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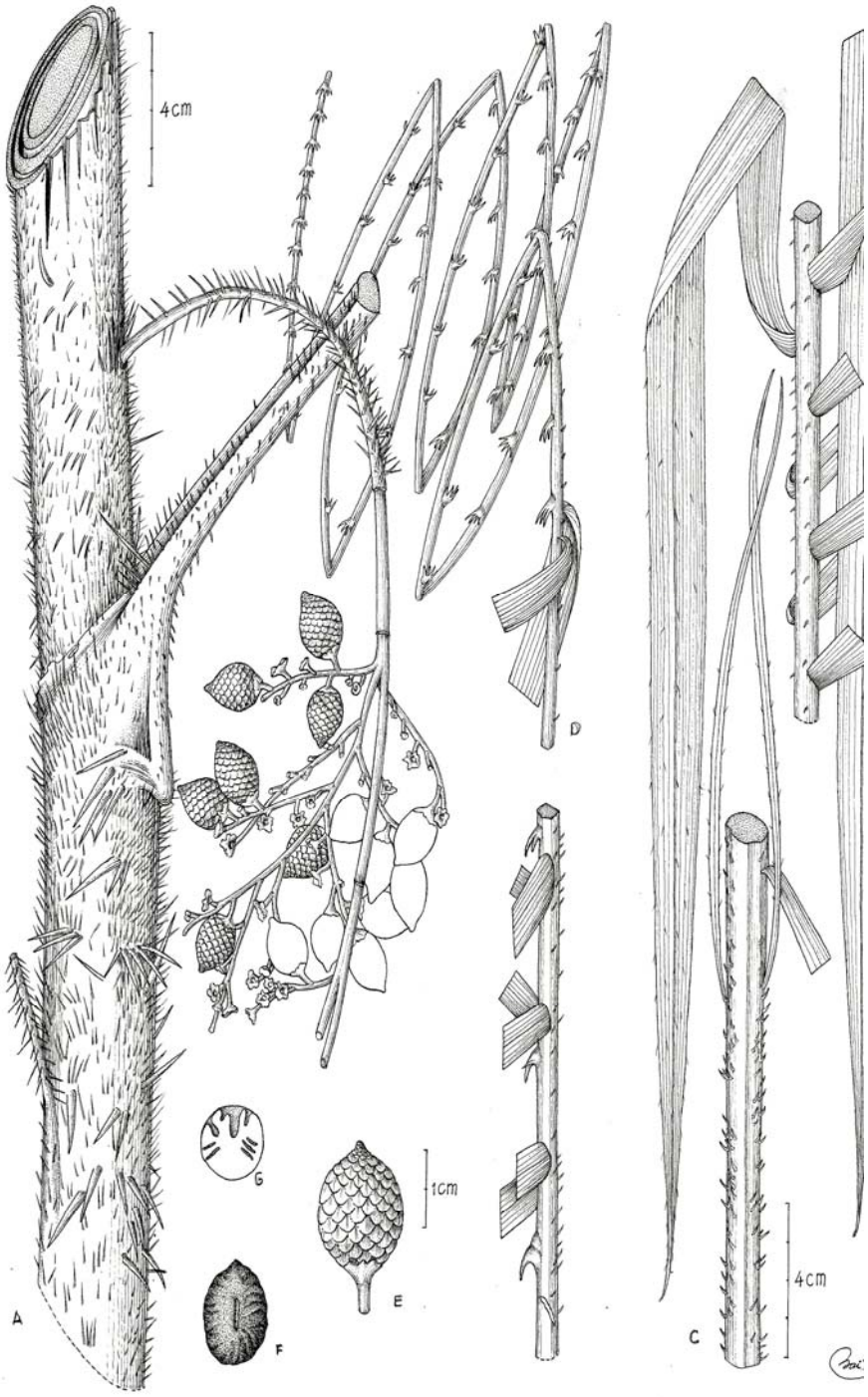

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AN UNDESCRIBED LOWLAND NATURAL FOREST AT BODOGOL, THE GUNUNG GEDE PANGRANGO NATIONAL PARK, CIBODAS BIOSPHERE RESERVE, WEST JAWA, INDONESIA

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ABSTRACT
HELMI, N., KARTAWINATA, K., & SAMSOEDIN, I. 2009. An undescribed lowland natural forest at Bodogol, Gunung Gede Pangrango National Park, Cibodas Biosphere Reserve, West Java, Indonesia. *Reinwardtia* 13(1): 33–46. — An analysis of the structure and floristic composition of trees with diameters at breast height ≥ 10 cm in a one–hectare plot in a lowland natural forest at the elevation of 800 m at Bodogol, the Gunung Gede Pangrango National Park, Cibodas Biosphere Reserve, recorded 70 spesies and 30 families with a density of 350 trees/hectare and a total basal area of 23.36 m^2. As high as 37 tree spesies (52.86 %) were not recorded in the flora of Mt.Gede Pangrango; they were species of upper lowland forest and dominated the plot. Among 10 main species, only *Altingia excelsa* and *Ficus ribes* are montane forest species. Thus the forest plot represents a transition between lowland forest and lower montane forest, which may be called an upper lowland forest. This is a new phenomenon which has not been recorded previously at the Gunung Gede Pangrango National Park. The most prominent species with Importance Value (VI) > 10 % are *Schima wallichii, Pternandra caerulescens, Neesia altissima, Luvunga sarmentosa* and *Maesopsis eminii*; the latter is an exotic species invading the natural forest. *Dipterocarpus hasseltii* is present in the area.

Key words*:* Species composition, structure, lowland and montane forests

ABSTRAK

HELMI, N., KARTAWINATA, K., & SAMSOEDIN, I. 2009. Hutan alam pamah dataran rendah yang belum pernah dipertelakan di Bodogol, Taman Nasional Gunung Gede Pangrango, Cagar Biosfer Cibodas, Jawa Barat, Indonesia. *Reinwardtia* 13(1): 33–46. — Analisis struktur dan komposisi floristik pohon dengan diameter setinggi dada ≥ 10 cm dalam petak satu hektar di hutan pada elevasi 800 m di Bodogol, Taman Nasional Gunung Gede Pangrango, Cagar Biosfer Cibodas, mencatat 70 jenis dan 30 suku dengan kerapatan 350 pohon/hektar dan luas bidang dasar total 23,36 m^2. Sebanyak 37 jenis pohon (52,86 %) tidak tercatat dalam flora Gunung Gede Pangrango dan merupakan jenis pohon hutan pamah, yang mendominasi petak ini; dari 10 jenis utama hanya tercatat dua jenis hutan pegunungan, yaitu *Altingia excelsa* dan *Ficus ribes*. Hutan di sini dapat dikatakan transisi antara hutan pamah dan hutan pegunungan bawah, yang dapat dinamakan hutan pamah atas. Ini merupakan fenomena baru yang belum tercatat sebelumnya bagi Taman Nasional Gunung Gede Pangrango. Jenis yang paling menonjol dengan Nilai Penting (NP) > 10 adalah *Schima wallichii*, *Pternandra caerulescens*, *Neesia altissima*, *Luvunga sarmentosa* dan *Maesopsis eminii;* jenis terakhir ini adalah jenis eksotik, yang menginvasi hutan alam. *Dipterocarpus hasseltii* terdapat juga di hutan ini.

Kata kunci: Komposisi floristik, struktur, hutan pamah dan pegunungan

INTRODUCTION

The Gunung Gede Pangrango National Park (GGPNP) or the Taman Nasional Gunung Gede Pangrango (TNGGP) is one of the first National Parks established in Indonesia in 1980, comprising the entire Mt. Gede Pangrango complex (Departemen Kehutanan, 1994; Rustiami, 2004). The GGPNP along with the man–made ecosystems around it bordered by encircling inter–city highway between Ciawi, Sukabumi, Cianjur, and Cipanas (Figure 1) was designated as the Cibodas Biosphere Reserve in 1977 and has been a member of the the World Network of Biosphere Reserves (Rustiami, 2004).

Since the establishment of the Botanic Gardens in Bogor in 1817, especially after the Cibodas Botanical Garden was instituted in 1840, a large number of research activities, including qualitative assessment of vegetation, were conducted by many botanists in the forest of the Mt.Gede Pangrango behind the Botanical Garden (Steenis–Kruseman 1953) and the most prominent result is that of Docters van Leeuwen (1933). Steenis *et al.* (1971, 2006 a & b) based his book on the Mountain flora of Java mainly on the data collected from this area. After the 2nd World War quantitative vegetation studies in the same area were undertaken by Abdulhadi *et al.* (1998), Meijer (1959), Rollet *et al.* (1976), Sadili *et al.* (2009), Sriyanto (1987), and Yamada (1975, 1976a & b, 1977). The studies were carried out on sites located between the Botanical Garden (1400 m) and the top of Mt. Pangrango (3019 m), while the natural vegetation of the GGPNP extend from the altitudes of 700 m to 3019 m. It is surprising that after more than one and a half century research in the area no one has paid attention to the lowland section of the Mt. Gede Pangrango at the altitude of less than 1000 m. To date no vegetation data are available for the forest area below the altitude of 1400 m, except for floristic records made recently (Ismail *et al.* 2000, Sadili *et al.* 2007). The present paper deals with the floristic composition and structure of an undescribed lowland natural forest at an altitude of 800 m at Bodogol, on the western side of the GGPNP.

STUDY SITE AND METHOD

The study was conducted in April 2005 at the edge of a lowland natural forest bordering with the planted forest at the Bodogol Section in the south–western part of the GGPNP, in the Bogor Regency (Figure 1). The topography of the area is hilly with steep slopes. The soils belong to the Red–Yellow Podsolic Soil (Soepraptohardjo, 1975). The rainfall in the study area belongs to the type A of the rainfalll classification system of Schmidt & Ferguson (1951). The nearest meteorological station at Tapos with an elevation of 806 m (LMG 1969), about 10 km north of Bodogol, shows a rainfall variation of the mean monthly rainfall over a 12 month period from January to December, based on data for 32 years (Figure 1), The mean annual rainfall is 2094 mm and the mean monthly rainfall show the driest (196 mm) in August and the wettest (446 mm) in December.

We established a one–hectare plot to analyze the floristic composition and structure of the forest on a slope of a ridge near the aerial observation bridge. We laid down 25 quadrats of 20 m x 20 m each, side by side in such away so as to form a plot of 100 m x 100 m (one hectare). We measured the diameter of all trees with DBH (Diameter at Breast Height) $\geq$ 10 cm and determined their positions within the plots and identify their identities to species level.

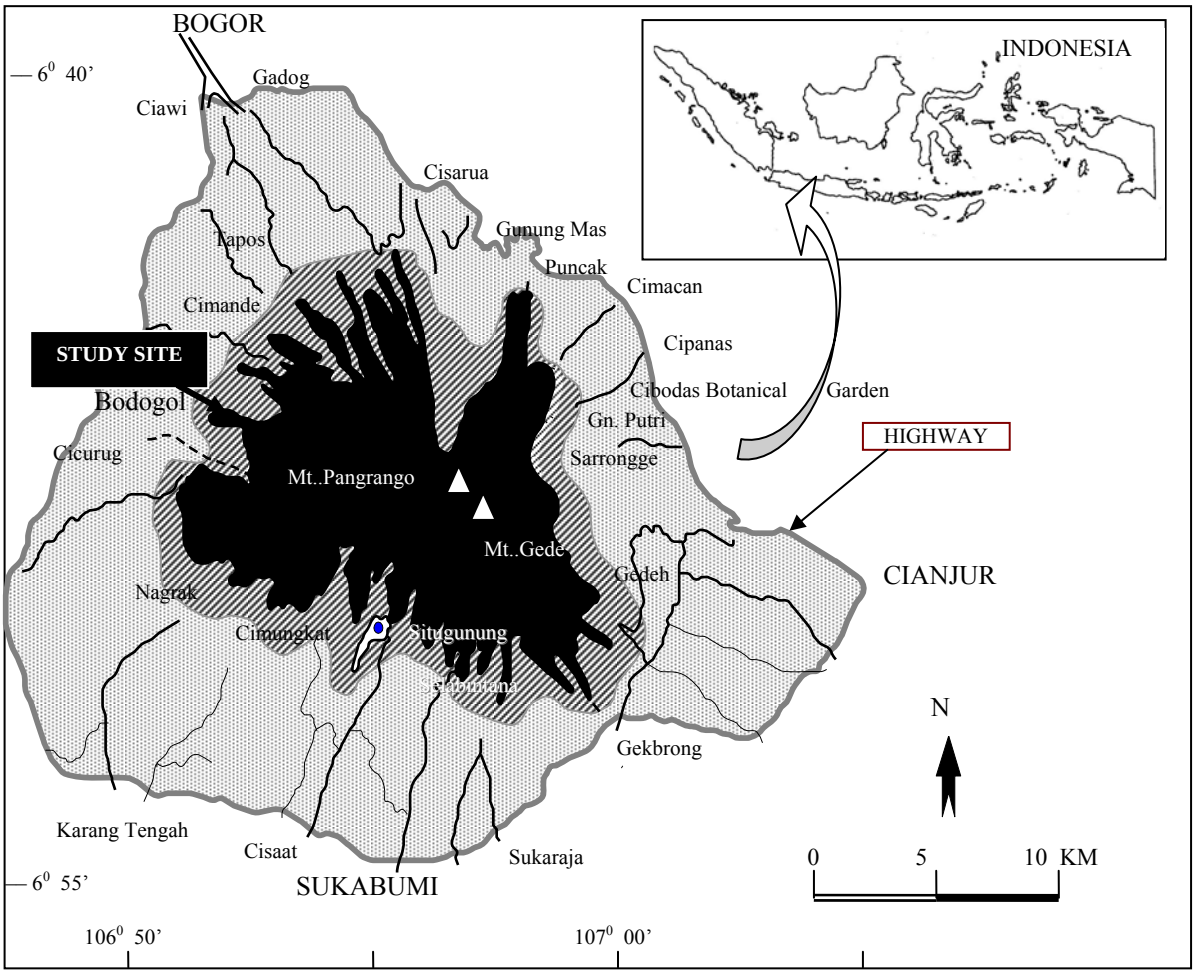
A voucher specimen for each tree was collected for identification at the Herbarium Bogoriense, Bogor, and the nomenclature of plant names followed Backer & Bakhuizen van den Brink, Jr. (1958–1965). Analysis of data on density, frequency and dominance (expressed with basal area) and importance value for each species follows Mueller–Dombois & Ellenberg (1972).

RESULTS AND DISCUSSION

Floristic Composition

The enumeration of trees with DBH $\geq$ 10 cm reveals that the one–hectare plot of a Bodogol lowland forest contains 70 species of 30 families represented by 350 trees, with the total basal area of 23,36 m^2. Appendix 1 shows the list of all tree species arranged according to families and species, complemented with data on density (D), relative density (RD), frequency (F), relative frequency (RF), basal area (BA), relative basal area (RBA) and importance value (IV). The sum of IVs of all species within a family indicates the total species importance values for families (TSIVF), calculated using the method applied by Kartawinata *et al.* (2004).

Out of 70 species listed in Appendix 1, 37 species (52.86 %) were not recorded in the "Flora Taman Nasional Gede Pangrango" (Sunarno & Rugayah, 1992). They include *Actinodaphne glomerata, Actinodaphne angustifolia, Aglaia argentea, Alangium javanicum, Antidesma velutinum, Beilschmiedia madang, Blumeodendron kurzii, Canarium littorale, Diospyros frutescens, Evodia latifo-*



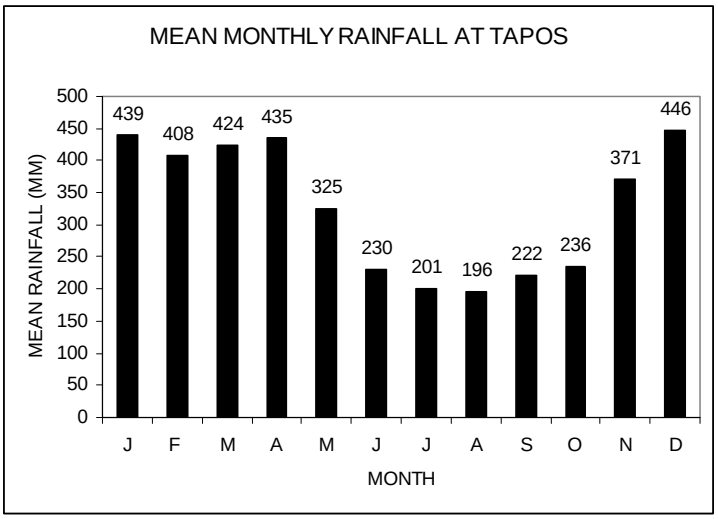


Figure 1. Map of the Gunung Gede Pangrango National Park–Cibodas Biosphere Reserve, (redrawn and modified after TNGGP in Rustiami, 2004), showing the study site at Bodogol and the mean monthly rainfall at Tapos, the nearest rainfall station to Bodogol (LMG 1969).

lia, Ficus callosa, Garcinia lateriflora, Gnetum cuspidatum, Knema intermedia, Macaranga triloba, Mallotus paniculatus, Neesia altissima, Pternandra caerulescens, and *Radermachera gigantea.* Observation outside the plot reveals also the presence of *Dipterocarpus hasseltii* in the area, and this species along with other two dipterocarps, *Anisoptera costata* and *Vatica* sp. were recorded by Ismail *et al.* (2000). The presence of these species justifies to call the forest in this area as one of the remnants of the more widespread lowland mixed dipterocarp forest of Jawa (Mirmanto & Simbolon. 1998; Suryanti, 2006; Wardani & Kalima, 2008).

Appendix 1 shows that the forest contains also a number of species characterizing montane forest, but with low IVs. The species of *Castanopsis* and *Lithocarpus* (*Fagaceae*), that are usually present abundantly in montane forests do not occur in the study area. Quantitatively, the floristic composition of the plot differs from that of Yamada (1975, 1976), located at the altitude of 1600 m, with Jaccard Index of Similarity (based on the species presence) of only 8.26 %. It may be implied that the forest at Bodogol is the transition between lowland and montane forests.

Compared with other areas (Table 1) in the montane forests of Java (Mt. Gede Pangrango and Mt. Halimun) and Papua it is clear that the number of species is comparable to that in Gunung Kendeng in Mt Halimun and greater than those in Cibodas 2 and Wanduga (Papua), but smaller than that in Kurulu (Papua). The number of species in Bodogol is much smaller than that in lowland forests of Kalimantan and Sumatra (see Kartawinata 2005).

Ten most important families in descending order of the number of species are shown in Table 2, where the *Euphorbiaceae* recorded as the richest family. It differs from the findings of Abdulhadi *et*

Table 1. The comparison of density and number of tree species with DBH of ≥10 cm in the forest at Bodogol and other montane forests at GGPNP, Mt. Halimun National Park in West Java, Sungai Barang in East Kalimantan, Batang Gadis National Park in North Sumatra and in Yapen and Wamena, Papua.

Locality	Elevation (m)	Plot size (ha)	Density (trees.ha)	Number of Species	Reference
WEST JAVA					
Gunung Gede–Pangrango National Park					
Bodogol	**806**	**1.0**	**352**	**70**	**Present study**
Cibodas 1	1500–1900	4.0	889	93	Abdulhadi *et al.* (1998)
Cibodas 2	1600	1.0	427	57	Yamada (1975)
Gunung Halimun National Park					
Gunung Kendeng	1000	1.0	406	64	Suryanti (2006)
Gunung . Malang	1000	1.0	421	69	Suryanti (2006)
Gunung Panenjoan	1000	1.0	405	69	Suryanti (2006)
Citalahab: secondary forest	1000–1200	0.7	395	51	Rahayoe (1996)
Citorek: Plot 1	905–1127	5 x 0.1	530	56	Mirmanto & Simbolon (1998)
Plot 2	761–893	5 x 0.1	384	61	Mirmanto & Simbolon (1998)
Plot 3	784–939	2 x 0.1	106	26	Mirmanto & Simbolon (1998)
Cikaniki	850–1500	26 x 0.09	601	73	Simbolon & Mirmanto (1997)
Cikelat	1000–1600		624	80	Simbolon & Mirmanto (1997)
EAST KALIMANTAN					
Sungai Barang					
Site 1	700–770	4 x 0.16	719	179	Bratawinata (1986)
Site 2	850–930	4 x 0.16	838	78	Bratawinata (1986)
NORTH SUMATRA					
Batang Gadis National Park Aek Nangali	660	1	583	182	Kartawinata *et al.* (2004)
PAPUA					
Wamena: Wanduga	2800	0.5	528	28	Partomihardjo & Supardiyono (1993)
Wamena:Tengon	1600	0.15	813	38	Partomihardjo (1991)
Wamena: Kurulu	1600–2350	0.7	564	76	Partomihardjo (1991)
Yapen Tengah.	600–1200	14 x 0.1	799	235	Partomihardjo (2001)

al. (1998) at 1500–1900 m altitude and Yamada (1975) at 1600 m altitude in the montane forest of Mt. Gede Pangrango as well as of Simbolon & Mirmanto (1997) and Suryanti (1996) at Mt. Halimun, where *Euphorbiaceae* occupies lower orders in the 10 most important families. The high number of species of *Euphorbiaceae* in Bodogol is attributed to the presence of *Macaranga rhizinoides, M. semiglobosa, M. triloba* and *Mallotus paniculatus*, filling up the gaps of the forest. The presence of these species along with an exotic species, *Maesopsis eminii*, indicates that the forest at Bodogol has been disturbed.

Ten most important species are shown in Table 3. It differs from those at the altitude of 1400 m in the montane forest at Mt. Gede Pangrango (Abdulhadi *et al.* 1998; Yamada 1975) and at Mt. Halimun (Simbolon & Mirmanto 1997; Suryanti 2006). The most important species is, *Schima wallichii*, while at the same elevation in Mt Gede Pangrango and Mt. Halimun, *S. wallichii* occupies a lower position in the species order.

The species–area curve (Figure 2) shows the cumulative increase of the number of species in the one–hectare plot, where it increases rapidly and there is no indication of flattening up. The pattern is comparable to the curve in the same montane forest but at altitudes of 1400–1900 m, which slightly flattens when the plots were extended to 4 hectare

Table 2. Ten most important families according to the Total Species Importance Values for Families (TSIVF) in one–hectare plot of a lowland forest at Bodogol, GGPNP

No.	Families	Number of spesies
1	Euphorbiaceae	8
2	Melastomataceae	6
3	Meliaceae	6
4	Moraceae	6
5	Rubiaceae	5
6	Rutaceae	4
7	Theaceae	4
8	Araliaceae	3
9	Lauraceae	3
10	Myrtaceae	3

Table 3. Ten leading tree species based on Important Value (IV) in a one–hectare plot of a lowland forest at Bodogol, GGPNP. (*) Strictly lowland forest species; (**) lowland to montane forest species)

No	Species	IV
1	*Schima wallichii* (**)	19.03
2	*Pternandra caerulescens* (*)	11.78
3	*Neesia altissima* (*)	11.71
4	*Luvunga sarmentosa* (*)	11.60
5	*Maesopsis eminii* (**)	10.5
6	*Gynotroches axillares*	9.16
7	*Dysoxylum parasticum* (**)	9.09
8	*Altingia excelsa*	8.35
9	*Radermachera gigantea* (*)	7.77
10	*Ficus ribes* (**)	7.18
	Total	97.08 (32.3 %)

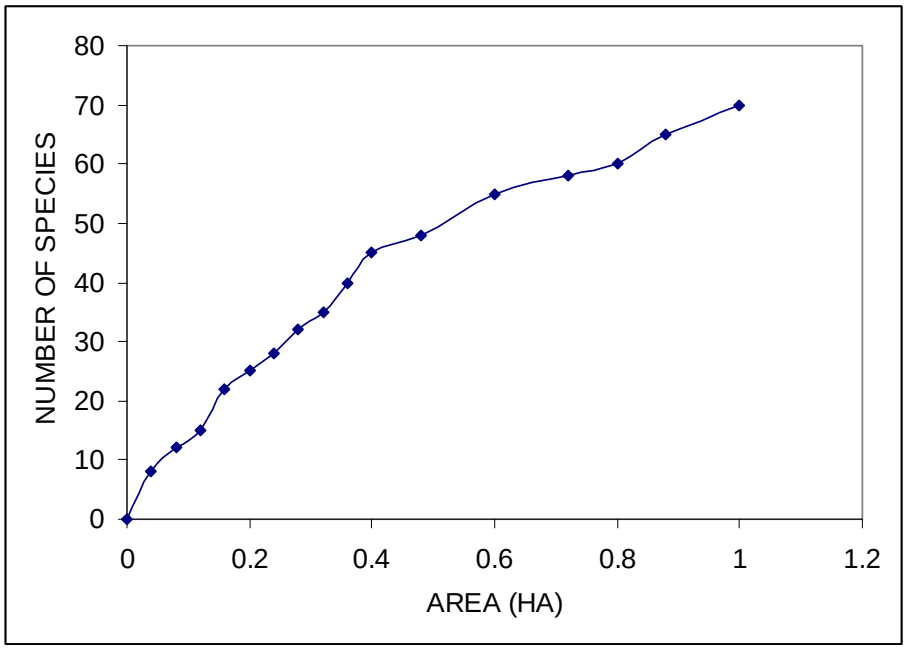


Figure 2. Species–area curve for trees in a one–hectare plot of a lowland forest at Bodogol, GGPNP.

Forest structure

It is apparent that the ten species with highest density and basal area (Tables 4–6) are mostly lowland forest species, including species whose distribution ranges from low to high altitudes, such as *Dysoxylum parasiticum, Gynotroches axillaris, Meliosma pinnata, Schima wallichii* and *Maesopsis eminii.* The order of ten most important species according to frequency, density and basal area and even the species combination differ.

Table 1 shows that tree density in Bodogol is the lowest (350 trees/ha) compared to those in the montane forests in Java and Papua and even is very much lower in comparison to those in the lowland forests in Indonesia (Kartawinata 2005). In Bodogol the species with the highest density is *Pternandra caerulescens* and *Schima wallichii* (each 15 trees/ hectare), which differs from that in montane forest in Gede Pangrango at an altitude of 1400, where the highest was *Schima wallichii (*47 trees/ha) and *Saurarua pendula* (46 trees/ha) (Yamada 1975), while at Mt. Halimun, they are *Castanopsis acuminatissima* (87 trees/ha) and *Schima wallichii* (42 trees/ ha) (Mirmanto & Simbolon, 1998). It is interesting to note that *Schima wallichii* occurs abundantly (53 trees per hectare) in the upper montane forest at an altitude of 2400 m (Yamada 1977). From the density perspective *Schima wallichii* is the species that can be implied as spesies characterizing the upper lowland to upper montane forest at the elevation of 800–2400 m.

Appendix 1 shows that no species is distributed evenly whitin a one–hectare plot of forest and the frequency values of most species are low. The frequency of 24–44 % are considered high in this forest and shared by the following species: *Aglaia argentea, Neesia altissima, Pternandra caerulescens, Meliosma pinnata Maesopsis eminii, Luvunga sarmentosa, Knema intermedia, Gynotroches axillaris, Dysoxylum parasiticum* and *Schima wallichii.* Other species with low frequency may be considered uncommon, such as *Alangium javanicum, Garcinia lateriflora* and *Bridelia insulana,* or gregarious, such as *Symplocos costata* and *Altingia excelsa*.

The total BA of the 350 trees within one hectare plot is 23,36 m^2. It is smaller than that in the forest at Cibodas at the altitude of 1400 m (Abdulhadi *et al.* 1998; Yamada 1975) and at Mt. Halimun (Suryanti 2006). Table 5 shows ten species with highest BA, totaling 11.841 m^2 (52,68 % of the total BA). The low BA is attributed to the absence of trees with large diameters (Figure 3), which may be lost due to illegal cutting or natural catastrophe such as severe rainstorms that took place in 1983. It is clear also that most of the trees with highest BA are lowland species, including three species which occurs also at higher elevation, *i.e., Orophea hexandra, Ficus ribes,* dan *Schima wallichii*. This indicates the dominance of the lowland species.

Table 4. Ten leading species according to the density (D) of trees in a one–hectare plot of a lowland forest in Bodogol, GGPNP; (*) Lowland forest species; (**) lowland– montane forest species.

No.	Species	Density (trees/ha)
1	*Schima wallichii* (**)	15
2	*Pternandra caerulescens* (*)	15
3	*Dysoxylum parasiticum* (**)	14
4	*Gynotroches axillaries* (**)	12
5	*Knema intermedia* (*)	10
6	*Luvunga sarmentosa* (*)	10
7	*Meliosma pinnata* (**)	10
8	*Neesia altissima* (*)	9
9	*Maesopsis eminii (**)*	9
10	*Memecylon excelsum* (*)	8
	Total	112 (32,0 %)

Table 5. Ten leading tree species according to the basal area (BA) in a one–hectare plot of a lowland forest at Bodogol, GGPNP; (*) lowland forest species, (**) lowland–montane forest species.

No.	Species	Density (trees/ha)
1	*Schima wallichii* (**)	15
2	*Pternandra caerulescens* (*)	15
3	*Dysoxylum parasiticum* (**)	14
4	*Gynotroches axillaries* (**)	12
5	*Knema intermedia* (*)	10
6	*Luvunga sarmentosa* (*)	10
7	*Meliosma pinnata* (**)	10
8	*Neesia altissima* (*)	9
9	*Maesopsis eminii (**)*	9
10	*Memecylon excelsum* (*)	8
	Total	112 (32,0 %)

Most of the trees have diameters of less than 50 cm, especially in diameter class of 10–20 cm.

The diameter–class distribution does not exactly follow the inverted J shape of typical primary tropical forest. No trees with diameters of 60–70 cm , 90–100 cm were recorded in the plot. This may be implied that the forest in this plot has been disturbed, which, as mentioned above, could be attributed to illegal cutting and natural death, as indi-

cated by the presence of gaps and decaying dead trees on the ground within the plot.

Planting the African exotic spesies, *Maesopsis eminii,* carried out by the state forest corporation, Perum Perhutani, and local people around the park has allowed this species to invade the natural gaps and disturbed areas within the primary forest and established itself as one of the important components of the lowland forest at Bodogol. Observations outside the plot show that it has spread widely along the edges of the park and that the Javan gibbons eat the fruits voraciously and disperse the seeds widely. It has been reported also that the seeds are dispersed by bats (Mirmanto, personal communication).

CONCLUSION

The botanical research in the Mt. Gede Pangrango area has been going on since at least 1817 and yet it is surprising that no one has paid attention to the lowland section of these twin mountains. From the present study it may be concluded that the tree species recorded in the plot are mainly the lowland species that have not been recorded in the flora of Mt. Gede Pangrango (Sunarno & Rugayah, 1992) and constitute a new set of scientific data for the GGPNP. The forest at Bodogol is a disturbed forest and can be considered as the transition between upper lowland forest and the lower montane forest. Undisturbed forests of this kind occur over a relatively large area at GGPNP at the altitude of 700 m and 1000 m, extending at least on the lower western and south–western slopes of Mt. Gede Pangrango (Sadili, personal communication). The presence of *Anisoptera costata, Dipterocarpus hasseltii* and *Vatica* sp. (Ismail *et al*. 2000) justifies to call the forest in this area as one of the remnants of the more widespread mixed dipterocarp forest of Java. The fast growing exotic tree species, *Maesopsis eminii,* has apparently invaded the primary forest in the area for some time and will continue to spread filling up suitable open habitats and in the long run may threaten the purity of the natural forest ecosystem in the park.

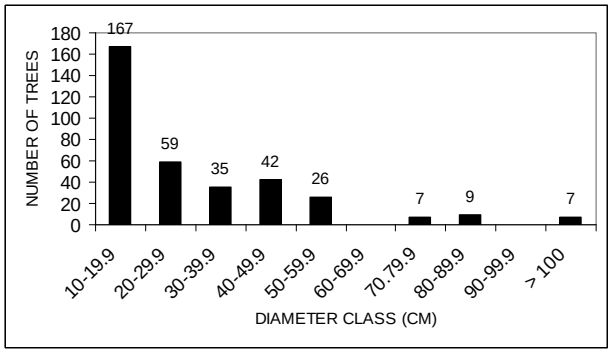


Figure 3. Diameter class distribution of trees in a one –hectare plot of a lowland forest at Bodogol, GGPNP

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Appendix 1. List of families and species with density (D), relative density (RD), frequency (F), relative frequency (RF), basal Area (BA), relative basal area (RBA), importance value (IV) and total species importance values for family (TSIVF) in one–hectare block of lowland natural forest at Bodogol, GGPNP – Cibodas Biosphere Reserve. SR indicates that the species is not listed in the Flora Taman Nasional–Gede Pangrango (Sunarno & Rugayah 1992).

No. Spe-sies	Family & Species	SR	D (trees//ha)	DR (%)	F (%)	RF (%)	BA (m^2)	RBA (%)	IV (%)
	1. Alangiaceae								
1	*Alangium javanicum* (K. & V.) Wang	x	1	0.28	4	0.43	0.01	0.020	0.71
	TSIVF								**0.71**
	2. Annonaceae								
2	*Orophea hexandra* Bl		6	1.7	20	2.16	0.84	3.720	7.58
	TSIVF								**7.58**
	3. Araliacea								
3	*Macropanax dispermus* (Bl.) O.K.		6	1.7	8	0.86	0.32	1.420	3.98
4	*Macropanax undulatus* (Wall. ex G. Don) Seem.		5	1.4	16	1.73	0.30	1.131	4.44
5	*Trevesia sundaica* Miq.		3	0.85	8	0.86	0.28	1.250	2.96
	TSIVF								**11.38**
	4. Bombacaceae								**11.71**
6	*Neesia altissima* (Bl.) Bl.	x	9	2.5	24	2.59	1.49	6.620	11.71
	TSIVF								**11.71**
	5. Bignoniaceae								
7	*Radermachera gigantea* (Bl.) Miq.	x	7	1.9	16	1.73	0.93	4.140	7.77
	TSIVF								**7.77**
	6. Burseraceae								
8	*Canarium littorale* Bl.	x	5	1.4	16	1.73	0.23	0.480	3.61
	TSIVF								**3.61**
	7. Clusiaceae								
9	*Garcinia lateriflora* Bl.	x	1	0.28	4	0.43	0.02	0.070	0.78
	TSIVF								**0.78**
	8. Crypteroniaceae								
10	*Crypteronia paniculata* Bl.	x	5	1.4	16	1.73	0.23	1.030	4.16
	TSIVF								**4.16**
	9. Ebenaceae								
11	*Diospyros frutescens* Bl.	x	4	1.1	12	1.29	0.34	0.150	2.54
	TSIVF								**2.54**
	10. Euphorbiaceae								
12	*Antidesma velutinosum* Bl.	x	7	1.9	20	2.16	0.17	0.690	4.75
13	*Blumeodendron kurzii* (Hook.f.) J.J.S.	x	3	0.85	8	0.86	0.17	0.760	2.47
14	*Bridelia* sp.	x	1	0.28	4	0.43	0.01	0.004	0.75
15	*Glochidion rubrum* Bl.		5	1.4	12	1.29	0.13	0.580	3.27
16	*Macaranga rhizinoides* (Bl.) M.A.		2	0.85	8	0.86	0.23	1.020	2.73
17	*Macaranga semiglobosa* J.J.S.	x	6	1.7	16	1.73	0.22	0.960	5.25
18	*Macaranga triloba* (Reinw. ex Bl.) M.A.	x	3	0.85	12	1.29	0.39	1.740	3.88
19	*Mallotus paniculatus* (Lmk) M.A.	x	4	1.1	4	0.43	0.11	0.460	1.99
	TSIVF								**25.09**
	11. Gnetaceae								
20	*Gnetum cuspidatum* Bl.	x	2	0.56	4	0.43	0.05	0.190	1.18
	TSIVF								1.18

No. Spesies	Family & Species	SR	D (trees//ha)	DR (%)	F (%)	RF (%)	BA (m^2)	RBA (%)	IV (%)
	12. Hamamealidaceae								
21	*Altingia excelsa* Noroña		9	2.5	8	0.86	1.13	4.990	8.35
	TSIVF								**8.35**
	13. Hydrangeaceae								
22	*Dichroa sylvatica* (Reinw. ex Bl.) Merr.		5	1.4	16	1.73	0.20	0.860	3.99
	TSIVF								**3.99**
	14. Lauraceae								
23	*Actinodaphne angustifolia* (Bl.) Nees	x	6	1.7	16	1.73	0.33	1.480	4.29
24	*Actinodaphne glomerata* (Bl.) Nees	x	3	0.85	12	1.29	0.10	0.460	2.6
25	*Beilschmiedia madang* (Bl.)	x	3	0.85	4	0.43	0.14	0.600	1.88
	TSIVF								**25.52**
	15. Magnoliaceae								
26	*Magnolia candollii* (Bl.) Keng		4	1.1	16	1.73	0.39	1.740	4.57
	TSIVF								**4.57**
	16. Melastomataceae								
27	*Astronia macrophylla* Bl.	x	5	1.4	16	1.73	0.18	0.810	3.94
28	*Astronia spectabilis* Bl.		4	1.1	16	1.73	0.21	0.900	3.73
29	*Bellucia axinanthera* Triana	x	5	1.4	12	1.29	0.23	1.020	3.71
30	*Memecylon excelsum* Bl.	x	8	2.2	12	1.29	0.25	1.090	4.58
31	*Pternandra caerulescens* Jack	x	15	4.2	24	2.59	1.13	4.990	11.78
	TSIVF								**27.74**
	17. Meliaceae								
32	*Aglaia argentea* Bl.	x	8	0.82	24	2.59	0.18	0.780	5.57
33	*Aglaia* sp.	x	4	1.1	4	0.43	0.15	0.670	2.2
34	*Dysoxylum nutans* (BI.) Merr.		2	0.56	4	0.43	0.03	0.120	1.11
35	*Dysoxylum parasiticum* (Osb.) Kostem.		14	3.9	40	4.32	0.20	0.870	9.09
36	*Sandoricum koetjape* (Burm. f.) Merr.	x	4	1.1	12	1.29	0.15	0.650	3.04
37	*Toona sureni* (BI.) Merr.	x	3	0.85	4	0.43	0.33	0.150	2.48
	TSIVF								**23.49**
	18. Moraceae								
38	*Artocarpus gomeziana* Wall. ex Tréc.	x	2	0.56	4	0.43	0.02	0.930	1.19
39	*Ficus callosa* Willd.	x	2	0.56	4	0.43	0.17	0.760	1.75
40	*Ficus fistulosa* Reinw. ex Bl.		4	1.1	8	0.86	0.37	1.630	3.59
41	*Ficus montana* Burm. f.		5	1.4	20	2.16	0.60	2.670	6.22
42	*Ficus punctata* Thunb.		4	1.1	12	1.29	0.34	1.510	3.9
43	*Ficus ribes* Reinw. ex Bl.		6	1.7	16	1.73	0.85	3.750	7.18
	TSIVF								**23.83**
	19. Myristicaceae								
44	*Knema intermedia* (Bl.) Warb.	x	10	2.8	36	3.89	0.36	1.580	8.27
	TSIVF								**8.27**
	20. Myrtaceae								
45	*Syzygium chloranthum* (Duthie) Merr. & Perry	x	4	1.1	12	1.29	0.26	1.130	3.52
46	*Syzygium gracile* (Korth.) Amsh.		2	0.56	8	0.86	0.27	0.290	1.71
47	*Syzygium rostratum* (Bl..) DC.		5	1.4	12	1.29	0.30	1.300	3.99
	TSIVF								**9.22**
	21. Rhamnaceae								
48	*Maesopsisi eminii* Engl.	x	9	2.5	32	3.46	1.03	4.540	10.50
	TSIVF								**10.50**

No. Spesies	Family & Species	SR	D (trees//ha)	DR (%)	F (%)	RF (%)	BA (m^2)	RBA (%)	IV (%)
47	*Syzygium rostratum* (Bl.) DC.		5	1.4	12	1.29	0.30	1.300	3.99
	TSIVF								**9.22**
	21. Rhamnaceae								
48	*Maesopsisi eminii* Engl.	x	9	2.5	32	3.46	1.03	4.540	10.50
	TSIVF								**10.50**
	22. Rhizophoraceae								
49	*Gynotroches axillaris* Bl.		12	3.4	40	4.32	0.33	1.440	9.16
	TSIVF								**9.16**
	23. Rosaceae								
50	*Prunus gricea* (C. Muell.) Kalkm		3	1.4	16	1.73	0.11	0.480	3.61
	TSIVF								**3.61**
	24. Rubiaceae								
51	*Canthum didymum* (Gaertn.) T. & B.	x	6	1.7	8	0.86	0.06	0.250	2.81
52	*Neanotis hirsuta* (L.f.) W.H. Lewis	x	4	1.1	4	0.43	0.07	0.320	2.13
53	*Neonauclea lanceolata* (Bl.) Merr		3	0.85	8	0.86	0.37	1.650	3.36
54	*Urophyllum arboreum* (Reinw. ex Bl.) Korth	x	2	0.56	4	0.43	0.02	0.100	1.09
55	*Urophyllum macrophyllum* (Bl.) Korth.	x	3	0.85	12	1.29	0.62	2.750	4.89
	TSIVF								**14.28**
	25. Rutaceae								
56	*Acronychya laurifolia* Bl.		3	0.85	12	1.29	0.06	0.240	2.38
57	*Euodia latifolia* DC.	x	4	1.1	8	0.86	0.07	0.320	2.28
58	*Luvunga sarmentosa* (Bl.) Kurz.		10	2.8	32	3.46	1.20	5.340	11.6
59	*Zanthoxylum scandens* Bl.		6	1.7	12	1.29	0.12	0.540	3.53
	TSIVF								**19.79**
	26. Sabiaceae								
60	*Meliosma nitida* Bl.	x	3	0.85	4	0.43	0.04	0.160	1.44
61	*Meliosma pinnata* (Roxb.) Maxim. ssp. *ferruginea* (Bl.) Beus.		10	2.8			0.14	0.590	6.42
	TSIVF								**7.86**
	27, Symplocaceae								
62	*Symplocos costata* (Bl.) Choisy		7	1.9	4	0.43	0.14	0.620	2.95
63	*Symplocos fasciculata* Zoll.		3	0.85	12	1.29	0.05	0.220	2.37
64	*Symplocos odoratissima* (Bl.) Choisy		2	0.56	8	0.86	0.03	0.110	1.53
	TSIVF								**6.85**
	28. Sterculiaceae								
65	*Sterculia oblongata* R. Br.	x	5	1.4	12	1.29	0.08	0.350	3.04
	TSIVF								**3.04**
	29. Theaceae								
66	*Eurya acuminata* DC.		3	0.85	4	0.43	0.20	0.880	2.16
67	*Gordonia excelsa* (Bl.) Bl.		2	0.56	8	0.86	0.03	0.140	1.56
68	*Laplacea integerrima* Miq.		2	0.56	4	0.43	0.02	0.093	1.08
69	*Schima wallichii* (DC.) Korth.		15	4.2	44	4.76	2.27	10.070	19.03
	TSIVF								**23.83**
	30. Urticaceae								
70	*Villebrunea rubescens* (Bl.) Bl.		4	1.1	12	1.29	0.98	4.320	6.71
	TSIVF								**6.71**
	Total		**350**				**23.36**		