
Research Article

Checklist of trees in Crocker Range Park Permanent Research Plot, Sabah, Malaysia

Rimi Repin¹, Luiza Majuakim^{2*}, Monica Suleiman², Reuben Nilus³, Handry Mujih¹ and Geofarry Gunsalam¹

¹*Research and Education Division, Sabah Parks, Lot 45 & 46, 1st-5th Floor, Block H, Signature Office, KK Times Square, Coastal Highway, 88100 Kota Kinabalu, Sabah, Malaysia.*

²*Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah, Jalan UMS, 88400 Kota Kinabalu, Sabah, Malaysia. *email: majuakim@lycos.com*

³*Forest Research Centre, Sabah Forestry Department, P.O.Box 1407, 90715 Sandakan, Sabah, Malaysia.*

ABSTRACT. This paper presents a checklist of trees from six 0.25 ha permanent research plots in Crocker Range Park (CRP). A total of 73 tree families with 199 genera and 527 species were identified from the plots. Euphorbiaceae was the largest family, with 15 genera containing 52 species. The other dominant tree families in terms of species composition were Myrtaceae, Lauraceae, Meliaceae, Rubiaceae, Moraceae and Annonaceae. The timber tree family, Dipterocarpaceae, consisted of 19 species with *Shorea* being the species rich genus. There were 21 least dominant families that were represented by only one species. At least 47 species are new records for CRP, while three species are new records for Sabah - *Gonystylus nervosus*, *Sterculia rhynchophylla* and *Palaquium ferrugineum*. Seventy tree species were found to be endemic to Borneo, and seven species could be Sabah endemics. The findings of this paper show that CRP is diverse and rich in terms of tree flora.

Keywords: Tree diversity, Crocker Range Park, permanent research plots, Borneo.

INTRODUCTION

The Crocker Range Park (CRP) Permanent Research Plot is a project initiated by the Bornean Biodiversity and Ecosystem Conservation (BBEC) Programme Phase I (2002-2007) in Sabah, Malaysia. The objectives of this project are to clarify the forest ecosystem dynamics and biodiversity in CRP, and to perform effective scientific management using data from monitoring and research results (Suleiman *et al.*, 2007). This long-term project is a collaborative effort between Sabah Parks and the Institute for Tropical Biology and Conservation (ITBC) at Universiti Malaysia Sabah (UMS) together with the School of International Forestry of UMS, Sabah Forestry Department and Yayasan Sabah.

CRP encompasses a variety of ecosystems, from lowland to upper montane forests. Thus, it supports a high diversity of flora. There were three major scientific expeditions carried out in CRP to document its flora and fauna (Ghazally & Laily, 2001; Maryati *et al.*, 2004; Maryati *et al.*, 2005).

Latiff *et al.* (2001) and Ipor *et al.* (2001) reported 144 tree species from Mahua, Mount Alab, Bunsit, Kimanis-Keningau Road, Tikolod and Ulu Senagang at the Northern and South-eastern parts of the park. Meanwhile, Rimi *et al.* (2004) reported 83 species of trees from the Ulu Kimanis, Papar and Membakut areas at the West-coastal side of the park. These expeditions, however, covered a relatively small area of CRP due to time constraints during expeditions. Nonetheless, these areas have covered all the three forest zones in CRP, namely the upper montane rain forest, lower montane rain forest and lowland rain forest (Usui *et al.*, 2006). The number of tree species reported thus far from CRP does not reflect the true diversity of this huge park. Therefore, this paper is part of an effort to document the diversity of tree species in CRP based on specimens collected in the CRP Permanent Research Plots.

METHODOLOGY

Six permanent research plots were established in CRP from April 2005 to December 2006. These plots were established at Inobong, Keningau, Mahua, Mount Alab, Ulu Senagang and Ulu Kimanis (Figure 1). These sites were selected based on three criteria: 1) Altitudinal variation from lowland to highland, 2) West side versus east side of the Crocker Range, and 3) Primary forest versus secondary forest (Figure 2).

The size of the permanent plots is 50 m x 50 m each, divided into 10 m x 10 m sub-plots (total 25 subplots per plot). Five sub-plots of sapling census for each plot were identified (Figure 3). Tree census of all living trees with DBH \geq 5 cm and above 1.3 m tall were recorded during plot establishment. Sub-plots for sapling census also included saplings with

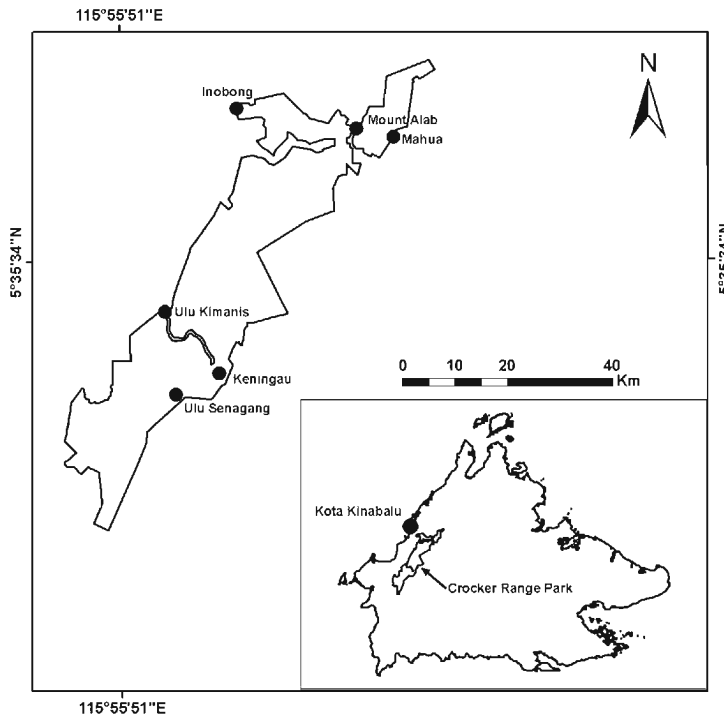


Figure 1. Map of Crocker Range Park showing the locations of CRP Permanent Research Plot. Inset map shows the geographical location of CRP in Sabah.

Forest vegetation zone	Primary forest		Secondary forest	
	West	East	West	East
Upper montane rain forest	Mount Alab (1800 m)			
Lower montane rain forest		Mahua (1000 m)		Keningau (1000 m)
Lowland rain forest	Ulu Kimanis (600 m)	Ulu Senagang (600 m)	Inobong (600 m)	

Figure 2. Detail of CRP Permanent Research Plot. Modified from Suleiman *et al.* (2007).

DBH \geq 1 cm and above 1.3 cm tall (Ishida *et al.*, 2006).

Voucher specimens of all target trees and saplings were collected and identified to species level. These specimens are deposited at the Sabah Park Herbarium (SNP) and BORNEENSIS Herbarium (BORH) of the ITBC, UMS. Identification of specimens were carried out by referring to the Tree Flora of Sabah and Sarawak (Soepadmo & Wong, 1995; Soepadmo *et al.*, 1996; Soepadmo & Saw, 2000; Soepadmo *et al.*, 2002; Soepadmo *et al.*, 2004; Soepadmo *et al.*, 2007; Soepadmo *et al.*, 2011), and authentic specimens at SNP, BORH and Sandakan Herbarium (SAN) at the Forest Research Centre Herbarium, Sabah Forestry Department. The identities of species were then verified by botanists from these herbaria.

RESULTS AND DISCUSSION

A total of 73 tree families with 199 genera and 527 species were encountered within the six CRP Permanent Research Plots (Table 1). Out of the 527 species, five were identified to only generic level. The largest family was Euphorbiaceae with 15 genera containing 52 species. There were 21 families which were represented by only one species. Among them was the Bornean endemic at family and generic level, Scyphostegiaceae, with sole species *Scyphostegia borneensis*.

Apart from Euphorbiaceae, the other species rich families were Lauraceae, Meliaceae, Myrtaceae and Rubiaceae (Figure 4). The dominant tree families (top ten) contributed approximately 54% to the overall

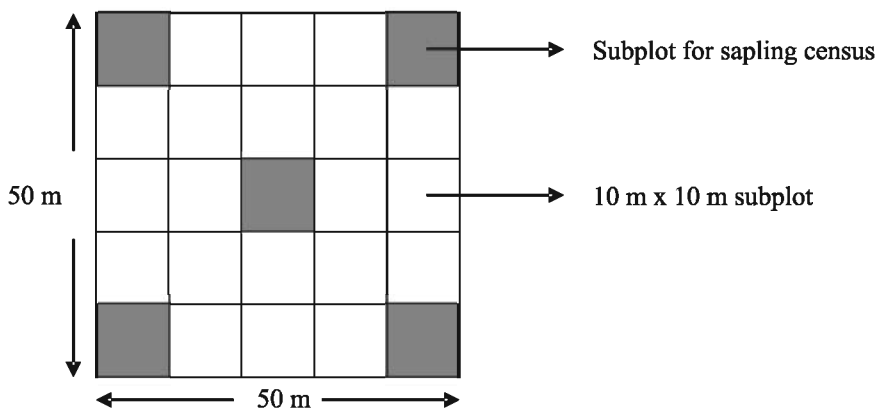


Figure 3. Plot design of CRP Permanent Research Plot.

Table 1. The number of taxa encountered in CRP Permanent Research Plot.

No.	Family	No. of Genera	No. of Species
1.	EUPHORBIACEAE	16	52
2.	LAURACEAE	9	36
3.	MELIACEAE	8	34
4.	RUBIACEAE	18	29
5.	MYRTACEAE	5	30
6.	MORACEAE	3	27
7.	ANNONACEAE	9	22
8.	DIPTEROCARPACEAE	5	19
9.	FAGACEAE	4	18
10.	CLUSIACEAE	3	15
11.	BURSERACEAE	3	13
12.	EBENACEAE	1	14
13.	STERCULIACEAE	5	12
14.	MYRISTICACEAE	4	12
15.	SAPINDACEAE	6	11
16.	ELAEOCARPACEAE	2	10
17.	POLYGALACEAE	2	9
18.	ANACARDIACEAE	6	10
19.	SAPOTACEAE	4	10
20.	FABACEAE	6	9
21.	TILIACEAE	2	9
22.	THEACEAE	4	8
23.	FLACOURTIACEAE	2	5
24.	MELASTOMATACEAE	5	6
25.	OLEACEAE	1	6
26.	CELASTRACEAE	3	5
27.	ICACINACEAE	2	5
28.	LECYTHIDACEAE	2	4
29.	MAGNOLIACEAE	1	5
30.	SYMPLOCACEAE	1	5
31.	MYRSINACEAE	1	3
32.	THYMELAEACEAE	2	4
33.	ULMACEAE	3	4
34.	VERBENACEAE	2	4
35.	ARALIACEAE	3	3
36.	ERICACEAE	2	3
37.	HYPERICACEAE	1	3
38.	PODOCARPACEAE	3	3
39.	ROSACEAE	1	3
40.	ALANGIACEAE	1	2
41.	APOCYNACEAE	2	2
42.	BOMBACACEAE	1	2
43.	CHRYSOBALANACEAE	1	2
44.	CORNACEAE	1	2
45.	DAPHNIPHYLLACEAE	1	2
46.	ESCALLONIAACEAE	1	2
47.	LOGANIACEAE	1	2
48.	PANDACEAE	2	2
49.	PROTEACEAE	2	2
50.	RHAMNACEAE	1	2
51.	RHIZOPHORACEAE	2	2
52.	RUTACEAE	2	2

53.	AQUAFOLIACEAE	1	1
54.	ASTERACEAE	1	1
55.	COMBRETACEAE	1	1
56.	CONNARACEAE	1	1
57.	CONVOLVULACEAE	1	1
58.	CRYPTERONIACEAE	1	1
59.	CTENOLOPHONACEAE	1	1
60.	CUNONIACEAE	1	1
61.	GNETACEAE	1	1
62.	IRVINGIACEAE	1	1
63.	IXONANTHACEAE	1	1
64.	JUGLANDACEAE	1	1
65.	LYTHRACEAE	1	1
66.	OLACACEAE	1	1
67.	PHYLLOCLADACEAE	1	1
68.	PITTOSPORACEAE	1	1
69.	SABIACEAE	1	1
70.	SCYPHOSTEGIACEAE	1	1
71.	SIMAROUBACEAE	1	1
72.	URTICACEAE	1	1
73.	WINTERACEAE	1	1
Total		199	527

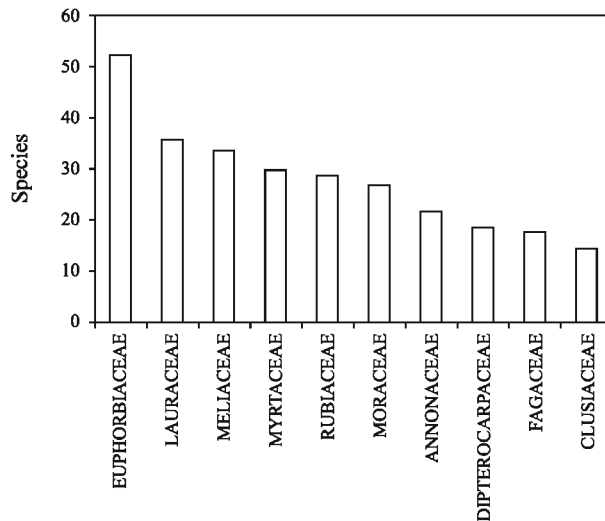


Figure 4. Species composition of dominant tree families in CRP Permanent Research Plot.

species composition in the six plots. Exceptionally, Myrtaceae, Lauraceae and Meliaceae were each represented by one particular genus. The largest genus in Myrtaceae was *Syzygium* with 25 species contributing to more than half of the total number of species within the family. It was also the largest genus observed in all of the

permanent research plots combined. Lauraceae and Meliaceae were well represented by the genus *Litsea* (15 species) and *Aglaiia* (21 species), respectively.

In contrast, the number of species in Euphorbiaceae was evenly distributed within its genera. The genus *Macaranga*, which consists

of 10 species, was the most diverse in terms of species composition (Appendix 1). The family Rubiaceae was the most diverse in terms of number of genera, containing 18 genera. Out of the 18 genera in Rubiaceae, 11 genera were represented by one species, whereas the other eight genera had comparatively similar number of species. The largest genus in Rubiaceae was *Urophyllum* containing five species. The economically important timber tree family, Dipterocarpaceae, was represented by five genera and 19 species, with *Shorea* being the most species rich genera (13 species). In addition, three genera contributed one species each, namely *Anisoptera laevis*, *Dipterocarpus caudatus* and *Parashorea malaanonan*. The genus *Vatica* was represented by three species.

Trees present in the plots consist of lowland and montane species commonly found in a tropical forest. Tree species typical of secondary or disturbed ecosystems were observed. Two permanent research plots were dominated by secondary (Inobong) and old growth forests (Keningau). Members of the Euphorbiaceae family are common inhabitants of secondary and disturbed forests. *Macaranga* species are usually an indication of forest disturbance; its presence is a common feature in secondary and logged over forests. Slik *et al.* (2003) postulated that most *Macaranga* species were distinctively found in forests of high disturbance levels, whereas most *Mallotus* species occurred in less disturbed forests. Several species of *Mallotus* were encountered in the plots indicating slight disturbance within the plots.

The checklist has resulted in the discovery of new records of tree species for CRP and Sabah. At least 47 species are new records for CRP, while three species are new records for Sabah (Appendix 1). The Sabah new records are *Gonystylus nervosus*, *Sterculia rhynchophylla* and *Palaquium ferrugineum*. Seventy tree species are found to be endemic to Borneo, and seven species could be Sabah endemics, namely *Melastoma sabahense*, *Dysoxylum oppositifolium*, *Aglaiia edulis*, *A. luzoniensis*, *A. simplicifolia*, *A. speciosa* and

Syzygium elopuriae (Appendix 1). Overall, this checklist has produced a fairly comprehensive documentation of tree species in Crocker Range although the study was carried out in only 1.5 ha plots. The variety of vegetation comprising lowland, mixed dipterocarp to montane forests of the plots definitely contributed significantly to the higher species composition observed in the area as compared to previous reports (Rimi *et al.*, 2004; Latiff *et al.*, 2001; Ipor *et al.*, 2001).

Floristic study in 20 m x 20 m plots carried out by Ipor *et al.* (2001) found a total of 44 tree species in Mahua. Only 12 species out of the 44 species reported by Ipor *et al.* (2001) were recorded in the current checklist suggesting more species may occur in CRP. Other floristic and ecological studies in Sabah and other areas in Malaysia have focussed in the lowland dipterocarp forests using plots of various sizes from 2 ha to 52 ha (Seino *et al.*, 2007; Lee *et al.*, 2002; Kochummen *et al.*, 1990; Newberry *et al.*, 1992; Proctor *et al.*, 1983). Kochummen *et al.* (1990) and Lee *et al.* (2002) have reported a more comprehensive species composition for lowland tree species in plot sizes of 50 ha (820 species in 294 genera and 78 families) and 52 ha (1173 species in 286 genera and 81 families), respectively. In a smaller plot size established at 280 – 870 m asl at Gunung Silam, Proctor *et al.* (1988) recorded a total of 412 tree species from ten plots ranging 0.04 – 0.4 ha totalling 2.6 ha. In a similar study in Kinabalu Park, Aiba *et al.* (2002) found 148 tree species in 1 ha plots at 700 m asl, lower species composition (81 – 109 species) at 1,700 m asl with the same plot size, and 4–17 species at 3,100 m asl in 0.06 – 0.2 ha plots. They also observed that geological substrate and higher altitude influenced species composition and endemism. Species composition generally exhibits a decreasing pattern as the altitude increases due to extreme climate conditions, resulting in adaptation of specialized species. The CRP Permanent Research Plots were established at various altitudes that ranged from 600 m asl to 1,800 m asl, and as a consequence, increasing altitude and soil substrate which affect forest types as well as

species composition may account for the comparatively higher tree species composition in the CRP Permanent Research Plots.

Time and manpower constraints were the major contributing factors of previous expeditions in CRP that resulted in the depauperated diversity in the tree species assessment. Floristic survey in CRP Permanent Research Plots complements the existing knowledge of CRP tree flora obtained from previous expeditions. However, more replicates of the permanent research plot or expansion of plot size are necessary to capture the actual diversity of tree species in CRP. Long term ecological research plot projects may contribute to the evaluation of tree flora conservation status in CRP and Sabah.

CONCLUSION

The compilation of the tree flora of CRP in the current checklist will certainly be an important tool for management and conservation efforts of the park in future. To date, this checklist is the only comprehensive documented tree flora of CRP. The findings indicate that CRP harbours a significant number of endemic species and a diverse tree flora. Nonetheless, this tree flora documentation is far from completed considering the vast unexplored areas of CRP. These areas should be targeted for periodic botanical expeditions.

ACKNOWLEDGEMENTS

We would like to express our thanks and appreciation to BBEC-JICA for providing financial and technical support throughout the establishment of the CRP Permanent Research Plot. We are grateful to Sabah Parks and the Institute for Tropical Biology and Conservation (ITBC) for financially supporting this project. We are also indebted to all the members of this project for their continued support and assistance, especially to Dr. Maklarim Hj. Lakim, Dr. Abdul Hamid Ahmad, Aya Sugawara, John Sugau, Dr. Yap Sau Wai, Dolois Sumbin and Johnny Gisil. We appreciate the help of Arnie Abdul Hamid of GIS Lab, ITBC, for producing the map.

REFERENCES

- Aiba, S., K. Kitayama & Rimi Repin. 2002. Species composition and species-area relationships of trees in nine permanent plots in altitudinal sequences on different geological substrates of Mount Kinabalu. *Sabah Parks Nature Journal* 5: 7-69.
- Ghazally, I. & A. Lamri. 2001. *A scientific journey through Borneo: The Crocker Range National Park Sabah*. Vol. 1. England: ASEAN Academic Press.
- Ipor, L., Hamsawi Sani & C. Tawan. 2001. Floristic composition of forest formation at Mahua, Crocker Range National Park, Sabah. In: Ghazally, I. & A. Lamri. (eds.). *A scientific journey through Borneo: The Crocker Range National Park Sabah*. Vol. 1. England: ASEAN Academic Press, pp. 21-31.
- Ishida, H., H. Takahira-Ishida, I.M. Said & Rimi Repin. 2006. Manual for Permanent Research Plot in Crocker Range Park. Kota Kinabalu: Universiti Malaysia Sabah and JICA.
- Kochummen, K.M., J.V. LaFrankie & N. Manokaran. 1990. Floristic composition of Pasoh Forest Reserve, a lowland rain forest in Peninsular Malaysia. *Journal of Tropical Forest Science* 3(1): 1-13.
- Latiff, A., A. Berhaman, A. Zainudin Ibrahim & K. Mat-Salleh. 2001. An account and preliminary checklist of the angiosperms and gymnosperms of Crocker Range, Sabah. In: Ghazally, I. & A. Lamri. (eds.) *A scientific journey through Borneo: The Crocker Range National Park Sabah*. Vol. 1. England: ASEAN Academic Press, pp. 33-53.
- Lee, H. S., S.J. Davies, J.V. LaFrankie, S. Tan, T. Yamakura, A. Itoh, T. Ohkubo & P.S. Ashton. 2002. Floristic and structural diversity of mixed dipterocarp forest in Lambir Hills National Park, Sarawak, Malaysia. *Journal of Tropical Forest Science* 14(3): 379-400.
- Newberry, D. McC., E.J.F. Campbell, Y.F. Lee, C.E. Ridsdale & M.J. Still. 1992. Primary lowland dipterocarp forest at Danum Valley, Sabah, Malaysia: Structure, relative abundance and family composition. *Phil. Trans. R. Soc. London* Vol. 335: 341-356.
- Maryati Mohamed, Zulhazman Hamzah, T. Tachi & J. Nais. 2004. *Crocker Range Scientific Expedition 2002*. Kota Kinabalu: Universiti Malaysia Sabah.
- Maryati Mohamed, Nurhuda Manshoor & A. Takahashi. 2005. *Proceedings of Melalap Scientific Expedition*. Kota Kinabalu: Universiti Malaysia Sabah.
- Rimi Repin, Dolois Sumbin, Rahimah Parmin, Yabainus Jahalin & Gusili Johalin. 2004. Additions to the checklist of the plants of Crocker Range Park. In: Maryati Mohamed, Zulhazman Hamzah, T. Tachi & J. Nais (eds.). *Crocker Range Scientific Expedition 2002*. Kota Kinabalu: Universiti Malaysia Sabah, pp. 39-50.
- Proctor, J., Y.F. Lee, M. Langley, W.R.C. Munro & T. Nelson. 1988. Ecological studies on Gunung Silam, a small ultrabasic mountain in Sabah, Malaysia. I. Environment, forest structure and floristics. *Journal of Ecology* 76: 320-340.

- Seino, T., K. Kitayama & Maklarin Lakim. 2007.** Floristic composition and stand structure of the mixed dipterocarp forest in Tawau Hills Park, Sabah, Malaysia. *Sabah Parks Nature Journal* 8: 63-82.
- Slik, J.W.F., P.J.A. Keßler & P. C. van Welzen. 2003.** *Macaranga* and *Mallotus* species (Euphorbiaceae) as indicators for disturbance in the mixed lowland dipterocarp forest of East Kalimantan (Indonesia). *Ecological Indicators* 2: 311–324.
- Soepadmo, E. & K.M. Wong. 1995.** *Tree Flora of Sabah and Sarawak* Volume 1. Kuala Lumpur: Forest Research Institute Malaysia.
- Soepadmo, E., K.M. Wong & L.G. Saw. 1996.** *Tree Flora of Sabah and Sarawak* Volume 2. Kuala Lumpur: Forest Research Institute Malaysia.
- Soepadmo, E. & L.G. Saw. 2000.** *Tree Flora of Sabah and Sarawak* Volume 3. Kuala Lumpur: Malayan Nature Society.
- Soepadmo, E., L.G. Saw & R.C.K. Chung. 2002.** *Tree Flora of Sabah and Sarawak* Volume 4. Kuala Lumpur: Forest Research Institute Malaysia.
- Soepadmo, E., L.G. Saw & R.C.K. Chung. 2004.** *Tree Flora of Sabah and Sarawak* Volume 5. Kuala Lumpur: Forest Research Institute Malaysia.
- Soepadmo, E., L.G. Saw, R.C.K. Chung & R. Kiew. 2007.** *Tree Flora of Sabah and Sarawak* Volume 6. Kuala Lumpur: Forest Research Institute Malaysia.
- Soepadmo, E., L.G. Saw, R.C.K. Chung & R. Kiew. 2011.** *Tree Flora of Sabah and Sarawak* Volume 7. Kuala Lumpur: Forest Research Institute Malaysia.
- Suleiman, M., H. Ishida, M. Spait, I.M. Said, A. Sugawara & Rimi Repin. 2007.** *An introduction to the Crocker Range Permanent Research Plot Project*. Kota Kinabalu: Universiti Malaysia Sabah.
- Usui, S., H. Sato, A. Lee-Agama & R. Chua. (eds.). 2006.** *Range Park Management Plan*. Kota Kinabalu: Sabah Parks, pp. 5-43.

Appendix 1. The checklist of tree species from CRP Permanent Research Plot (*Bornean endemic; **Sabah endemic; ●New record for CRP; ○New record for Sabah).

GYMNOSPERMS

PODOCARPACEAE

Dacrycarpus imbricatus (Blume) de Laub.
Dacrydium xanthandrum Pilg.
Falcatifolium falciforme (Parl.) de Laub.

PHYLLOCLADACEAE

Phyllocladus hypophyllus Hook.f.

ANGIOSPERMS

ALANGIACEAE

Alangium javanicum (Blume) Wangerin
Alangium rotundifolium (Hassk.) Bloemb.

ANACARDIACEAE

Buchanania sessifolia Blume
Gluta wallichii (Hook.f.) Ding Hou
Mangifera rufocostata Kosterm.
Melanochyla angustifolia Hook.f.●
Melanochyla beccariana Oliv.*●
Melanochyla castaneifolia Ding Hou*●
Melanochyla elmeri Merr.*●
Semecarpus paucinervius Merr.●
Swintonia acuta Engl.●
Swintonia minutalata Ding Hou*

ANNONACEAE

Desmos dumosus (Roxb.) Saff.
Enicosanthum grandifolium (Elmer) Airy Shaw
Goniothalamus borneensis Mat-Salleh
Goniothalamus clemensii Bân
Goniothalamus fasciculatus Boerl.
Goniothalamus velutinus Airy Shaw
Neouvaria acuminatissima (Boerl.) H.Okada & K.Ueda
Polyalthia bullata King
Polyalthia canangioides (Miq.) Boerl.
Polyalthia cauliflora Hook.f. & Thomson
Polyalthia chrysotricha Ridl.
Polyalthia cinnamomea Hook.f. & Thomson
Polyalthia longipes (Miq.) Koord. & Valetton
Polyalthia obliqua Hook.f. & Thomson
Polyalthia sumatrana (Miq.) Kurz
Sageraea lanceolata Miq.
Uvaria ovalifolia Blume
Woodiellantha sympetala (Merr.) Rauschert
Xylopiya dehiscens Merr.
Xylopiya elliptica Maingay ex Hook.f.
Xylopiya ferruginea (Hook.f. & Thomson) Hook.f. & Thomson
Xylopiya malayana Hook.f. & Thomson

APOCYNACEAE

Alstonia angustiloba Miq.
Tabernaemontana macrocarpa Jack

AQUIFOLIACEAE

Illex promecophylla S.Andrews*

ARALIACEAE

Aralia scandens (Merr.) Ha
Dendropanax borneensis (Philipson) Merr.
Gastonia serratifolia (Miq.) Philipson

ASTERACEAE

Vernonia arborea Buch.-Ham. ex Buch.-Ham

BOMBACACEAE

Durio affinis Becc.
Durio grandiflorus (Mast.) Kosterm. & Soegeng

BURSERACEAE

Canarium asperum Benth.
Canarium caudatum King●
Canarium decumanum Gaertn.●
Canarium denticulatum Blume
Canarium megalanthum Merr.●
Canarium merrillii H.J.Lam*
Canarium odontophyllum Miq.
Canarium ovatum Engl.
Dacryodes costata (A.W.Benn.) H.J.Lam●
Dacryodes longifolia (King) H.J.Lam
Santiria apiculata A.W.Benn.
Santiria griffithii (Hook.f.) Engl.●
Santiria tomentosa Blume

CELASTRACEAE

Bhesa paniculata Arn.
Euonymus castaneifolius Ridl.
Lophopetalum beccarianum Pierre
Lophopetalum glabrum Ding Hou*
Lophopetalum javanicum (Zoll.) Turcz.

CHRYSOBALANACEAE

Parinari canarioides Kosterm.
Parinari elmeri Merr.

CLUSIACEAE

Calophyllum blancoi Planch. & Triana
Calophyllum depressinervosum M.R.Hend. & Wyatt-Sm
Calophyllum ferrugineum Ridl.
Calophyllum gracilipes Merr.

Calophyllum soulattri Burm.f.
Calophyllum venulosum Zoll.
Garcinia caudiculata Ridl.
Garcinia forbesii King
Garcinia gaudichaudii Planch. & Triana
Garcinia maingayi Hook.f. ex T.Anderson
Garcinia mangostana L.
Garcinia minimiflora Ridl.
Garcinia parvifolia (Miq.) Miq.
Garcinia trianaii Pierre
Mammea calciphila Kosterm.

COMBRETACEAE

Terminalia foetidissima Griff.

CONNARACEAE

Ellipanthus tomentosus Kurz●

CONVOLVULACEAE

Erycibe borneensis (Merr.) Hoogland

CORNACEAE

Mastixia rostrata Blume
Mastixia trichotoma Blume

CRYPTERONIACEAE

Crypteronia paniculata Blume

CTENOLOPHONACEAE

Ctenolophon parvifolius Oliv.

CUNONIACEAE

Weinmannia blumei Planch.

DAPHNIPHYLLACEAE

Daphniphyllum borneense Stapf●
Daphniphyllum laurinum (Benth.) Baill.●

DIPTEROCARPACEAE

Anisoptera laevis Ridl.
Dipterocarpus caudatus Foxw.
Parashorea malaanonan (Blanco) Merr.
Shorea argentifolia Symington *
Shorea fagueticana F.Heim
Shorea fallax Meijer *
Shorea foxworthyi Symington●
Shorea gibbosa Brandis
Shorea laevis Ridl.
Shorea macroptera Dyer
Shorea multiflora (Burck) Symington
Shorea ovata Dyer ex Brandis
Shorea parvifolia Dyer
Shorea pauciflora King
Shorea rubra P.S.Ashton *
Shorea smithiana Symington *
Vatica albiramis Slooten *

Vatica micrantha Slooten *
Vatica umbonata (Hook.f.) Burck

EBENACEAE

Diospyros areolata King & Gamble
Diospyros borneensis Hiern
Diospyros cauliflora Blume
Diospyros curranii Merr.
Diospyros densa Bakh. *
Diospyros discocalyx Merr. *
Diospyros ferruginescens Bakh. *
Diospyros foxworthyi Bakh.
Diospyros frutescens Blume
Diospyros fusiformis Kosterm. *●
Diospyros lanceifolia Roxb.
Diospyros macrophylla Blume
Diospyros oligantha Merr. *
Diospyros virgata (Gürke) Brenan

ELAEOCARPACEAE

Elaeocarpus acrantherus Merr.
Elaeocarpus angustipes R.Knuth
Elaeocarpus clementis var. *clemensiae* (R.Knuth)
 Coode
Elaeocarpus ferrugineus (Jacq.) Steud.
Elaeocarpus ferrugineus subsp. *elliptifolius* (Merr.)
 Coode
Elaeocarpus kinabaluensis Knuth
Elaeocarpus knuthii Merr.
Elaeocarpus kostermansii Weibel
Elaeocarpus sp.
Sloanea sigun (Blume) K.Schum.

ERICACEAE

Rhododendron maxwellii Gibbs
Rhododendron stenophyllum subsp. *angustifolium*
 (J.J.Sm.) Argent, A.L.Lamb & Phillipps
Vaccinium bancanum Miq.

ESCALLONIACEAE

Polyosma latifolia Schltr.
Polyosma sp.

EUPHORBIACEAE

Antidesma bangueyense Merr.
Antidesma leucopodium Miq.
Antidesma montanum Blume
Antidesma polystylum Airy Shaw
Aporosa symplocoides var. *chalarocarpa* (Airy Shaw) Schot
Aporosa confusa Gage
Aporosa elmeri Merr.
Aporosa grandistipula Merr.
Aporosa lucida (Miq.) Airy Shaw
Aporosa penangensis (Ridl.) Airy Shaw
Aporosa subcaudata Merr.
Baccaurea bracteata Müll.Arg.

Baccaurea polyneura Hook.f.
Baccaurea lanceolata (Miq.) Müll.Arg.
Baccaurea macrocarpa (Miq.) Müll.Arg.
Baccaurea membranacea Pax & K.Hoffm.
Baccaurea pubera (Miq.) Müll.Arg.
Baccaurea stipulata J.J.Sm.
Baccaurea tetrandra (Baill.) Müll.Arg.
Blumeodendron concolor Gage
Blumeodendron tokbrai (Blume) Kurz
Cleistanthus bakonensis Airy Shaw
Cleistanthus myrianthus (Hassk.) Kurz
Croton oblongifolius Delile
Croton oblongus Burm.f.
Dimorphocalyx malayanus Hook.f.
Drypetes kikir Airy Shaw
Drypetes longifolia (Blume) Pax & K.Hoffm.
Drypetes pendula Ridl.
Drypetes polyneura Airy Shaw
Drypetes subcubica (J.J.Sm.) Pax & K.Hoffm.
Glochidion pubicarpum Elmer
Glochidion rubrum Blume
Koilocarpus laevigatum Airy Shaw
Macaranga aetheadenia Airy Shaw
Macaranga bancana (Miq.) Müell.Arg.
Macaranga beccariana Merr.
Macaranga conifera (Rchb.f. & Zoll.) Müell.Arg.
Macaranga gigantea (Rchb.f. & Zoll.) Müell.Arg.
Macaranga hypoleuca (Rchb.f. & Zoll.) Müell.Arg.
Macaranga kinabaluensis Airy Shaw
Macaranga lowii (Rchb.f. & Zoll.) Müell.Arg.
Macaranga pearsonii Merr.
Macaranga triloba (Thunb.) Müell.Arg.
Mallotus caudatus Merr.
Mallotus korthalsii Müell.Arg.
Mallotus paniculatus (Lam.) Müell.Arg.
Hancea stipularis (Airy Shaw) S.E.C.Sierra, Kulju & Welzen
Neoscortechinia angustifolia (Airy Shaw) Welzen
Neoscortechinia forbesii (Hook.f.) S.Moore
Pimeleodendron griffithianum (Müll.Arg.) Benth. ex Hook.f.
Ptychopyxis arborea (Merr.) Airy Shaw

FABACEAE

Archidendron borneense (Benth.) I.C.Nielsen
Archidendron cockburnii I.C. Nielsen
Archidendron ellipticum (Blanco) I.C.Nielsen
Archidendron triplinervium (Kosterm.) I.C.Nielsen
Dialium indum L.
Erythrina subumbrans (Hassk.) Merr.
Parkia javanica (Lam.) Merr.
Sindora irpicina de Wit *
Spatholobus gyrocarpus Benth.

FAGACEAE

Castanopsis evansii Elmer

Castanopsis hypophoenicea (Seemen) Soepadmo *
Castanopsis megacarpa Gamble
Castanopsis psilophylla Soepadmo
Lithocarpus bullatus Soepadmo *
Lithocarpus cantleyanus (King ex Hook.f.) Rehder
Lithocarpus caudatifolius (Merr.) Rehder
Lithocarpus clementianus (King ex Hook.f.) A.Camus
Lithocarpus elegans (Blume) Hatus. ex Soepadmo
Lithocarpus ewyckii (Korth.) Rehder
Lithocarpus gracilis (Korth.) Soepadmo
Lithocarpus hatusimae Soepadmo *
Lithocarpus havilandii (Stapf) Burnett
Lithocarpus leptogyne (Korth.) Soepadmo
Lithocarpus malaidus (Roxb.) Rehder
Lithocarpus pseudokunstleri A.Camus
Quercus lineata Blume ●
Trigonobalanus verticillata Forman ●

FLACOURTIACEAE

Casearia grewiiifolia Vent.
Hydnocarpus anomalus (Merr.) Sleumer
Hydnocarpus polypetalus (Slooten) Sleumer
Hydnocarpus sumatrana Koord.
Hydnocarpus woodii Merrill ex v.Slooten

GNETACEAE

Gnetum gnemon L.

HYPERICACEAE

Cratoxylum arborescens (Vahl) Blume
Cratoxylum cochinchinense (Lour.) Blume
Cratoxylum formosum (Jacq.) Benth. & Hook.f. ex Dyer

ICACINACEAE

Gonocaryum macrophyllum (Blume) Sleumer
Stemonurus grandifolius Becc.
Stemonurus malaccensis (Mast.) Sleumer
Stemonurus scorpioides Becc.
Stemonurus umbellatus Becc.

IRVINGIACEAE

Irvingia malayana Oliv. ex A.W.Benn

IXONANTHACEAE

Ixonanthes reticulata Jack

JUGLANDACEAE

Engelhardia serrata Blume

LAURACEAE

Actinodaphne glabra Blume
Actinodaphne oleifolia Gamble
Actinodaphne sesquipedalis Hook.f. & Thomson ex Meisn.
Alseodaphne oblanceolata (Merr.) Kosterm.
Beilschmiedia maingayi Hook.f.

Beilschmiedia lucidula (Miq.) Kosterm.
Beilschmiedia micrantha Merr.
Beilschmiedia perakensis Gamble
Cinnamomum angustitepalum Kosterm.
Cinnamomum burmanni (Nees & T.Nees) Blume
Cinnamomum camphora (L.) J.Presl
Cinnamomum iners Reinw. ex Blume
Cryptocarya ferrea Blume
Cryptocarya crassinervia Miq.
Dehaasia caesia Blume
Dehaasia cuneata (Blume) Blume
Dehaasia incrassata (Jack) Kosterm.
Lindera bibracteata Boerl.
Lindera kinabaluensis Kosterm.
Lindera lucida Boerl.
Litsea accedens (Blume) Boerl.
Litsea caulocarpa Merr.
Litsea costalis (Ness) Kosterm.
Litsea cubeba (Lour.) Pers.
Litsea cylindrocarpa Gamble
Litsea ferruginea Blume
Litsea fulva (Blume) Villar
Litsea grandis (Ness) Hook f.
Litsea lancifolia (Roxb. ex Nees) Benth. & Hook. f.
 ex Villar
Litsea mappacea Boerl.
Litsea oppositifolia Gibbs
Litsea sessilis Boerl.
Litsea staintonii Kosterm.
Litsea subumbelliflora (Blume) Ng
Litsea unita Boerl.
Tetranthera elliptica (Blume) Nees

LECYTHIDACEAE

Barringtonia lanceolata (Ridl.) Payson *
Barringtonia macrostachya (Jack) Kurz
Barringtonia sarcostachys (Blume) Miq.
Planchonia grandis Ridl. ●

LOGANIACEAE

Fagraea cuspidata Blume
Fagraea spicata Baker ●

LYTHRACEAE

Duabanga moluccana Blume

MAGNOLIACEAE

Magnolia acuminate (L.) L.
Magnolia candollii (Blume) H.Keng
Magnolia candollii var. *candollii* (Blume) H.Keng
Magnolia carsonii Dandy ex Noot.
Magnolia gigantifolia (Miq.) Noot.

MELASTOMATACEAE

Astronia cumingiana S. Vidal
Melastoma malabathricum L.

Melastoma sabahense K.Meyer **
Memecylon beccarianum Cogn.
Plethiandra molleyi Hook f.
Pternandra coerulescens Jack

MELIACEAE

Aglaiia crassinervia Kurz ex Hiern
Aglaiia cumingiana Turcz.
Aglaiia edulis (Roxb.) Wall. **
Aglaiia elliptica (C.DC.) Blume
Aglaiia elliptica subsp. *elliptica* Blume
Aglaiia elliptica subsp. *clementis* (Merr.) Pannell
Aglaiia forbesii King
Aglaiia korthalsii Miq.
Aglaiia lawii subsp. *oligocarpa* (Miq.) Pannell
Aglaiia leptantha Miq.
Aglaiia leucophylla King
Aglaiia luzoniensis (Vidal) Merr. & Rolfe **
Aglaiia macrocarpa (Miq.) Pannell
Aglaiia meliosmoides Craib
Aglaiia monozyga Harms
Aglaiia odoratissima Blume
Aglaiia rufinervis (Blume) Benth.
Aglaiia simplicifolia (Bedd.) Harms **
Aglaiia speciosa Blume **
Aglaiia tomentosa Teijsm. & Binn.
Aglaiia tomentosa subsp. *cordata* (Hiern) Pannell
Aphanamixis borneensis (Miq.) Merr.
Aphanamixis polystachya (Wall.) R.Parker
Chisocheton ceramicus (Miq.) C.DC.
Chisocheton lansifolius Mabb.*
Chisocheton pentandrus subsp. *paucijugus* (Miq.) Mabb.
Dysoxylum carolinae Mabb.
Dysoxylum cauliflorum Hiern
Dysoxylum oppositifolium F.Muell. **●
Dysoxylum rugulosum King
Lansium domesticum Corrêa
Reinwardtiodendron humile (Hassk.) Mabb.
Sandoricum koetjape (Burm.f.) Merr.
Walsura pinnata Hassk.

MORACEAE

Artocarpus anisophyllus Miq.
Artocarpus anisophyllus var. *sessilifolius* Kochummen *
Artocarpus dadah Miq.
Artocarpus elasticus Reinw. ex Blume
Artocarpus kemando Miq.
Artocarpus lanceifolius Roxb.
Artocarpus melinoxylus Gagnep. *
Artocarpus odoratissimus Blanco *
Artocarpus primackiana Kochummen *
Artocarpus tamaran Becc. *
Artocarpus toxicaria Lesch.
Artocarpus teysmannii Miq. ●
Ficus androchaete Corner * ●
Ficus aurita var. *auriculifera* (Merr.) Corner ●

Ficus benamina L.
Ficus deltoidea Jack
Ficus fistulosa Reinw. ex Blume
Ficus fulva Reinw. ex Blume
Ficus hemsleyana King * ●
Ficus leptocalama Corner * ●
Ficus megaleia Corner * ●
Ficus subterranea Corner * ●
Ficus treubii King * ●
Ficus uncinata (King) Becc.
Ficus uniglandulosa Wall.
Ficus villosa Blume
Prainea limpato (Miq.) Beumee ex Heyne ●

MYRISTICACEAE

Gymnacranthera contracta Warb. * ●
Gymnacranthera farquhariana var. *zippeliana*
 (Miq.) R. T. A. Schouten
Horsfieldia grandis (Hook. f.) Warb.
Horsfieldia polyspherula (Hook. f. emend. King) J. Sinclair
Knema cinerea (Warb.)
Knema conferta (King) Warb.
Knema galeata J. Sinclair *
Knema kunstleri (King) Warb.
Knema kunstleri subsp. *alpinia* (J. Sinclair) W. J. de
 Wilde *
Knema latifolia Warb.
Knema laurina (Blume) Warb.
Myristica maxima Warb.

MYRSINACEAE

Ardisia paniculata Roxb.
Ardisia copelandii Mez
Ardisia macrophylla Reinw. ex Blume

MYRTACEAE

Blepharocalyx salicifolius (Kunth) O. Berg
Eugenia uniflora L.
Leptospermum flavescens Sm.
Leptospermum javanicum Blume
Syzygium attenuatum (Miq.) Merr. & L. M. Perry
Syzygium bankense (Hassk.) Merr. & L. M. Perry
Syzygium barringtonioides (Ridl.) Masam. *
Syzygium caudatilimbium (Merr.) Merr. & L. M. Perry
Syzygium creaghii (Ridl.) Merr. & L. M. Perry *
Syzygium elliptilimbium (Merr.) Merr. & L. M. Perry *
Syzygium elopuriae (Ridl.) Merr. & L. M. Perry **
Syzygium fastigiatum (Blume) Merr. & L. M. Perry
Syzygium hirtum (Korth.) Merr. & L. M. Perry
Syzygium incarnatum (Elmer) Merr. & L. M. Perry
Syzygium kunstleri (King) Bahadur & R. C. Gaur
Syzygium leptostemon (Korth.) Merr. & L. M. Perry
Syzygium leucoxydon Korth.
Syzygium longiflorum C. Presl
Syzygium multibracteolatum (Merr.) Merr. & L. M. Perry * ●

Syzygium napiforme (Koord. & Valetton) Merr. & L. M. Perry
Syzygium polyanthum (Wight) Walp
Syzygium oligomyrum Diels *
Syzygium pachysepalum Merr. & L. M. Perry *
Syzygium penibukanense Merr. & L. M. Perry *
Syzygium punctilimbium (Merr.) Merr. & L. M. Perry *
Syzygium racemosum (Blume) DC.
Syzygium samarangense (Blume) Merr. & L. M. Perry
Syzygium villamilii (Merr.) Merr. & L. M. Perry *
Syzygium sp.
Tristaniopsis sp.

OLACACEAE

Ochanostachys amantacea Mast.

OLEACEAE

Chionanthus callophyllus Blume ●
Chionanthus curvicaulus Kiew
Chionanthus pluriflorus (Knobl.) Kiew *
Chionanthus polygamus (Roxb.) Kiew
Chionanthus pubicalyx (Ridl.) Kiew *
Chionanthus spicatus Blume

PANDACEAE

Galearia fulva (Tul.) Miq.
Microdesmis caseariifolia Planch. ex Hook.

PITTOSPORACEAE

Pittosporum ferrugineum Aiton

POLYGALACEAE

Suregada glomerulata (Blume) Baill.
Xanthophyllum flavescens Roxb.
Xanthophyllum montanum Meijden
Xanthophyllum penibukanense Heine *
Xanthophyllum purpureum Ridl *
Xanthophyllum rufum A. W. Benn
Xanthophyllum stipitatum A. W. Benn
Xanthophyllum subcoriaceum (Chodat) Meijden *
Xanthophyllum velutinum Chodat *

PROTEACEAE

Helicia petiolaris Benn.
Heliciopsis velutina (Prain) Sleumer ●

RHAMNACEAE

Ziziphus angustifolia (Miq.) Hatus. ex Steenis
Ziziphus borneensis Merr.

RHIZOPHORACEAE

Carallia brachiata (Lour.) Merr.
Pellacalyx lobbii (Hook. f.) Schimper

ROSACEAE

Prunus arborea (Blume) Kalkman

Prunus grisea Kalkman

Prunus javanica (Teijsm. & Binn.) Miq.

RUBIACEAE

Aidia borneensis Ridsdale

Canthium confertum Korth.

Cowiea borneensis Wernham

Diplospora malaccensis Hook.f.

Diplospora singularis Korth.

Discospermum abnorme (Korth.) S.J. Ali & Robbr.

Gardenia tubifera Wall. ex Roxb.

Ixora brachyantha Merr.

Ixora elliptica R.Br. ex Ridl.

Metadina trichotoma (Zoll. & Moritzi) Bakh.f.

Mussaendopsis beccariana Baill.

Neonauclea artocarpoides Ridsdale

Neonauclea gigantea (Valeton) Merr.

Porterandia chanii Zahid

Praravinia borneensis (Merr.) Bremek.

Praravinia creaghii (Ridl.) Bremek.

Praravinia suberosa (Merr.) Bremek.

Prismatomeris beccariana (Baill. ex K. Schum.) J.T. Johanss.

Prismatomeris tetrandra (Roxb.) K. Schum.

Psychotria angulata Korth.

Rothmannia pseudoternifolia J.T. Pereira

Rothmannia pseudoternifolia var. *pseudoternifolia*

J.T. Pereira

Tarenna cumingiana (S. Vidal) Elmer

Timonius flavescens (Jacq.) Baker

Urophyllum arboreum (Reinw. ex Blume) Korth.

Urophyllum congestiflorum Ridl.

Urophyllum glabrum Jack ex Wall.

Urophyllum longidens Stapf

Urophyllum streptopodium Wall. ex Hook.f.

RUTACEAE

Acronychia pedunculata (L.) Miq.

Maclurodendron porteri (Hook.f.) T.G. Hartley

SABIACEAE

Meliosma sumatrana Walp.

SAPINDACEAE

Cubilia cubili (Blanco) Adelbert ●

Dimocarpus longan Lour.

Lepisanthes amoena (Hassk.) Leenh.

Lepisanthes falcata subsp. *borneensis* (Leenh.)

Leenh. ●

Nephelium cuspidatum Blume

Nephelium lappaceum L.

Nephelium maingayi Hiern

Nephelium ramboutan-ake (Labill.) Leenh.

Pometia pinnata J.R. Forst. & G. Forst.

Pometia ridleyi King ex Radlk. ●

Xerospermum noronhianum (Blume) Blume

SAPOTACEAE

Madhuca endertii H.J. Lam * ●

Madhuca glabrescens H.J. Lam

Palaquium dasyphyllum Pierre ex Dubard ●

Palaquium edenii Pierre ex Dubard * ●

Palaquium ferrugineum Pierre ex Dubard * ● ●

Palaquium rostratum (Miq.) Burck ●

Palaquium sericeum H.J. Lam ●

Palaquium sp.

Payena microphylla (de Vriese) Pierre *

Planchonella obovata (R.Br.) Pierre

SCYPHOSTEGIACEAE

Scyphostegia borneensis Stapf *

SIMAROUBACEAE

Eurycoma longifolia Jack

STERCULIACEAE

Heritiera elata Ridl.

Heritiera javanica (Blume) Kosterm.

Leptonychia heteroclita Kurz

Pterospermum elongatum Korth.

Scaphium longipetiolatum (Kosterm.) Kosterm. *

Scaphium macropodium (Miq.) Beumée ex K. Heyne

Sterculia coccinea Jack

Sterculia cordata Blume

Sterculia longipetiolata Merr. * ● ●

Sterculia rhynchophylla K. Schum. ● ●

Sterculia rubiginosa Vent.

Sterculia stipulata Korth. *

SYMPLOCACEAE

Symplocos adenophylla Wall. ex G. Don

Symplocos celastrifolia Griff. ex C.B. Clarke

Symplocos confusa Brand

Symplocos fasciculata (Kuntze) Zoll.

Symplocos ophirensis C.B. Clarke

THEACEAE

Adinandra acuminata Korth.

Adinandra clemensiae Kobuski

Adinandra dumosa Jack

Gordonia havilandii Burkill

Schima wallichii Choisy

Ternstroemia aneura Miq.

Ternstroemia beccarii Stapf ex Ridl.

Ternstroemia patens Choisy

THYMELAEACEAE

Aquilaria malaccensis Lam

Gonystylus forbesii Gilg

Gonystylus keithii Airy Shaw *

Gonystylus nervosus Airy Shaw * ● ●

TILIACEAE

- Microcos antidesmifolia* Burret
Microcos crassifolia Burret
Microcos elmeri Merr.
Microcos latistipulata Burret
Microcos ossea Burret
Microcos triflora (Blanco) R.C.K. Chung
Microcos triflora var. *longipetiolata* (Merr.)
R.C.K. Chung
Pentace erectinervia Kosterm.
Pentace laxiflora Merr.

ULMACEAE

- Celtis timorensis* Span. ●
Gironniera parvifolia Planch.

- Gironniera subaequalis* Planch.
Trema orientalis (L.) Blume

URTICACEAE

- Oreocnide trinervis* (Wedd.) Miq.

VERBENACEAE

- Teijsmanniodendron bogoriense* Koord.
Teijsmanniodendron glabrum Merr.
Teijsmanniodendron simplicifolium Merr.
Vitex vestita Wall. ex Schauer

WINTERACEAE

- Tasmania piperita* (Hook.f.) Miers

