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Diversity and Community Structure of Plants in Selected Areas within Lake Mainit Watershed

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Abstract:- Lake Mainit is one of the key biodiversity areas in the country, its watershed area is a habitat of endemic and native plant species but is now threatened due to anthropogenic activities such as mining, kaingin and expansion of agriculture. This study assessed the diversity and community structure of plants in the lowland and upland of the two selected areas (Cantugas and Jabonga) of Lake Mainit watershed through a transect and quadrat method. A total of 321 floral species were identified distributed into 85 families. The taxonomically well distributed families were Arecaceae, Moraceae and Fabaceae with 18, 17 and 14 species respectively and most species were trees and shrubs (187 species). The highest species diversity, richness and abundance was observed in the lowland of Jabonga while the highest dominance was observed in the upland of Catugas. The floral species of Lake Mainit watershed are threatened by anthropogenic activities especially expansion of agriculture and tree felling for infrastructure developments regardless of their environmental roles and inherent benefits. Therefore, sustainable conservation efforts should be geared towards ensuring their continuous existence in order to maintain environmental integrity.

Keywords:- *Diversity, Community Structure, Lake Mainit.*

I. INTRODUCTION

Lake Mainit is considerably the most important ecosystem in the Philippines given its diverse potentials for food and habitat requirements of various flora and fauna. Covering approximately 17,340 hectares, Lake Mainit is the fourth largest lake in the Philippines. The shores of the lake are being shared by the provinces of Surigao del Norte and Agusan del Norte which stretched an approximate total of 62.10 km (Lake Mainit Development Alliance – Environmental Management Plan 2014).

Lake Mainit watershed is blessed with bountiful resources in both upland and lake ecosystems as shown in researches and studies conducted by various institutions (Gracia, 1981) as cited by Demetillo, et al, 2016. However, these data need to be monitored and reassessed due to the most likely occurrence of degradation because of human activities and a continuing decline in the amount of agricultural land per person which led to indiscriminate exploitation of natural resources particularly by the upland population in developing countries (Mahtab and Karim, 1992). As a result of increasing demand for firewood, timber, pasture, shelter and food crops, natural land covers, particularly tropical forests, are being degraded or converted to cropland at an alarming rate (Hall et al., 1993).

Moreover, assessment and validation of these data are imperative as the ecosystem is rapidly degrading as manifested by the recent occurrence of typhoon Basyang which brought about flash floods and a huge extent of cropland and infrastructure devastated or partially destroyed and this can be attributed to declining of terrestrial vegetation. Furthermore, assessment is necessary to determine whether previously identified species can still be found thriving in their respective habitat whose results could provide baseline information for concerned governing institutions like DENR, LMDA, and other stakeholders as a basis in their future planning and possible measures to undertake for conservation.

II. MATERIALS AND METHODS

➢ *Study Areas*

The study is within the Lake Mainit watershed area in the province of Surigao del Norte and Agusan del Norte. Two sites were chosen, site 1 at Barangay Cantugas, Mainit, Surigao del Norte and site 2 at San Pablo, Jabonga, Agusan del Norte. Each site covered lowland and upland areas.

The type of vegetations observed site 1 lowland were the dipterocarps and patches of premium tree species such as Pterocarpus indicus, Dao *(Dracontomelon dao)* and Kamagong *(Diospyrus philippensis).* Some rare wildlife flora and fauna are also found in the area such as Kalau and primate species as indicators of a regenerating tropical rainforest. Coconut trees intercropped with falcata and some agricultural crops were also observed. It has stony substrate and the ground covers are mostly ferns, grasses and wildlings with an elevation ranging from 200 to 500 meters above sea level. While the site 1 upland have patches of abandoned coconut and abaca plantation, dominated by endemic tree species and some notable wildlife such as *Rafflesia mixta* with an elevation ranging from 519 to 805 meters above sea level, a very steep slope with humus and rocky substrate, ground covers are mostly ferns, mosses, lianas and wildlings.

Site 2 is located in Sitio Dinarawan of Barangay San Pablo, Agusan del Norte. The area is adjacent to the lake with a very steep slope at lower portion and gradually becoming rolling at the ridge with intermittent water

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system and disturbed habitat due to hunting and gathering of forest products by forest occupants. The lowland area is shrubby forest, some portions are planted with falcata, coconut and other agricultural crops such as banana, pineapple and papaya. It has rocky substrate, elevation ranging from 98 to 221 meters above sea level, ground covers are mostly ferns, grasses, vines and wildlings. While the upland area was observed to have vegetation like ferns, Mangium plantation and endemic species of forest trees. The substrates found were humus and sandy substrate and elevation ranging from 421 to 522 meters above sea level. The most notable species is Mancono "the Philippine Iron wood".

➢ *Sampling design*

The transect and quadrat method was employed in the study. Two transects were established per area, laid in the lowland and the upland. Nine sampling plots with a dimension of 20m x 20m was laid along the two kilometers transect line with an interval of 250 meters. All floral species (fern, fern allies, grass, herbs, palms, trees and shrubs, vines) found within the sampling plots were recorded, measured, counted and assessed.

➢ *Plant species identification, endemicity and conservation status*

Plant species were identified with the help of local guides and collection of sample specimen for unidentified plants were done for further identification. Assessment in terms of conservation status and endemicity were based on the International Union for Conservation of Nature and Natural Resources (IUCN) and the Philippine List of Threatened Species DAO 2017-11 otherwise known as the Updated National List of Threatened Philippine Plants and their Categories.

➢ *Data Analysis*

The community structure of plants based on species abundance was also analyzed using a series of ecological community structure analysis including cluster analysis (CA) and non-metric multidimensional scaling (nMDS). Prior to the analysis, the abundance data was transformed using square root transformation technique and were subjected to Bray-Curtis similarity coefficient using Plymouth Routine in Multivariate Ecological Research (PRIMER 6) software.

The diversity of plants was computed using the Shannon-Wiener's diversity index (Shannon & Wiener, 1963), which indicates a quantitative description of plant species in terms of species distribution and evenness with the aid of Paleontological Statistics Software developed by Hammer, et al (2001).

➢ *Adequacy of Sampling Effort*

The species accumulation plot showed increased accumulation rates of plant species with increasing area sampled (Figure 1). This indicated a highly adequate sampling effort as depicted by the saturation and asymptotic curves of species richness estimators (i.e MM, UGE) and actual observed species (Sobs). The results were further supported by the similarity in the mean values of species estimators with observed species (Sobs). The actual observed species had a mean of 169 with standard deviation (Sobs SD) of 13.126 species. This value is the same with two species estimators, Michaelis Menten (MM) and UGE, with a mean value of 169 suggesting highly sufficient plant survey covering the majority of the species in the area. When bootstrapped at 999 permutations, it showed that 13 more species can be recorded if sampling intensity increases. However, the expected number of species to be found if sampling frequency increases may not affect the current sampling effort.

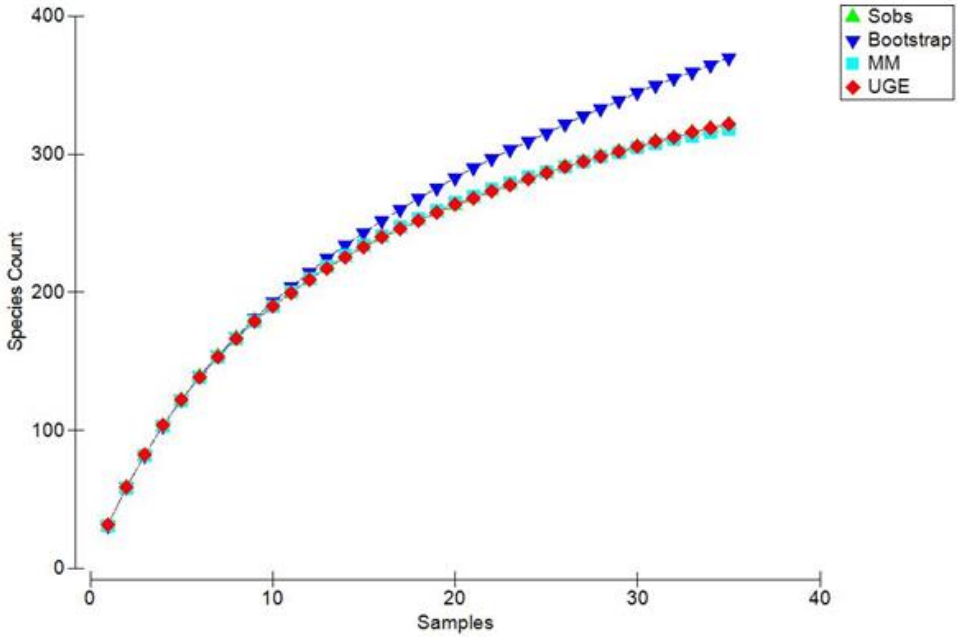

Fig 1:- Species Accumulation Curve of Terrestrial Flora in Jabonga and Cantugas Sampling Sites

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III. RESULTS AND DISCUSSIONS

➢ *Species Composition*

A total of 321 floral species distributed into 85 families were recorded within two sampling sites. As shown in figure 2, Site 2 (Jabonga) has the highest number of species with 260 observed and distributed in 79 families, while Site 1 (Cantugas) has 158 species distributed into 60 families.

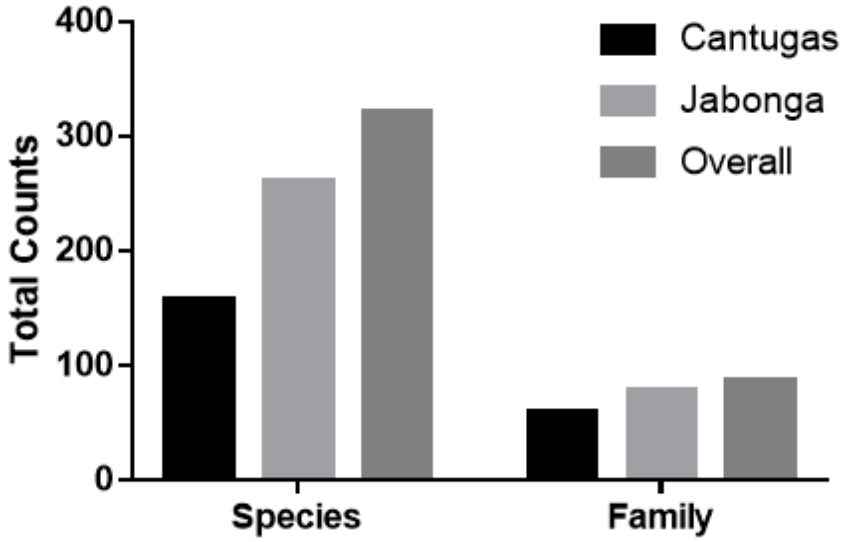

Fig 2:- The abundance of species and families of plants in Lake Mainit Watershed

The taxonomically well-represented families within the two sampling sites were Arecaceae, Fabaceae and Moraceae which registered the highest number of species with 18, 17 and 14 respectively (Table 1). In Jabonga: Arecaceae, Fabaceae, Moraceae were the most dominant families with 17, 13, 13 species respectively, while in Cantugas: Fabaceae, Arecaceae, Moraceae were the most dominant families with 9, 8, 8 species respectively. A similar study conducted by Demetillo et al (2015), Fabaceae, Moraceae, Myrtaceae, and Rubiaceae were amongst the most dominant families in the watershed area of Lake Mainit.

Rank	Jabonga	Cantugas	Overall
1	Arecaceae (17)	Fabaceae (9)	Arecaceae (18)
2	Fabaceae (13)	Arecaceae (8)	Fabaceae (17)
3	Moraceae (13)	Moraceae (8)	Moraceae (14)
4	Euphorbiaceae (10)	Araceae (7)	Euphorbiaceae (11)
5	Araceae (7)	Myrtaceae (6)	Araceae (10)
6	Dipterocarpaceae (7)	Euphorbiaceae (5)	Dipterocarpaceae (9)
7	Malvaceae (7)	Poaceae (5)	Myrtaceae (8)
8	Rubiaceae (7)	Dipterocarpaceae (4)	Rubiaceae (8)
9	Musaceae (6)	Rubiaceae (4)	Malvaceae (7)
10	Myrtaceae (6)	Asteraceae (3)	Musaceae (7)

Table 1:- The proportion of plant families representing the sampling sites. Shown are the top 10 most represented families and the number of species per family in parenthesis

Family Arecaceae is characterized by having various growth forms and can grow best in moist and shady areas and usually among the most cultivated plant families. Species of these families are often used as materials for constructions, food, handicrafts, rituals and therapeutics (Bates, 1988). Fabaceae family can thrive well in ultramafic areas with low amounts of essential nutrients because of its ability to fix nitrogen in the atmosphere with the help of associated Rhizobacteria in their roots. The importance of Fabaceae family for health and human alimentation is highlighted, although they also provide wood resources and dyes, resins, insecticides, fibers, fodder (Isely, 1982). The family Moraceae commonly known as mulberry or fig family has many representative species with cosmopolitan distribution and widely spread in different habitats of the tropical region.

The plant species recorded in the area were characterized into seven (7) plant habit groupings including herbs, grass, vine, palm, ferns, fern allies, and trees and shrubs (Table 2). Among the plant habits, Trees and Shrubs accounts the highest number of species with 58.255%,

followed by Herb (15.576%), Fern (7.165%), Vine (6.542%), Palm (5.607%), Grass (2.804%) and Fern Allies (0.935%). The abundance of trees and shrubs indicates that there is less to intermediate human-induced anthropogenic disturbance within two sites especially in the upland where the advance secondary forest was still present. It could also support the growth of herbs and vines in the forest floor. The abundance of palms and ferns indicates that the area was disturbed especially in the lowland where anthropogenic activities are very common such kaingin and establishment of coconut plantation which facilitates the growth of several fern species.

Plant Group	Jabonga	Cantugas	Overall
Fern	18	15	23
Fern Allies	3	3	3
Grass	7	5	9
Herb	41	28	50
Palm	16	8	18
Trees and Shrubs	157	90	187
Vine	18	9	21
Total	**260**	**158**	**321**

Table 2:- The seven plant habit groupings in the sampling sites. Values are number of species per plant group.

➢ *Species Diversity*

The floristic data collected in the field were subjected to diversity profiles and biodiversity analyses (Table 3; Figure 3). The diversity measurements were calculated including species richness, evenness, dominance, abundance, and Shannon diversity. When the resulting species abundance was pooled in each site, it showed that there is a moderate diversity in Cantugas lowland, low diversity in Cantugas upland and high diversity in Jabonga lowland and upland based on Fernando Biodiversity Scale (1998). The Jabonga lowland had the highest species richness, abundance, and Shannon Diversity. The highest dominance was observed in Cantugas upland. In contrast, Cantugas upland gave the lowest values of species evenness and Shannon Diversity. Evenness was almost the same in Cantugas lowland, Jabonga lowland and upland.

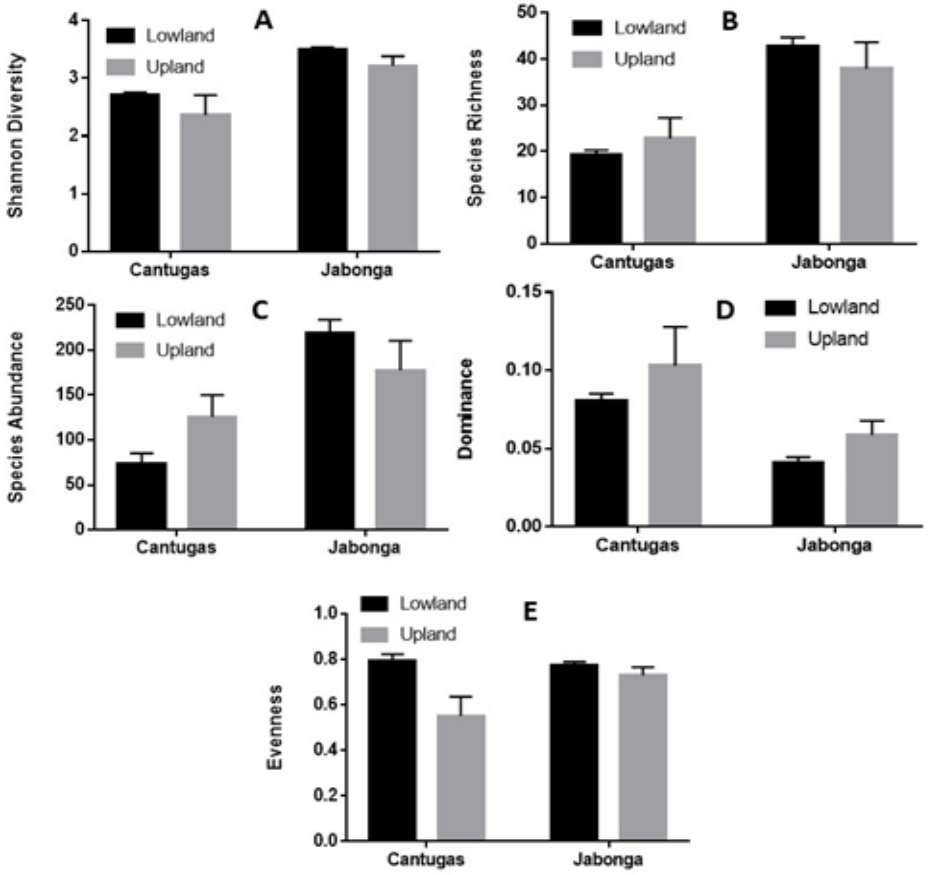

Fig 3:- The comparison of biodiversity indices in the sampling locations and elevation including a) Shannon diversity, b) Species Richness, c) Abundance d) Dominance and e) Evenness. Shown are mean ± SE of diversity indices.

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The plant diversity measurements were also analyzed and compared between sampling areas and elevation using Two-way ANOVA (Table 3). The analysis detected a significantly higher difference in species richness (F=26), species abundance (F=18.9), Shannon diversity (F=17.5) and dominance (F=9.6) between sampling areas. On the other hand, there is a significant difference in species evenness between elevations (F=8.65) and between elevation*sampling areas (F=4.3).

Test Factor and Source of Variation	Shannon diversity	Species Richness	Species Abundance	Dominance	Evenness
Sampling Areas	17.5***	26***	18.9***	9.6**	2.6
Elevation	2.5	0.03	0.06	2.1	8.65*
Elevation*Sampling areas	0.03	**1.22**	4.25*	0.03	4.3*

Table 3:- Two-way ANOVA results (F-ratios and significance levels) for the comparison of biodiversity measurements between sampling areas and elevations. Significance levels: "*" p< 0.05, "**" p< 0.01, and "***" p<0.001)

➢ *Community Structure and Ordination*

The community structure of plants based on species abundance was analyzed using a series of ecological community structure analysis including cluster analysis and non-metric multidimensional scaling (NMDS). Prior to the analysis, the abundance data was transformed using a square root transformation technique and was subjected to Bray-Curtis similarity coefficient. Then, the similarity matrix was used to analyze the community structure of plants using the previously mentioned analyses.

The cluster analyses through hierarchical agglomerative clustering method and non-metric multidimensional scaling (NMDS) were used to find natural grouping patterns of sites with similar species assemblages (Figure 5). Based on the dendrogram, there were three distinct groupings of plots sampled from the two sampling sites at 25% similarity. The biggest group form was comprised of all sampling plots from Jabonga lowland. On the other hand, all sampling plots from Cantugas lowland discriminate independently into two separate grouping patterns in the tree diagram. This suggested a unique plant species composition in the sites.

With NMDS, the relative position of sampling sites in the two-dimensional graph also explains the distribution of plant communities in the area. The analysis is non-metric therefore the plot has no scale. Similar to cluster analyses, there were four groups created at 25% similarity; the Jabonga lowland was pooled into one group with 20% similarity index, whereas Cantugas lowland was divided into two plant groups with 25% similarity index which suggest a lower species similarity or a unique plant grouping.

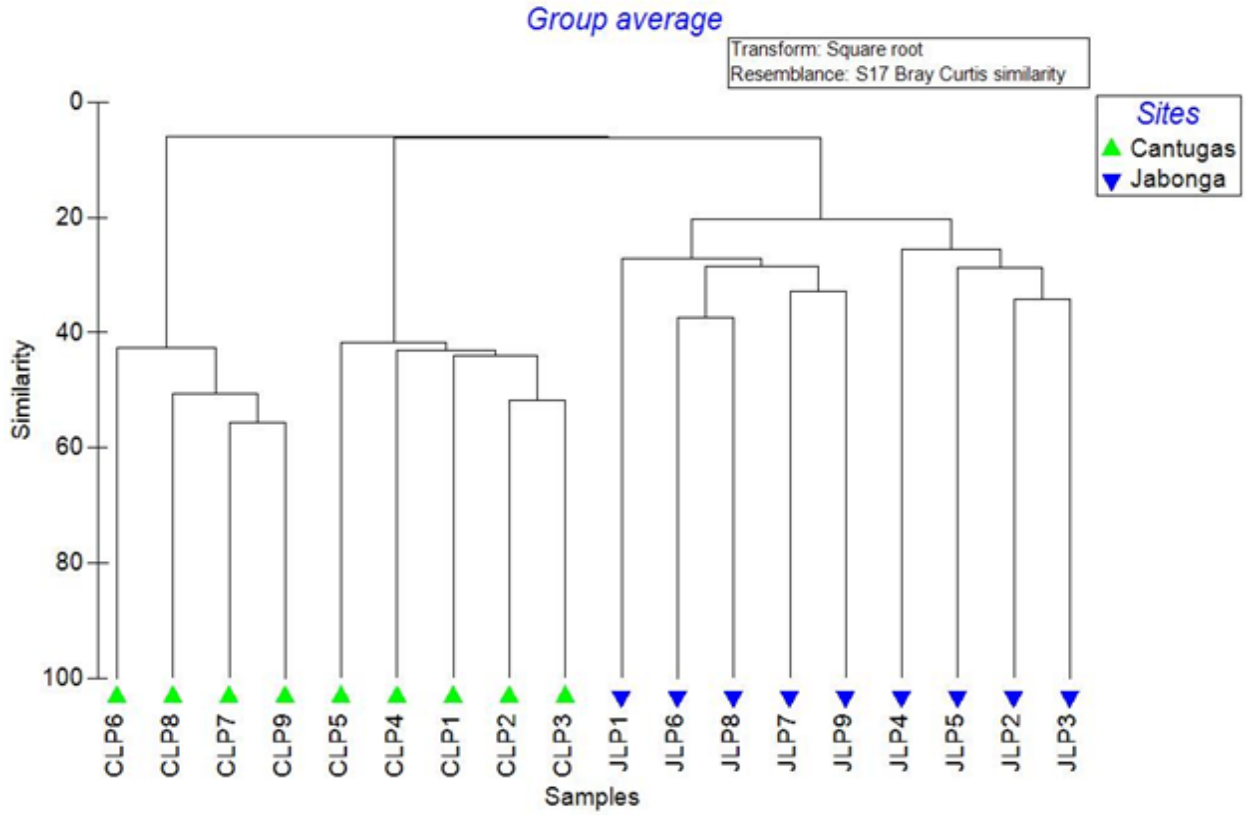

Fig 4

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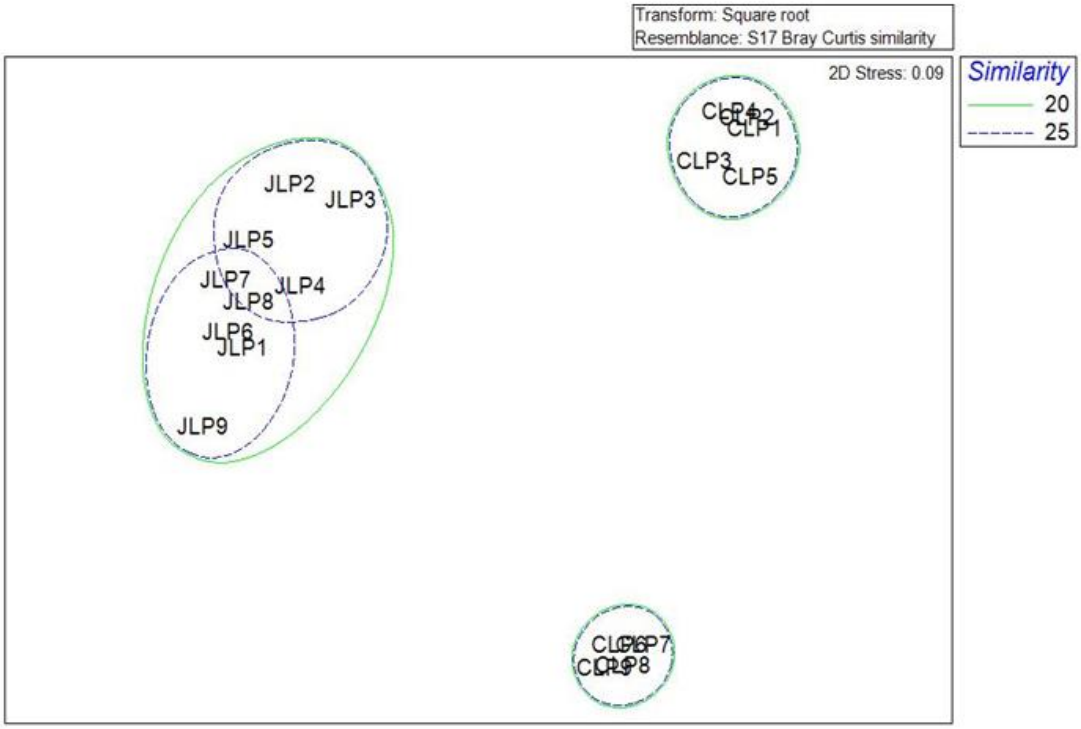
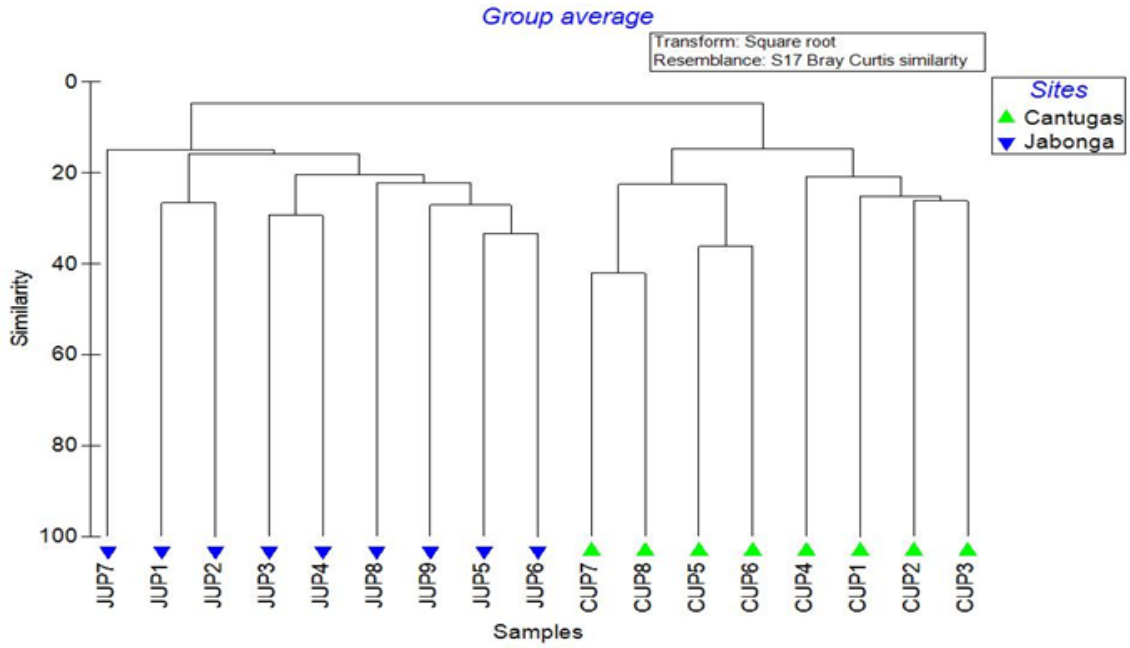


Fig 5:- Dendrogram of Cluster analysis and Non-metric Multidimensional scaling (NMDS) plot showing the Bray-curtis similarities of the terrestrial flora in lowland of Jabonga and Cantugas sampling sites

The dendrogram of Cantugas and Jabonga uplands on Cluster analysis and Non-metric Multidimensional scaling (NMDS) as shown in Fig. 6 suggest five plant groupings. The biggest group was comprised of six sampling plots from Jabonga upland which indicated the co-occurrence of floral species in these sampling plots. On the other hand, the Cantugas lowland discriminates independently into two separate grouping patterns in the tree diagram, in which plot 1 to 4 has a different plant composition from plot 6 to 8. This suggested a unique plant species composition in this site.

With 20% similarity in NMDS; the Jabonga upland formed the biggest group which indicates higher plant species similarity among the area, whereas Cantugas upland was divided into two plant groupings which suggest a lower species similarity or a unique plant grouping. Although, the overlapping of confidence ellipses to some degree may indicate overlapping of species composition probably due to the proximity of locations allowing exchanges of plant species within these areas.



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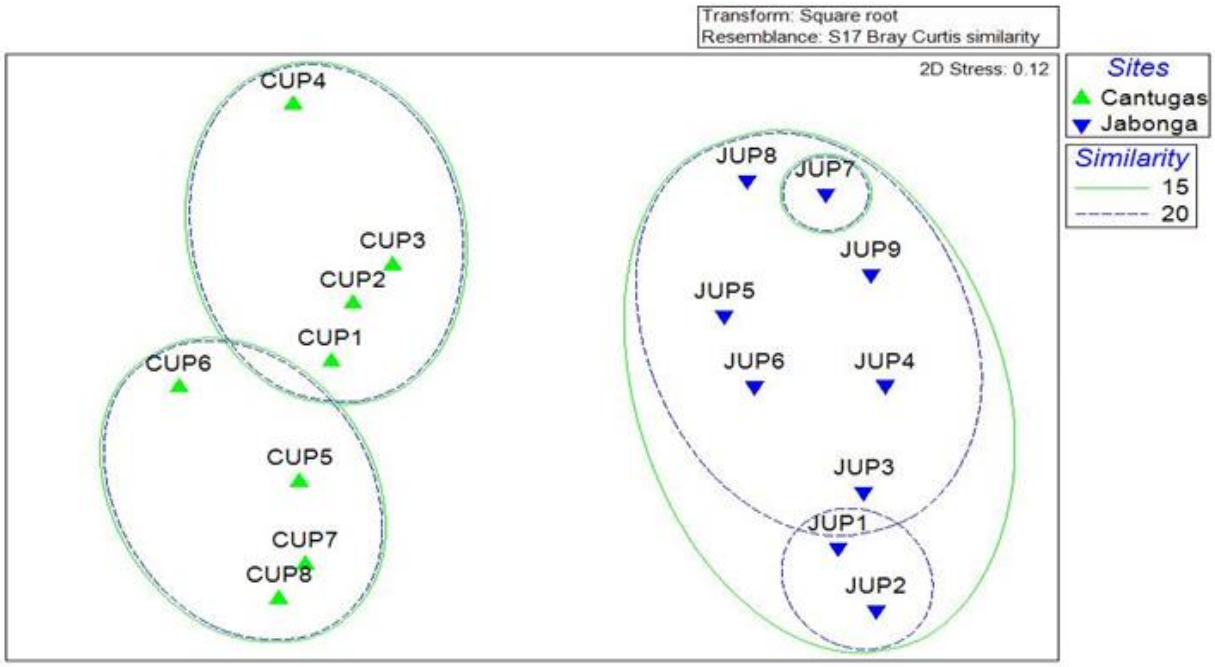
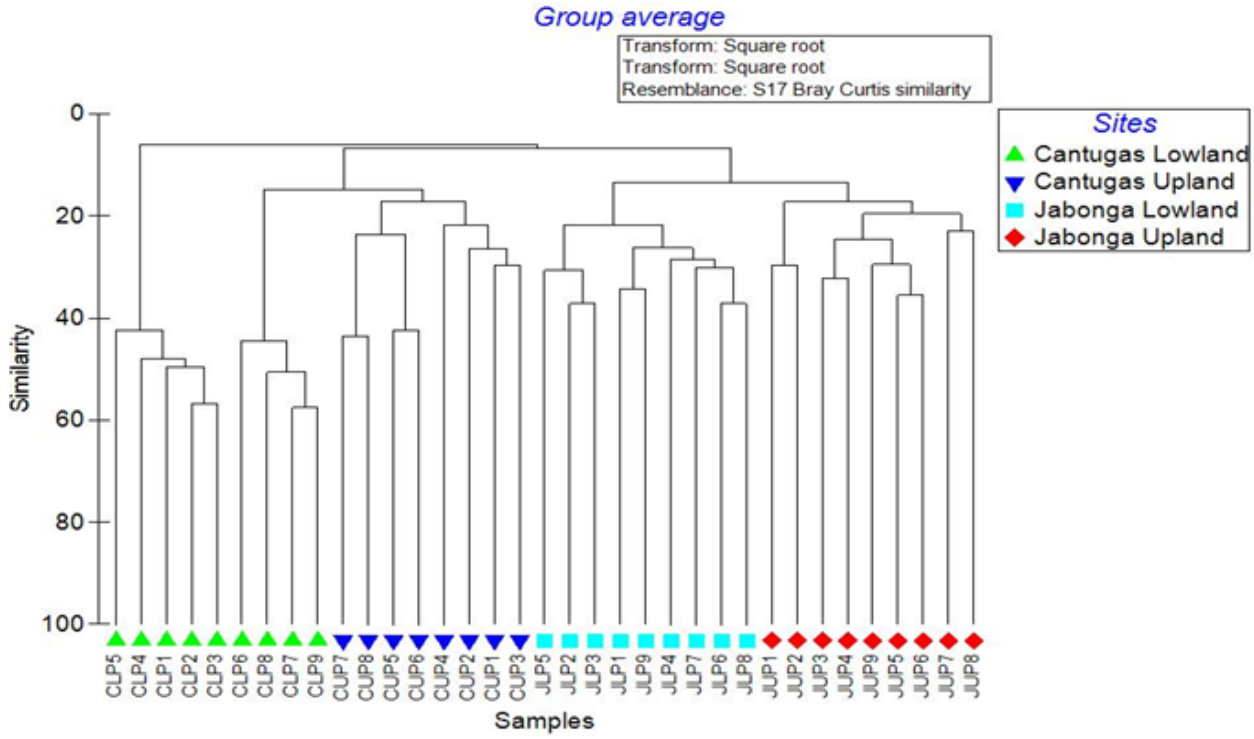


Fig 6:- Dendrogram of Cluster analysis (a) and Non-metric Multidimensional scaling (NMDS) plot showing the Bray-curtis similarities of the terrestrial flora in upland of Jabonga and Cantugas sampling sites

When the species from both sampling sites were pooled, the dendrogram for cluster analysis shows a unique composition of plant species between two sampling sites and between lowland and upland. Though it suggests a lower species similarity between sampling sites, the plant species of both sampling sites lowland and upland has a high species similarity index.

With 15% similarity and a stress value of 0.21 in NMDS; the Jabonga upland and lowland formed the biggest group which indicates higher plant species similarity among the sites, whereas Cantugas upland was divided into two plant groupings which suggest a lower species similarity or a unique plant grouping, while Cantugas lowland formed a single group. Although, the overlapping of confidence ellipses to some degree may indicate overlapping of species composition probably due to the proximity of locations allowing exchanges of plant species within these areas.



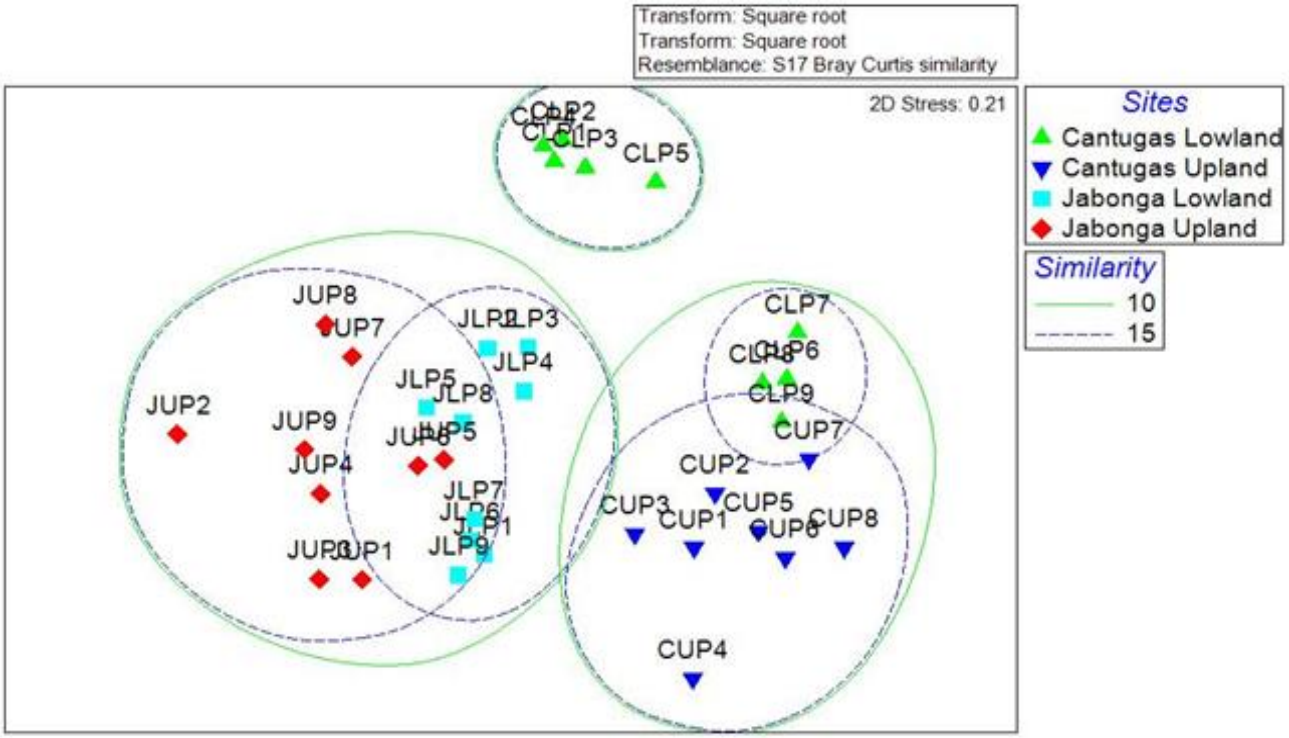


Fig 7:- Dendrogram of Cluster analysis (a) and Non-metric Multidimensional scaling (NMDS) plot showing the Bray-curtis similarities of the terrestrial flora pooled across all sampling sites and elevation

➢ *Plant Conservation Status and Endemicity*

Of the all plant species encountered, 9 species were critically endangered; 1 endangered; and 14 species were vulnerable based on the International Union for Conservation of Nature and Natural Resources, while there were 2 critically endangered, 2 endangered, 10 vulnerable and 3 other threatened species found within the two sampling sites as listed in DAO 2017-11 (Appendix 1). The presence of this threatened species urges a given sufficient protection measures in order to ensure their continued existence in the wild.

Of the total 321 species encountered within the two sampling sites, 20 species were classified Philippine endemic, 49 endemic species, 26 native species, and 29 introduced species. The Philippine endemic species were species which could only be seen in the country and most of these species were threatened and endangered such as *Hopea acuminata, Shorea contorta, Shorea negrosensis, Shorea polysperma, Myristica philippinensis* and *Mitrepora lanotan*. Some of the introduced species which were also classified as an invasive species such as *Chromolaena odorata, Mimosa pigra* and *Sacharrum spontaneum* were also present in the watershed area of Lake Mainit.

IV. CONCLUSION

The study recorded a total of 321 plant species, 58.255% of this species were trees and shrubs, 20 species were Philippine endemic, 24 species were classified threatened by the IUCN and 17 threatened species based on the DAO 2017-11. The area is considered moderately high in terms of diversity status with high endemicity status which is noteworthy for conservation and protection. Most of these threatened species were distributed in both sampling sites but diminishing in numbers due to natural and several anthropogenic activities thus these areas worth conserving and preserving for future use. The result of this study is very useful to develop the template for the local ordinance to support local endemics.

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APPENDIX 1

List of Floral Species Found Within the Two Sampling Sites with Conservation Status, Endemicity and Plant Habit

Family Name	Scientific Name	Common Name	Plant Habit	Conservation Status	Endemicity
Amaranthaceae	*Amaranthus sp.*		Herb		
Anacardiaceae	*Anacardia sp.*	Manga-manga	Tree & Shrub		
Annonaceae	*Annonaceae*	Urayo	Tree & Shrub		
Annonaceae	*Cananga odorata* (Lam.) Hook.f. & Thomson	Alangilan	Tree & Shrub		Native
Annonaceae	*Mitrephora lanotan* (Blanco) Merr.	Lanutan	Tree & Shrub	VU[1] OTS[2]	Phil Endemic
Apocynaceae	*Alstonia scholaris* (L.) R.Br.	Dita	Tree & Shrub		Native
Apocynaceae	*Wrightia pubescens* R.Br., 1811	Laniti	Tree & Shrub	LC[1]	Endemic
Apocynaceae	*Dischidia sp.*		Vine		
Apocynaceae	*Hoya sp.*		Vine		
Araceae	*Aglaonema sp.*		Herb		
Araceae	*Alocasia macrorrhizos* (L.) G.Don		Herb		Endemic
Araceae	*Alocasia zebrina* Schott ex Van Houtte		Herb		Endemic
Araceae	*Araceae*	Panangkilon	Herb		
Araceae	*Colocasia esculenta* (L.) Schott	Taro	Herb		Native
Araceae	*Epipremnum pinnatum* (L.) Engl.		Vine		Endemic
Araceae	*Homalomena philippinensis*	Payaw	Herb		Phil Endemic
Araceae	*Philodendron sp.*		Vine		
Araceae	*Pothos sp.*	Lukmoy	Vine		
Araceae	*Rhapidopora sp.*		Herb		
Araceae	*Selaginella delicatula* (Desv. ex Poir.) Alston	Butitay	Fern Allies		
Araliaceae	*Arthrophyllum borneense* Merr.	Bingliw	Tree & Shrub		
Araliaceae	*Osmoxylon diversifolium*		Tree & Shrub		
Araliaceae	*Polyscias nodosa* Blume	Malapapaya	Tree & Shrub		
Arecaceae	*Areca catechu* L.	Bunga	Palm		Endemic
Arecaceae	*Arenga pinnata* (Wurmb) Merr.	Kaong	Palm		

Table 4

Family Name	Scientific Name	Common Name	Plant Habit	Conservation Status	Endemicity
Arecaceae	*Baris palm*	Baris palm	Palm		
Arecaceae	*Calamus microcarpus*	Rattan / Piyay	Palm		
Arecaceae	*Calamus microcarpus var. microcarpus*	Paag daga	Palm		
Arecaceae	*Calamus mitis*		Palm		
Arecaceae	*Calamus sp. 1*	Bal-esan	Palm		
Arecaceae	*Calamus sp. 2*	Atibangalan	Palm		
Arecaceae	*Caryota cumingi*	Pugahan	Palm	LC[1]	Endemic
Arecaceae	*Cocos nucifera* L.	Niyog	Tree & Shrub		
Arecaceae	*Orania palindan* Blanco	Banga	Palm	VU[2]	Endemic
Arecaceae	*Pinanga insignis* Becc.	Rattan / Sarawag	Palm		Endemic
Arecaceae	*Pinanga maculata*		Palm		Endemic
Arecaceae	*Pinangga sp.*	Biga palm	Palm		
Arecaceae	*Rattan / Kurambuto*	Rattan / Kurambuto	Palm		
Arecaceae	*Rattan / Tublangag*	Rattan / Tublangag	Palm		
Fabaceae	*Securinega flexuosa Muell.-Arg.*	Anislag	Tree & Shrub	VU[1]	Phil Endemic
Arecaceae	*Tamsi palm*	Tamsi palm	Palm		
Asparagaceae	*Dracaena sp.*		Herb		
Asphodelaceae	*Dianella sp.*		Herb		
Aspleniaceae	*Asplenium nidus* L.		Fern		Native
Aspleniaceae	*Asplenium polyodon*G. Forst		Fern		Introduced
Asteraceae	*Blumea sp.*	Sambong	Herb		
Asteraceae	*Chromolaena odorata*(L.) R.M.King & H.Rob.	Hagonoy	Herb		Introduced
Asteraceae	*Elephantopus tomentosus*L.	Elepante	Herb		Introduced
Asteraceae	*Mikania cordata* Kunth	Mote-mote	Vine		
Athyriaceae	*Diplazium esculentum* (Retz.) Sw.	Pako	Fern	LC[1]	Endemic
Begoniaceae	*Begonia bolsteri* Merr.		Herb		

Table 5

Family Name	Scientific Name	Common Name	Plant Habit	Conservation Status	Endemicity
Begoniaceae	*Begonia pseudolateralis* Warb.		Herb		
Begoniaceae	*Begonia sp.*		Herb		
Begoniaceae	*Begonia sp. 1*		Herb		
Bignoniaceae	*Radermachera pinnata* Blanco	Banay-banay	Tree & Shrub	LC[1]	
Bignoniaceae	*Tecoma stans* (L.) Juss. Ex Kunth	Kampanilya	Tree & Shrub		
Bignoniaceae	*Schismatoglottis sp.*	Pusaw	Herb		
Bromeliaceae	*Ananas comosus* (L) Merr.	Pinya	Herb		Introduced
Burseraceae	*Canarium ovatum* Engl.	Pili	Tree & Shrub	VU[1]	native
Burseraceae	*Canarium sp. 1*	Pagsahangin	Tree & Shrub	LC[1]	

Burseraceae	*Canarium sp. 2*	Sagasa	Tree & Shrub		
Calophylaceae	*Calophyllum blancoi* Planch. & Triana	Bitanghol	Tree & Shrub		Endemic
Calophylaceae	*Calophylum inophyllum* L.	Bitaog	Tree & Shrub	LC[1]	Native
Cannabaceae	*Trema orientalis* (L.) Blume	Hanagdong	Tree & Shrub	LC[1]	Endemic
Caricaceae	*Carica papaya* L.	Papaya	Herb		Introduced
Clethraceae	*Clethra canescens* Reinw. Ex Blume	Banilag	Tree & Shrub		
Clusiaceae	*Garcinia ituman* Merr.	Ituman	Tree & Shrub		
Clusiaceae	*Garcinia 1492orella* (Gaertn.) Desr.	Batuan	Tree & Shrub		Endemic
Clusiaceae	*Garcinia rubra* Merr.	Kandiiis	Tree & Shrub		
Combretaceae	*Terminalia nitens* Presl.	Magtalisay	Tree & Shrub	VU[1]	Endemic
Commelinaceae	*Amischotolype sp.*		Herb		
Commelinaceae	*Commelina benghalensis* L.		Herb		Endemic
Costaceae	*Cheilocostus speciosus* (J.Konig) C.Specht	Tambabasi	Herb		Native
Cyatheaceae	*Cyathea contaminans*	Anotong	Fern	LC[1] E[2]	Endemic
Datiscaceae	*Octomeles sumatrana* Miq.	Binuang	Tree & Shrub		Endemic
Dennstaedtiaceae	*Pteridium aquilinum* (L.) Kuhn	Bracken fern	Fern	LC[1]	Introduced

Table 6

Family Name	**Scientific Name**	**Common Name**	**Plant Habit**	**Conservation Status**	**Endemicity**
Dilleniaceae	*Dillenia philippinensis* Rolfe	katmon	Herb	VU[1]	Phil Endemic
Dioscoreaceae	*Dioscorea hispida* Dennst	Baay/Puyot	Vine		
Dioscoreaceae	*Dioscorea sp. 1*	Buyo-buyo	Vine		
Dioscoreaceae	*Dioscorea sp. 2*	Liana / Panamog	Vine		
Dioscoreaceae	*Tacca 1492hore a* Blume		Herb		Endemic
Dipterocarpaceae	*Dipterocarpaceae*	Halong-halong	Tree & Shrub		
Dipterocarpaceae	*Dipterocarpaceae*	Tupsan	Tree & Shrub		
Dipterocarpaceae	*Dipterocarpus grandiflorus* Blanco	Apitong	Tree & Shrub	CE[1] VU[2]	Endemic
Dipterocarpaceae	*Dipterocarpus mayapis*	Mayapis	Tree & Shrub	CE[1]	Endemic
Dipterocarpaceae	*Dipterocarpacea*	Maglilipot	Tree & Shrub		
Dipterocarpaceae	*Hopea 1492hore asp* Merr.	Manggachapui	Tree & Shrub	CE[1]	Phil Endemic
Dipterocarpaceae	*1492hore as.*	Balit	Tree & Shrub		
Dipterocarpaceae	*Parashorea malaanonan* (Blanco) Merr.	Bagtikan	Tree & Shrub	CE[1]	Endemic
Dipterocarpaceae	*Shorea contorta* Vidal	White Lauan	Tree & Shrub	CE[1] VU[2]	Phil Endemic

Dipterocarpaceae	*Shorea gisok/falciferoides* Foxw.	Gisok	Tree & Shrub	CE[1] VU[2]	Endemic
Dipterocarpaceae	*Shorea negrosensis* Foxw.	Red lawaan	Tree & Shrub	CE[1] VU[2]	Phil Endemic
Dipterocarpaceae	*Shorea polysperma* (Blanco) Merr.	Tangile	Tree & Shrub	CE[1] VU[2]	Phil Endemic
Dipterocarpaceae	*1493hore asp.*	Halong-halong	Tree & Shrub		
Dipterocarpaceae	*Shorea astylosa* Foxw.	Yakal	Tree & Shrub	CE[1] CE[2]	
Dryopteridaceae	*Dryopteris sp.*		Fern		
Ebenaceae	*Diospyros philippinensis*	Kamagong	Tree & Shrub	VU[2]	Phil Endemic
Euphorbiaceae	*Euphorbiaceae*	Marapot	Tree & Shrub		
Euphorbiaceae	*Homalanthus populneus* (Geiseler) Pax	Balanti	Tree & Shrub	LC[1]	Endemic
Euphorbiaceae	*Macaranga bicolor* Muell.-Arg.	Hamil-ig	Tree & Shrub	VU[1]	Phil Endemic

Table 7

Family Name	Scientific Name	Common Name	Plant Habit	Conservation Status	Endemicity
Euphorbiaceae	*Macaranga gigantifolia* Merr.		Tree & Shrub		
Euphorbiaceae	*Macaranga hispida* (Blume) Müll.Arg.		Tree & Shrub		
Euphorbiaceae	*Macaranga sp.*		Tree & Shrub		
Euphorbiaceae	*Macaranga tanarius* (L.) Müll.Arg.	Binunga	Tree & Shrub		
Euphorbiaceae	*Mallotus cumingii* (Müll.Arg.)	Apanang	Tree & Shrub		Endemic
Euphorbiaceae	*Mallotus sp.*	Salimbugaw	Tree & Shrub		
Euphorbiaceae	*Melanolepis multiglandulosa* (Reinw. Ex Blume) Rchb.f. & Zoll.	Alim	Tree & Shrub		Native
Euphorbiaceae	*Euphorbia hirta* L.	Tawa-tawa	Herb		Endemic
Fabaceae	*Calopogonium sp.*	Cover crop	Grass	LC[1]	
Fabaceae	*Centrosema pubescens* Benth.	Kodso	Vine		Introduced
Fabaceae	*Derris elliptica* (Wall.) Benth.	Bagon	Vine		Endemic
Fabaceae	*Derris sp.*		Vine		
Fabaceae	*Acacia mangium* Willd.	Mangium	Tree & Shrub	LC[1]	Introduced
Fabaceae	*Afzelia rhomboidea* (Blanco) S.Vidal	Tindalo	Tree & Shrub	VU[1] E[2]	Endemic
Fabaceae	*Bauhinia sp.*	Alibangbang	Tree & Shrub		
Fabaceae	*Dagong (fabaceae with thorns)*		Tree & Shrub		
Fabaceae	*Erythrina orientalis* L.	Dapdap	Tree & Shrub		Introduced
Fabaceae	*Flemingia sp.*	Flamengia	Tree & Shrub		
Fabaceae	*Leucaena leucocephala* (Lam.) de Wit[	Ipil-ipil	Tree & Shrub		Introduced
Fabaceae	*Litsea philippinensis* Merr.	Bakan	Tree &		Phil

			Shrub		Endemic
Fabaceae	*Ormosia cavalensis*	Bahay	Tree & Shrub		
Fabaceae	*Paraserianthes falcataria* L.	Falcata	Tree & Shrub		Introduced
Fabaceae	*Pterocarpus indicus* Willd.	Narra	Tree & Shrub	E[1] VU[2]	Native
Fabaceae	*Tagum-tagum*	Tagum-tagum	Tree & Shrub		
Fabaceae	*Mimosa pigra* L.	Sampinit	Vine		Invasive

Table 8

Family Name	Scientific Name	Common Name	Plant Habit	Conservation Status	Endemicity
Fagaceae	*Lithocarpus ilanosii*	Ulayan	Tree & Shrub		
Flagellariaceae	*Flagellaria indica* L.	Aliwangkai	Vine		Endemic
Gesneriaceae	*Aeschynanthus sp.*	Lipstick plant	Tree & Shrub		
Gleichnaceae	*Dicranopteris linearis* (Burm.f.) Underw.		Fern		Endemic
Hypericaceae	*Cratoxylum sumatranum* (Jack) Bl.	Pag-uringon	Tree & Shrub	LC[1]	Endemic
Lamiaceae	*Gmelina arborea* Roxb.	Gmelina	Tree & Shrub		Introduced
Lamiaceae	*Premna odorata* Blanco	Adgaw	Tree & Shrub		Endemic
Lamiaceae	*Teijsmanniodendron ahernianum* Merr.	Kulipapa	Tree & Shrub		Endemic
Lamiaceae	*Vitex parviflora* Juss.	Tugas	Tree & Shrub	VU[1]	Endemic
Lauraceae	*Cinnamomum mercadoi* S.Vidal	Kalingag	Tree & Shrub	VU[1]	indigenous
Lecythidaceae	*Petersianthus quadrialatus* (Merr.) Merr.	Toog	Tree & Shrub		indigenous
Loganiaceae	*Fragrae racemosa*	Malakape	Tree & Shrub		
Malvaceae	*Ceiba pentandra* (L.) Gaertn.	Gapas	Tree & Shrub		Introduced
Malvaceae	*Colona serratifolia* Cav.	Anilau	Tree & Shrub		
Malvaceae	*Commersonia bartramia* (L.) Merr.	Banitlong	Tree & Shrub		
Malvaceae	*Diplodiscus paniculatus* Turcz.	Balobo	Tree & Shrub	VU[1]	indigenous
Malvaceae	*Kleinhovia 1494ospital* L.	Bitan-ag	Tree & Shrub		Endemic
Malvaceae	*Pterospermum sp.*	Bayog	Tree & Shrub		
Malvaceae	*Theobroma sp.*	Kakaw-kakaw	Tree & Shrub		
Marantaceae	*Donax canniformis* (G.Forst.) K.Schum.	Banban	Tree & Shrub		Endemic
Marantaceae	*Phrynium interruptum*	Hagikhik	Herb		Endemic
Marratiaceae	*Angiopteris palmiformis* (Cav.) C. Chr.	Giant fern	Fern		
Marratiaceae	*Marratia sylvatica* Blume	Giant fern	Fern		
Melastomaceae	*Dissochaeta sp.*		Tree &		

			Shrub		
Melastomaceae	*Melastoma malabahtricum*	Hantutuknaw	Tree & Shrub		
Melastomaceae	*Melastoma sp.*		Tree & Shrub		

Table 9

Family Name	Scientific Name	Common Name	Plant Habit	Conservation Status	Endemicity
Meliaceae	*Aglaia sp.*	Saging sa unggoy	Tree & Shrub		
Meliaceae	*Chisocheton tetrapetalus* Turcz.	Ibo	Tree & Shrub		
Meliaceae	*Lansium domesticum* (Osbeck) Sahni & Bennet	Lanzones	Tree & Shrub		Introduced
Meliaceae	*Swietenia macrophylla* King	Mahogany	Tree & Shrub	VU[1]	Introduced
Meliaceae	*Toona calantas* Merr. & Rolfe	Lanipga	Tree & Shrub	DD[1] VU[2]	Endemic
Minespermaceae	*Minespermaceae*	Lagtang	Vine		
Moraceae	*Artocarpus blancoi* Merr.	Antipolo	Tree & Shrub	VU[1]	Phil Endemic
Moraceae	*Artocarpus heterophyllus* Lam.	Nangka	Tree & Shrub		Introduced
Moraceae	*Artocarpus treculianus* Elmer	Tugop/Marang dahon	Tree & Shrub	VU[1]	Phil Endemic
Moraceae	*Ficus balete*	Balibalete	Tree & Shrub		
Moraceae	*Ficus heteropoda* Miq.	Langas	Tree & Shrub		
Moraceae	*Ficus minahassae* Tesym. & De Vr.	Hagimit	Tree & Shrub		
Moraceae	*Ficus nota*	Tubog	Tree & Shrub		Phil Endemic
Moraceae	*Ficus odorata* (Blanco) Merr.	Hagupit	Tree & Shrub		
Moraceae	*Ficus pseudopalma* Blanco	Niog-niogan	Tree & Shrub		Phil Endemic
Moraceae	*Ficus septica* Burm.f.	Hawili	Tree & Shrub		Endemic
Moraceae	*Ficus sp.*	Piri	Tree & Shrub		
Moraceae	*Ficus stipulosa* Miq.	Dakit	Tree & Shrub		Endemic
Moraceae	*Ficus ulmifolia* Lam.	Sagusahis	Tree & Shrub	VU[1]	Phil Endemic
Moraceae	*Ficus 1495cuminate* Blume	Kaw-ot/Tangisang bayawak	Tree & Shrub		Endemic
Musaceae	*Musa 1495cuminate* Colla	Paguha	Herb	LC[1]	Native
Musaceae	*Musa balbisiana* Colla	Tundan	Herb		Native
Musaceae	*Musa paradisiaca* L.	Abaka	Herb		Introduced
Musaceae	*Musa sapientum* L.	Saging	Herb		Native
Musaceae	*Musa sp.*	Karnaba	Herb		

Table 10

Family Name	Scientific Name	Common Name	Plant Habit	Conservation Status	Endemicity
Musaceae	*Musa sp.*	Barobongoran	Herb		
Musaceae	*Musa textilis* Née	Wild Abaca / Laguras	Herb		Native
Myricaceae	*Myrica javanica* Blume	Hindang	Tree & Shrub		
Myricaceae	*Myrica sp. 1*	Hindang bato	Tree & Shrub		
Myricaceae	*Myrica sp. 2*	Hindang malaavocado	Tree & Shrub		
Myricaceae	*Myrica sp. 3*	Hindang talisay	Tree & Shrub		
Myristicaceae	*Knema sp.*	Banajakaw	Tree & Shrub		
Myristicaceae	*Myristica philippinensis* Gandoger	Duguan	Tree & Shrub	VU[1]	Phil Endemic
Myrtaceae	*Eugenia sp. 1*	Bansilay	Tree & Shrub		
Myrtaceae	*Eugenia sp. 2*	Sagimsim	Tree & Shrub		
Myrtaceae	*Myrtaceae*	Bansilay	Tree & Shrub		
Myrtaceae	*Myrtaceae*	Sagimsim pula	Tree & Shrub		
Myrtaceae	*Psidium guajava* L.	Bayabas	Tree & Shrub		Introduced
Myrtaceae	*Syzygium hutchinsonii* (C.B.Robinson) Merr.	Malatambis	Tree & Shrub		Phil Endemic
Myrtaceae	*Syzygium sp.*	Hantatamsi	Tree & Shrub		
Myrtaceae	*Tristaniopsis littoralis* (Merr.) Peter G.Wilson & J.T.Waterh.	Tiga	Tree & Shrub	VU[1] VU[2]	Phil Endemic
Nephrolepidaceae	*Nephrolepis biserrata* (Sw.) Schott	Lukdo	Fern		Endemic
Nephrolepidaceae	*Nephrolepis cordata*		Fern		Native
Orchidaceae	*Dendrobium sp.*	Ground orchid	Herb		
Orchidaceae	*Liparis sp.*		Herb		
Orchidaceae	*Orchidaceae (gagmay dahon red)*		Herb		
Orchidaceae	*Spathoglottis plicata* Blume	Lubi lubi	Herb		Endemic
Osmundaceae	*Osmunda banksifollia*		Fern		
Oxalidaceae	*Averrhoa bilimbi* L.	Iba	Tree & Shrub		Introduced
Pandanaceae	*Freycinetia multiflora* Merr.		Vine		
Pandanaceae	*Pandanus affinis*		Herb		

Table 11

Family Name	Scientific Name	Common Name	Plant Habit	Conservation Status	Endemicity
Pandanaceae	*Pandanus copelandii* Merr.	Baliw	Herb		
Pandanaceae	*Pandanus odoratissimus* (Kewda)		Herb		Native
Phyllanthaceae	*Antidesma bunius* (L.) Spreng.	Bignay	Tree & Shrub		Native
Phyllanthaceae	*Breynia sp.*	Salampaturog	Tree & Shrub	LC[1]	
Phyllanthaceae	*Glochidion sp.*	Bonot-bonot	Tree & Shrub		

Piperaceae	*Piper aduncum* L.	Loblobay	Tree & Shrub		Introduced
Poaceae	*Bambusa blumeana* Schult. & Schult.f.	Bokawe	Grass		Endemic
Poaceae	*Bambusa sp.*		Grass		
Poaceae	*Bambusa sp. (pantahi)*		Grass		
Poaceae	*Imperata 1497rabica1497cal* (L.) P.Beauv.	Cogon	Grass		Endemic
Poaceae	*Paspalum conjugatum* P.J.Bergius	Carabao grass	Grass		Endemic
Poaceae	*Saccharrum spontaneum* L.	Bugang	Grass		Introduced
Polypodiaceae	*Drynaria quercifolia* (L.) Hovenkamp & S. Linds.		Fern		Native
Polypodiaceae	*Microsorum sp.*		Fern		
Pteridaceae	*Adiantum sp.*		Fern		
Pteridaceae	*Antrophyum reticulatum* (G. Forst.) Kaulf.		Fern		
Raflessiaceae	*Rafflessia mixta*		Herb	CE^2	Phil Endemic
Raflessiaceae	*Scleria scloribata*	Daat	Grass		
Ranunculaceae	*Clematis smilacifolia* L.		Vine		Native
Rhamnaceae	*Ziziphus sp.*		Tree & Shrub		
Rubiaceae	*Hydnophytum formicarum* Jack	Ant plant	Herb		Native
Rubiaceae	*Coffee 1497rabica* L.	Kape	Tree & Shrub		Introduced
Rubiaceae	*Morinda citrifolia* L.	Nino	Tree & Shrub		Native
Rubiaceae	*Mussaenda sp.*	Talatawa	Tree & Shrub		
Rubiaceae	*Nauclea occidentalis*	Bangkal	Tree & Shrub		Endemic
Rubiaceae	*Neonauclea formicaria* (Elmer) Merr.	Hambabalod	Tree & Shrub		

Table 12

Family Name	Scientific Name	Common Name	Plant Habit	Conservation Status	Endemicity
Rubiaceae	*Neonauclea sp.*	Anitap	Tree & Shrub		
Rubiaceae	*Rubos sp.*		Tree & Shrub		
Rubiaceae	*Selaginella magnifica*		Fern Allies		
Rubiaceae	*Selaginella plana* (Desv. Ex Poir.) Hieron.		Fern Allies		Native
Rutaceae	*Evodia bintoko*	Bintoko	Tree & Shrub		
Rutaceae	*Evodia 1497onfuse* Merr.	Bugawak	Tree & Shrub		
Santalaceae	*Exocarpos latifolius* R.Br.	payospos	Tree & Shrub		Introduced
Sapindaceae	*Nephelium rambutan* L.	rambutan/Kapulasan	Tree & Shrub		Endemic
Sapindaceae	*Nephelium sp.*	Wild rambutan	Tree & Shrub		
Sapotaceae	*Palaquium sp.*	Tagkan	Tree & Shrub		

Sapotaceae	*Pouteria velutina* Elmer	Wakatan	Tree & Shrub		
Schizaeaceae	*Lygodium circinatum* (Burm. F.) Sw.		Fern		Native
Schizaeaceae	*Lygodium japonicum* (Thunb.) Sw.	Nito	Fern		Native
Smilaceae	*Smilax aspera* L.	Smilax aspera	Vine		Introduced
Smilaceae	*Smilax bracteata* C.Presl	Banag	Vine		
Solanaceae	*Capsicum annuum* L.	Sili	Herb		Introduced
Sterculiaceae	*Sterculia glavifera*	Uos	Tree & Shrub		
Tectariaceae	*Tectaria decurrens* (C. Presl) Copel.		Fern		
Thelypteridaceae	*Christella parasitica* (L.) Holttum		Fern		
Thelypteridaceae	*Sphaerostephanos unitus* (L.) Holttum		Fern		
Thymeleaceae	*Aquilaria cumingiana* (Decne) Ridley	Lapnisan/Agarwood	Tree & Shrub	VU[1]	Endemic
Urticaceae	*Poikilospermum suaveolens* (Blume) Merr.	Hanopol	Herb		
Urticaceae	*Leucosyke capitellata* Wedd.	Alagasi	Tree & Shrub		
Urticaceae	*Musanga cecropioides* R.Br. & Tedlie		Tree & Shrub		Introduced
Urticaceae	*Pipturus arborescens* (Link) C.B. Rob.	Handadamay	Tree & Shrub		
Urticaceae	*Urtica dioica* L.	Sagay/Alingatong	Tree & Shrub		Introduced
Urticaceae	*Urticaceae*	Balansaging	Tree & Shrub		

Table 13

Family Name	**Scientific Name**	**Common Name**	**Plant Habit**	**Conservation Status**	**Endemicity**
Verbenaceae	*Lantana camara* L.	Baho-baho	Tree & Shrub		Introduced
Verbenaceae	*Stachytarpheta jamaicensis* (L.) Vahl	Kanding-kanding	Tree & Shrub		
Vitaceae	*Tetrastigma sp.*		Vine		
Vitaceae	*Leea aculeata* Blume ex Spreng.	Amamali	Tree & Shrub		Endemic
Zingeberaceae	*Alpinia haenkei* C.Presl	Pinoon	Herb		
Zingeberaceae	*Alpinia rufa* (C.Presl) Náves	Bagonbon	Herb		
Unidentified		Alalibabaw	Tree & Shrub		
Unidentified		Alibobot	Tree & Shrub		
Unidentified		Alipayas	Tree & Shrub		
Unidentified		Ando	Tree & Shrub		
Unidentified		Aragpange	Tree & Shrub		
Unidentified		Atibangalan	Palm		
Unidentified		Atulob	Tree & Shrub		
Unidentified		Baga-baga	Tree & Shrub		
Unidentified		Bagkangay	Tree & Shrub		
Unidentified		Baje	Tree & Shrub		
Unidentified		Bali-bali	Herb		
Unidentified		Balitadhan	Herb		

Unidentified		Bangayaw	Tree & Shrub		
Unidentified		Bantana	Tree & Shrub		
Unidentified		Bayasbas	Tree & Shrub		
Unidentified		Boracan	Vine		
Unidentified		Bugna / Mala Anislag	Tree & Shrub		
Unidentified		Bugtong	Tree & Shrub		
Unidentified		Bungogon	Tree & Shrub		
Unidentified		Busungan	Tree & Shrub		
Unidentified		Comagascas	Tree & Shrub		

Table 14

Family Name	Scientific Name	Common Name	Plant Habit	Conservation Status	Endemicity
Unidentified		Darari	Tree & Shrub		
Unidentified		Gala	Tree & Shrub		
Unidentified		Galahais	Tree & Shrub		
Unidentified		Gitisan	Tree & Shrub		
Unidentified		Gutok	Tree & Shrub		
Unidentified		Handarugkot	Grass		
Unidentified		Hantitikol	Tree & Shrub		
Unidentified		Kandong	Tree & Shrub		
Unidentified		Kararimay	Tree & Shrub		
Unidentified		Karupi	Herb		
Unidentified		Koyla	Tree & Shrub		
Unidentified		Kusisay	Tree & Shrub		
Unidentified		Labaw	Tree & Shrub		
Unidentified		Langkog	Tree & Shrub		
Unidentified		Ligad	Tree & Shrub		
Unidentified		Limbahan	Tree & Shrub		
Unidentified		Magtangale	Tree & Shrub		
Unidentified		Magutamban	Tree & Shrub		
Unidentified		Magutayo	Tree & Shrub		
Unidentified		Mahalan	Tree & Shrub		
Unidentified		Mahulay	Tree & Shrub		
Unidentified		Makaragho	Fern		
Unidentified		Makasirong	Tree & Shrub		
Unidentified		Makulibhag	Tree & Shrub		
Unidentified		Malagtik	Tree & Shrub		
Unidentified		Masel	Tree & Shrub		
Unidentified		Mata-mata	Tree & Shrub		

Table 15

Family Name	Scientific Name	Common Name	Plant Habit	Conservation Status	Endemicity
Unidentified		Minutay	Tree & Shrub		
Unidentified		Parang-parang	Tree & Shrub		
Unidentified		Patagon	Tree & Shrub		
Unidentified		Pipi	Tree & Shrub		
Unidentified		Puyuhon	Tree & Shrub		
Unidentified		Sampapad-on	Vine		
Unidentified		Sibaw	Tree & Shrub		
Unidentified		Sukab	Tree & Shrub		
Unidentified		Taramag	Palm		
Unidentified		Tawin-tawin	Tree & Shrub		
Unidentified		Ulos	Tree & Shrub		
Unidentified		Unidentified fern	Fern		

Note: For conservation status ([1]) IUCN and ([2]) for DAO 2017-11. Critically Endangered (CE), Endangered €, Vulnerable (VU), Other Threatened Species (OST), Least Concern (LC) and Data Deficient (DD)

Table 16