FLORISTIC COMPOSITION OF FOREST FORMATION AT MAHUA, CROCKER RANGE NATIONAL PARK, SABAH

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ABSTRACT

The floristic composition of mixed dipterocarp forest of Mahua Crocker Range National Park Sabah was investigated with respect to plant diversity, vegetative structure and physiognomy. The assessment of above ground biomass, relative frequency, relative density, relative dominance and important values of tree species revealed that Duabanga moluccana *tops the list of the tree species studied with respect to dominance. This was followed by* Knema ashtonii, Agathis lanceolata, Lithocarpus cantleyanus *and* Litsea ochracea. *The least dominant species was* Xanthophyllum schizocarpum *and followed by* Baringtonia sarcostachys, Shorea maxwelliana, Alseodaphne insignis, Litsea resinosa, Beilsmedia pauciflora, Alseodaphne foxiana, Endiandra kingiana *and* Litsea machilifolia.

INTRODUCTION

The Crocker Range National Park (CRNP) is located on the southern section of the Crocker Mountain Range in Northwest Borneo, Sabah, Malaysia. A large extent of tropical rainforest highland divides the west coast of Sabah from the remote interior regions of the state. The Crocker Range consists of several rugged and uninhabitable peaks over 1500m, including G. Alab (1964m), G. Tambuyukon (2579m), G. Trusmadi (2642m) and G. Kinabalu (4218m). The rich forest resources that have been most vulnerable to unsustainable exploitation here include both timber and non-timber products. In an effort to conserve the integrity of the forest habitats of Crocker Range, the Sabah State government had declared two National Parks within the range. To the southwest is the Crocker Range National Park (the location for the Crocker XCPD'99) and to the north is the Kinabalu Park. While the plants of Kinabalu Park have been amply studied and documented since as far back as 1894 by Stapf to as recently as Beaman and Beaman (1998), the information on the flora of CRNP remains scanty.

Today the vegetation of the CRNP consists of many sizeable patches of lowland forests that have been cleared for agriculture and human settlements, the remaining larger portion of undisturbed mixed dipterocarp forests (MDF) and a stretch of pristine montane and upper montane moss forests on its many peaks. The uniqueness of most MDF in Borneo is in its very high species diversity (Ashton 1964; Austin et al. 1973; Baillie & Ashton 1983; Baillie 1987) and the dynamics of its regeneration process in the aftermaths of natural disturbances (Hortshorn 1978; Whitmore 1984; Brokaw 1985 & 1987; Clark & Clark 1984; Denslow 1987). Other aspects of MDF that have attracted the attention of many plant taxonomists and ecologists in Borneo include its complex floristic composition (Yamakura et al. 1986), tree sizes (Sukardjo et al. 1990), tree forms (Yamakura et al. 1987) and its high above-ground biomass (Yamakura et al. 1986b). Information on floral composition, diversity and biomass estimation are absolutely pertinent in our understanding of the forest ecosystem dynamic (Leigh et al. 1985; Gentry 1990;

Hartshorn 1990). During the Crocker Range XPDC 2000, a study was undertaken to sample and describe the density, diversity and floristic composition of a small patch of mixed dipterocarp forest formation at Mahua, Crocker Range National Park, Sabah.

MATERIALS AND METHODS

A survey was conducted in the MDF at Mahua, CRNP Sabah. Plots of 20 x 20m were used to analyse the floristic composition of tree taxa in this vegetation. All trees with 5cm diameter breast height (dbh) were measured, enumerated and identified. The voucher specimen of most trees were prepared and identified at the Herbarium of Sarawak Forest Department. The calculation of importance value (Iv) of each tree species within the plot was done as describe by Soepadmo (1987). From the calculated importance values, individual tree species can be ranked for their dominance.

The estimated above ground biomass of every plot was assessed by deriving the allometric equations as described by Yamakura et al. (1986b) and Kato (1979). The estimation was based on the diameter of each tree at breast height to obtain the total biomass of leaf, branch and stem portions.

RESULTS

The species composition is considered moderately diverse. It has a total of 44 species where *Duabanga moluccana* represents the most dominant species (Iv = 24.54). *Duabanga moluccana* also contributed 17.49% of the total basal area in this forest association. The co-dominant species are *Knema ashtonii* (Iv =14.87), *Agathis lanceolata* (Iv =12.68), *Lithocarpus cantleyanus* (Iv =12.30) and *Litsea ochracea* (Iv =9.90). The least dominant species is *Xanthophyllum schizocarpum* (Iv = 2.02) and followed by *Baringtonia sarcostachys* (Iv= 2.04), *Shorea maxwelliana* (Iv = 2.16), *Alseodaphne insignis* (Iv =2.16), *Litsea resinosa* (lv = 2.17), *Beilsmedia pauciflora* (lv =2.18), *Alseodaphne foxiana* (Iv = 2.21), *Endiandra kingiana* (lv = 2.36) and *Litsea machilifolia* (Iv = 2.38). The MDF has a total estimated above ground biomass of 1737.4 tonnes/ha. *Duabanga moluccana* contributed the most, followed by *Knema ashtonii, Agathis lanceolata* and *Lithocarpus cantleyanus*

Table 1. Relative density (Rd), relative frequency (Rf), relative dominance (RD) and importance value (Iv) of tree species with DBH of 5cm at Mahua. Crocker Range National Park, Sabah.

Species	Rd	Rf	RD	Iv
Duabanga moluccana	3.82	3.23	17.49	24.54
Knema ashtonii	4.64	3.63	6.60	14.87
Agathis lanceolata	1.91	2.42	8.35	12.68
Lithocarpus cantleyanus	6.28	4.03	1.98	12.30
Litsea ochracea	0.55	0.81	8.54	9.90
Canarium divergens	3.55	2.82	0.26	6.63
Chionanthus montana	2.19	1.61	2.76	6.56
Knema cinerea	0.82	0.80	4.93	6.55

Bhesa paniculata	2.19	2.02	1.85	6.05
Diospyros borneensis	1.09	0.81	3.38	5.28
Chionanthus cuspidatus	1.91	2.02	0.94	4.87
Canarium asperum	2.19	1.21	1.22	4.62
Baccaurea javanica	1.37	1.21	1.41	3.99
Gluta speciosa	2.46	1.21	0.21	3.87
Litsea fenestrata	1.09	1.21	1.49	3.80
Aglaia crassinervia	1.64	1.21	0.81	3.66
Endiandra falcata	1.37	1.61	0.65	3.63
Heheropsis maingaiyi	0.55	0.81	2.25	3.60
Litsea rubicunda	1.37	1.21	0.84	3.42
Teijsmanniodendron sarawakanum	1.37	1.61	0.42	3.40
Chionanthus laxiflorus	1.91	0.81	0.67	3.39
Artocarpus limpato	1.64	1.61	0.10	3.36
Endocomia virella	1.37	1.61	0.20	3.18
Podocarpus imbricatus	1.37	1.61	0.15	3.12
Callophyllum gracilipes	1.37	0.81	0.95	3.12
Garcinia dulcis	0.27	0.40	2.33	3.01
Diospyros ferruginescens	0.82	1.21	0.94	2.97
Euonimus javanicus	1.09	1.61	0.21	2.92
Lithorcapus falvoneri	1.09	1.61	0.17	2.88
Baccaurea reticulata	1.37	1.21	0.24	2.81
Garcinia forbesii	1.37	0.40	1.02	2.79
Lithocarpus contragosus	0.55	0.81	1.41	2.76
Stemonurus malaccensis	0.82	0.81	0.98	2.61
Dyera costulata	1.37	0.81	0.28	2.45
Callophyllum biflorum	1.09	0.81	0.53	2.42
Litsea machilifolia	1.09	0.81	0.48	2.38
Endiandra kingiana	0.27	0.40	1.68	2.36
Alseodaphne foxiana	0.27	0.40	1.53	2.21
Beilsmedia pauciflora	0.55	0.81	0.82	2.18
Litsea resinosa	0.82	1.21	0.14	2.17
Alseodaphne insignis	0.55	0.81	0.81	2.16
Shorea maxwelliana	1.09	0.80	0.23	2.16
Baringtonia sarcostachys	0.82	0.81	0.42	2.04
Xanthophyllum schizocarpum	0.82	0.81	0.39	2.02

Table 2. Estimated above ground biomass of trees with a DBH of 5cm of forest at Mahua, Crocker Range National Park, Sabah (Ws = Weight of stems; Wb = Weight of branches; Wl = Weight of leaves).

Species	**Ws (kg)**	**Wb (kg)**	**Wl (kg)**	**Biomass (kg)**
Duabanga moluccana	18299.12	3446.42	233.45	21978.99
Knema ashtonii	11269.14	2316.76	97.00	13682.90
Agathis lanceolata	10623.89	2105.97	105.31	12835.17
Lithocarpus cantleyanus	6775.13	1224.85	105.54	8105.52
Litsea ochracea	5592.42	1096.2	60.13	6748.76
Canarium divergens	3244.51	587.79	48.64	3880.95
Chionanthus montana	2687.96	496.23	39.45	3223.64

Knema cinerea	2222.32	417.39	28.01	2667.73
Bhesa paniculata	2138.71	400.69	27.33	2566.73
Diospyros borneensis	1831.38	340.06	24.31	2195.75
Chionanthus cuspidatus	1614.20	297.51	22.16	1933.87
Canarium asperum	1601.08	294.64	22.29	1918.01
Baccaurea javanica	1547.92	283.17	22.56	1853.65
Gluta speciosa	1365.43	243.10	23.57	1632.10
Litsea fenestrata	1272.40	231.25	18.61	1522.26
Aglaia crassinervia	1017.17	176.94	18.37	1212.48
Endiandra falcata	992.30	170.07	19.61	1181.98
Heheropsis maingaiyi	983.59	176.06	15.41	1175.06
Litsea rubicunda	911.15	162.36	14.57	1088.07
Teijsmanniodendron sarawakanum	872.78	155.13	14.12	1042.03
Chionanthus laxiflorus	866.92	132.56	28.74	1028.23
Artocarpus limpato	861.82	148.12	17.17	1027.11
Endocomia virella	745.74	126.40	15.47	887.61
Podocarpus imbricatus	726.17	125.04	14.09	865.30
Callophyllum gracilipes	685.12	120.05	11.82	816.99
Garcinia dulcis	643.76	112.39	11.29	767.44
Diospyros ferruginescens	630.77	109.99	11.13	751.89
Euonimus javanicus	610.88	102.16	13.04	726.08
Lithorcapus falvoneri	575.77	98.96	11.07	685.80
Baccaurea reticulata	554.61	94.30	11.52	660.44
Garcinia forbesii	539.04	92.11	10.77	641.92
Lithocarpus contragosus	528.13	91.13	9.77	629.03
Stemonurus malaccensis	506.21	87.13	9.47	602.81
Dyera costulata	498.89	76.36	16.02	591.28
Callophyllum biflorum	480.97	82.54	9.12	572.63
Shorea maxwelliana	404.17	66.55	9.82	480.55
Endiandra kingiana	397.31	67.41	7.93	472.65
Alseodaphne foxiana	358.28	60.42	7.35	426.06
Baringtonia sarcostachys	357.36	58.92	8.62	424.90
Litsea resinosa	351.53	56.54	9.10	417.17
Alseodaphne insignis	338.30	55.31	8.35	401.96
Litsea machilifolia	273.47	41.35	9.51	324.32
Beilsmedia pauciflora	270.53	44.87	5.98	321.39
Xanthophyllum schizocarpum	248.61	41.03	5.62	295.26
TOTAL = 1737.4 tonnes/ha				

DISCUSSION

A reliable estimate of a forest ecological value and its net primary productivity can be indicative of its total yield of commercial products. Such information can hence foretell the viability of any intended silvicultural practice or the success of any conservation programme planned for the CRNP. Generally the estimated total biomass of the Mahua mixed dipterocarp forest seems to mirror the values previously documented by other researchers who had worked in different parts of the tropical rain-forests in Southeast Asia (Yamakura et al. 1986b; Kato et al. 1979;

Soepadmo 1987; Yamada 1975, 1976; Grubb 1977; Edwards & Grubb 1977; Martin 1977; Kira 1978 and Proctor et al. 1983). The forest has a total biomass of 1737.4 tonnes/ha. The high value of the total estimated above ground biomass of MDF was similarly recorded by Soepadmo (1987). He recorded a value of 2101.0 tonnes/ha at Gunung Janing, Taman Negara. The tallest and largest tree recorded was *Shorea curtisii* which was about 40.7m and 70.0cm respectively. In our recent assessment at Batu Lawi, Bario, a similarly high value was generated for plots that harbour several giant mature trees (Ipor et al. 1998). In this area, trees of *Agathis alba* gave DBH values exceeding 120cm and attaining heights more than 50m. This species contributed approximately 20% of the total estimated above ground biomass. Our present result for MDF of Mahua gave similarly high value for its biomass and here the major contributory factor is the huge size of the Dipterocarp trees found in the area. In the 52ha plot of MDF at Lambir National Park, Yamakura et al. (1995) reported distinct variations in the biomass values generated between plots. Here they recorded the highest biomass of 1900 tonnes/ha.

Our study revealed that the vegetation at Mahua MDF exhibit moderate diversity of tree species despite having high density of plants. The high plant diversity coupled with the occurrence of dense plant population in diverse habitat types of MDF can provide the faunal inhabitants of the CRNP with a wide range of food sources. Cant (1980) and Terborg (1986) postulated that the primate densities are primarily determined by the availability of food sources within their home range. The wide variety of food sources is important to enable the wildlife inhabiting the area to switch their dietary strategies particularly during periods of low food availability (Yeager 1989). In this respect the MDF of Mahua CRNP is deemed capable of supporting a rich and diverse animal community and therefore serve as a suitable conservation area for the protection of Sabah' s flora and fauna.

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