

Vegetation Analysis of Mt. Maculot, Cuenca, Batangas, Philippines

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Abstract. The vegetation type of Mt. Maculot, Cuenca, Batangas, Philippines was investigated by determining the tree species composition, abundance and dominance using Point Center-Quarter Method (PCQM). This study also focused on the ecologically important species necessary for identifying appropriate measures for biodiversity conservation. Five 100-m transect lines were established along the selected areas of the mountain based on altitudinal range at 100-m interval. Trees encountered along the transects were tagged, the distance from the center and the diameter at breast height (dbh) were measured individually. Voucher specimens for each tree were collected for proper identification. The data were then analyzed and the Shannon's and Simpson's indices were computed. Results showed that 61 species belonging to 51 genera and 28 families were encountered. The tree species with highest importance value index (IVI) were: *Canarium asperum* Benth (Burseraceae), *Diplodiscus paniculatus* Turcz. (Malvaceae), *Bischoffia javanica* Bl. (Phyllanthaceae), and *Palaquium philippinense* (Perr.) C.B. Rob. (Sapotaceae). They were also recognized as the dominant species in the area. The area had 22.97% endemism which is considered high. Based on the data, it is suggested that the mountain should be conserved and long-term ecological research should be conducted.

Keywords: Biological diversity, endemic species, importance value index. Mt. Maculot, Philippines, vegetation analysis

1. Introduction

Mt. Maculot situated between 13°55.241'N latitude and 121°02.513'E longitude is found in the Southern part of Luzon and located adjacent to Mt. Makiling and part of Cuenca, Batangas. It has an altitude of 200 to 963 masl. It is considered as one of the popular mountains in Batangas often visited by mountaineers and even by Catholic devotees.

Although Mt. Maculot is not yet classified as a Protected Area (PA), the forest still had intact vegetation and with high diversity, worthy to be classified as a PA. There is a dearth of research data, such as the physico-chemical and edaphic factors in the area. At present, the vegetation is still intact with high diversity. Hence, there is a need to determine the tree species composition, relative abundance and diversity indices of the forest through vegetation analysis and to determine the ecologically important species in the areas in order to recommend measures for biodiversity conservation. The data obtained from this research will serve as baseline information in demarcating boundaries of areas for biodiversity protection and conservation.

2. Methodology

The study was focused on the tree species found within five transects (100-meter plot) in Mt. Maculot. The selection of transects was based on altitudinal ranges. These plots were delineated in every 100-m interval starting from 500 up to 900 masl. The selected sites were analyzed using Point Center – Quarter Method (PCQM) employed by Sajise and Cuevas (1995). Voucher specimens for each individual tree were collected. The specimen were processed in the laboratory and deposited in the DLSU-D herbarium.

Preliminary identification was done by examining the morphological characters of the specimen and was brought to Philippine National Herbarium (PNH) Manila, Philippines for further verification. The ecological formula in vegetation studies were used in the computation and analysis. Likewise, Shannon and Simpson's indices were also used in computing diversity indices.

3. Results

A total of 198 tree individuals were encountered in 5 plots. These tree individuals are further classified into 25 families, 51 genera and 61 species. The present study is not comparable to Mt. Kinasalapi (1-hectare plot study) having 43 species (Pipoly and Madulid 1997). It can still be inferred that the area is still diverse considering that only limited plots are sampled. For a non-permanent plot inventory using 14 plots (Medecilo and Luyon 2006) 96 species were encountered in 14 plots which is very high or diverse.

Species Diversity and Endemism

Five transects consisting of 198 tree individuals were classified into 28 families, 51 genera and 61 species. The data proved higher diversity since in 1-hectare plot in tropical forest, the number of species would range from 140 to 300 species (Pipoly and Madulid 1997). The size of the plot was less than 1-hectare so it can be implied that Mt. Maculot presents a high species richness. The most represented family was Moraceae consisting of 7 species belonging to 3 genera. *Ficus* was the most represented genus with 5 species followed by Euphorbiaceae, Lauraceae, Malvaceae, Meliaceae, and Sapindaceae with 4 species each (Table 1).

As to endemism, 14 or 22.95% species are endemic while 3 species are vulnerable. The unique feature of the mountain presents a serious conservation effort to protect the wildlife and plant species in the area. This means that the area should be conserved to prevent loss of endemic as well as vulnerable species. The endemic species are *Aglaia rimosa*, *Antidesma pentandrum*, *Canthium gynochodes*, *Caryota rumphiana*, *Diplodiscus paniculatus*, *Euphoria didyma*, *Guioa koelreuteria*, *Clausena anisum-olens*, *Homalanthus rotundus*, *Litchi chinensis*, *Neotrewia cumingii*, *Pterospermum divrsifolium*, *Semecarpus cuneiformis*, and *Voacanga globosa*. Three species such as *Dillenia philippinensis*, *Palaquium philippinenses* and *Wrightia pubescens* are considered as vulnerable species by the International Union for Conservation Network (IUCN 1994).

Important Value Index

The density of the plot consists of 198 tree individuals in 5 transects (500 m). The density determines in part and is determined by energy flow, resource availability and utilization, physiological stress, dispersal, and productivity of population (Smith and Smith 2002). The density of trees can be used in timber management and evaluation of site quality. In the present study, tree density was high with 198 individuals indicating that the area is diverse.

Table 1. Species Composition of Mt. Maculot, Cuenca, Batangas

Species	Dens.	Basal Area (cm ²)	Rel. Dens.	Rel. Freq.	Rel. Dom.	IVI
Apocynaceae						
<i>Ervatamia pandacaqui</i> (Poir.) Pich	1	394.98	0.83	0.94	0.41	2.179
<i>Voacanga globosa</i> (Blco.) Merr.	1	247.55	0.83	1.03	0.11	1.970
<i>Wrightia pubescens</i> R. Br.	1	702.19	0.83	1.03	0.32	2.175
Annonaceae						
Annonaceae indet.	1	1267.93	2.5	2.94	1.82	7.26
Araliaceae						
<i>Schefflera</i> sp.	2	5074.45	0.833	1.02	5.15	6.999
Boraginaceae						
<i>Cordia dichotoma</i> Forst. f.	5	192.12	1.403	1.40	0.95	3.748
Burseraceae						
<i>Canarium asperum</i> Benth	16	1051.28	6.67	5.25	10.80	22.708

Cornaceae						
<i>Alangium chinense</i> (Lour.) Harms	1	4118.71	1.38	2.74	0.45	3.201
Dilleniaceae						
<i>Dillenia philippinensis</i> Rolfe	1	274.29	0.876	1.06	0.20	2.135
Euphorbiaceae						
<i>Macaranga</i> sp.	1	1963.44	1.752	1.06	2.87	5.683
<i>Mallotus paniculatus</i> (Lam.) Muell.-Arg.	1	428.59	0.44	0.94	0.44	2.231
<i>Mallotus philippinensis</i> (Lam.) Muell.-Arg.	8	386.955	1.343	1.63	1.343	3.404
<i>Neotrewia cumingii</i> (Muell.-Arg.) Pax & K. Hoffm.	2	560.19	3.93	0.64	1.87	9.434
Fabaceae						
<i>Gliricidia sepium</i> (Jacq.) Kunth ex Walp.	1	198.18	0.83	1.03	0.09	1.948
Flacourtiaceae						
<i>Homalium</i> sp.	1	617.16	0.83	1.03	0.28	2.137
Icacinaceae						
Icacinaceae indet.	2	167.49	0.83	0.99	0.08	1.904
Lauraceae						
Lauraceae indet.	1	1547.19	0.83	1.09	0.76	2.561
<i>Litsea perrottetii</i> (Bl.) F.-Vill.	6	1216.30	2.50	1.90	1.22	5.619
<i>Litsea</i> sp.	4	834.28	3.51	2.11	2.44	8.063
<i>Machilus philippinensis</i> Merr.	2	1915.43	1.67	1.87	0.01	3.543
Leeaceae						
<i>Leea guineensis</i> G. Don	2	348.87	1.25	1.61	0.39	3.249
Malvaceae						
<i>Diplodiscus paniculatus</i> Turcz.	11	3311.00	4.58	3.21	14.12	21.913
<i>Grewia multiflora</i> Juss.	1	1327.59	0.88	1.06	0.97	2.906
<i>Pterospermum diversifolium</i> Bl.	4	1390.76	1.67	0.99	1.35	3.892
<i>Pterospermum obliquum</i> Blco.	1	274.29	0.83	1.09	0.21	2.139
Meliaceae						
<i>Aglaia rimosa</i> (Blco.) Merr.	14	532.73	2.94	2.56	1.5	2.937
<i>Dysoxylum arborescens</i> (Bl.) Miq.	1	1124.78	0.83	0.94	1.16	2.934
<i>Guioa koelreuteria</i> (Blco.) Merr.	1	394.98	0.83	1.03	0.18	2.036
<i>Harpullia arborea</i> (Blco.) Radlk.	1	680.42	0.83	1.03	0.32	2.175
Moraceae						
<i>Artocarpus heterophyllus</i> Lamk.	1	331.90	0.83	1.03	0.15	2.008
<i>Ficus gul</i> Laut. & K. Schum	1	428.59	1.67	2.19	0.43	4.284
<i>Ficus pubinervis</i> Bl.	1	1297.59	0.83	1.09	1.01	2.939
<i>Ficus septica</i> var. <i>septica</i> Burm. f.	2	1235.70	0.83	1.03	0.88	2.739
<i>Ficus variegata</i> Bl.	2	3642.03	1.67	1.93	3.60	7.192
<i>Ficus</i> sp. 1	6	325.67	4.10	4.68	2.02	11.701
<i>Streblus asper</i> Lour.	6	483.36	1.67	1.99	0.81	4.459
Myrsinaceae						
<i>Maesa</i> sp.	1	724.31	0.88	1.06	0.54	2.472
Myrtaceae						
<i>Syzygium</i> sp.	1	518.59	0.83	0.94	0.54	2.307
Palmae						
<i>Caryota rumphiana</i> Mart.	7	1271.04	1.18	1.40	1.21	3.783
Phyllanthaceae						
<i>Antidesma pentandrum</i> (Blco.) Merr.	2	706.05	0.83	0.96	0.63	2.423
<i>Bischoffia javanica</i> Bl.	6	3750.04	4.98	4.82	11.12	20.936
Rosaceae						
<i>Prunus grisea</i> (C. Muell.) Kalkm.	2	2794.03	0.86	1.07	2.10	4.031
Rubiaceae						
<i>Canthium gynoethodes</i> Baill	1	247.55	0.83	0.94	0.26	2.026
<i>Neonauclea merrillii</i>	1	107.15	0.88	1.06	0.08	2.013
<i>Psychotria</i> sp.	1	651.79	0.83	0.95	0.45	2.231
Rutaceae						
<i>Clausena anisum-olens</i> (Blco.) Merr.	1	481.56	0.83	0.94	0.50	2.268
<i>Murraya</i> sp.	15	450.77	4.16	3.74	1.31	9.221
Rutaceae indet.	2	5383.03	1.75	2.11	7.88	11.742
Sapindaceae						
<i>Arytera littoralis</i> Bl.	4	420.17	1.25	1.06	0.36	2.666
<i>Euphoria didyma</i>	6	632.33	4.98	4.10	1.71	10.803
<i>Litchi chinensis</i> subsp. <i>philippinensis</i> Sonn.	2	197.58	1.67	2.05	0.18	3.892
<i>Mischocarpus pentapetalous</i> (Roxb.) Radlk.	1	1547.19	0.83	1.03	0.70	2.556
Sapotaceae						
<i>Palaquium philippinense</i> (Perr.) C.B. Rob	2	1944.44	4.38	4.23	7.11	15.723
<i>Pouteria duclitan</i> (Blco.) Baehni	1	1714.34	0.88	1.06	1.25	3.189
Urticaceae						

<i>Leucosyke capitellata</i> (Poir.) Wedd.	1	288.44	0.83	0.99	0.14	1.964
<i>Villibrunea trinervis</i> Wedd.	7	333.222	3.05	3.19	0.86	7.095
Unknown1	1	2306.82	0.83	0.96	1.14	2.936
Unknown2	2	913.17	0.83	1.09	0.71	2.639
Unknown3	3	107.15	0.83	1.09	0.21	2.139
TOTAL	198	69212.76	100.00	100.00	100.00	300.00

The species with the highest density was *Canarium asperum* with 16 individuals or 6.66% of all stems. *Murraya* sp. was represented by 15 individuals (4.16%), *Aglaiia rimosa* had 14 individuals or accounted for 2.93% of all stems. *Diplodiscus paniculatus* was represented by 11 individuals (5.56%), and *Neotrewia cumingii* had 9 individuals or 4.55% of all individuals. Twenty seven species were represented by only 1 individual.

The most dominant species were *Diplodiscus paniculatus* with a dominance value of 14.12%, *Bischoffia javanica* (11.12%), *Canarium asperum* (10.80%), Rutaceae (7.88%) and *Palaquium philippinense* (7.11%). The large basal area contributes to their dominance within the community. High importance value index were manifested among *Canarium asperum* (22.71%), *Diplodiscus paniculatus* (21.91%), *Bischoffia javanica* (20.94%), *Palaquium philippinense* (15.72%), and Rutaceae indet. (11.74%). This figure is comparable with any tropical forest inventories which range from 12.5 to 52.4 (Pipoly and Madulid 1997). In the study made by (Medecilo and Luyon 2006), the species with the highest IVI was *Shorea guiso* having a value of 12.32% which is lower compared to our data.

The structure of the forest of Mt. Maculot is similar in physiognomy to the forest of Mt. Makiling (Brown 1919) and Mts. Palaypalay/Mataas na Gulod (Medecilo and Luyon 2006). However, it differs from the two in the absence of dipterocarp species in the lower elevation thus, classifying it as semi-deciduous forest, midmontane forest and mossy. The absence of dipterocarps can be attributed to the agricultural crops planted in the areas, an evidence of conversion of the mountain into agricultural lands. In addition, *Barangay Pinagkaisahan* side was observed with human trails for mountaineers and other climbers.

The genera *Canarium*, *Palaquium*, *Syzygium*, *Dillenia*, *Diplodiscus*, *Cordia*, and *Ficus* are usually associated with lowland dipterocarp forest (de Guzman *et al.* 1995) as in the case of other Philippine forest, however, this result suggests that the mountain may have been a dipterocarp forest but because of slash and burn farming method the lower portion was converted to agricultural land. It is observed that at lower elevation, (200-400 masl) the forest is classified as agricultural land. Species of fruit trees, such as coconut (*Cocos nucifera*), mango (*Mangifera indica*), banana (*Musa sapientum*), lansones (*Lansium domesticum*), and other root crops like gabi (*Colocasia esculenta*) were evident. An interview with local residents revealed that some of them converted their lands within the mountain area into agricultural land.

At higher elevation 500-600 masl, patches of secondary forest can be observed. Species like *Antidesma pentandrum*, *Mallotus philippinensis*, *Murraya* sp., *Leea guineensis*, etc. are abundant in this altitude. The presence of these species indicates that the area is a secondary forest.

The present threat in the park are garbages dumped by irresponsible climbers. Garbages can harm the wildlife as well as the plant species found in the area. Thousands of people climb the mountain especially during Holy Week as part of their religious activities. As a result small business center were also built in the midland area of Mt. Maculot. Materials used in camping were left and thrown everywhere in the area. This may lead to suffocation of small animals and herb species such as grasses, zingibers, ferns, and terrestrial orchids that were observed to be abundant in the area.

Illegal logging, agricultural expansion, and deforestation were not observed in the park. The local government of Cuenca, Batangas fully supports the government program to conserve Mt. Maculot. The people are also aware on the effects if they will disturb the forest. During the conduct of the study, the researchers saw people carrying harvested logs coming from the forest for post purposes but in very small quantity. This is not an alarming scenario but if this activity will continue, this will also harm other species that are dependent on the species that they are harvesting. In Brgy. Don Juan side, the lower portion of the forest was cleared to be planted with agricultural crops.

Inventories of animals and other organisms aside from trees may also be investigated to establish plant and animal relationship and other plant types such as herbs and shrubs. Information regarding the biodiversity of the mountain should be disseminated to the locals. Complete plant and animal inventory should be conducted to establish a set of baseline information and to propose mechanisms for the conservation of the species with economic, scientific, and ecological importance.

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