monsoon (seasonal) forest types were identified and studied in Mae Wong National Park including the use of six transects at different elevations. Trees and woody climbers with a girth at breast height (GBH)  $\geq 10$  cm were tagged, measured, collected, and identified. Almost 600 vascular plant species are enumerated in this study including the habit, habitat, elevation, abundance, and phenology. The four monsoon forest types can be divided into two main types, viz. deciduous and evergreen based on the availability of soil and atmospheric moisture in the dry season. Evergreen forests occur where soil moisture is sufficient for maintaining photosynthesis in all months, while deciduous forests occur where it is depleted during the dry season. Elevation is also a determining factor for soil moisture. Deciduous forest occurs from 140 m to c. 600 m, a mixed evergreen + deciduous forest (MXF) from c. 600 to 1,100 m, and above 1,100 m is primary evergreen forest (EGF). The MXF occurs as a gradual transition between deciduous forest with bamboo (BB/DF) and EGF, from a forest with more than 80% deciduous species at the lowest limit to one with more than 80% evergreen species at the upper limit. Grassland and secondary growth, the result of forest clearance and destruction by forest fires, occur throughout the park at all elevations.

Quantitative analysis was performed to estimate species dominance, species diversity, and species rareness within each vegetation type. Evergreen forest (EGF) supports the highest species richness (119), but a relative low species diversity as compared with mixed evergreen + deciduous forest (MXF, 93 spp.), which also contains a distinct set of species not found in other forest types. Deciduous dipterocarp forest (DDF) had the lowest species richness (49) and species diversity. It is completely dominated by *Shorea siamensis* var. *siamensis* and *Dipterocarpus obtusifolius* var. *obtusifolius* (both Dipterocarpaceae). Most forest types had a high tree density/ha (DBH  $\geq 10$  cm, 364–605 trees ha<sup>-1</sup>) except for MXF (335 trees ha<sup>-1</sup>).

Mae Wong still supports high plant diversity, but widespread human disturbance has degraded the vegetation. The area has been subject to uncontrolled, agricultural practices (e.g. slash and burn), logging, and annual fires. Due to these disturbances species diversity and forest structures have been reduced and the remaining intact forests, especially MXF, are threatened with further degradation and loss of biodiversity.

Keywords: floristic composition, Mae Wong National Park, Thailand, forest types.

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## INTRODUCTION

The natural vegetation of Mae Wong National Park has suffered heavily from uncontrolled agricultural expansion, destructive exploitation (logging and road construction), and forest fires. Several ethnic groups (Hmong, Karen, Lisu, and Muser), have lived in the area for decades. Their primitive agricultural practices (shifting or slash-and-burn cultivation) have destroyed much of the original vegetation, especially above 800 m elevation. Their crops have included upland rice, corn, vegetables, and opium. Encroachment, by both hill tribes and Thais, was further encouraged by the extension of the original logging road from Klong Lan to Umpang in the late 1960s by the Thai army to gain access to the last putative communist strongholds. In 1982 all the hill tribe settlements were relocated to areas just outside the eastern border of the park. It was designated as the 55<sup>th</sup> national park of Thailand in September 1987.

Intensive logging, especially in deciduous lowland teak forest, stripped the area of most of its valuable timber species such as *Tectona grandis* (teak, Verbenaceae), *Xylia xylocarpa* var. *kerrii* (Leguminosae, Mimosoideae), *Pterocarpus macrocarpus* (Leguminosae, Papilionoideae), and *Azelia xylocarpa* (Leguminosae, Caesalpinioideae). When the stocks of these species were depleted, other less valuable species such as *Lagerstroemia cochinchinensis* var. *ovalifolia* (Lythraceae), *Canarium subulatum* (Burseraceae), and *Terminalia bellirica* (Combretaceae) followed suit. Commercial logging officially stopped in the early 1970s, but illegal logging is still a major threat to the remaining forested areas.

Annual (mostly manmade) forest fires are also a concern, as they not only destroy seedlings, saplings, and ground flora, but also damage larger trees. These fires penetrate and degrade evergreen forests at higher elevations.

The aims of this study were to identify and describe forest types and their floristic composition from the lowlands at *c.* 140 m elevation up the mountains to elevations of over 1400 m. Four major forest types are traditionally recognized in this elevational range: Deciduous Dipterocarp Forest, Mixed Deciduous Forest, Dry Evergreen Forest, and Hill Evergreen Forest. Dry Evergreen Forest actually contains a mixture of deciduous and evergreen species, and therefore has been called Mixed Evergreen + Deciduous Forest (MXF) by MAXWELL & ELLIOTT (2001) in their study of the vegetation of Doi Sutep-Pui. We wished to determine how distinct this forest type really is, and whether the transition from deciduous to a more evergreen state is abrupt or involves a gradual replacement along the elevation gradient. After presenting our rather surprising findings we will comment on the definition and distributional range of this forest type.

## LOCATION

Mae Wong National Park (NP) is located in western Thailand close to the Burmese border at 99°02' – 99°22' E and 15°40' – 16°07' N (Fig. 1). It is part of Thailand's Western Forest Complex, which consists of 17 nearly contiguous protected areas which together cover more than 18,000 km<sup>2</sup> (VAN DE BULT, 2003). Mae Wong NP is situated in Nakhon Sawan and Khampaeng Phet Provinces and is bordered by Khlong Lan NP in the north, Umpang Wildlife Sanctuary (WS) in the west, and Huai Kha Khaeng WS and Thung Yai Naresuan WS in the south. The total park area is 894 km<sup>2</sup>. The park headquarters lies

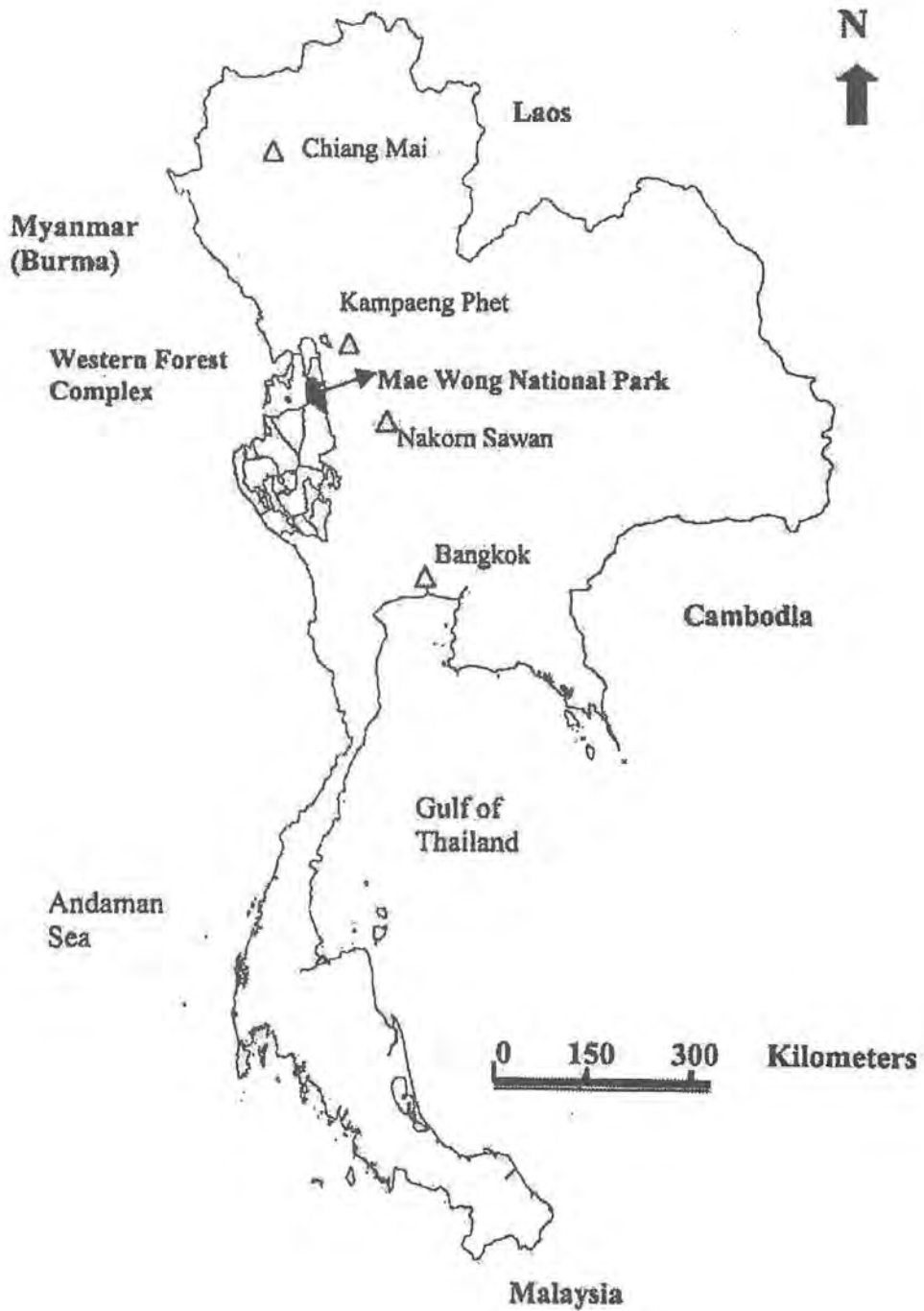


Figure 1 Location of Mae Wong National Park, Western Forest Complex, Thailand.

70 km south of Khampaeng Phet town in Muang District of Khampaeng Phet Province and is roughly 350 km northwest of Bangkok.

### PHYSIOGRAPHY AND GEOLOGY

Mae Wong National Park is largely mountainous along its northern, western, and southern borders and is part of the north-south aligned ridges of the Dawna and Thanon Tong Chai mountain ranges. The eastern and central parts are extensive undulating lowlands, especially along the Mae Wong river basin. Elevations vary from *c.* 140 m above mean sea level to the highest point, Doi Mokoju, at 1,960 m. The park is an important water catchment area for the Mae Ping River with three main tributaries, *viz.* Mae Wong, Khlong Klung, and Huai Klung Pho. In the west and higher parts of the park, Mesozoic granites, Devonian and Silurian phyllites (metamorphosed siltstone), and some Cambrian quartzites (metamorphosed sandstone) occur (RID, 1986; DOMR, 1974 and 1976). Most of the inner park area consists of Precambrian metamorphic complexes, the east area towards the central plains is made up of Pleistocene terrace gravels, sand, silt, laterite, and lateritic soils. In general the soils in the NP are deep and highly weathered except on exposed ridges and in most of the deciduous dipterocarp forests where soils have been eroded and subsoil exposed.

### CLIMATE

The region has three distinct seasons: the hot dry season from February to May, the rainy season from June to October, and the cool-dry season from November to January. The dry season receives less than 50 mm of rain per month, while the rainy season receives 125 to 260 mm per month. The average annual rainfall of the Mae Wong River basin is 1,120 mm of which 85% is concentrated in the rainy season with, September the wettest month with 262 mm (RID, 1986). Figure 2 shows the average rainfall and temperature in Uthai Thani, 60 km east of the park. Average rainfall is 1,061 mm in Nakhon Sawan (120 km SE of park HQ) and 1,259 mm in Kampaeng Phet (70 km NE of Park HQ). Temperature differences are relatively small between two lowland meteorological stations near the park. Nakhon Sawan has a mean temperature of 28.3°C and Khampaeng Phet 27.4°C (METEOROLOGICAL DEPARTMENT, 2000). The hottest month is April with an average temperature of 31.9°C. Temperatures can soar to over 40°C in daytime in the lowlands at the height of the hot-dry season (April). The coolest month, December, has an average temperature of 25.2°C and night temperatures can drop to close to 0°C at high elevation.

Average annual rainfall increases and temperatures decrease (*c.* 0.4°C /100 m) with elevation. It is estimated that the mountainous parts of the NP receive about 1,320 mm, and up to 1,800 mm at higher elevations, of rain annually (RID, 1986).

## METHODS

## Field Work

Surveys and fieldwork for this study were done between August 1997 and May 1999. Forests were sampled based on physiognomic differences and elevation, ranging from 140 m to 1,400 m. Sampling was carried out in representative stands of the four forest types at different sites in the park. Data were collected from transects ranging in length from 100 to 200 m parallel to the gradient. Each transect was divided into sub-plots of 10 x 10 m in which trees with a girth at breast height (GBH) greater than 10 cm were inventoried. Both tree height and clear bole height were measured with a clinometer. Specimens collected from the sampled trees and woody climbers were mostly identified at the Chiang Mai University Herbarium (CMU) in Chiang Mai and in the Forest Herbarium, Royal Forest Department (BKF) in Bangkok.

Voucher specimens are deposited at CMU, BKF, and L (National Herbarium Netherlands at Leiden). Many vegetative specimens were collected for identification, but were not retained. Some emergent trees could not be identified because of collecting difficulties and/or incomplete material. Additional sampling of ground flora, shrubs, vines, and treelets was done for flowering and fruiting specimens only. Site parameters for each transect included slope, aspect, and elevation. Slope was measured by a clinometer and aspect by a compass. Descriptions of the site included general observations of bedrock, soil, occurrence of forest fire, and condition of the forest stand.

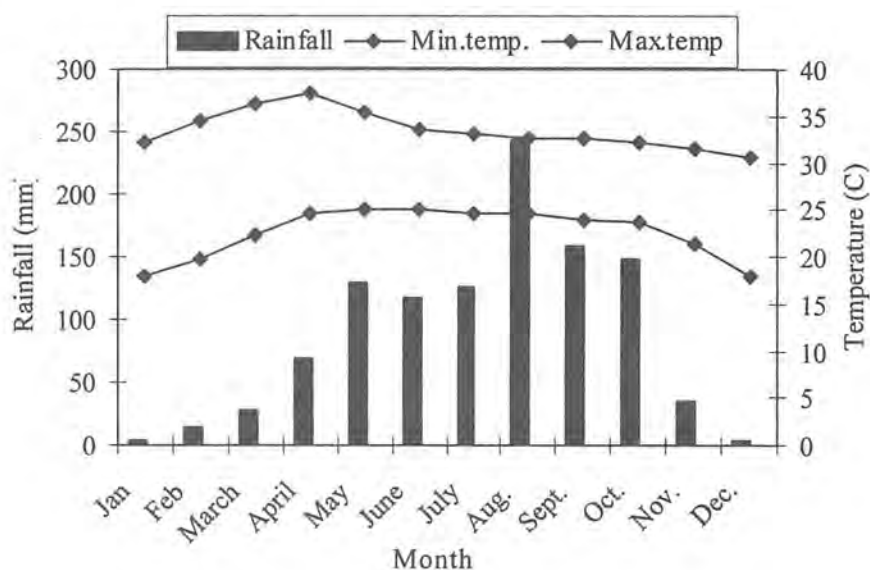


Figure 2 Average rainfall and temperatures at Uthai Thani, 60 km east of Mae Wong National Park, 1986–1996. Source: Meteorological Department, Bangkok, 1999.

## Analysis

Data from the sampled forest types has been analyzed using simple stand description measures as well as species richness and diversity measures such as described by MAGURRAN (1988), KREBS (1989), and KENT & COKER (1994).

## RESULTS

A total of 242 tree species from 64 families were recorded and collected from the transects. The families represented with the most species are Euphorbiaceae (19), Rubiaceae (15), Lauraceae (14), Annonaceae (10), and Fagaceae (9). In contrast, 22 families are represented with only one species. Dipterocarpaceae had the most individuals (129), followed by Euphorbiaceae (115), and Rubiaceae (49). Appendix 1 shows the species list of all the plants recorded during the survey. A summary of all the vascular flora recorded in Mae Wong National Park is given in table 1.

## Forest Types

Describing the forests of Thailand has been hampered by the lack of a clear and concise forest classification system over the past century. Well over 20 classification systems have been developed, each with their own variations in terminology, since the first forest type descriptions (for Burma) was made by Kurz in 1877 (MAXWELL, 2001). In this article we follow the latest system by MAXWELL (2001), based on the results of our analysis (see discussion), who developed a simplified forest classification system which also takes forest degradation into account. We included the widely used terminology of the Royal Forest Department (RFD) and SANTISUK (1988) respectively. The four main forest types recognized are described briefly below and floristic descriptions are given in more detail in the following section.

**Deciduous Dipterocarp Forest (DDF)** (dry dipterocarp forest, deciduous dipterocarp forest).—This is a fire climax forest type with an open structure, a ground flora dominated by grasses and sedges, and poor, rocky soils and frequent forest fires. Oaks (*Quercus* ssp.) are an important component in this type according to MAXWELL (1988, 2001) hence the name deciduous dipterocarp-oak forest in his system. We found very few oaks in this type

Table 1. Summary of all vascular flora recorded in Mae Wong National Park

	Families	Genera	Species
Pteridophyta (fern allies and ferns)	10	12	13
Gymnospermae	3	3	3
Monocotyledonae	16	94	112
Dicotyledonae	87	286	443
Total	116	395	571

Table 2. Quantitative vegetation characteristics of the forest types (GBH  $\geq$  10 cm)

	DDF	BB/DF	MXF	EGF
Sample area (m <sup>2</sup> )	1,700	2,300	2,000	2,000
Number of trees/ha, GBH $\geq$ 10 cm	1,124	1,109	560	1,680
Number of trees/ha, DBH $\geq$ 10 cm	364	534	335	60
Basal Area (m <sup>2</sup> /ha)	22.28	16.77	33.53	57.70
Species counted	33	64	69	104
N1 (Shannon-Wiener index)	9.13	41.16	60.33	65.13
N2 (Simpson's index)	3.60	29.65	52.02	32.30
E5 (Evenness index)	0.32	0.71	0.86	0.49

in Mae Wong, therefore we omitted the oak component. DDF may often be the result of severe disturbance or destruction of both BB/DF and evergreen forests (MAXWELL, 1995, 1997, MAXWELL & ELLIOTT, 2001). The origin of this forest type has been subject to debate for a long time, but human-caused degradation and increase in fires appear to be major contributing factors in the occurrence and further expansion of this forest type. The DDF in Mae Wong NP is found in the lowlands from 140 m to *c.* 700 m and frequently forms a mosaic pattern with BB/DF, often with abrupt changes without any transition zone. This is not a natural situation and is the result of destruction and disturbance by fires resulting in the degradation of forest vegetation and soil, thus allowing typical DDF species to invade. DDF is more common on ridges and on poorer, eroded, rockier soils where regeneration for non-fire-resilient trees is difficult. It is a very open, mainly deciduous, and mostly one-layered tree stand reaching 10–20 m with only a few trees emerging from the canopy to 30 m in height. The canopy of DDF is discontinuous and irregular, and a lower story, including seedlings, coppices, and saplings, is almost absent. Figure 4 shows high numbers in the smallest GBH size-classes.

In some areas, especially at transition zones with BB/DF, vigorous regeneration and coppicing, mostly of *Shorea siamensis*, forms a dense, 4–8 m high understory. This is reflected in the high number of trees ha<sup>-1</sup> (Table 2). Seedlings and saplings are damaged or perish in forest fires. Approximately 8% of the labeled, mostly small trees in DDF of one transect were killed by fires in 1998. This forest type is the poorest in tree species richness (Tables 2 and 4) of all forest types and is, as the name implies, completely dominated by Dipterocarpaceae.

**Deciduous Forest with Bamboo (BB/DF).**—(mixed deciduous forest, tropical mixed deciduous forest). BB/DF is a remnant of the original teak-dominated deciduous forests that covered most of the lowlands in northern Thailand before extensive logging took its toll. In some undisturbed circumstances teak may have accounted for 40–50% of the total tree density, while bamboo was a lesser part of it (MAHIDOL UNIVERSITY, 1995; MAXWELL, 1997; 2001). Bamboo, though common naturally in BB/DF, often becomes a dominating feature as a result of human-caused degradation and the frequent forest fires.

In Mae Wong BB/DF occurs from 140 to *c.* 750 m. There is some variation in overall species composition and structure, which can be attributed to logging history and topography. The BB/DF in the foothills and on steeper slopes has a lower main canopy height reaching

16–25 m with a few trees reaching 30 meters. The stand is open, although the canopy is continuous and more or less closed when in leaf. Light penetration to the ground is low in the rainy and cool seasons also because of the presence of dense clusters of bamboo, viz. *Dendrocalamus membranaceus* and *Gigantochloa albociliata* (Gramineae, Bambusoideae). The layers below the main canopy are ill-defined and open. Tree seedlings and coppices are present, but many perish in annual forest fires. Many trees have damage at the base of the trunk caused by rocks rolling down the slopes and crashing into them. Fires inflict further damage and can result in the death and fall of trees. Ground cover is low and consists mostly of deciduous herbs and shrubs.

The BB/DF in the alluvial plains and hills along the Mae Wong River was logged and encroached about 35 years ago. People settled in the area after logging, and were relocated in the late 1980s. Though illegal logging is evident, teak still occurs in relatively high numbers and is regenerating well. The canopy here is about 22–30 m, with some trees reaching 35 m, and is irregular, open, and discontinuous. The open canopy allows other species to develop and has resulted in a moderately dense understory of 7–12 m (Figure 5), and a dense ground layer consisting of tree seedlings and saplings, shrubs, and grasses. Species richness and diversity are reasonably high (Table 2). Many species in the understory will eventually perish when the canopy becomes more closed and light availability at ground level becomes less. This will allow more shade tolerant species to develop.

**Mixed Evergreen + Deciduous Forest (MXF)** (dry evergreen forest, seasonal rain forest).—The elevation zone between *c.* 600 and 1,100 m is often considered as a transition zone between evergreen species from the highlands and deciduous species of lower altitudes. There has been some confusion regarding the classification of this forest type and many classifications do not recognize it as distinct. As this zone has both (lowland) deciduous and (highland) evergreen elements and has a wider range (see discussion) the term MXF is appropriate. It has to be considered as a distinct forest type since many species occurring here are restricted to this type and supports a high tree species richness (MAXWELL *ET AL.*, 1988; ELLIOTT *ET AL.* 1989; MAXWELL & ELLIOTT, 2001). The MXF and EGF types have received less attention than BB/DF and DDF types by most other researchers although the diversity and species richness are much higher in the former two (Tables 2 and 4). MXF is found from *c.* 600 to *c.* 1,100 m. In areas along streams it occurs as low as 400 m where it forms a narrow strip and is often referred to as evergreen gallery forest. The MXF is a tall, not clearly defined stand with several trees reaching well over 30 m. The canopy height is 24–30 m in undisturbed circumstances and is usually closed and continuous.

In Mae Wong MXF has suffered greatly from logging and destructive agricultural practices of hill tribes with large areas transformed into grassland and scrub areas dominated by *Imperata cylindrica*. The tall palm, *Livistona speciosa* (Palmae), is often the only tree left in these devastated areas and is an easy recognizable feature at 700–1,100 m elevation. The distribution of MXF is fragmented with a low tree density of 560 trees ha<sup>-1</sup> (Table 2), while forest fires still have a major degrading impact on the remaining MXF. It has a disturbed irregular structure.

It is interesting to note that huge *Dipterocarpus costatus* individuals, a characteristic species of MXF (MAXWELL & ELLIOTT, 2001), occur as low as 350 m in some parts of the park. This strongly suggests that evergreen and MXF forest were more widespread in the past. Most individuals have been logged for the valuable timber, but a few of them



remain as the sole surviving canopy trees. Most of the trees have large, fire-scarred cavities cut into the base of their trunks from where resin, used as a varnish component and a fuel for lighting, was collected.

**Primary, Evergreen, Seasonal, Hardwood Forest (EGF)** (hill evergreen forest, lower/upper montane forest).—EGF occurs from c. 1,100–1,900 m and is becoming more fragmented as a result of continuous (fire) disturbances. It is tall and most complex in structure. EGF is a multi-layered stand with a dense, continuous canopy reaching 25–30 m high. There are two indistinct tree layers below the canopy with one layer consisting of medium sized trees up to 15 m high and a relatively dense layer consisting of saplings, treelets and small trees up to 8 m high. The ground vegetation is dense with seedlings, shrubs, lianas, vines, and herbs. The dense canopy and lower levels do not allow much light penetration to ground level, thus maintaining high humidity in the rainy season and less exposure in the dry season. The result of this is a high basal area of 57.7 m<sup>2</sup> ha<sup>-1</sup> shared by 1,680 trees ha<sup>-1</sup> (Table 2). Many of the tree trunks and branches are covered with algae, lichens, mosses, and vascular epiphytes as a result of the shade and seasonally high humidity.

Besides the four vegetation types recognized, additional types, not discussed here, include secondary growth (SG) and deforested grassland areas dominated by *Imperata cylindrica* var. *major* (Graminae) which account for 11% of the total area in the NP (Figure 3.).

### Tree Densities

To make a comparison with other studies possible, which were using a GBH limit of 31.4 cm (10 cm DBH), a reanalysis of the data ignoring the 10–31.4 cm GBH classes was necessary (Table 2.). The densities for DDF and BB/DF of trees with DBH  $\geq$  10 cm are 364 and 534 trees ha<sup>-1</sup>, respectively. For DDF, this is comparable to densities reported (262–395 trees ha<sup>-1</sup>) by Bunyavejchewin (1983) in northern Thailand. The figure for BB/DF is comparable with densities reported by OGAWA (1965) in similar forest types (monsoon forest, 475 trees ha<sup>-1</sup>) in northern Thailand. Though Ogawa reported a much higher figure (581 trees ha<sup>-1</sup>) for DDF (dipterocarp-savanna forest). ELLIOTT *ET AL.* (1989) reported a tree density of 536 trees ha<sup>-1</sup> for a mosaic of MXF, DDF, and BB/DF forest on Doi Sutep, northern Thailand. These figures show that the DDF and BB/DF forest of Mae Wong do not differ much in terms of tree density from other sites in northern Thailand. Tree densities in MXF drop to 335 trees ha<sup>-1</sup> after re-analysis. This figure is even lower than DDF. In contrast, EGF still retains a high tree density (605 trees ha<sup>-1</sup>) after reanalysis, which compares favorably with the lowland rain forests in peninsular Malaysia (530 trees ha<sup>-1</sup>, KOCHUMEN *ET AL.*, 1990) and tropical rain forests in New Guinea (245–740 trees ha<sup>-1</sup>, PAIJMANS, 1970). Unfortunately, EGF is also under threat of degradation and fragmentation.

### Forest Type Descriptions

**Deciduous Dipterocarp Forest, DDF** (dry dipterocarp forest, deciduous dipterocarp forest).—BUNYAVEJCHEWIN (1983) divides deciduous dipterocarp forest into five main dominance types based on elevation, soil properties, and the importance values of the four

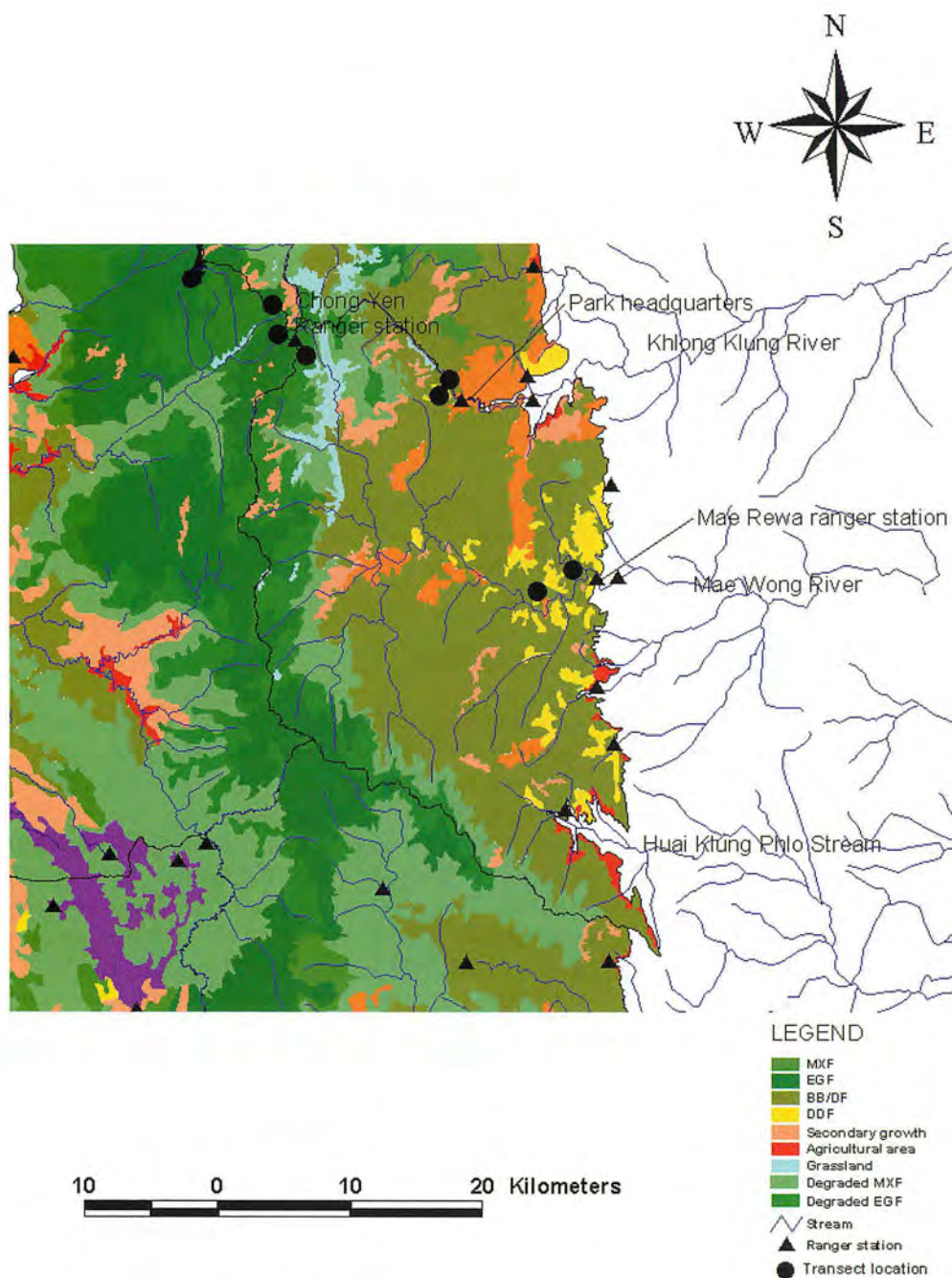


Figure 3. Vegetation types of Mae Wong National Park and transect locations. Source: Ecological Monitoring Section, Wefcom Project.

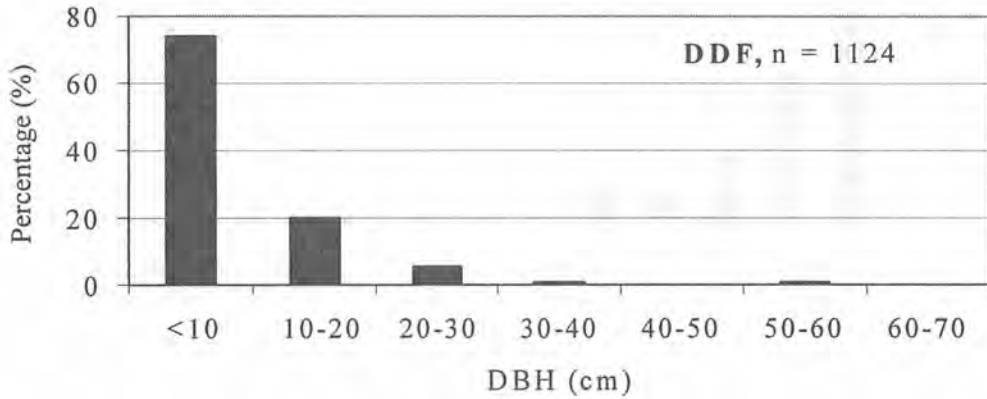


Figure 4. Diameter distribution of tree species in DDF. *Shorea siamensis*, when mature, is a dominant fire-resistant species and is present in all diameter classes.

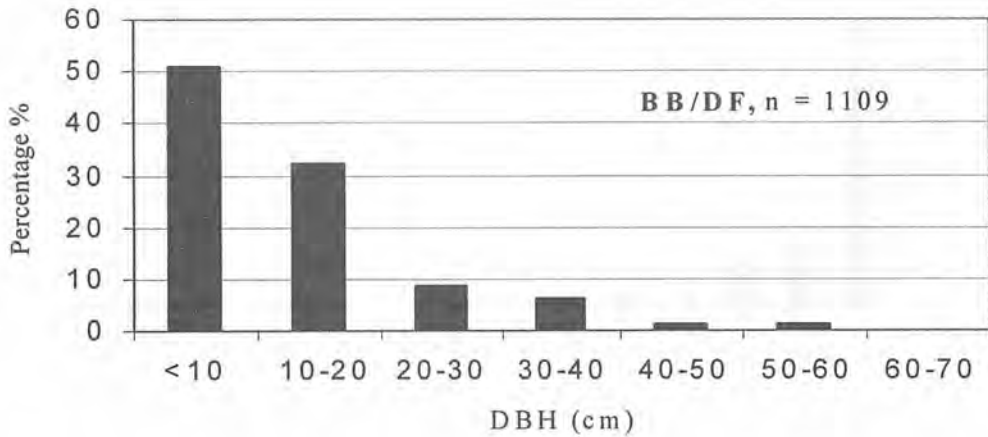


Figure 5. Diameter distribution of all species in BB/DF. Natural regeneration is vigorous in places with an opened canopy, but is low in forests with a closed canopy. Logging, mainly of *Tectona grandis* (teak), has reduced larger diameter classes. Annual fire has also destroyed seed and seedlings.

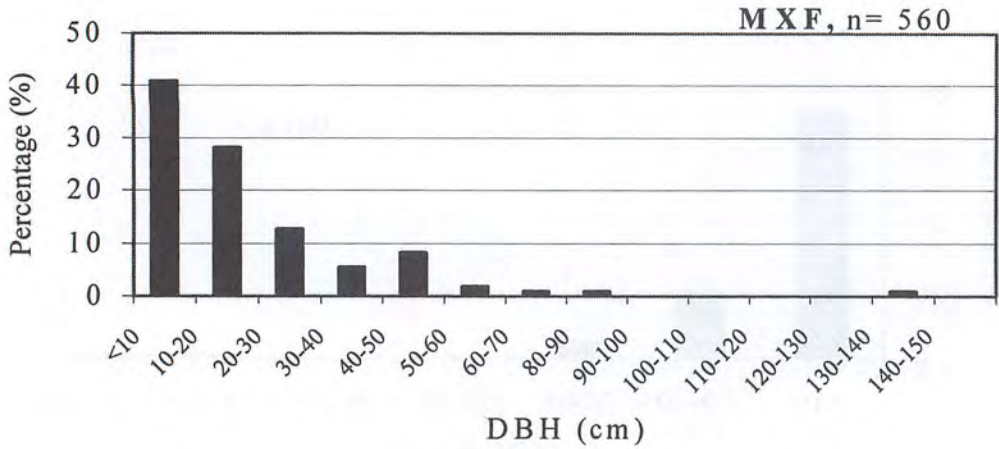


Figure 6. Diameter distribution of all species in MXF. It indicates an open disturbed forest with an irregular structure and many gaps.

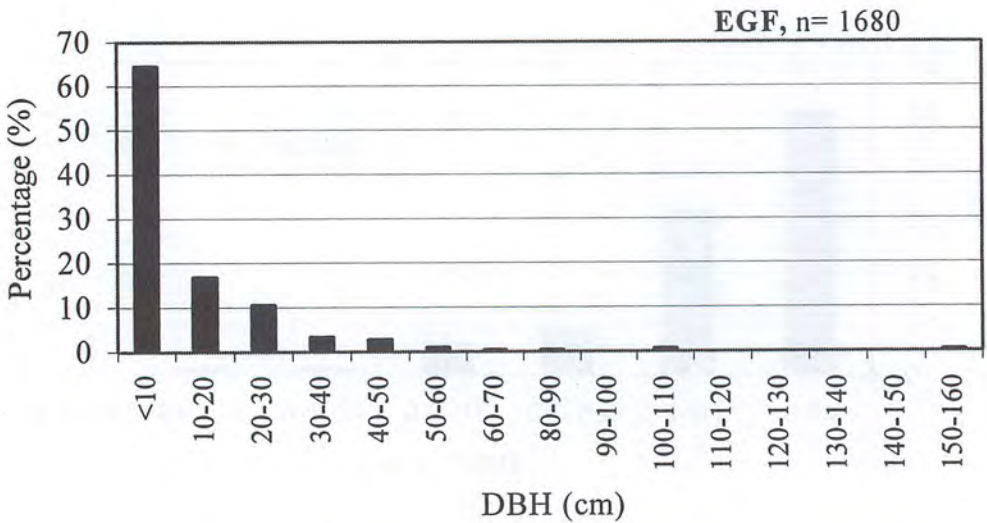


Figure 7. Diameter distribution of all species in EGF: *Mallotus obtusifolius* is abundant in the understory. There are some tall individuals of *Michelia champaca* and *Ficus altissima*.

Table 3. Relative density, relative frequency, relative dominance, and the Importance Value Index (IVI) for top 5 species in each forest types.

Forest type	Species	Relative Density (%)	Relative Frequency (%)	Relative Dominance (%)	IVI
DDF	<i>Shorea siamensis</i>	51.31	20.48	44.49	116.28
	<i>Dipterocarpus obtusifolius</i>	6.28	7.23	6.00	19.51
	<i>Dalbergia cultrata</i>	4.71	6.02	6.40	17.13
	<i>Canarium subulatum</i>	4.19	6.02	2.05	12.20
	<i>Pterocarpus macrocarpus</i>	1.05	2.41	8.68	12.14
BB/DF	<i>Tectona grandis</i>	7.63	4.44	12.11	24.18
	<i>Terminalia mucronata</i>	6.83	4.44	6.50	17.77
	<i>Anogeissus acuminata</i>	3.21	3.89	6.68	13.78
	<i>Croton hutchinsonianus</i>	5.62	5.00	2.53	13.15
	<i>Millettia xylocarpa</i>	4.02	3.89	4.37	12.28
MXF	<i>Duabanga grandiflora</i>	0.89	0.98	23.02	24.88
	<i>Lithocarpus</i> sect. <i>Cyclobalanopsis</i>	1.7	1.96	9.35	13.08
	<i>Vitex quinata</i> var. <i>puberula</i>	2.66	1.96	7.43	12.04
	<i>Trigonostemon thyrsoides</i>	7.08	2.94	0.75	10.77
	<i>Polyalthia simiarum</i>	4.43	3.92	1.89	10.24
EGF	<i>Mallotus oblongifolius</i>	14.03	6.81	2.74	23.58
	<i>Michelia champaca</i>	0.90	1.28	19.34	21.51
	<i>Ficus altissima</i>	0.60	0.85	19.31	20.75
	<i>Eugenia albiflora</i>	2.99	2.55	3.19	8.73
	<i>Cryptocarya</i> sp.	2.09	2.13	3.33	7.54

dominant species *Shorea siamensis*, *S. obtusa*, *Dipterocarpus obtusifolius*, and *D. tuberculatus*. Because we have not studied some of these parameters in detail we will not further discuss this division of deciduous dipterocarp forest.

*Shorea siamensis* is the most common species in DDF, both in density, frequency, and dominance (Table 3). *Dipterocarpus tuberculatus*, *D. obtusifolius*, and *Shorea obtusa* are less dominant, but still form a major part of the tree community. *Shorea obtusa* is more common in flat and undulating areas. Leguminosae, with *Dalbergia cultrata*, *D. cana* (both Papilionoideae), *Sindora siamensis* (Caesalpinioideae), and *Xylia xylocarpa* (Mimosoideae), are also well represented in DDF. The low species diversity in this forest type is documented in Table 1 by the low Shannon-Weaver (9.13) and Simpson (3.60) diversity indices. The low evenness index (0.32) indicates an unequal representation of each tree species with only a few common species and several rarer ones present (an evenness index of 1.0 would indicate that all tree species are represented by the same number of individuals).

Other typical deciduous tree and treelet species found in DDF were *Ochna integerrima* (Ochnaceae), *Antidesma acidum*, *Croton roxburghii* (both Euphorbiaceae), *Canarium subulatum* (Burseraceae), *Morinda tomentosa*, *Mitragyna rotundifolia* and the treelet *Pavetta*

*tomentosa* var. *tomentosa* (all Rubiaceae). Scattered throughout DDF is the treelet *Dioecrescis erythroclada* (Rubiaceae), with its characteristic orange-red, peeling bark, stout branches, and thorns. One of the few evergreen species (only 7.9%, Table 4) is *Melientha suavis* (Opiliaceae). The edible young shoots of this small tree, "pak wan" in Thai (= sweet vegetable), are highly valued and extensively collected early in the dry season. The trees were too damaged to develop to full size and were stunted and deformed as a result. This species was never seen in fruit or flower during the 2 year survey.

The understory consists mostly of seedlings, coppices, and saplings of *Shorea siamensis*, *Dipterocarpus obtusifolius*, and *Dipterocarpus tuberculatus*. Coppices and seedlings of *Dillenia parviflora* (Dilleniaceae) are a distinct feature in the ground layer and produce large leaves in profusion after the first rains in May. Coppices and seedlings of *Tectona grandis* (teak), together with seedlings of *Bombax anceps* var. *anceps* (Bombacaceae), *Dalbergia oliveri*, *Senna garrettiana* (Leguminosae, Caesalpinioideae) and *Grewia eriocarpa*, occur in some DDF areas. The occurrence of species typical of BB/DF suggests that this type is reinvading into DDF forests if given a chance to survive. As mentioned above, forest fires destroy many of the seedlings and saplings and degrade soil in the process; thus it seems more likely that DDF is expanding into BB/DF areas. One of the more easily identified indicator species for DDF is the 1-m tall, fire-resistant pachycaulous, evergreen cycad, *Cycas siamensis* (Cycadaceae). It is most common in level, lower areas. This species is a popular ornamental plant and has become rare as result of overcollecting.

Woody climbers are rare in DDF, but seedlings of *Cissus repanda* (Vitaceae) and *Spatholobus parviflorus* (Leguminosae, Papilionoideae) were found. Both species were also recorded in other forest types. The annual vine *Cayratia trifolia* (Vitaceae) is abundant in more open parts of DDF. The deciduous vines *Aristolochia kerrii* (Aristolochiaceae) and *Ipomoea siamensis* (Convolvulaceae) are less abundant and grow also as trailing vines. The deciduous, shrubby or scandent *Pueraria wallichii* (Leguminosae, Papilionoideae) is restricted to shadier areas.

Bamboos, including *Dendrocalamus nudus*, are uncommon and are only found in shady areas near watercourses or transition zones with BB/DF where the soil is suitable. Also scarce are epiphytes, with only a few species of Orchidaceae recorded including *Seidenfadenia mitrata* and *Cleisostoma* sp., both of which also occur in BB/DF. The creeping, clustered, succulent, evergreen epiphyte *Dischidia major* (Asclepiadaceae) is also found rarely. Shrubs and treelets are not typical of this forest type and are most abundant near transition zones. Some examples include *Ellipeiopsis cherrevensis* (Annonaceae), *Leea indica* (Leeaceae), and *Sauropus quadrangularis* (Euphorbiaceae). The treelets *Clerodendrum serratum* (Verbenaceae) and *Desmodium pulchellum* (Leguminosae, Papilionoideae) are very common in open areas on steeper slopes.

Deciduous herbs are well represented in the ground flora of DDF. Many of the BB/DF species also occur here, such as *Barleria strigosa* (Acanthaceae), *Globba schomburgkii*, *Kaempferia pulchra* (both Zingiberaceae) and the annual herb *Blumea lacera* (Compositae). Characteristic DDF species are *Kaempferia rotunda*, which flowers before the appearance of its leaves, and *Vernonia squarrosa* var. *orientalis* (Compositae) which is common in rocky areas. Leguminosae is extremely well-represented with *Crotalaria alata*, *C. cytisoides*, *Galactia tenuiflora*, and *Uraria crinita* (all Papilionoideae) as typical examples. Herbs such as *Leucas decemdentata* (Labiatae) and *Tridax procumbens* (Compositae) are abundant throughout DDF in both flat and hilly areas. The leafless, herbaceous, and deciduous

Table 4. Distribution of families, genera, and species for trees in each forest type. Deciduousness is calculated from the tree species occurring in the transects.

	DDF	BB/DF	MXF	EGF
Families found	24	31	40	49
Genera found	39	69	72	84
Species found	49	89	91	119
Evergreen species (%)	7.9	7.1	71.6	88.5
Deciduous species (%)	92.1	92.9	28.3	11.5
Evergreen trees (%)	2	4.5	73.2	91.6
Deciduous trees (%)	98	95.7	26.8	7.4

ground parasite *Aeginetia indica* (Orobanchaceae), which grows in scattered clusters on the roots of bamboo and other grass species, is found in shady areas in bamboo thickets. Ferns and fern allies are represented by *Adiantum zollingeri* (Parkeriaceae) and *Selaginella delicatula* (Selaginellaceae). Both are uncommon and confined to shady, moist areas near seasonal streams.

Light penetration to ground level is very high and hence Gramineae (grasses) and Cyperaceae (sedges) dominate the ground flora. *Panicum notatum*, *Microstegium vagans*, and *Apluda mutica* are the most common species. They form a dense undergrowth which is extremely prone to fires in the dry season. Cyperaceae have a more scattered distribution pattern and are represented by *Cyperus cyperoides*, *C. laxis* var. *laxis*, *C. leucocephalus*, and *Fimbristylis dichotoma* ssp. *dichotoma*, which is very abundant.

**Deciduous Forest with Bamboo, BB/DF** (mixed deciduous forest, tropical mixed deciduous forest).—No single tree species reaches dominance in BB/DF (Table 3), but well-represented families include Leguminosae, Combretaceae, Verbenaceae, Euphorbiaceae, Tiliaceae, and Bignoniaceae. Commercially important species like teak become scarce from 600 m upwards. *Azelia xylocarpa* is found up to 750 m and some good stands with massive individuals still occur in the more inaccessible areas of the park. One of the most distinctive tree species for this forest type is *Albizia lebbek* (Leguminosae, Mimosoideae), which flowers and fruits profusely. It occurs from the lowlands to c. 850 m elevation where it disappears abruptly. Other common deciduous tree species, totaling 92.9% here (Table 4), include *Markhamia stipulata* var. *stipulata*, *Stereospermum fimbriatum* (both Bignoniaceae), *Vitex peduncularis*, *V. limoniifolia* (Verbenaceae), *Bombax anceps* (Bombacaceae), *Terminalia bellirica*, *T. mucronata*, *Anogeissus acuminata* (all Combretaceae), *Millettia xylocarpa*, *Dalbergia oliveri* (both Leguminosae, Papilionoideae), *Lagerstroemia floribunda* var. *floribunda*, and *L. cochinchinensis* var. *ovalifolia* (Lythraceae). The latter five species are most common on steep slopes. It was interesting to find some large *Shorea siamensis* trees in some of the plots. This species is normally not found in BB/DF and is one of the dominant species in DDF forest. Deciduous trees more restricted to the understory are *Colona winittii* and *Grewia eriocarpa* (both Tiliaceae), *Schleichera oleosa* (Sapindaceae), *Firmiana colorata*, *Sterculia villosa* (both Sterculiaceae), *Fernandoa adenophylla*, *Oroxylum indicum* (both Bignoniaceae), *Holarrhena pubescens* (Apocynaceae) as well as the treelets *Antidesma sootepense* and *Croton hutchinsonianus* (both Euphorbiaceae). Some tree species



produce new leaves vigorously after the first rains, e.g. *Firmiana colorata*, *Sterculia villosa*, *Grewia eriocarpa*, and *Croton roxburghii*.

Woody climbers (lianas) are characteristic features of this forest type (SANTISUK, 1988, MAXWELL & ELLIOTT, 2001). They are represented here by *Butea superba* (Leguminosae, Papilionoideae), *Cissus repanda*, and *Congea tomentosa* var. *tomentosa* (Verbenaceae). Another distinct species is *Harrisoniana perforata* (Simaroubaceae), a scandent, prickly plant which forms a dense, impenetrable mass of branches and is common in secondary growth.

Common shrubs and treelets in more shady areas include *Bauhinia viridescens* var. *viridescens* (Leguminosae, Caesalpinioideae), *Helicteres elongata* (Sterculiaceae), and *Grewia laevigata* (Tiliaceae). Typical species in open, more degraded areas are *Bauhinia saccocalyx*, *Allophyllus cobbe* (Sapindaceae), and *Grewia abutilifolia*. Noteworthy is the presence of *Cycas siamensis* which is normally confined to DDF, but found here in more xeric and open BB/DF areas. Plants only found in open, rocky areas near streams include the thorny woody climber *Acacia pennata* (Leguminosae, Mimosoideae) and the abundant rheophytic shrub/treelet *Homonoia riparia* (Euphorbiaceae).

Vascular epiphytes are not very common due to illegal collecting by locals, and tourists, forest fires, or because their support trees have decreased in numbers. Three orchid species, *Bulbophyllum* sp., *Seidenfadenia mitrata*, and *Cleisostoma* sp., were found though more species were observed, but could not be identified since flowers were not available. The deciduous, epiphytic fern *Platyserium wallichii* (Polypodiaceae) is a particularly massive and characteristic species found high in trees in BB/DF.

Vines are represented by *Stephania oblata*, *Cissampelos pareira* var. *hirsuta* (both Menispermaceae), and *Thunbergia similis* (Acanthaceae). *Stemona tuberosa* var. *tuberosa* (Stemonaceae) is rare and only found in shady areas.

Among the first herbs to appear and flower in early May, after the hot-dry season, are members of the Zingiberaceae. *Globba schomburgkii* and *Kaempferia pulchra* are among the most common species occurring in both shaded and open areas. *Globba xantholeuca* is confined to more shady areas and grows near and on rocks and logs. Other species include *Boesenbergia rotunda*, *Curcuma parviflora*, and *Costus speciosus*. *Amorphophallus* sp. (Araceae) also flowers early, but is rare and found only in moist and shady places near gullies. No inflorescences of this species were found during the survey so identification could not be made. Numerous are the herbs *Knoxia corymbosa*, *Hedyotis ovatifolia* (both Rubiaceae), *Barleria strigosa* (Acanthaceae), and several members of the Compositae, e.g. *Blumea lacera*, *B. membranacea* var. *membranacea*, and *Ageratum conyzoides*. The annual herb *Corchorus aestuans* (Tiliaceae), which grows up to 180 cm, is very common in open, degraded areas. Rare herbs include *Rauvolfia serpentina* (Apocynaceae), which is confined to shady, moist edges of gullies and *Polygala umbonata* (Polygalaceae). Both are medicinal plants and have been over-collected. The weeds *Celosia argentea* (Amaranthaceae), *Physalis angulata* (Solanaceae), and the up to 3-m tall grasses (Gramineae) *Saccharum spontaneum* and *Phragmites vallatoria*, are common on stream banks.

Four species of deciduous ground ferns and fern allies were found. *Adiantum philippense* (Parkeriaceae) occurs in both shady and open areas. *Lygodium salicifolium* (Schizaeaceae), a vine, is common in more open areas especially, near bamboo thickets. Rarer is *Adiantum zollingeri*, found on rocks and logs. The annual fern ally *Selaginella delicatula* (Selaginellaceae) is very common in shaded and moist areas.



Common bamboo species (Gramineae, Bambusoideae) include *Bambusa tulda*, *Dendrocalamus nudus*, *D. membranaceus*, and *Gigantochloa albo-ciliata*. Grasses (Gramineae) are a dominant feature in the ground flora in degraded and open areas, but are hardly present in shaded places. The abundant *Microstegium vagans* and *Panicum notatum* form a dense undergrowth and provide ample fuel for forest fires in the dry season. Other species include *Oplismenus compositus*, *Ottochloa nodosa*, *Pennisetum pedicellatum*, and *P. polystachyon*.

**Mixed Evergreen + Deciduous Forest, MXF** (dry evergreen forest, seasonal rain forest).— No single species or family reached dominance in this forest type (Table 3), although some families are well represented, viz. Euphorbiaceae, Annonaceae, Moraceae, Lauraceae, Araliaceae, and Sapindaceae. Several species are shared with BB/DF where most reached their upper elevation limit in MXF. These include the deciduous species *Markhamia stipulata* var. *stipulata*, *Grewia eriocarpa*, and the canopy trees *Lagerstroemia calyculata* (Lythraceae), and *Spondias pinnata*. Other typical examples of deciduous canopy trees include *Morus macroura* (Moraceae), *Michelia baillonii* (Magnoliaceae), and *Acrocarpus fraxinifolius* (Leguminosae, Caesalpinioideae), which can become one of the tallest trees in the forest. Common deciduous understory trees include *Ficus fistulosa* (Moraceae), *Mitrephora vandaeflora* and *Polyalthia simiarum* (both Annonaceae), and *Trigonostemon thyrsoides* (Euphorbiaceae). Evergreen canopy species shared with BB/DF include *Irvingia malayana* (Irvingiaceae) and *Vitex quinata* var. *puberula* (Verbenaceae). A distinct feature for MXF is the large, evergreen tree *Duabanga grandiflora* (Sonneratiaceae) (Table 3) which is also common in open, disturbed places in both BB/DF and EGF. Other evergreen tree species, which start to occur from the lower limits of MXF upwards, are *Lithocarpus* sect. *cyclobalanopsis* (Fagaceae) and the common understory trees *Acronychia pedunculata* (Rutaceae), *Memecylon umbellatum* (Melastomataceae), *Magnolia liliifera* var. *obovata* (Magnoliaceae), and *Macropanax dispersum* (Araliaceae). Some of the tree species are tropophyllous, i.e. intermediate between deciduous and evergreen. These trees shed their leaves, but at irregular times and varying periods or sometimes change their leaves while remaining evergreen, depending on water availability, temperature, and elevation in the dry season (ELLIOTT ET AL., 1989). Typical examples are *Schima wallichii* (Theaceae) and *Bischofia javanica* (Euphorbiaceae). Members of the palm family (Palmae), of which *Arenga pinnata* is characteristic for MXF, are well represented. Other species include *Calamus* ssp. (rattans), *Livistona speciosa*, and *Caryota urens*.

Characteristic tree species reinvading open, (fire) degraded areas are the deciduous *Betula alnoides* (Betulaceae) and *Erythrina subumbrans* (Leguminosae, Papilionoideae), both also being common at higher elevations. Most of these and other seedlings and saplings perish in fires before having a chance to grow to maturity and reestablish the original vegetation cover.

*Pandanus penetrans* (Pandanaeae) is common near streams, sometimes reaching over 5 m tall. Another obvious species found near streams and occurring as low as 500 m elevation is *Eugenia megacarpa* (Myrtaceae). Shrubs and treelets up to 5 m tall are found scattered in the groundstorey, with *Ardisia quinquegona* (Myrsinaceae), *Boehmeria clidemioides*, *Dendrocnide sinuata* (both Urticaceae), and *Aralia polyacantha* (Araliaceae) as common examples. Other species are *Phlogacanthus curviflorus* (Acanthaceae), a treelet found near streams; *Helicia formosana* var. *oblanceolata* (Proteaceae), and *Clerodendrum*

*glandulosum* (Verbenaceae). *Melastoma malabathricum* ssp. *malabathricum* (Melastomataceae) is restricted to exposed and open, disturbed areas.

Woody climbers are common and include *Spatholobus parviflorus*, also recorded from DDF and BB/DF, *Parameria laevigata* (Apocynaceae), *Tetrastigma* sp. (Vitaceae), *Ziziphus oenoplia* var. *oenoplia* (Rhamnaceae), and *Bauhinia ornata*. The vine *Shuteria hirsuta* (Leguminosae, Papilionoideae) is rare.

Vascular epiphytes were not thoroughly studied in MXF, but they are common. Some of the most distinct epiphytes (only initially) are the 'strangling' figs *Ficus benjamina* var. *benjamina* and *F. altissima* (Moraceae). The latter can become one of the tallest trees in the forest when mature. The large, evergreen, epiphytic fern *Asplenium nidus* (Aspleniaceae) and many Orchidaceae species including *Dendrobium* sp., *Calanthe* sp., *Malaxis* sp., and *Bulbophyllum* sp. were also recorded, but not identified to species level as no flowers were available.

The ground flora is very sensitive to forest fires in MXF and evergreen forests and it may take many years for the ground flora to recover after fire damage (MAXWELL & ELLIOTT, 2001). Herbs are, therefore, relatively scarce in the MXF of Mae Wong while in undisturbed MXF elsewhere they are diverse (MAXWELL, 2001). Common examples are *Impatiens violaeiflora* (Balsaminaceae) in shady areas, *Strobilanthes speciosa* (Acanthaceae), which is very abundant, and *Rhopalephora scaberrimum* (Commelinaceae), which grows in moist open areas. The herbs *Solanum macrodon* and *S. barbisetum* (Solanaceae) are typical examples for open, disturbed areas. Grasses occur where fires have destroyed the original ground layer and in places with an open canopy with species similar to those of BB/DF with the addition of *Imperata cylindrica*.

**Primary Seasonal Evergreen Forest, EGF** (hill evergreen forest, lower/upper montane forest).—Tree species richness in EGF is the highest of all forest types in Mae Wong (Tables 2 and 4). No single species or family is dominant, but the families Euphorbiaceae, Fagaceae, Myrtaceae, Lauraceae, Theaceae, and Rubiaceae are well represented. Important canopy species include *Michelia champaca*, which is deciduous, *Garcinia plena* (Guttiferae), *Castanopsis acuminatissima*, *C. diversifolia*, *Lithocarpus elegans* (all Fagaceae), and *Phoebe cathia* (Lauraceae), which are all evergreen. Also the massive 'strangler' figs *Ficus glaberrima* var. *glaberrima* and *F. altissima* are found here. The large evergreen tree *Photinia integrifolia* (Rosaceae) is very rare in Mae Wong (only one record). Common medium sized evergreen trees include *Hydnocarpus kurzii*, *Casearia grewiifolia* var. *gelonioides* (both Flacourtiaceae), *Cinnamomum iners* (Lauraceae), *Podocarpus neriifolius* (Podocarpaceae), *Pyrenaria garrettiana* (Theaceae), *Carallia brachiata* (Rhizophoraceae), often found in moister areas, and *Calophyllum polyanthum* (Guttiferae). The evergreen understory tree *Mallotus oblongifolius* is by far the most frequently observed species in the lower story (Table 3). This level also includes *Eugenia fruticosa* (Myrtaceae), *Turpinia nepalensis* (Staphyleaceae), *Helicia formosana* var. *oblanceolata*, and *Camellia pleurocarpa* (Theaceae), all of which are evergreen. The deciduous tree *Aesculus assamica* (Hippocastanaceae), the evergreen tree *Brassaiopsis glomerulata* (Araliaceae), and the evergreen tree fern *Cyathea chinensis* (Cyatheaceae) are commonly found in shaded, moist gullies and near streams. Secondary growth or pioneer species include *Erythrina subumbrans*, the evergreen *Macaranga denticulata*, *M. siamensis* (both Euphorbiaceae), and *Eurya acuminata* var. *wallichiana* (Theaceae) are all common in open areas, forest edges, and

in natural gaps. *Betula alnoides* is very common and sometimes occurs in pure stands and favors open areas. Typical is the occurrence of the wild banana *Musa itinerans* (Musaceae), some being over 7 m high, in moist stream valleys. This is an indicator of good upper watershed habitat.

Woody climbers are a distinct and abundant feature in EGF. Notable is *Bauhinia bassacensis*, whose flattened stems form the typical 'monkey ladders', *Parthenocissus semicordata*, and *Cayratia mollissima* (both Vitaceae). *Tetrastigma cruciatum* (Vitaceae) and the epiphytic *Schefflera benghalensis* (Araliaceae) are abundant. The diversity of vine species along disturbed and open forest edges is high. Leguminosae, Papilionoideae are especially well represented and include *Cruddasia insignis*, *Apios carnea*, and *Vigna umbellata*. Particularly distinct are the rare *Ceropegia siamensis* (Asclepiaceae) and *Diplocyclos palmata* (Cucurbitaceae). The prickly *Rubus alceifolius* (Rosaceae) is abundant in open, disturbed areas on ridges.

Treelets and shrubs are abundant in EGF and sometimes form dense thickets, especially near gaps. Typical species are the very common *Psychotria adenophylla*, *P. monticola*, *Ixora coccinea*, *Pavetta indica*, *Lasianthus kurzii* (all Rubiaceae), *Polygala arillata* (Polygalaceae), and *Oreocnide rubescens* (Urticaceae). Confined to open and disturbed areas and secondary growth, especially on ridges, are the evergreen treelets *Debregeasia longifolia* (Urticaceae) and *Aralia thomsonii* (Araliaceae) and the spiny scandent evergreen shrubs *Oxyceros horridus* (Rubiaceae) and *Zanthoxylum acanthopodium* (Rutaceae). The evergreen shrub *Dichroa febrifuga* (Saxifragaceae) is common in moister and shadier upper catchment areas and is an indicator of healthy and undisturbed EGF conditions.

Vascular epiphytes are a distinct feature of EGF. Many members of Orchidaceae were observed, but not identified to species due to lack of flowering material. Common genera are *Bulbophyllum*, *Dendrobium* (including *D. thyrsoiflorum* and *D. falconeri*), *Malaxis*, *Eria*, and *Thunia alba*. Other characteristic epiphytes are *Aeschynanthus garrettii*, *Didymocarpus aureoglandulosus* (both Gesneriaceae), and *Agapetes parishii* (Ericaceae). Evergreen, epiphytic, creeping vines include *Hoya siamensis* (Asclepiadaceae) and the abundant *Pothos chinensis* (Araceae). The epiphytic fern *Asplenium nidus*, commonly found in MXF, also occurs here. The deciduous epiphytic shrub *Fagraea ceilanica* (Loganiaceae) is rare. The diverse herbaceous ground flora received little attention during the survey. Characteristic species are *Amorphophallus* sp., the robust *Alpinia malaccensis* and *Amomum* ssp. (both Zingiberaceae), *Dracaena angustifolia* (Agavaceae), and the delicate *Agrostemma verticillatum* (Rubiaceae), which grows on moist rocks and tree trunks. Rarer are *Sarcandra glabra* ssp. *brachystachys* (Chloranthaceae), *Lobelia zeylanica* (Campanulaceae), and *Sonerila maculata* (Melastomataceae). Extremely rare are the ground orchids *Tainia viridifusca* and *Habenaria* cf. *medioflexa*, both only found twice in shady and moist areas. *Habenaria dentata* is common in open, grassy areas along forest edges up to 1,200 m. The evergreen herbs *Begonia laciniata* var. *laciniata* (Begoniaceae) and *Baliospermum siamense* (Euphorbiaceae) are abundant in shady areas. The creeping herb *Hydrocotyle javanica* (Umbelliferae) was found only in wet and shady areas at forest edges. Common herbs in open, disturbed areas are *Rhopalephora scaberrimum*, *Commelina diffusa* (both Commelinaceae), and the treelet/shrub *Melastoma malabathricum* (Melastomataceae).

Bamboo is very scarce and is only represented by dense thickets of the straggling and sprawling *Dinochloa maclellandii* (Gramineae, Bambusoideae). Grasses and sedges are

also scarce. *Oplismenus compositus* (Gramineae) is rare and found in partly shaded places while *Carex baccans* (Cyperaceae) is common in moist, open areas and forest edges.

Of great interest is the finding of the leafless parasite *Sapria himalayana* (Rafflesiaceae) in a small, shady, and moist area near a gully at 1,300 m. In Thailand it is known to grow only on the stems and roots of the lianas *Tetrastigma cruciatum*, *T. obovatum*, and *T. laoticum* (Vitaceae). In Mae Wong it was found growing on *T. cruciatum*. *Sapria himalayana* is a rare species restricted to some parts of western and northern Thailand. It has been proposed to include this species in the Red Data Book of the International Union for the Conservation of Nature (IUCN) as an endangered species, but has not yet been approved at time of writing. Threats to this species are vandalism, collection for supposed medicinal purposes, habitat loss, low dispersal and reproduction rate, and high degree of host specificity (ELLIOTT, 1992).

**Summit flora of Doi Mokoju.**—An additional type of vegetation is included here, which has been visited by the first author. Doi (mountain) Mokoju is covered with secondary growth from c. 1,870 m upward to the summit at 1,960 m. It is completely dominated by bracken fern *Pteridium aquilinum* (Dennstaedtiaceae), indicating fire disturbance, the shrubs *Lespedeza decora* (Leguminosae, Papilionoideae), *Hypericum hookerianum* (Guttiferae), and the herb *Anaphalis margaritacea* (Compositae). Some tall, fire-scarred, dead trees are found at the summit indicating past forest cover. It also indicates that fires have had a devastating effect. This vegetation type is not completely original, at least not up to c. 1,920 m. The summit area originally supported an evergreen forest with a lower canopy similar to evergreen forests above 1,800 m elevation at nearby mountain areas (e.g. Doi Kajela, 2,152 m, Umpang Wildlife Sanctuary, Tak Province). Canopy height here was c. 20–24 m. Dominating families are Fagaceae, Theaceae, Myrtaceae, and Lauraceae, but overall species richness is lower than in EGF at lower elevations. Several of the trees in this forest have twisted, deformed and buttressed trunks as a result of the harsh and exposed climatic conditions. This forest is very sensitive to disturbances and is easily damaged by many factors. Disturbances, especially fires, have adversely affected the tree stand. Exposure to strong winds at the summit has caused many trees to fall. The increased exposure to strong winds has resulted in a ‘domino’ effect with trees toppling over more easily as wind and fires inflicting more and more irreparable damage to the stand, which eventually disappears from the summit. Soil erosion in combination with the steep slopes and fires is severely hampering the regeneration and rehabilitation of this forest and the result is a secondary vegetation type. This situation is readily apparent on some of the peaks and ridges above 1,800 m in northern Thailand (e.g. Doi Inthanon, 2,565 m).

### The Deciduous–Evergreen Transition

There is no sharp transition zone between MXF and EGF. The numbers of evergreen species gradually increases and deciduous species gradually decrease toward the upper limit of MXF at c. 1,100 m (see Figures 8 and 9). There is an equal mixture of evergreen and deciduous species between 800 and 900 m and an equilibrium (c. 80% evergreen and c. 20% deciduous) is reached between 1,100 and 1,200 m elevation. A similar trend is shown in Table 5, revealing the proportion of evergreen and deciduous species in relation to elevation. This indicates that the cut-off point for deciduous forest is at c. 600–700 m

Table 5. Proportion (%) of evergreen (E), deciduous (D), and tropophyllus (D-E) species and elevation.

Elevation (m)	D (%)	E (%)	D-E (%)
100	89.2	10	0.8
200	89.2	10	0.8
300	88.5	10.7	0.8
400	88.6	10.6	0.8
500	86.6	12.6	0.8
600	80.5	18.8	0.7
700	67.4	30.5	2.1
800	51.4	46.4	2.2
900	36.2	61.6	2.2
1,000	23.6	74	2.4
1,100	20	79.1	0.9
1,200	18.5	80.7	0.8
1,300	16.9	82.3	0.8
1,400	15.9	83.2	0.9
> 1,400	15.5	83.3	1.2

and for primary evergreen forest at *c.* 1,100–1,200 m elevation with a broad deciduous–evergreen zone (MXF) in between. Figures 10a. and 10b. show the lower and upper distribution limits of all deciduous and evergreen tree and woody climber species, respectively. Well over 200 species are found in the lowlands with only a few of these species occurring in the highlands. Most lowland species start to disappear from *c.* 500 m upwards, and at *c.* 1,100 m they have all disappeared. The zone between 600 and 1,200 m shows a mixture of lowland species, species restricted to this zone only, and highland species. At 1,100 m there is a gradual increase of typical ‘montane’ species. Over 40 species have their lower limits at 500–700 m and there is a clear peak of, mostly deciduous, species (38) reaching their upper limits at 1,000 m. Well over 20 species are reaching their upper limits between 1,000 and 1,200 m. Almost a fifth (19.6%) of all woody climber and tree species (e.g. *Trigonostemon thyrsoides* and *Livistona speciosa*) are restricted to the 600–1,200 m zone. This is supported by Figure 11, which shows the number of new tree and woody climber species with each 100 m increase in elevation (rare species ( $N < 5$ ) and species found at only one elevation excluded). It clearly shows a difference in floristics in deciduous, MXF and evergreen forest.

## DISCUSSION

The availability of soil moisture in the dry season is a determining factor in the distribution of evergreen and deciduous species. With increasing elevation the rate of

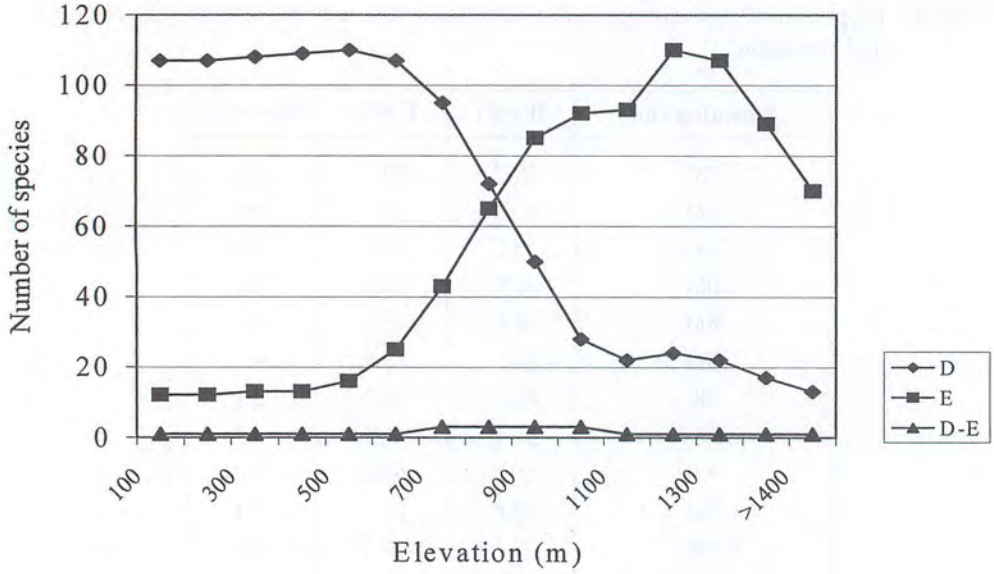


Figure 8. Leafing phenology and elevation of all tree (279) and woody climber (33) species in Mae Wong National Park (D = deciduous, E = evergreen, D-E = tropophyllus).

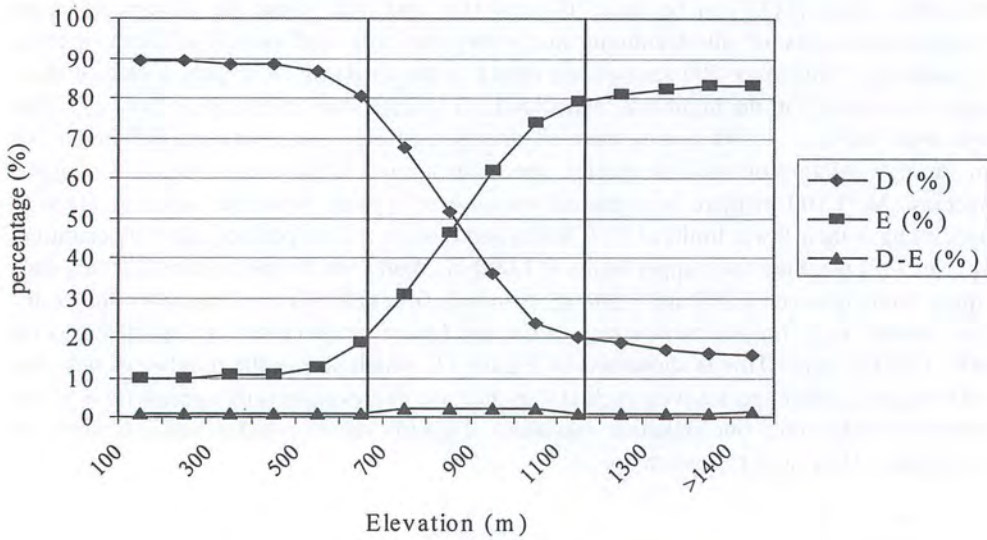


Figure 9. Percentage of deciduous (D), evergreen (E), and tropophyllus (D-E) tree and woody climber species in relation to elevation in Mae Wong NP. The vertical lines represent the approximate limits of MXF.

evapotranspiration drops and rainfall increases. Mist, dew and cloud cover maintains relatively high soil moisture during the dry season at high elevations, hence a higher proportion of evergreen species. The low values for evergreen species in DDF and BB/DF can partly be attributed to the loss of vegetation cover, depletion of soil, reduced soil moisture, and fire. Soils are drying out and becoming less fertile making it difficult for evergreen trees to colonize and survive, especially during the dry season, and so are gradually replaced with deciduous, fire-tolerant species and bamboos. The same happens when MXF and EGF are further disturbed, now mainly by fire.

### Definition of Forest Types

An important question is where deciduous forest stops and where evergreen forest begins, and what is the definition of "evergreen forest". It is an oversimplification to call a forest evergreen merely on the fact that it looks green in the dry season. It still may contain a great majority of deciduous species, especially at lower elevations. Deciduous forest naturally contains several evergreen species and evergreen forest contains several deciduous species as shown in Figure 8. Conventional forest type classification in Thailand has been based on the presence and absence of various commercial species (e.g. teak), elevation and climate. None were based on the entire species assemblages, floristics, and quantitative analysis thus often lacking biological sense and botanical credibility. We classify the forest types in Mae Wong National Park according to physiognomy and floristics.

Figure 9 shows the gradual decrease of deciduous species and increase of evergreen species over a broad range. Most deciduous species disappear between the 700–1100 m range while evergreen species start coming in at 600 m and steadily increase till c. 1,200 m. The transition between deciduous and evergreen occurs over a broad continuum and hence does not support the distinction between 'deciduous' and 'evergreen' types. We define a deciduous forest as a forest with more than 80% of the species deciduous and less than 20% of the species evergreen. An evergreen forest is a forest with less than 20% of the species deciduous and more than 80% of the species evergreen. Hence the transition between deciduous and evergreen forest is a broad continuum with 20–80% of the species either deciduous or evergreen (see Figure 9). The elevation range for deciduous forest in Mae Wong is 0 – c. 600, for MXF c. 600 to c. 1,100 m, and for EGF c. 1,100 m upwards. Table 6 shows the classification of forest types based on degree of deciduous/evergreen species and elevation.

Table 6. Classification of forest types based on the degree of deciduous/evergreen tree and woody climber species and elevation in Mae Wong National Park.

Forest type	Percentage deciduous	Percentage evergreen	Elevation limits (m)	
			Lower	Upper
DDF and BB/DF	> 80	< 20	0	c. 600
MXF	20–80	20–80	c. 600	c. 1100
EGF	< 20	> 80	c. 1100	c. 1920

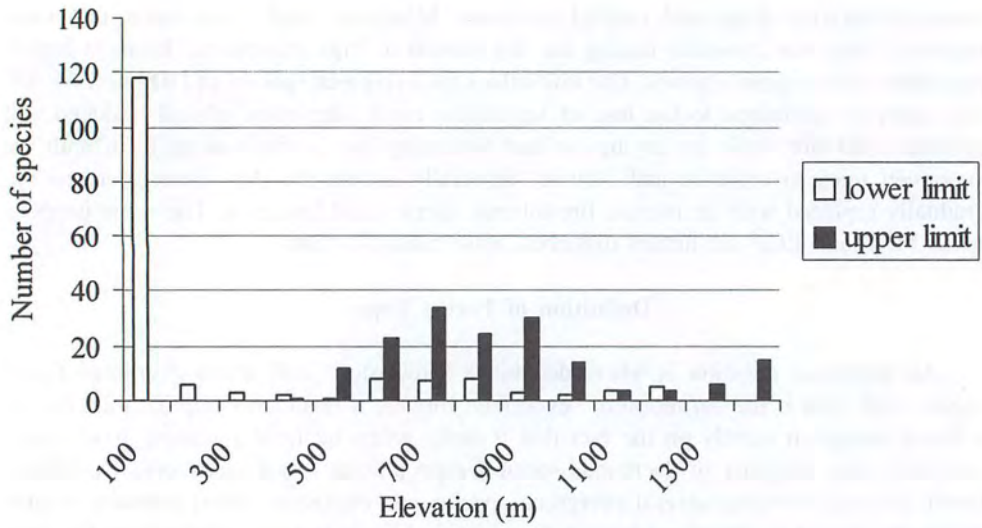


Figure 10. a. lower and upper limit distribution of all deciduous tree and woody climber species in Mae Wong NP.

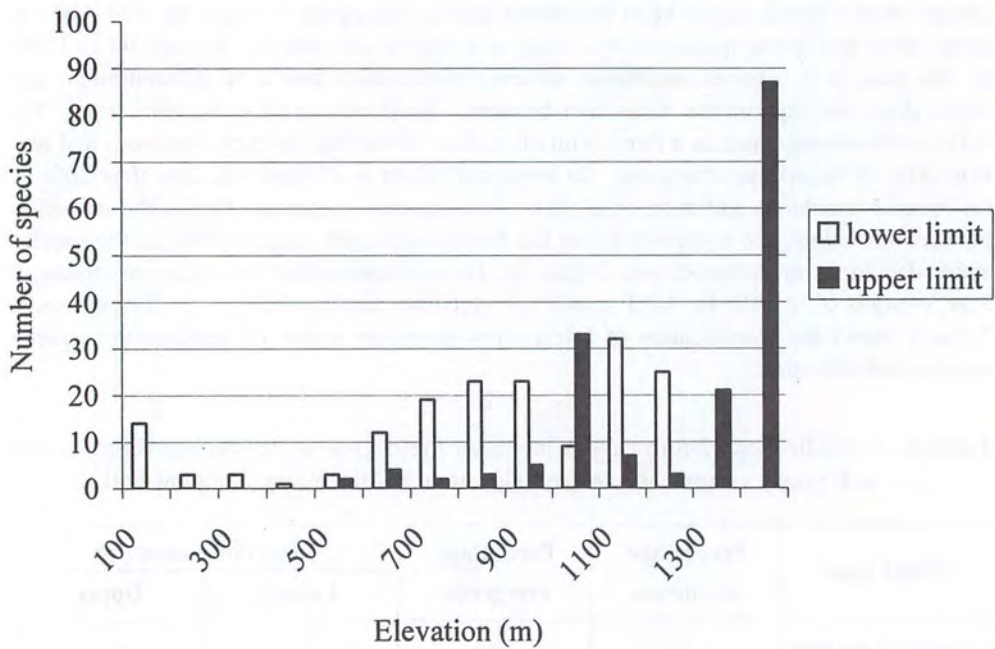


Figure 10. b. Lower and upper limit distribution of all evergreen tree and woody climber species in Mae Wong NP.



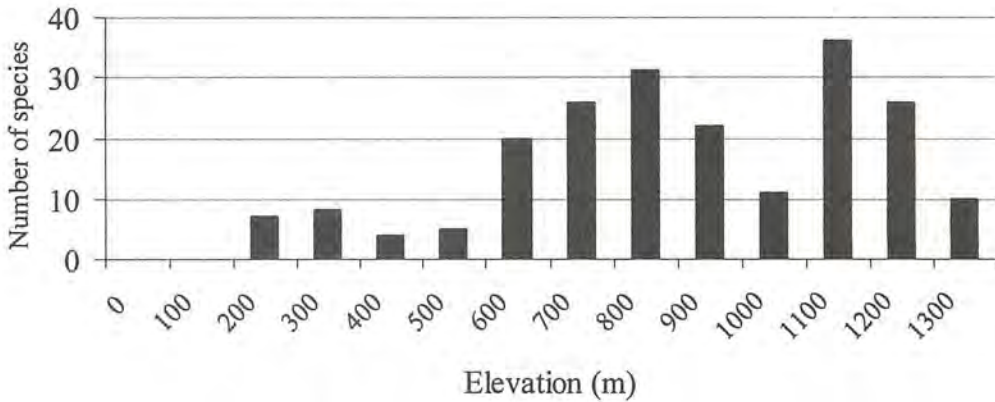


Figure 11. Number of new woody climber and tree species appearing with each 100 m increase in elevation. Rare species ( $n < 5$ ) and species recorded at only one elevation are excluded.

The floristics of the three zones are different as shown in Figure 11. There are sharp floristic changes as one moves up the mountain with clear peaks at the 600–900 m range and above 1100 m thus indicating three different floristic zones. The MXF zone, in combination with the leafing phenology data and a unique set of species should, therefore, be recognized as a distinct vegetation type and not merely as a transition zone. Furthermore, it indicates that the elevation range of MXF is larger than given for MXF (800–1,000 m) by MAXWELL (2001) for Northern Thailand.

#### Distinctiveness of Forest Types

EGF contains the most habitat-restricted tree species (93; Table 7). This indicates the number of species that might be lost when this forest type is further degraded or disappears. In contrast, DDF supports the least habitat-restricted tree species (25) though this number still accounts for 50% of the total number of tree species in this type. The number of tree species restricted to BB/DF and MXF are 53 and 49, respectively, thus again indicating the distinctiveness of MXF. DDF and BB/DF share 24 species, BB/DF and MXF 14 species, and MXF and EGF 29 species.

Table 7. Tree, treelet, and woody climber species shared with other forest types. Numbers in bold indicate the number of species restricted to one forest type.

Species in:	Shared with:				Total number of species
	DDF	BB/DF	MXF	EGF	
DDF	25	24	1	0	50
BB/DF	24	53	14	1	92
MXF	1	14	49	29	93
EGF	0	1	29	93	123

### Species Composition of Forest Types

The species composition of the forest types in Mae Wong NP is similar to that reported from other areas in northern Thailand (OGAWA, 1961 and 1962; SANTISUK, 1988; ELLIOTT, 1989; MAXWELL, 1996; MAXWELL, 2001). A floristic study done by HARA *ET AL.* (2002) in which all trees  $\geq 1$  cm DBH were enumerated in a 15-ha plot in "tropical montane forest" (= EGF) at 1,700 m on Doi Inthanon (Chiang Mai Province), showed similar tree family composition to Mae Wong NP. The species composition, however was different. The most dominant species on Doi Inthanon was *Mastixia euonymoides* (Cornaceae) which is rare in Mae Wong, and 3 of the top 5 species of relative basal area, *Quercus eumorpha* Kurz, *Q. brevicalyx* A. Camus (Fagaceae) and *Manglietia garrettii* Craib (Magnoliaceae), were not recorded in Mae Wong.

### Tree Densities

The tree densities showed a highly irregular pattern in some transects. Two transects in DDF and BB/DF had a high number of saplings and coppices in the 10–30 cm GBH class indicating a vigorous regeneration after disturbance resulting in a high tree density (1,507 and 1,928 ha<sup>-1</sup>, respectively). This has caused a high overall tree density. MXF has a high tree density in undisturbed circumstances. The low tree density figure for MXF (335 trees ha<sup>-1</sup>, DBH  $\geq 10$  cm) in Mae Wong clearly shows the devastating effect of forest fires and past agricultural practices. This is the most threatened forest habitat in Mae Wong.

### Disturbances

It is obvious that human activities are still threatening biodiversity in the NP. Encroachment and illegal logging still cause loss of forest cover. Illegal collecting of orchids, ferns, cycads, and medicinal plants by both locals and tourists has seriously depleted their abundances in some parts of the park. All forest types have experienced heavy logging in the past. Typical deciduous lowland and secondary growth species invading MXF and EGF can be attributed to these disturbances. Annual fires degrade those areas further and cause the loss of typical climax (MXF and EGF) forest species. The destruction of all seedlings and saplings is serious threat to survival of the forest or will cause a shift

to a more degraded deciduous vegetation type. The forests will need many fire-free years to recover. Still, the plant diversity of Mae Wong National Park is very high. In the two years of surveys, mainly focused on transects, 571 species and varieties were recorded including several rare species. This figure seems low considering the wide range of elevation and habitats, but a detailed floristic study of each forest type in Mae Wong NP will certainly result in a much higher number of species. The relatively high plant diversity can be attributed to the bio-geographical location of the region with plant species from the Himalayan, Indo-Chinese and Sundaic bio-geographical regions occurring here.

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**Appendix 1.** Enumeration of the vascular plants of Mae Wong National Park including a key to abbreviations used in the list.

**Key to abbreviations used in the species list**

**Phenology:**

A	Annual
D	Deciduous
D-E	Tropophyllus
E	Evergreen

**Habit:**

Cr	Creeping
El	Epilithic
Ep	Epiphytic
H	Herb
Pa	Parasite
S	Shrub
T	Tree
Te	Terrestrial
Tl	Treelet
V	Vine
WC	Woody Climber

**Habitat:**

BB/DF	Deciduous Forest with bamboo
Da	Degraded areas
DDF	Deciduous Dipterocarp forest
EGF	Primary evergreen seasonal forest
G	Grassland
MXF	Mixed evergreen + deciduous forest
SG	Secondary growth
Str	Stream

**Abundance:**

1	Rare
2	Uncommon
3	Common
4	Abundant

Species	Family	Phenology	HaHit	Habitat	Abundance	Elevation (m)
<i>Abrus pulchellus</i> Wall. ex Thw. ssp. <i>pulchellus</i>	Leguminosae, Papilionoideae	A	V	BB/DF	2	140-500
<i>Acacia pennata</i> Willd.	Leguminosae, Mimosoideae	D	S WC	BB/DF Str	3	140-500
<i>Acanthephippium striatum</i> Lindl.	Orchidaceae	PE	TeH	EGF	1	1100-1300
<i>Acer laurinum</i> Hassk.	Aceraceae	D	T	EGF	2	1000-1500
<i>Acrocarpus fraxinifolius</i> Wight ex Arn.	Leguminosae, Caesalpinioideae	D	T	MXF	2	600-1000
<i>Acronychia pedunculata</i> (L.) Miq.	Rutaceae	E	T	MXF	3	700-1000
<i>Actephila ovalis</i> (Ridl.) Gage	Euphorbiaceae	E	T	EGF	2	1200-1850
<i>Adiantum philippense</i> L.	Parkeriaceae	D	Te El H	DDF BB/DF	3	140-600
<i>Adiantum zollingeri</i> Mett. ex Kuhn	Parkeriaceae	D	Te El H	DDF BB/DF	3	140-500
<i>Aeginetia indica</i> Roxb.	Orobanchaceae	D	PaH	BB/DF	2	140-500
<i>Aerides</i> sp.	Orchidaceae	PE	EpH	BB/DF	2	140-500
<i>Aeschynanthus garrettii</i> Craib	Gesneriaceae	E	EpH	EGF	3	1200-1850
<i>Aesculus assamica</i> Griff.	Hippocastanaceae	D	T	EGF Str	2	1100-1700
<i>Afzelia xylocarpa</i> (Kurz) Craib	Leguminosae, Caesalpinioideae	D	T	BB/DF	2	140-900
<i>Agapetes parishii</i> Cl.	Ericaceae	E	EpS H	EGF	3	1400-1850
<i>Ageratum conyzoides</i> L.	Compositae	A	TeH	BB/DF	4	140-500
<i>Aglaiia lawii</i> (Wight) Sald. & Rama.	Meliaceae	E	T	EGF	2	800-1400
<i>Aglaiia</i> sp.	Meliaceae	E	T	MXF	2	700-1000
<i>Aglaonema simplex</i> (Bl.) Bl.	Araceae	PE	H	BB/DF MXF	3	200-900
<i>Aidia cochinchinensis</i> Lour.	Rubiaceae	E	T	EGF	2	1100-1500
<i>Alangium kurzii</i> Craib	Alangiaceae	D	T	MXF EGF	2	900-1300
<i>Albizia lebbeck</i> (L.) Bth.	Leguminosae, Mimosoideae	D	T	BB/DF	4	140-800
<i>Albizia odoratissima</i> (L. f.) Bth.	Leguminosae, Mimosoideae	D	T	BB/DF MXF	3	140-900
<i>Allophyllus cobbe</i> (L.) Raesch.	Sapindaceae	D	S TI	BB/DF	2	140-600
<i>Alphonsea boniana</i> Craib	Annonaceae	E	T	EGF	2	1100-1400
<i>Alpinia malaccensis</i> (Burm. f.) Rosc.	Zingiberaceae	PE	TeH	EGF	4	1200-1850
<i>Alstonia scholaris</i> (L.) R. Br. var. <i>scholaris</i>	Apocynaceae	D	T	BB/DF	3	140-900
<i>Amomum</i> cf. <i>dealbatum</i> Roxb.	Zingiberaceae	E	TeH	EGF	1	1200-1850
<i>Amomum</i> sp.	Zingiberaceae	PD	TeH	EGF	4	1200-1850
<i>Amorphophallus</i> sp.	Araceae	PD	TeH	EGF	3	1200-1850
<i>Amorphophallus</i> sp.	Araceae	PD	TeH	BB/DF	2	140-600
<i>Anaphalis margaritacea</i> (L.) Bth. & Hk. f.	Compositae	A	TeH	EGF	4	1100-1960
<i>Anisoptera costata</i> Korth.	Dipterocarpaceae	E	T	BB/DF MXF	2	140-1100
<i>Anoectochilus</i> sp.	Orchidaceae	PE	TeH	EGF	2	1000-1400

Species	Family	Phenology	HaHit	Habitat	Abundance	Elevation (m)
<i>Anogeissus accuminata</i> (Roxb. ex DC.) Guill. & Perr.	Combretaceae	D	T	BB/DF	3	140-700
<i>Antidesma acidum</i> Retz.	Euphorbiaceae	D	TI	DDF	3	140-500
<i>Antidesma sootepense</i> Craib	Euphorbiaceae	D	TI	DDF BB/DF	3	140-600
<i>Antidesma</i> sp.	Euphorbiaceae	D	T	MXF	2	700-1000
<i>Aphanamixis polystachya</i> (Wall.) R. Parker	Meliaceae	E	T	MXF EGF	3	800-1400
<i>Apios carnea</i> (Wall.) Bth. ex Baker	Leguminosae, Papilionoideae	D	V	Da	2	1100-1500
<i>Apluda mutica</i> L.	Gramineae	PD	TeH	DDF BB/DF	4	140-700
<i>Aporosa octandra</i> (B.-H. ex D. Don) Vick. var. <i>octandra</i>	Euphorbiaceae	D	T	BB/DF	2	140-500
<i>Aporosa villosa</i> (Lindl.) Baill.	Euphorbiaceae	D	T	DDF BB/DF S	3	300-1000
<i>Aralia thomsonii</i> Seem. ex Cl.	Araliaceae	D	TI	EGF	3	1200-1850
<i>Ardisia quinqueгона</i> Bl.	Myrsinaceae	E	T TI	MXF EGF	2	700-1850
<i>Arenga pinnata</i> (Wurmb) Merr.	Palmae	E	T	MXF	3	600-1100
<i>Argostemma verticillatum</i> Wall.	Rubiaceae	A	EIH	EGF	2	1200-1850
<i>Argyreia capitiformis</i> (Poir.) Oost.	Convolvulaceae	PE	V	EGF	3	1200-1850
<i>Argyreia siamensis</i> (Craib) Stap.	Convolvulaceae	D	V	DDF	2	140-700
<i>Arisaema</i> sp.	Araceae	D	EpH	EGF	3	1200-1850
<i>Aristolochia kerrii</i> Craib	Aristolochiaceae	PD	V	DDF	2	140-700
<i>Artocarpus lakoocha</i> Roxb.	Moraceae	D	T	MXF EGF	2	500-1200
<i>Artocarpus gomezianus</i> Wall. Ex Trec.	Moraceae	E	T	MXF	2	900-1000
<i>Arundinella setosa</i> Trin. var. <i>setosa</i>	Gramineae	PD	TeH	DDF BB/DF	3	140-800
<i>Asplenium nidus</i> L. var. <i>nidus</i>	Aspleniaceae	E	EpH	MXF EGF	3	700-1600
<i>Asystasia salicifolia</i> Craib var. <i>salicifolia</i>	Acanthaceae	A	TeH	EGF SG	2	1100-1300
<i>Baccaurea ramiflora</i> Lour.	Euphorbiaceae	E	T	MXF EGF	3	800-1300
<i>Balanophora fungosa</i> J. R. & G. Forst.	Balanophoraceae	D	PaTeH	EGF	1	1100-1850
<i>Baliospermum solanifolium</i> (Burnm.) Suresh	Euphorbiaceae	PE	TeH	BB/DF SG	2	140-300
<i>Baliospermum calicinum</i> M.-A.	Euphorbiaceae	PE	TeH	EGF	3	1200-1850
<i>Dendrocalamus membranaceus</i> Munro	Gramineae, Bambusoideae	E	TeH	BB/DF MXF	4	140-1000
<i>Bambusa tulda</i> Roxb.	Gramineae, Bambusoideae	E	TeH	BB/DF MXF	3	140-1000
<i>Barleria strigosa</i> Willd.	Acanthaceae	PD	TeH	BB/DF MXF	3	140-1000
<i>Barringtonia acutangula</i> (L.) Gaertn.	Lecythidaceae	D	T	BB/DF	3	140-700

Species	Family	Phenology	HaHit	Habitat	Abundance	Elevation (m)
<i>Bauhinia bassacensis</i> Pierre ex Gagnep.	Leguminosae, Caesalpinioideae	E	WC	EGF	3	1100-1850
<i>Bauhinia ornata</i> Kurz var. <i>kerrii</i> (Gagnep.) K. & S. S. Lar.	Leguminosae, Caesalpinioideae	E	WC	MXF	3	800-1100
<i>Bauhinia saccoalalyx</i> Pierre	Leguminosae, Caesalpinioideae	D	S TI	BB/DF	3	140-700
<i>Bauhinia viridescens</i> Desv. var. <i>hirsuta</i> . K. & S. S. Lar	Leguminosae, Caesalpinioideae	D	TI	BB/DF	2	140-500
<i>Bauhinia viridescens</i> Desv. var. <i>viridescens</i>	Leguminosae, Caesalpinioideae	D	S TI	BB/DF	3	140-700
<i>Bauhinia</i> sp.	Leguminosae, Caesalpinioideae	D	WC	BB/DF	3	140-700
<i>Begonia laciniata</i> Roxb. var. <i>laciniata</i>	Begoniaceae	PD	TeH	EGF	4	1100-1850
<i>Beilschmiedia elegantissima</i> Kosterm.	Lauraceae	E	T	EGF	2	1200-1700
<i>Beilschmiedia</i> sp.	Lauraceae	E	T	MXF EGF	2	900-1300
<i>Berrya mollis</i> Wall. ex Kurz	Tiliaceae	D	T	BB/DF	2	140-600
<i>Betula alnoides</i> Ham. ex G. Don	Betulaceae	D	T	MXF EGF Da	4	600-1850
<i>Biophytum sensitivum</i> DC.	Oxalidaceae	A	TeH	BB/DF Str	3	140-500
<i>Bischofia javanica</i> Bl.	Euphorbiaceae	D-E	T	MXF	2	600-1000
<i>Blumea lacera</i> (Burm. f.) DC.	Compositae	A	TeH	DDF BB/DF	4	140-700
<i>Blumea membranacea</i> DC. var. <i>membranacea</i>	Compositae	A	TeH	DDF BB/DF	4	140-700
<i>Boehmeria clidemioides</i> Miq. var. <i>clidemioides</i>	Urticaceae	E	S TI	MXF	3	700-1000
<i>Boesenbergia rotunda</i> (L.) Mansf.	Zingiberaceae	PD	TeH	BB/DF	3	140-800
<i>Bombax anceps</i> Pierre var. <i>anceps</i>	Bombacaceae	D	T	DDF BB/DF	3	140-900
<i>Bothriochloa bladhii</i> (Retz.) S. T. Blake	Gramineae	A	TeH	BB/DF Da	3	140-500
<i>Brassaiaopsis glomerulata</i> (Bl.) Regel	Araliaceae	E	T	EGF Str	2	1100-1850
<i>Bridelia retusa</i> (L.) Spreng.	Euphorbiaceae	D	T	BB/DF	3	140-600
<i>Broussonetia papyrifera</i> (L.) Vent.	Moraceae	D	TI	BB/DF Da	2	140-900
<i>Buchanania glabra</i> Wall. ex Hk. f.	Anacardiaceae	D	T	BB/DF	2	140-800
<i>Buchanania lanzan</i> Spreng.	Anacardiaceae	D	T	DDF	2	140-600
<i>Buddleja asiatica</i> Lour.	Loganiaceae	D	S TI	MXF EGF	2	900-1300
<i>Bulbophyllum capillipes</i> Par. & Rchb. f.	Orchidaceae	PE	EpH	EGF Da	2	1100-1400
<i>Bulbophyllum forrestii</i> Seidenf.	Orchidaceae	PE	EpH	EGF	1	1000-1400
<i>Bulbophyllum khasyanum</i> Griff.	Orchidaceae	PE	EpH	EGF	2	1000-1400
<i>Bulbophyllum morphologorum</i> F. Kranzl.	Orchidaceae	PE	EpH	EGF Da	2	1100-1400
<i>Bulbophyllum sukhakulii</i> Seidenf.	Orchidaceae	E	EpH	EGF	1	1100-1300
<i>Bulbophyllum taeniophyllum</i> Par. & Rchb. f.	Orchidaceae	E	EpH	HEF	1	1100-1400
<i>Bulbophyllum</i> sp.	Orchidaceae	E	EpH	EGF	2	1100-1500



Species	Family	Phenology	HaHit	Habitat	Abundance	Elevation (m)
<i>Butea superba</i> Roxb.	Leguminosae, Papilionoideae	D	WC	BB/DF	3	140-700
<i>Caesalpinia sappan</i> L.	Leguminosae, Caesalpinioideae	PE	S	BB/DF SG	2	140-400
<i>Calamus</i> sp.	Palmae	E	S V	MXF Str	3	700-1000
<i>Calanthe triplicata</i> (Willen.) Ames	Orchidaceae	PD	TeH	MXF	2	600-1100
<i>Callerya atropurpurea</i> (Wall.) Schot. var. <i>pubescens</i> (Craib) P. K.	Leguminosae, Papilionoideae	D	T	BB/DF MXF SG	3	140-1000
<i>Callicarpa arborea</i> Roxb. var. <i>arborea</i>	Verbenaceae	D	TI	BB/DF MXF	3	140-1000
<i>Calophyllum inophyllum</i> L.	Guttiferae	E	T	EGF	2	1100-1850
<i>Calophyllum polyanthum</i> Wall. ex Pl. & Tr.	Guttiferae	E	T	EGF	3	1100-1850
<i>Camellia pleurocarpa</i> (Gagnep.) Sealy	Theaceae	E	T	EGF	3	1200-1850
<i>Camellia taliensis</i> (W. W. Sm.) Mel.	Theaceae	E	T	EGF	2	1200-1850
<i>Canarium subulatum</i> Guill.	Burseraceae	D	T	DDF BB/DF	3	140-700
<i>Canthium coffeoides</i> Pierre ex Pit.	Rubiaceae	D	S TI	EGF Da	2	1000-1850
<i>Carallia brachiata</i> (Lour.) Merr.	Rhizophoraceae	E	T	BB/DF MXF EGF	3	300-1850
<i>Carex baccans</i> Nees	Cyperaceae	D	TeH	EGF Da	3	1100-1850
<i>Careya arborea</i> Roxb.	Lecythidaceae	D	T	DDF BB/DF S SG	3	140-600
<i>Caryota mitis</i> Lour.	Palmae	E	TI	MXF Str	3	700-1000
<i>Caryota urens</i> L.	Palmae	E	T	EGF	2	900-1300
<i>Casearia grewiifolia</i> Vent. var. <i>gelonioides</i> (Bl.) Sleum.	Flacourtiaceae	E	T	EGF	3	1100-1850
<i>Casearia grewiifolia</i> Vent. var. <i>grewiifolia</i>	Flacourtiaceae	D	T	DDF	1	400-700
<i>Cassia fistula</i> L.	Leguminosae, Caesalpinioideae	D	T	BB/DF	3	140-700
<i>Castanopsis acuminatissima</i> (Bl.) A. DC.	Fagaceae	E	T	MXF EGF	3	800-1600
<i>Castanopsis diversifolia</i> King ex Hk. f	Fagaceae	E	T	EGF	3	1100-1850
<i>Castanopsis tribuloides</i> (Sm.) A. DC.	Fagaceae	E	T	EGF	3	800-1850
<i>Castanopsis</i> sp.	Fagaceae	E	T	EGF	2	1200-1850
<i>Castanopsis</i> sp.	Fagaceae	E	T	EGF	3	1200-1850
<i>Catunaregam spathulifolia</i> Tirv.	Rubiaceae	D	S TI	DDF BB/DF	2	140-700
<i>Catunaregam tomentosa</i> (Roxb. ex Link) Tirv.	Rubiaceae	D	S TI	BB/DF	2	140-500
<i>Cayratia mollissima</i> (Wall.) Gagnep.	Vitaceae	D	WC	EGF	2	1200-1850
<i>Cayratia trifolia</i> (L.) Domin. var. <i>trifolia</i>	Vitaceae	D	V	DDF	3	140-600
<i>Celastrus monospermus</i> Roxb.	Celastraceae	D	WC	EGF	2	900-1850
<i>Celosia argentea</i> L.	Amaranthaceae	A	TeH	BB/DF Str	4	140-500
<i>Centotheca lappacea</i> (L.) Desv. var. <i>lappacea</i>	Gramineae	A	TeH	BB/DF	2	140-400

Species	Family	Phenology	HaHit	Habitat	Abundance	Elevation (m)
<i>Centrosema pubescens</i> Benth.	Leguminosae, Papilionoideae	A	V	BB/DF Da	2	140-400
<i>Ceropegia siamensis</i> Kerr	Asclepiadaceae	D	V	EGF Da	1	1100-1400
<i>Chirita anachoreta</i> Hance	Gesneriaceae	A	EIH	EGF	2	1100-1400
<i>Chlorophytum intermedium</i> Craib	Liliaceae	E	H	BB/DF	2	140-600
<i>Christisonia siamensis</i> Craib	Orobanchaceae	D	PaTeH	BB/DF	2	140-700
<i>Chukrasia tabularis</i> A. Juss.	Meliaceae	D	T	DDF BB/DF	2	140-900
<i>Cinnamomum bejolghota</i> (Ham.) Sweet	Lauraceae	E	T	EGF	2	900-1850
<i>Cinnamomum iners</i> Reinw. ex Bl.	Lauraceae	E	T	MXF EGF	3	700-1600
<i>Cissampelos pareira</i> L. var. <i>hirsuta</i> (B.-H. ex DC.) For.	Menispermaceae	D	V	BB/DF	2	140-600
<i>Cissus repanda</i> Vahl	Vitaceae	D	WC	BB/DF	3	140-700
<i>Cissus</i> sp.	Vitaceae	D	WC	EGF	2	1200-1850
<i>Citrus ? hystrix</i> DC.	Rutaceae	E	T	EGF	1	1200-1400
<i>Claoxylon indicum</i> (Reinw. ex Bl.) Hassk.	Euphorbiaceae	D	T	EGF	2	1100-1500
<i>Clausena excavata</i> Burm. f. var. <i>excavata</i>	Rutaceae	E	T	BB/DF MXF	2	200-900
<i>Cleisostoma</i> sp.	Orchidaceae	PE	EpH	EGF	2	1000-1400
<i>Cleisostoma complicatum</i> (Seid.) Garay	Orchidaceae	E	EpH	DDF BB/DF	2	140-750
<i>Cleistanthus hirsutulus</i> Hk. f.	Euphorbiaceae	E	T	BB/DF	3	140-500
<i>Clerodendrum glandulosum</i> Colebr. ex Lindl.	Verbenaceae	D	S	EGF Da	3	900-1500
<i>Clerodendrum paniculatum</i> L.	Verbenaceae	D	TeH	BB/DF	3	140-600
<i>Clerodendrum serratum</i> (L.) Moon var. <i>wallichii</i> CL.	Verbenaceae	D	TeH S TI	DDF	2	140-900
<i>Codonopsis parviflora</i> Wall. ex A. DC.	Campanulaceae	A	TeH	EGF SG	2	1000-1300
<i>Coelogyne ovalis</i> Lindl.	Orchidaceae	PE	EpH	EGF	2	1000-1400
<i>Coelogyne trinervis</i> Lindl.	Orchidaceae	PE	EpH	EGF	2	1000-1400
<i>Colona auriculata</i> (Desf.) Craib	Tiliaceae	D	S TI	BB/DF Da	3	140-600
<i>Colona winitii</i> Craib	Tiliaceae	D	TI	DDF BB/DF	4	140-900
<i>Commelinia diffusa</i> Burm. f.	Commelinaceae	A-P	TeH	EGF Da	3	1100-1850
<i>Congea tomentosa</i> Roxb. var. <i>tomentosa</i>	Verbenaceae	D	WC	BB/DF	3	140-600
<i>Corchorus aestuans</i> L.	Tiliaceae	A	TeH	BB/DF	2	140-600
<i>Cordia dichotoma</i> Forst. f.	Boraginaceae	D	T	BB/DF	2	140-600
<i>Costus speciosus</i> (Koeh.) J. E. Sm.	Zingiberaceae	PD	TeH	BB/DF Da	3	140-900
<i>Cratoxylum formosum</i> (Jack) Dyer spp. <i>pruniflorum</i> (Kurz) Gog.	Guttiferae	D	TI T	BB/DF	3	140-800

Species	Family	Phenology	HaHit	Habitat	Abundance	Elevation (m)
<i>Crotalaria alata</i> D. Don	Leguminosae, Papilionoideae	A	TeH	DDF	2	140-600
<i>Crotalaria cytisoides</i> Roxb. ex DC.	Leguminosae, Papilionoideae	A	TeH	DDF	2	140-700
<i>Crotalaria verrucosa</i> L.	Leguminosae, Papilionoideae	A	TeH	BB/DF	2	140-700
<i>Croton hutchinsonianus</i> Hoss.	Euphorbiaceae	D	T	DDF BB/DF	4	140-700
<i>Croton roxburghii</i> N.P. Balakr.	Euphorbiaceae	D	T	DDF BB/DF	4	140-800
<i>Cruddasia insignis</i> Prain	Leguminosae, Papilionoideae	D	V	EGF Da	2	1100-1700
<i>Cryptocarya</i> sp.	Lauraceae	E	T	EGF	2	1100-1850
<i>Curcuma parviflora</i> Wall.	Zingiberaceae	PD	TeH	BB/DF	3	140-800
<i>Curcuma zedoaria</i> (Berg.) Rosc.	Zingiberaceae	PD	TeH	DDF S	4	300-600
<i>Cyathea chinensis</i> Copel.	Cyatheaaceae	E	TH	EGF Str	2	1100-1850
<i>Cycas siamensis</i> Miq.	Cycadaceae	E	TI	DDF BB/DF	3	140-500
<i>Cyclea barbata</i> Miers	Menispermaceae	E	V	DDF BB/DF SG	3	140-600
<i>Cymbidium insigne</i> Rolfe	Orchidaceae	PE	EpH	EGF	2	1000-1400
<i>Cymbidium mastersii</i> Griff. ex Lindl.	Orchidaceae	PE	EpH	EGF	2	1000-1400
<i>Cymbopogon flexuosus</i> (Nees ex Steud.) Wats.	Gramineae	PD	TeH	DDF	3	140-500
<i>Cyperus cyperoides</i> (L.) OK.	Cyperaceae	PD	TeH	DDF	3	140-700
<i>Cyperus laxus</i> Lmk. var. <i>laxus</i>	Cyperaceae	PE	TeH	DDF	3	140-700
<i>Cyperus leucocephalus</i> Retz.	Cyperaceae	PD	TeH	DDF	3	140-700
<i>Cyperus rotundus</i> L. ssp. <i>rotundus</i>	Cyperaceae	PD	TeH	BB/DF	3	140-600
<i>Cyrtandromoea grandiflora</i> Cl.	Scrophulariaceae	E	TeSH	EGF Da	2	1000-1300
<i>Dalbergia cana</i> Grah. ex Kurz var. <i>cana</i>	Leguminosae, Papilionoideae	D	T	DDF	3	140-700
<i>Dalbergia cultrata</i> Grah. ex Bth.	Leguminosae, Papilionoideae	D	T	DDF	3	140-700
<i>Dalbergia foliacea</i> Wall. ex Bth.	Leguminosae, Papilionoideae	D	TI WC	BB/DF	2	140-800
<i>Dalbergia oliveri</i> Gamb. ex Prain	Leguminosae, Papilionoideae	D	T	BB/DF MXF	3	140-900
<i>Daphne composita</i> (L. f.) Gilg.	Thymelaeaceae	E	S TI	EGF	2	1200-1850
<i>Debregeasia longifolia</i> (Burm. f.) Wedd.	Urticaceae	E	TI T	EGF Da	3	1100-1700
<i>Dendrobium chrysotoxum</i> Lindl.	Orchidaceae	D	EpH	EGF	2	1100-1850
<i>Dendrobium cumulatum</i> Lindl.	Orchidaceae	PE	EpH	EGF	1	1100-1300
<i>Dendrobium denudans</i> D. Don	Orchidaceae	PE	EpH	EGF	2	1000-1400
<i>Dendrobium falconeri</i> Hk.	Orchidaceae	D	EpH	EGF	2	1100-1850
<i>Dendrobium heterocarpum</i> Lindl.	Orchidaceae	D	EpH	EGF	2	1100-1850
<i>Dendrobium primulinum</i> Lindl.	Orchidaceae	PD	EpH	EGF	1	1200-1300
<i>Dendrobium thyrsiflorum</i> Rchb. f.	Orchidaceae	D	EpH	EGF	3	1100-1850
<i>Dendrobium wardianum</i> Warner	Orchidaceae	D	EpH	EGF	2	1100-1850

Species	Family	Phenology	HaHit	Habitat	Abundance	Elevation (m)
<i>Dendrobium</i> sp.	Orchidaceae	D	EpH	MXF EGF	2	700-1200
<i>Dendrocalamus nudus</i> Pilg.	Gramineae, Bambusoideae	PD	TeH	BB/DF	3	140-700
<i>Dendrocnide sinuata</i> (Bl.) Chew	Urticaceae	E	S TI	MXF	2	700-1000
<i>Desmodium heterocarpon</i> (L.) DC. ssp. <i>heterocarpon</i> var. <i>heterocarpon</i>	Leguminosae, Papilionoideae	D	TeH	EGF Da	2	1100-1850
<i>Desmodium pulchellum</i> (L.) Bth.	Leguminosae, Papilionoideae	D	S TI	BB/DF	3	140-700
<i>Desmos</i> sp.	Annonaceae	E	WC	DDF BB/DF	2	140-600
<i>Dianella ensifolia</i> (L.) DC.	Liliaceae	E	TeH	BB/DF EGF	3	140-1300
<i>Dichroa febrifuga</i> Lour.	Saxifragaceae	E	S	EGF	2	1200-1850
<i>Dicliptera roxburghiana</i> Nees	Acanthaceae	A	TeH	BB/DF	3	140-500
<i>Didymocarpus aureoglandulosus</i> Cl.	Gesneriaceae	D	EpH	EGF	2	1200-1850
<i>Dillenia parviflora</i> Griff. var. <i>kerrii</i> (Craib) Hoogl.	Dilleniaceae	D	T	DDF BB/DF	3	140-700
<i>Dillenia pentagyna</i> Roxb.	Dilleniaceae	D	T	BB/DF	2	140-500
<i>Dimocarpus longan</i> Lour. ssp. <i>longan</i> var. <i>longan</i>	Sapindaceae	E	T	MXF	2	600-1100
<i>Dinochloa maclellandii</i> (Munro) Kurz	Gramineae, Bambusoideae	E	TeH	EGF Da	2	1300-1850
<i>Dioecrescis erythroclada</i> (Kurz) Tirv.	Rubiaceae	D	TI	DDF	2	140-500
<i>Dioscorea alata</i> L.	Dioscoreaceae	D	V	EGF Da	2	1000-1400
<i>Diospyros castanea</i> (Craib) Fletcher	Ebenaceae	D	T	BB/DF	2	200-500
<i>Diospyros ehretioides</i> Wall. ex G. Don	Ebenaceae	D	T	DDF BB/DF SG	3	140-800
<i>Diospyros mollis</i> Griff.	Ebenaceae	D	T	BB/DF MXF	3	300-1000
<i>Diplazium esculentum</i> (Retz.) Sw.	Athyriaceae	PE	TeH	BB/DF SG	3	200-600
<i>Diplocyclos palmatus</i> (L.) C. Jeff.	Cucurbitaceae	PD	V	EGF Da	2	1100-1500
<i>Dipterocarpus alatus</i> Roxb. ex G. Don	Dipterocarpaceae	E	T	BB/DF MXF	2	200-700
<i>Dipterocarpus costatus</i> Gaertn. f.	Dipterocarpaceae	E	T	BB/DF	2	300-900
<i>Dipterocarpus obtusifolius</i> Teijsm. ex Miq. var. <i>obtusifolius</i>	Dipterocarpaceae	D	T	DDF	4	140-800
<i>Dipterocarpus tuberculatus</i> Roxb. var. <i>tuberculatus</i>	Dipterocarpaceae	D	T	DDF	3	140-700
<i>Dischidia major</i> (Vahl) Merr.	Asclepiadaceae	E	CrEpH	DDF	1	140-500
<i>Dracaena angustifolia</i> Roxb.	Agavaceae	E	TI	EGF	3	1100-1850
<i>Drypetes indica</i> (M.-A.) Pax & Hoffm.	Euphorbiaceae	E	T	EGF	2	1100-1850
<i>Drypetes roxburghii</i> (Wall.) Huru.	Euphorbiaceae	E	T	MXF EGF	2	800-1850
<i>Duabanga grandiflora</i> (Roxb. ex DC.) Walp.	Sonneratiaceae	E	T	BB/DF MXF Da Str	4	140-1300
<i>Dunbaria bella</i> Prain	Leguminosae, Papilionoideae	D	V	DDF	3	140-700
<i>Dysolobium grande</i> (Wall. ex Bth.) Prain	Leguminosae, Papilionoideae	A	V	BB/DFDa	3	140-800

Species	Family	Phenology	HaHit	Habitat	Abundance	Elevation (m)
<i>Dysoxylum cyrtobotryum</i> Miq.	Meliaceae	E	T	EGF	2	1100-1850
<i>Dysoxylum</i> sp.	Meliaceae	E	T	EGF	3	1000-1850
<i>Elaeocarpus prunifolius</i> Wall. ex Muell.	Elaeocarpaceae	E	T	EGF	2	900-1850
<i>Elaeocarpus robustus</i> Roxb.	Elaeocarpaceae	D	T	EGF	3	1000-1850
<i>Ellipeiopsis cherrevensis</i> (Pierre ex Finet & Gagnep.) R. E. Fr.	Annonaceae	D	S	DDF	2	140-500
<i>Entada rheedii</i> Spreng. ssp. <i>rheedii</i>	Leguminosae, Mimosoideae	D	WC	BB/DF MXF	2	300-900
<i>Equisetum debile</i> Roxb. ex Vauch	Equisetaceae	PE	TeH	MXF EGF	2	800-1200
<i>Eranthemum macrophyllum</i> Wall. ex Nees	Acanthaceae	A	TeH	BB/DF	2	140-400
<i>Eria pannea</i> Lindl.	Orchidaceae	PE	EpH	EGF	1	1200-1850
<i>Eria siamensis</i> Schltr.	Orchidaceae	PE	EpH	EGF	1	1100-1400
<i>Erycibe subspicata</i> Wall.	Convolvulaceae	E	WC	EGF	2	1200-1300
<i>Erythrina subumbrans</i> (Hassk.) Merr.	Leguminosae, Papilionoideae	D	T	MXF EGF	3	700-1300
<i>Eugenia albiflora</i> Duth. ex Kurz	Myrtaceae	E	T	MXF EGF	3	800-1850
<i>Eugenia fruticosa</i> (DC.) Roxb.	Myrtaceae	E	T	EGF	3	1100-1850
<i>Eugenia megacarpum</i> Craib	Myrtaceae	E	T	MXF Str	2	500-900
<i>Eugenia syzygoides</i> (Miq.) Hend.	Myrtaceae	E	T	EGF	3	1000-1400
<i>Eugenia tetragona</i> Wight	Myrtaceae	E	T	EGF	2	700-1000
<i>Eugenia</i> sp.	Myrtaceae	E	T	EGF	3	1200-1850
<i>Eugenia</i> sp.	Myrtaceae	E	T	MXF EGF	2	700-1300
<i>Euonymus cochinchinensis</i> Pierreb	Celastraceae	E	T	MXF EGF	2	800-1400
<i>Eupatorium cannabinum</i> L.	Compositae	A	TeH	BB/DF	4	140-500
<i>Eurya acumminata</i> DC. var. <i>wallichiana</i> Dyer	Theaceae	E	T	EGF	2	1200-1850
<i>Fagraea ceilanica</i> Thunb.	Loganiaceae	D	EpT	EGF	1	1200-1300
<i>Fernandoa adenophylla</i> (Wall. ex G. Don) Steen.	Bignoniaceae	D	T	BB/DF	3	140-700
<i>Ficus altissima</i> Bl.	Moraceae	E	EpT	MXF EGF	3	600-1300
<i>Ficus benjamina</i> L. var. <i>benjamina</i>	Moraceae	E	EpT	MXF	3	600-1100
<i>Ficus fistulosa</i> Reinw. ex Bl. var. <i>fistulosa</i>	Moraceae	D	Tl T	BB/DF MXF EGF	3	140-1300
<i>Ficus glaberrima</i> Bl. var. <i>glaberrima</i>	Moraceae	E	EpT	EGF	2	1100-1400
<i>Ficus hispida</i> L. f. var. <i>hispida</i>	Moraceae	D	Tl	MXF BB/DF	3	400-900
<i>Ficus sarmentosa</i> B.-H. ex J. E. Sm. var. <i>nipponica</i> (Fr. & Sav.) Corn.	Moraceae	E	WC	MXF	2	900-1000
<i>Ficus semicordata</i> B.-H. ex J. E. Sm. ar. <i>semicordata</i>	Moraceae	D	T	MXF EGF	3	600-1400

Species	Family	Phenology	HaHit	Habitat	Abundance	Elevation (m)
<i>Ficus subulata</i> Bl. var. <i>subulata</i>	Moraceae	E	TI	MXF	2	700-1000
<i>Fimbristylis dichotoma</i> (L.) Vahl ssp. <i>dichotoma</i>	Cyperaceae	PE	TeH	DDF	3	140-800
<i>Firmiana colorata</i> (Roxb.) R. Br.	Sterculiaceae	D	T	BB/DF	3	140-900
<i>Flacourtia indica</i> (Burm. f.) Merr.	Flacourtiaceae	D	TI	BB/DF	3	140-600
<i>Galactia tenuiflora</i> (Klein ex Willd.) W. & A.	Leguminosae, Papilionoideae	A	TeH V	DDF	2	140-700
<i>Garcinia mackeaniana</i> Craib	Guttiferae	E	T	MXF	2	700-1000
<i>Garcinia plena</i> Craib	Guttiferae	E	T	EGF	3	900-1500
<i>Garcinia speciosa</i> Wall.	Guttiferae	E	T	MXF	2	600-1000
<i>Garuga pinnata</i> Roxb.	Burseraceae	D	T	BB/DF	3	140-700
<i>Geodorum</i> sp.	Orchidaceae	PD	TeH	MXF EGF	2	800-1200
<i>Geostachys</i> sp.	Zingiberaceae	PD	TeH	EGF	1	1200-1300
<i>Gigantochloa albociliata</i> (Munro) Kurz	Gramineae, Bambusoideae	D	TeH	BB/DF	4	140-800
<i>Gironniera subaequalis</i> Pl.	Ulmaceae	E	T	MXF	2	800-1000
<i>Globba schomburgkii</i> Hk. f. var. <i>schomburgkii</i>	Zingiberaceae	PD	TeH	DDF BB/DF	3	140-800
<i>Globba</i> sect. <i>Cerantanthera</i>	Zingiberaceae	PD	TeH	BB/DF	2	140-500
<i>Globba</i> sect. <i>Globba</i>	Zingiberaceae	PD	TeH	BB/DF	2	140-500
<i>Globba xantholeuca</i> Craib	Zingiberaceae	D	TeH	BB/DF	3	140-800
<i>Globba</i> sp.	Zingiberaceae	PD	TeH	EGF	2	1200-1850
<i>Glochidion rubrum</i> Bl.	Euphorbiaceae	D	TI	MXF	3	700-1000
<i>Gluta usitata</i> (Wall.) Hou	Anacardiaceae	D	T	DDF BB/DF	2	140-700
<i>Gnetum montanum</i> Mgf.	Gnetaceae	E	WC	EGF	2	1200-1850
<i>Gomphostemma javanicum</i> (Bl.) Benth.	Labiatae	PD	TeH	EGF	2	1200-1500
<i>Gomphostemma lucidum</i> Wall. ex Benth.	Labiatae	E	TeH	EGF	2	1200-1400
<i>Gomphostemma strobilinum</i> Wall. ex Benth. var. <i>acaulis</i> (Kurz ex Hk. f.) Prain	Labiatae	PD	TeH	BB/DF	3	140-700
<i>Goniothalamus</i> sp.	Annonaceae	E	T	HEF	3	900-1300
<i>Grewia abutifolia</i> Vent. ex Juss.	Tiliaceae	D	S TI	DDF BB/DF	3	140-800
<i>Grewia eriocarpa</i> Juss.	Tiliaceae	D	T TI	DDF BB/DF	4	140-900
<i>Grewia hirsuta</i> Vahl	Tiliaceae	D	TI	DDF BB/DF	3	140-600
<i>Grewia leavigata</i> Vahl	Tiliaceae	D	S	BB/DF	2	140-700
<i>Habenaria dentata</i> (Sw.) Schltr.	Orchidaceae	PD	TeH	BB/DF MXF EGF Da	3	400-1200
<i>Habenaria malintana</i> (Blanco) Merr.	Orchidaceae	PD	TeH	EGF Da	2	1000-1400
<i>Habenaria medioflexa</i> Turill.	Orchidaceae	PD	TeH	EGF	1	1100-1300
<i>Haldina cordifolia</i> (Roxb.) Rids.	Rubiaceae	D	T	BB/DF	2	140-800

Species	Family	Phenology	HaHit	Habitat	Abundance	Elevation (m)
<i>Halopegia brachystachys</i> Craib	Marantaceae	D	TeH	BB/DF MXF	3	200-600
<i>Harrisoniana perforata</i> (Blanco) Merr.	Simaroubaceae	D	WC	BB/DF Da	3	140-900
<i>Hedychium gardnerianum</i> Rosc.	Zingiberaceae	PD	TeH	EGF SG	2	1000-1800
<i>Hedyotis ovatifolia</i> Cav.	Rubiaceae	A	TeH	DDF BB/DF	3	140-800
<i>Hedyotis pinifolia</i> Wall. ex G. Don	Rubiaceae	PD	TeH	BB/DF	3	140-800
<i>Hedyotis tenelliflora</i> Bl.	Rubiaceae	PD	TeH	BB/DF	3	140-700
<i>Helicia formosana</i> Hemsl. var. <i>oblancheolata</i> Sleum.	Protaceae	E	T TI	MXF EGF	3	800-1300
<i>Helicteres elongata</i> Wall. ex Boj.	Sterculiaceae	D	S TI	BB/DF	2	140-800
<i>Hewittia scandens</i> (Milne) Mabb.	Convolvulaceae	D	V	BB/DF	3	140-600
<i>Heynea trijuga</i> Roxb. ex Sims	Meliaceae	E	T	EGF	3	900-1500
<i>Hibiscus radiatus</i> Cav.	Malvaceae	PD	TI	DDF	2	140-400
<i>Hiptage benghalensis</i> (L.) Kurz ssp. <i>benghalensis</i>	Malpighiaceae	D	WC	BB/DF	2	140-700
<i>Holarrhena pubescens</i> Wall. ex G. Don	Apocynaceae	D	T	BB/DF	3	140-600
<i>Homalium ceylanicum</i> (Gard.) Bth.	Flacourtiaceae	D	T	BB/DF	3	140-700
<i>Homonoia riparia</i> Lour.	Euphorbiaceae	D-E	S TI	BB/DF Str	3	140-500
<i>Hopea odorata</i> Roxb.	Dipterocarpaceae	E	T	BB/DF	2	140-800
<i>Hoya siamensis</i> Craib	Asclepiadaceae	E	EpH	EGF	2	1200-1850
<i>Hydnocarpus kurzii</i> (King) Warb.	Flacourtiaceae	E	T	EGF	3	1100-1500
<i>Hydrocotyle javanica</i> Pont. ex Thunb.	Umbelliferae	PE	TeH	EGF	2	1100-1500
<i>Hymenodictyon orixense</i> (Roxb.) Mabb.	Rubiaceae	D	T	BB/DF	2	140-600
<i>Hymenopogon parasiticus</i> Wall.	Rubiaceae	D	EpEIS	EGF Da	3	800-1850
<i>Hypericum hookerianum</i> Wight & Arn.	Guttiferae	D	EIS	EGF Da	3	1800-1960
<i>Hyptis suaveolens</i> (L.) Poit.	Labiatae	A	TeH	BB/DF Da	3	140-500
<i>Impatiens mengtzeana</i> Hk. f.	Balsaminaceae	E	TeH	EGF	1	1200-1500
<i>Impatiens violaeiflora</i> Hk. f.	Balsaminaceae	A	TeH	MXF EGF Str	3	700-1100
<i>Imperata cylindrica</i> (L.) P. Beauv. var. <i>major</i> (Nees) C. E. Hubb. ex Hubb. & Vaugh.	Gramineae	E	TeH	Da	4	140-1700
<i>Inula cappa</i> (Ham. ex D. Don) DC. <i>forma cappa</i>	Compositae	PD	TeH	DDF	3	140-700
<i>Irvingia malayana</i> Oliv. ex Benn.	Irvingiaceae	E	T	DDF BB/DF	3	140-800
<i>Ixora coccinea</i> L.	Rubiaceae	E	S TI	EGF	3	1000-1500
<i>Jasminum subglandulosum</i> Wall. ex G. Don	Oleaceae	E	WC	EGF	2	1200-1500
<i>Justicia flava</i> Kurz	Acanthaceae	D	TeH	BB/DF	3	140-800
<i>Justicia procumbens</i> L.	Acanthaceae	A	TeH	BB/DF	3	140-800

Species	Family	Phenology	HaHit	Habitat	Abundance	Elevation (m)
<i>Justicia rhodantha</i> R. Ben.	Acanthaceae	D	TeH	BB/DF	3	140-800
<i>Kaempferia elegans</i> Baker	Zingiberaceae	PD	TeH	BB/DF	3	140-700
<i>Kaempferia pulchra</i> Ridl.	Zingiberaceae	PD	TeH	DDF BB/DF	3	140-900
<i>Kaempferia rotunda</i> L.	Zingiberaceae	PD	TeH	DDF	2	140-800
<i>Knema lenta</i> Warb.	Myristicaceae	E	T	MXF Str	2	700-1100
<i>Knoxia corymbosa</i> Willd.	Rubiaceae	D	TeH	BB/DF	4	140-800
<i>Lablab purpureus</i> (L.) Sw. ssp. <i>purpureus</i>	Leguminosae, Papilionoideae	E	V	Da	2	1200-1300
<i>Lagerstroemia calyculata</i> Kurz	Lythraceae	D	T	BB/DF MXF	2	140-900
<i>Lagerstroemia cochinchinensis</i> Pierre var. <i>ovalifolia</i> Furt. & Mont.	Lythraceae	D	T	BB/DF	3	140-800
<i>Lagerstroemia floribunda</i> Jack var. <i>floribunda</i>	Lythraceae	D	T	BB/DF	3	140-800
<i>Lagerstroemia macrocarpa</i> Kurz var. <i>macrocarpa</i>	Lythraceae	D	T	BB/DF	3	140-800
<i>Lagerstroemia tomentosa</i> Presl	Lythraceae	D	T	BB/DF	2	140-900
<i>Lannea coromandelica</i> (Hout.) Merr.	Anacardiaceae	D	T	DDF BB/DF	3	140-800
<i>Lasia spinosa</i> (L.) Thw.	Araceae	PE	TeH	BB/DF MXF Str	2	400-1000
<i>Lasianthus kurzii</i> Hk. f.	Rubiaceae	E	S TI	EGF	3	900-1500
<i>Leea indica</i> (Burm. f.) Merr.	Leeaceae	D-E	S TI	DDF Da	2	140-1000
<i>Lepisanthes rubiginosa</i> (Roxb.) Leenh.	Sapindaceae	D	TI	BB/DF MXF SG	3	140-900
<i>Lepedeza decora</i> Kurz	Leguminosae, Papilionoideae	D	S	EGF Da	3	1800-1960
<i>Leucas decemdentata</i> (Willd.) Sm.	Labiatae	A	TeH	DDF BB/DF	4	140-700
<i>Liparis viridiflora</i> (Bl.) Lindl.	Orchidaceae	PD	EpH	EGF	2	1000-1400
<i>Liparis</i> sp.	Orchidaceae	PD	TeH	EGF	2	1000-1400
<i>Lithocarpus elegans</i> (Bl.) Hatus. ex Soep.	Fagaceae	E	T	MXF EGF	3	600-1500
<i>Lithocarpus</i> sect. <i>Cyclobalanopsis</i>	Fagaceae	E	T	MXF	2	800-1000
<i>Lithocarpus</i> sp.	Fagaceae	E	T	MXF EGF	3	800-1300
<i>Litsea glutinosa</i> (Lour.) C. B. Rob. var. <i>glutinosa</i>	Lauraceae	D	T	BB/DF MXF	3	140-900
<i>Litsea monopetala</i> (Roxb.) Pers.	Lauraceae	E	T	EGF	3	1100-1500
<i>Litsea salicifolia</i> Nees ex Roxb.	Lauraceae	E	T	MXF EGF	3	800-1400
<i>Litsea viridis</i> Ho	Lauraceae	E	T	EGF	2	1200-1500
<i>Litsea</i> sp.	Lauraceae	E	T	MXF	2	800-1000
<i>Livistona speciosa</i> Kurz	Palmae	E	T	MXF EGF	3	700-1200
<i>Lobelia zeylanica</i> L.	Campanulaceae	A	TeH	EGF	1	1200-1400
<i>Luisia</i> sp.	Orchidaceae	PE	EpH	EGF	2	1000-1400
<i>Lycopodium cernuum</i> L.	Lycopodiaceae	PE	TeH	BB/DF MXF	2	300-900



Species	Family	Phenology	HaHit	Habitat	Abundance	Elevation (m)
<i>Lygodium salicifolium</i> Presl.	Schizaeaceae	E	V	DDF BB/DF	3	140-600
<i>Macaranga denticulata</i> (Bl.) M.-A.	Euphorbiaceae	E	T	MXF EGF Da	3	700-1400
<i>Macaranga siamensis</i> S. J. Davis	Euphorbiaceae	E	T	EGF Da	3	700-1700
<i>Macropanax dispermus</i> (Bl.) O. K.	Araliaceae	E	T	MXF	2	600-1000
<i>Magnolia liliifera</i> (L.) Baill. var. <i>obovata</i> (Korth.) Gov.	Magnoliaceae	E	T	MXF	3	800-1000
<i>Malaxis</i> sp.	Orchidaceae	D	TeH	MXF EGF Da	2	1000-1400
<i>Mallotus oblongifolius</i> (Miq.) M.-A.	Euphorbiaceae	E	T	EGF	4	1100-1500
<i>Mallotus paniculatus</i> (Lmk.) M.-A.	Euphorbiaceae	E	T	MXF	2	600-1000
<i>Mallotus philippensis</i> (Lmk.) M.-A.	Euphorbiaceae	E	T	MXF	2	500-1000
<i>Mammea siamensis</i> (Miq.) T. And.	Guttiferae	E	T	DDF	3	140-600
<i>Mangifera caloneura</i> Kurz	Anacardiaceae	E	T	BB/DF	2	140-900
<i>Mangifera sylvatica</i> Roxb.	Anacardiaceae	E	T	EGF	2	1000-1300
<i>Mangifera</i> sp.	Anacardiaceae	E	T	EGF	2	1200-1300
<i>Markhamia stipulata</i> (Wall.) Seem. ex K. Schum. var. <i>stipulata</i>	Bignoniaceae	D	T	BB/DF MXF	4	140-900
<i>Mastixia euonymoides</i> Prain	Cornaceae	E	T	EGF	1	1200-1300
<i>Melastoma malabathricum</i> L. ssp. <i>malabathricum</i>	Melastomataceae	E	S TI	MXF EGF Da	3	800-1400
<i>Melicope pterifolia</i> (Champ. ex Bth.) T. Hart.	Rutaceae	E	TI	EGF Da	3	900-1500
<i>Melientha suavis</i> Pierre ssp. <i>suavis</i>	Opiliaceae	E	T TI	DDF	2	140-700
<i>Memeylon umbellatum</i> Burm.f.	Melastomataceae	E	TI	MXF EGF	3	800-1400
<i>Merremia tridentata</i> (L.) Hall. f. ssp. <i>hastata</i> (Desr.) Oost.	Convolvulaceae	A	V	BB/DF Da	3	140-600
<i>Merremia vitifolia</i> (Burm. f.) Hall. f.	Convolvulaceae	E	V	BB/DF SG	3	140-600
<i>Metadina trichotoma</i> (Zoll. ex Mor.) Bakh. f.	Rubiaceae	E	T	MXF Str	2	600-1000
<i>Michelia baillonii</i> (Pierre) Finet & Gagnep.	Magnoliaceae	D	T	MXF	3	600-1200
<i>Michelia champaca</i> L. var. <i>champaca</i>	Magnoliaceae	D	T	MXF EGF	2	800-1400
<i>Microcos paniculata</i> L.	Tiliaceae	D	T	BB/DF	2	140-900
<i>Micromelum minutum</i> (Forst.f.) Wight & Arn.	Rutaceae	E	TI	MXF	3	400-1000
<i>Microstegium vagans</i> (Nees ex Steud.) A. Camus	Gramineae	PD	TeH	DDF BB/DF	4	140-700
<i>Milium velutina</i> (Dun.) Hk. f. & Th.	Annonaceae	D	T TI	BB/DF	2	140-800
<i>Millettia xylocarpa</i> Miq.	Leguminosae, Papilionoideae	D	T	BB/DF	3	140-700
<i>Millettia</i> sp.	Leguminosae, Papilionoideae	D	T	BB/DF	2	140-700
<i>Mimosa pigra</i> Linn.	Leguminosae, Mimosoideae	A	TeH	SG G	3	140-400

Species	Family	Phenology	HaHit	Habitat	Abundance	Elevation (m)
<i>Mischocarpus pentapetalus</i> (Roxb.) Radlk.	Sapindaceae	E	T	MXF	2	600-1000
<i>Mitragyna rotundifolia</i> (Roxb.) O. K.	Rubiaceae	D	T	DDF BB/DF	3	140-900
<i>Mitrephora vandaeflora</i> Kurz	Annonaceae	D-E	T	MXF	3	700-1000
<i>Morinda tomentosa</i> Heyne ex Roth	Rubiaceae	D	T	DDF	3	140-700
<i>Morus macroura</i> Miq.	Moraceae	D	T	MXF	3	800-1100
<i>Mucuna brevipes</i> Craib	Leguminosae, Papilionoideae	E	V	MXF	2	700-1000
<i>Musa itinerans</i> Chees.	Musaceae	PE	TeH	EGF	2	1200-1700
<i>Myriopterum extensum</i> (Wight) K. Schum.	Asclepiadaceae	A	V	BB/DF	2	140-800
<i>Nauclea orientalis</i> (L.) L.	Rubiaceae	E	T	BB/DF MXF	2	300-600
<i>Neolitsea reticulata</i> Kosterm.	Lauraceae	E	T	EGF	3	1100-1850
<i>Nephelium hypoleucum</i> Kurz	Sapindaceae	E	T	MXF EGF	3	800-1300
<i>Nervilia</i> sp.	Orchidaceae	PD	TeH	EGF	2	1000-1400
<i>Oberonia falconeri</i> Hk. f.	Orchidaceae	PD	EpH	EGF	2	1000-1400
<i>Oberonia</i> sp.	Orchidaceae	PE	EpH	BB/DF	2	140-500
<i>Ochna integerrima</i> (Lour.) Merr.	Ochnaceae	D	S TI	DDF	3	140-700
<i>Olea salicifolia</i> Wall. ex G. Don	Oleaceae	E	TI	MXF EGF	2	900-1300
<i>Ophiorrhizophyllum macrobotryum</i> Kurz	Acanthaceae	PE	TeH	EGF Str	2	1000-1500
<i>Oplismenus compositus</i> (L.) P. Beauv.	Gramineae	A	TeH	BB/DF	3	140-800
<i>Oreocnide rubescens</i> Bl.	Urticaceae	E	S TI	MXF EGF	3	900-1400
<i>Orophea polycarpa</i> A. DC.	Annonaceae	E	TI	MXF	3	600-1000
<i>Orophea</i> sp.	Annonaceae	E	TI	MXF	2	800-1000
<i>Oroxylum indicum</i> (L.) Vent.	Bignoniaceae	D	T	BB/DF Da	3	140-900
<i>Ostodes paniculata</i> Bl.	Euphorbiaceae	E	T	MXF EGF	3	700-1300
<i>Otochilus</i> sp.	Orchidaceae	PE	EpH	EGF	2	1000-1400
<i>Ottochloa nodosa</i> (Kunth) Dandy	Gramineae	A	TeH	BB/DF	4	140-800
<i>Oxyceros horridus</i> Lour.	Rubiaceae	E	S TI	EGF Da	3	1200-1500
<i>Paederia pallida</i> Craib	Rubiaceae	A	V	DDF BB/DF Da	3	140-600
<i>Pandanus penetrans</i> St. John	Pandanaceae	E	TI	BB/DF MXF Str	3	600-1000
<i>Panicum miliare</i> Lmk.	Gramineae	PD	TeH	BB/DF	3	140-500
<i>Panicum notatum</i> Retz.	Gramineae	PD	TeH	BB/DF	4	140-800
<i>Parameria laevigata</i> (Juss.) Mold.	Apocynaceae	E	WC	MXF	2	700-1000
<i>Parinari anamensis</i> Hance	Rosaceae	E	T	BB/DF	2	140-800
<i>Parthenocissus semicordata</i> (Wall.) Pl.	Vitaceae	D	WC	EGF	2	1200-1500
<i>Pauldopia ghorta</i> (G. Don) Steenis	Bignoniaceae	D	TI	EGF SG	2	1100-1400

Species	Family	Phenology	HaHit	Habitat	Abundance	Elevation (m)
<i>Pavetta indica</i> L.	Rubiaceae	E	Tl	EGF	3	900-1400
<i>Pavetta tomentosa</i> Roxb. ex Smith var. <i>tomentosa</i>	Rubiaceae	D	Tl	DDF	2	140-700
<i>Pavonia repanda</i> (Roxb. ex J.E. Sm.) Spreng.	Malvaceae	PD	TeH	BB/DF MXF SG	3	140-700
<i>Pennisetum polystachon</i> (L.) Schult.	Gramineae	PD	TeH	DDF BB/DF	4	140-800
<i>Phlogacanthus curviflorus</i> (Wall.) Nees var. <i>curviflorus</i>	Acanthaceae	E	Tl	MXF Str	3	600-1200
<i>Phlogacanthus racemosus</i> Brem.	Acanthaceae	E	TeH	BB/DF	2	140-800
<i>Phoebe cathia</i> (D. Don) Kosterm.	Lauraceae	E	T	MXF EGF	3	800-1400
<i>Phoebe lanceolata</i> (Nees) Nees	Lauraceae	E	T	EGF	3	900-1850
<i>Phoebe</i> sp.	Lauraceae	E	T	MXF	2	900-1000
<i>Pholidota</i> sp.	Orchidaceae	E	EpH	EGF	2	1100-1300
<i>Photinia integrifolia</i> Lindl.	Rosaceae	E	T	EGF	1	1200-1300
<i>Phragmites vallatoria</i> (Pluk. ex L.) Veldk.	Gramineae	PE	TeH	BB/DF	4	140-400
<i>Phyllanthus columnaris</i> M.-A.	Euphorbiaceae	D	T	BB/DF	2	140-500
<i>Phyllanthus emblica</i> L.	Euphorbiaceae	D	T	DDF BB/DF	3	140-900
<i>Physalis angulata</i> L.	Solanaceae	A	TeH	BB/DF Str	3	140-500
<i>Pilea trinervia</i> Wight	Urticaceae	A	TeEIH	EGF	3	1000-1400
<i>Platynerium wallichii</i> Hk.	Polypodiaceae	D	EpH	BB/DF	2	140-700
<i>Podocarpus neriiifolius</i> D. Don	Podocarpaceae	E	T	EGF	2	900-1400
<i>Polyalthia cerasoides</i> (Roxb.) Bth. ex Bedd.	Annonaceae	D	T	BB/DF	2	140-700
<i>Polyalthia simiarum</i> (Ham. ex Hk. f. & Th.) Bth. ex Hk. f. Th.	Annonaceae	D	T	MXF	2	500-1100
<i>Polyalthia viridis</i> Craib	Annonaceae	E	T	BB/DF	2	140-900
<i>Polyalthia</i> sp.	Annonaceae	E	T	EGF	3	1200-1500
<i>Polygala arillata</i> B.-H. ex G. Don	Polygalaceae	E	Tl	EGF	3	800-1300
<i>Polygala tricholopha</i> Chod.	Polygalaceae	E	Tl	MXF	2	600-1000
<i>Polygala umbonata</i> Craib	Polygalaceae	A	TeH	BB/DF	2	140-800
<i>Polygonum chinense</i> L.	Polygonaceae	PE	TeH	EGF Da	3	900-1500
<i>Polygonum odoratum</i> Lour.	Polygonaceae	PE A	TeH	BB/DF	3	140-600
<i>Pothos chinensis</i> (Raf.) Merr.	Araceae	E	EpH	EGF	4	1100-1850
<i>Polytoca digitata</i> (L. f.) Druce	Gramineae	PD	TeH	DDF BB/DF	3	140-600
<i>Pouzolzia hirta</i> Hassk.	Urticaceae	PD	TeH	EGF Da	3	1000-1400
<i>Premna corymbosa</i> (Burm.f) Rotll. ex Willd. var. <i>corymbosa</i>	Verbenaceae	PD	T	BB/DF	2	140-800

Species	Family	Phenology	HaHit	Habitat	Abundance	Elevation (m)
<i>Premna nana</i> Coll. & Hemsl.	Verbenaceae	D	TeH	BB/DF	2	140-600
<i>Prunus cerasoides</i> D. Don	Rosaceae	D	T	EGF	3	1100-1850
<i>Prunus wallichii</i> Steud.	Rosaceae	E	T	EGF	2	1200-1300
<i>Psychotria adenophylla</i> Wall.	Rubiaceae	E	TI	EGF	4	1100-1500
<i>Psychotria monticola</i> Kurz var. <i>monticola</i>	Rubiaceae	E	TI	EGF	3	1100-1500
<i>Psychotria sarmentosa</i> Vahl	Rubiaceae	E	CrV	EGF	2	1200-1400
<i>Pteridium aquilinum</i> (L.) Kuhn ssp. <i>aquilinum</i> var. <i>wightianum</i> (Ag.) Try.	Dennstaedtiaceae	E	TeH	Da	4	1300-1960
<i>Pterocarpus macrocarpus</i> Kurz	Leguminosae, Papilionoideae	D	T	DDF BB/DF	3	140-900
<i>Pterocymbium tinctorium</i> (Blanco) Merr.	Sterculiaceae	D	T	MXF	2	600-900
<i>Pterospermum diversifolium</i> Bl.	Sterculiaceae	D	T	BB/DF MXF	2	600-1000
<i>Pterospermum grande</i> Craib	Sterculiaceae	E	T	MXF	2	700-1100
<i>Pterospermum grandiflorum</i> Craib	Sterculiaceae	E	T	EGF	3	1100-1500
<i>Pterospermum semisagittatum</i> Ham. ex Roxb.	Sterculiaceae	D	T	MXF BB/DF	3	200-900
<i>Pueraria wallichii</i> DC.	Leguminosae, Papilionoideae	D	S	BB/DF	3	140-800
<i>Pyrenaria garrettiana</i> Craib	Theaceae	E	T TI	EGF	2	900-1500
<i>Quercus kerrii</i> Craib var. <i>kerrii</i>	Fagaceae	D	T	DDF	2	140-600
<i>Quercus rex</i> (Hemsl.) Schottky	Fagaceae	E	T	EGF	2	1200-1800
<i>Rademachera ignea</i> (Kurz) Steen.	Bignoniaceae	D	T	BB/DF MXF	3	200-900
<i>Rapanea yunnanensis</i> Mez	Myrsinaceae	E	T	EGF	2	900-1400
<i>Rauvolfia serpentina</i> (L.) Bth. ex Kurz	Apocynaceae	D	TeH	BB/DF	1	140-700
<i>Rhapidophora peepa</i> Schott	Araceae	E	CrV	EGF	2	1200-1850
<i>Rhododendron vietchianum</i> Hk.	Ericaceae	D	EpS	EGF	2	1200-1900
<i>Rhopalephora scaberrimum</i> (Bl.) Faden	Commelinaceae	A PD	TeH	MXF EGF	4	700-1400
<i>Rhus chinensis</i> Mill.	Anacardiaceae	D	TI	MXF Da	3	800-1200
<i>Rhynchosylos obliquum</i> BL.	Gesneriaceae	A	EpEITeH	EGF Da	2	1100-1500
<i>Rubus alceifolius</i> Poir.	Rosaceae	E	V	EGF Da	3	1000-1700
<i>Saccharum spontaneum</i> L.	Gramineae	PE	TeH	BB/DF	4	140-400
<i>Sambucus javanica</i> Rienw. ex Bl.	Caprifoliaceae	E	S TI	EGF Da	3	900-1500
<i>Sapria himalayana</i> Griff.	Rafflesiaceae	PD	PaH	EGF	1	1200-1400
<i>Sarcandra glabra</i> (Thunb.) Nakai ssp. <i>brachystachys</i> (Bl.) Verdc.	Chloranthaceae	E	S	EGF	2	1200-1500

Species	Family	Phenology	HaHit	Habitat	Abundance	Elevation (m)
<i>Sarcosperma arboretum</i> Bth.	Sapotaceae	E	T	EGF	2	900-1400
<i>Sauropus quadrangularis</i> (Willd.) M.-A. var. <i>quadrangularis</i>	Euphorbiaceae	D	S TI	DDF	2	140-800
<i>Schefflera benghalensis</i> Gamb.	Araliaceae	E	EpSTI	EGF	3	1100-1700
<i>Schima wallichii</i> (DC.) Korth.	Theaceae	D-E	T	MXF EGF	3	700-1500
<i>Schleichera oleosa</i> (Lour.) Oken	Sapindaceae	D	T	DDF BB/DF	3	140-800
<i>Seidenfadenia mitrata</i> (Rchb.f.) Garay	Orchidaceae	E	EpH	DDF MDF EGF	3	140-1300
<i>Selaginella delicatula</i> (Desv.) Alst.	Selaginellaceae	A	TeH	DDF BB/DF	4	140-700
<i>Senna garrettiana</i> Craib	Leguminosae, Caesalpinioideae	D	T	DDF	2	140-600
<i>Senna timoriensis</i> (DC.) Irw. & Barneby	Leguminosae, Caesalpinioideae	D	T	BB/DF	2	140-600
<i>Setaria parviflora</i> (Poir.) Kerg.	Gramineae	A	TeH	BB/DF	3	140-700
<i>Shorea obtusa</i> Wall. ex Bl.	Dipterocarpaceae	D	T	DDF	3	140-600
<i>Shorea roxburghii</i> G. Don	Dipterocarpaceae	D	T	BB/DF	2	140-600
<i>Shorea siamensis</i> Miq. var. <i>siamensis</i>	Dipterocarpaceae	D	T	DDF BB/DF	4	140-800
<i>Shutteria hirsuta</i> Baker	Leguminosae, Papilionoideae	D	V	MXF	2	800-1000
<i>Sida mysorensis</i> Wight & Arn.	Malvaceae	D	TeH	DDF	3	140-700
<i>Sida rhombifolia</i> L. ssp. <i>rhombifolia</i>	Malvaceae	E	TeH	EGF	3	1100-1500
<i>Sindora siamensis</i> Teysm. ex Miq. var. <i>siamensis</i>	Leguminosae, Caesalpinioideae	D	T	DDF	2	140-700
<i>Siphonodon celastrineus</i> Griff.	Celastraceae	D	T	DDF BB/DF	3	140-600
<i>Sloanea tomentosa</i> (Bth.) Rehd. & Wils.	Elaeocarpaceae	E	T	EGF	2	1200-1850
<i>Solanum barbisetum</i> Nees	Solanaceae	PD	TeH	MXF Da	3	700-1100
<i>Solanum macrodon</i> Wall. ex Nees	Solanaceae	D	TeH	MXF Da	3	800-1200
<i>Sonerila maculata</i> Roxb.	Melastomataceae	D	EpH	EGF	2	900-1500
<i>Sorghum nitidum</i> (Vahl) Pers.	Gramineae	PD	TeH	DDF BB/DF	3	140-600
<i>Spatholobus parviflorus</i> (Roxb. ex DC.) O. K.	Leguminosae, Papilionoideae	D	WC	DDF BB/DF MXF	3	140-900
<i>Spenodesme pentandra</i> Jack var. <i>wallichiana</i> (Schauer) Munir	Verbenaceae	D	WC	BB/DF SG	3	200-600
<i>Spondias axillaris</i> Roxb.	Anacardiaceae	D	T	MXF	3	700-1100
<i>Spondias pinnata</i> (L. f.) Kurz	Anacardiaceae	D	T	BB/DF MXF	3	140-1000
<i>Stemona tuberosa</i> Lour. var. <i>tuberosa</i>	Stemonaceae	D	V	BB/DF	1	140-600
<i>Stephania oblata</i> Craib	Menispermaceae	D	V	BB/DF	2	140-700
<i>Sterculia villosa</i> Roxb.	Sterculiaceae	D	T	BB/DF	3	140-900
<i>Sterculia urena</i> Roxb. var. <i>thorelii</i> (Pierre) Pheng.	Sterculiaceae	D	T	BB/DF MXF SG	3	140-800
<i>Stereospermum fimbriatum</i> (Wall. ex G. Don) DC.	Bignoniaceae	D	T	BB/DF	2	140-700

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<i>Stereospermum neuranthum</i> Kurz	Bignoniaceae	D	T	DDF Da	2	140-900
<i>Streblus ilicifolius</i> (Vidal) Corn.	Moraceae	E	Tl	BB/DF MXF	3	300-1000
<i>Strobilanthes tenuiflora</i> J. R. I. Wood	Acanthaceae	D	S	EGF	3	1200-1800
<i>Strobilanthes speciosa</i> Bl.	Acanthaceae	D	S	MXF	4	700-1000
<i>Sumbaviopsis albicans</i> (Bl.) J. J. Sm.	Euphorbiaceae	D	T	BB/DF MXF	2	200-700
<i>Styrax benzoides</i> Craib	Styracaceae	E	T	EGF Da	2	900-1400
<i>Symplocos cochinchinensis</i> (Lour.) S. Moore ssp. <i>cochinchinensis</i> var. <i>cochinchinensis</i>	Symplocaceae	E	T	EGF	3	900-1500
<i>Symplocos hookeri</i> Cl.	Symplocaceae	E	T	EGF	2	1200-1500
<i>Symplocos macrophylla</i> Wall. ex DC. ssp. <i>sulcata</i> (Kurz) Noot. var. <i>sulcata</i>	Symplocaceae	E	T	MXF EGF	3	800-1850
<i>Symplocos racemosa</i> Roxb.	Symplocaceae	D	Tl	DDF	2	140-500
<i>Tacca chantrieri</i> Andre	Taccaceae	PE	TeH	BB/DF MXF	3	300-800
<i>Tainia viridifusca</i> (Hk.) Benth. & Hk. f.	Orchidaceae	PE	TeH	EGF	1	1200-1300
<i>Tectaria fauriei</i> Tag.	Dryopteridaceae	PE	TeH	EGF	2	1100-1400
<i>Tectona grandis</i> L. f.	Verbenaceae	D	T	BB/DF	3	140-700
<i>Terminalia alata</i> Hey. ex Roth	Combretaceae	D	T	DDF BB/DF SG	3	140-800
<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Combretaceae	D	T	BB/DF	3	140-800
<i>Terminalia chebula</i> Retz. var. <i>chebula</i>	Combretaceae	D	T	DDF BB/DF	3	140-600
<i>Terminalia mucronata</i> Craib & Hutch.	Combretaceae	D	T	BB/DF	3	140-700
<i>Tetragium cruciatum</i> Craib & Gagnep.	Vitaceae	E	WC	EGF	4	1000-1700
<i>Tetragium</i> sp.	Vitaceae	E	WC	EGF	3	1200-1500
<i>Thep Brosia kerrii</i> Drum. & Craib	Leguminosae, Papilionoideae	PD	S	DDF	2	140-500
<i>Thunbergia similis</i> Craib	Acanthaceae	D	V	BB/DF	3	140-800
<i>Thunia alba</i> (Lindl.) Rchb. f.	Orchidaceae	E	EpH	EGF Da	2	1000-1400
<i>Toddalia asiatica</i> (L.) Lmk.	Rutaceae	E	WC	EGF Da	3	1000-1400
<i>Torenia fournieri</i> Lind. ex Four.	Scrophulariaceae	A	TeH	BB/DF Str	3	140-600
<i>Trema orientalis</i> (L.) Bl.	Ulmaceae	D-E	T	MXF Str	2	700-1100
<i>Trevesia palmata</i> (Roxb. ex Lindl.) Vis.	Araliaceae	E	Tl	MXF	3	1100-1700
<i>Trewia nudiflora</i> L.	Euphorbiaceae	D	T	BB/DF MXF	3	200-700
<i>Trichotosia dasyphylla</i> (Par. & Rchb. f.) Krzl.	Orchidaceae	PE	EpH	EGF	2	1000-1400
<i>Tridax procumbens</i> L.	Compositae	A	TeH	DDF BB/DF	4	140-800
<i>Trigonostemon thyrsoides</i> Stapf	Euphorbiaceae	E	T	MXF	3	800-1000
<i>Turpinia nepalensis</i> (Roxb.) Wall. ex Wight & Arn.	Staphyleaceae	E	T	EGF	2	1100-1500

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<i>Uraria crinita</i> (L.) Desv. ex DC.	Leguminosae, Papilionoideae	D	TeH	DDF	2	140-500
<i>Uvaria cordata</i> (Dun.) Alst.	Annonaceae	E	WC	MXF	1	900-1000
<i>Vanda</i> sp.	Orchidaceae	E	EpH	EGF	1	1200-1300
<i>Vernonia squarrosa</i> (D. Don) Less. var. <i>orientalis</i> Kit.	Compositae	D	TeH	DDF	2	140-700
<i>Vigna umbellata</i> (Willd.) Ohwi & Oha. var. <i>umbellata</i>	Leguminosae, Papilionoideae	A	V	EGF Da	2	1100-1700
<i>Vitex limoniifolia</i> Wall. ex Kurz	Verbenaceae	D	T	DDF BB/DF	3	140-700
<i>Vitex peduncularis</i> Wall. ex Schauer	Verbenaceae	D	T	DDF BB/DF	3	140-800
<i>Vitex quinata</i> (Lour.) Will. var. <i>puberula</i> (Lam) Mold.	Verbenaceae	E	T	BB/DF MXF	2	140-1000
<i>Walsura robusta</i> Roxb.	Meliaceae	E	T	BB/DF MXF EGF	2	500-1200
<i>Walsura trichostemon</i> Miq.	Meliaceae	D	T	BB/DF	3	140-800
<i>Wedelia montana</i> (Bl.) Boerl. var. <i>wallichii</i> (Less.) H. Koy.	Compositae	A	TeH	MXF EGF	4	900-1400
<i>Wightia speciosissima</i> (D. Don) Merr.	Scrophulariaceae	D	EpTl	MXF EGF	2	800-1300
<i>Wikstroemia polyantha</i> Merr.	Thymelaeaceae	E	Tl	EGF	2	1100-1500
<i>Wrightia arborea</i> (Dennst.) Mabb.	Apocynaceae	D	T	BB/DF	3	140-600
<i>Xanthophyllum flavescens</i> Roxb.	Polygalaceae	E	T	EGF	2	900-1500
<i>Xanthophyllum virens</i> Roxb.	Polygalaceae	E	T	EGF	2	1200-1500
<i>Xantolis burmanica</i> (Coll. & Hemsl.) Royen	Sapotaceae	E	T	BB/DF	2	140-600
<i>Xerospermum noronhianum</i> (Bl.) Bl.	Sapindaceae	E	T	MXF EGF	3	700-1300
<i>Xylia xylocarpa</i> (Roxb.) Taub. var. <i>kerrii</i> (Craib & Hutch.) Niels	Leguminosae, Mimosoideae	D	T	DDF BB/DF	3	140-800
<i>Zanthoxylum acanthopodium</i> DC.	Rutaceae	E	S Tl	EGF Da	3	1100-1850
<i>Zingiber smilesianum</i> Craib	Zingiberaceae	PD	TeH	BB/DF	3	200-600
<i>Zingiber</i> sp.	Zingiberaceae	PD	TeH	EGF	2	1200-1850
<i>Zingiber</i> sp.	Zingiberaceae	PD	TeH	DDF BB/DF	3	140-800
<i>Zingiber</i> sp.	Zingiberaceae	PD	TeH	BB/DF	2	140-800
<i>Ziziphus incurva</i> Roxb.	Rhamnaceae	D	WC	MXF	2	600-1000
<i>Ziziphus oenoplia</i> (L.) Mill. var. <i>oenoplia</i>	Rhamnaceae	D	WC	MXF	2	800-1000
unidentified	Lauraceae	E	T	EGF	1	1200-1300
unidentified	?	E	T	MXF	2	800-1000
unidentified	?	E	T	MXF	2	800-1000

