Angiosperms of the University of Mindanao, Davao City, Philippines

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ABSTRACT

University of Mindanao is a private institution in the southern part of the country. One of its campuses located in Matina, Davao City is a 28 hectare campus that houses various flora and fauna. These biotic factors offer the community various service with ecological, aesthetics, historical and scientific significance. An inventory of angiosperms was conducted on June 2016 to January 2017 that aims to provide list of flowering plants, its conservation status and IEC materials. Purposive sampling at different sites within the campus was performed. All flowering plant species were photo-documented and were preliminary identified using Co's Digital Flora of the Philippines, taxonomic keys, and comparing the works of Philippine botanists. Data mining was also conducted for the trees found in the campus. Results showed that there are 64 families of angiosperms composed of 195 genera and 277 species. Family Euphorbiaceae has the highest number of species identified with 20 genera and 25 species. Meanwhile, there are 40 families of trees found in the campus and is composed of 117 genera and 152 species wherein 84 species are exclusively found in the UM forest area. Most of the flowering plants found in the campus are introduced in the country. Among these plants, five (5) species are considered endemic namely: *Carmona retosa* (Vahl), *Canarium ovatum* (Engl.), *Afzelia rhomboidea* (Blanco), *Ficus septica* (Burm f.) and *Ixora cv.* While five (5) species are vulnerable namely: *Aleurite moluccana* (L.) Willd., *Antidesma pleuricum* Tul, *Mallotus philippinensis* (Muell), *Cratoxylum formosum* (Jack) Dyer and *Dracontomelon dao* (Banco) Merr and Rolfe. Moreover, a total of five (5) species are endangered namely: *Mangifera odorata* (Kwini), *Cananga odorata* (Lam) Hook f. & Thomson , *Afzelia rhomboidea* (Blanco) Vidal, *Shorea astylosa* (Foxworthy), and *Shorea malibato* (Foxworthy), and one (1) species is critically endangered, the *Pterocarpus indicus* (Forma echinatus) also known as Narra. It is recommended to preserve the flowering plants particularly the trees with the most concerned ecological status. The school community must develop consciousness and appreciation of the significance of the flowering plants to the school and the environment as a whole.

Keywords: *Flowering plants, Inventory, University of Mindanao, Philippines*

INTRODUCTION

Philippines has been noted as one of the biodiversity hotspots in the world. The country's biodiversity is comparable globally with 57% of species in the major floral and faunal groups. Taking a look on the country's flora, there are 8,000 species of flowering plants distributed in about 1,600 genera and 191 families. Also the absolute number of its endemic species is comparable to and often exceeds the much larger megadiverse countries (Digital Library Herbarium, 2015). With the country's small land area, approximately less than 5% of the global land area, it is clear that plant species concentration is high (Sinha and Heaney, 2006). But despite the vast number of flora in the country, Philippines is lagging behind with other countries in documenting its Endemic plants. This might cause serious effect to Biodiversity Conservation and Management in the country particularly that there is unprecedented loss of forested areas.

One of the three islands in the Philippines, Mindanao is generally composed of large land mass and might possibly host variety of plant species. But the place is already converted into various purposes as evidence in the sprouting of many cities in the area. Specifically in Davao City, most of the land are converted into various purposes such as housing, industrial and many others. It is regarded as the heart of Mindanao, where most of the people migrate to the place because it serves as a hub of many academic institutions such as University of Mindanao.

University of Mindanao is one of the largest universities in Region XI and occupies approximately 28 hectares in Matina, Davao City. Presently, one of the unique features of this institution is its beautiful man-made landscape that is composed of a variety of flowering plants that were introduced and purposely planted in the entire campus for aesthetic reason. But, there is still no record of the list of the flowering plants found in the campus. The only study on biodiversity in this institution is the Inventory of Trees by the Forestry and Environmental Science Department last July 2013 (Montero, *et. al.*, 2013). Recently, the University aims to be the "Center for Biodiversity Research in Region XI (Southeastern Mindanao). One of its advocacy is to promote studies on Sustainable Development and Environmental Conservation through Education and Environmental Assessment. To achieve this, a group of Science teachers from the Math and Science Department conducted an Inventory of Flora and Fauna within the campus.

The goal of this study is to conduct an inventory of angiosperms in the University of Mindanao, Matina Campus/h, Davao City which is part of its Rapid Biodiversity Assessment and Conservation Program. Specifically, it aims to: provide list of flowering plants in University of Mindanao; determine their conservation status; and produce IEC materials (ex. photoguide or calendar of flowering plants) and conduct public forum towards conservation of angiosperms in University of Mindanao.

MATERIALS AND METHODS

This study was conducted within the UM Matina campus (Figure 1) from June 2016 to January 2017. Purposive sampling at different habitat types such as forest and open spaces

near buildings were conducted. Specifically, the sampling areas and their respective coordinates and elevation are as follows: Matina Gate - 7,064778, 125,5984, 42m; HRM Building – 7,06425, 125,5949, 18m; BE Building – 7,065417, 125,597, 10m; Mini Forest – 7,066583, 125,5963, 9m; GET Building – 7,067556, 125,5966, 7m; DPT Building – 7,068333, 125,5959, 8m; and Maa Gate – 7,067417, 125,5916, 8m.

A)

B)

C)

Figure 1. A. Map of the Philippines and inset is the satellite view of the University of Mindanao, Matina campus, Davao City (The University of Mindanao. Retrieved Sept.7, 2018 at https://www.google.com/map/place). B. Sampling areas namely DPT Building (left), Mini Forest (center) and GET Building (right). C. Other sampling sites: Main Gate (left) and BE Building (center) including photo during the data collection (right)

A representative live plant species was photo-documented. Initial identification of angiosperm was done using Co's Digital Flora of the Philippines, using taxonomic keys,

and comparing to the works of Filipino Botanists like Madulid (1995). Data mining was also conducted for the trees found in the campus based on the institutional research of Montero, R., Podorado, C., and Gorgonio, C. conducted last 2013. The conservation status was determined using the National Assessment made by Fernando *et.al.* (2008) and IUCN List of Threatened Species (IUCN, 2015).

RESULTS AND DISCUSSION

An inventory of the flowering plants found near open spaces, near the various buildings and the man-made ecosystems such as mini-forest inside the campus of the University of Mindanao, Matina Campus was conducted from June 2016 to January 2017. Though these flowering plants were introduced mainly for beautification purposes, it can be noted that the various artificial ecosystems play an important role in the environment. For instance, in a study conducted by Carreon and Medina (2017), five families under 7 genera with 30 species of lichens as well as 2 families, 4 genera and 5 species of bryophytes were found at the mini forest of the campus. Both lichens and bryophytes are very good ecological indicators. Some trees in the forest also serve as substrate to various fern species. In a study conducted by Morales (2017), 6 species of ferns were identified. Furthermore, 17 species of birds were documented (Cabras and Medina, 2017). Bird fauna are also very good biological indicators and serve as seed dispersal and pollinators.

A total of 64 Families of flowering plants were identified that is composed of 195 genera and 277 species (Table 1). Family Euphorbiaceae has the highest number of genus and species with a total of 20 genera and 25 species respectively.

Table 1. List of angiosperms found in University of Mindanao

Family	No. of Genus	No. of Species
Acanthaceae	7	10
Agavaceae	5	12
Amaranthaceae	4	6
Amaryllidaceae	1	2
Anacardiaceae	4	6
Annonaceae	4	6
Apiaceae	1	1
Apocynacaea	8	11
Araceae	4	10
Araliacea	2	4
Arecaceae	9	10
Asteraceae	1	1
Bignoniaceae	4	4
Bombaceae	1	1
Boraginaceae	2	3
Burseraceae	2	3
Caesalpiniaceae	6	8

Cannaceae	1	1
Casuarinaceae	1	1
Celastraceae	1	1
Combretaceae	2	5
Compositae/Asteraceae	1	1
Commelinaceae	1	2
Convolvulaceae	1	1
Datiscaceae	1	1
Dipterocarpaceae	3	8
Ebenaceae	1	2
Elaeocarpaceae	1	1
Euphorbiaceae	20	25
Fabaceae	10	11
Family	**No. of Genus**	**No. of Species**
Flacourtiaceae	1	1
Guttiferae	2	3
Heliconiaceae	1	5
Iridaceae	1	1
Lauraceae	3	4
Lecythidaceae	2	3
Leeaceae	1	1
Liliaceae	1	1
Lythraceae	2	3
Malvaceae	1	3
Meliaceae	6	6
Mimosaceae	7	7
Moraceae	2	10
Moringaceae	1	1
Musaceae	1	1
Myrtaceae	3	3
Nyctaginaceae	1	1
Ochnaceae	1	2
Oxalidaceae	1	2
Passifloraceae	1	1
Piperaceae	1	1
Plumbaginaceae	1	2
Poaceae	8	8
Portulaceae	1	1
Rubiaceae	8	14
Rutaceae	2	2
Sapindaceae	4	4
Sapotaceae	3	3
Sterculiaceae	5	8

Solanaceae	2	2
Tiliaceae	2	2
Ulmaceae	2	2
Verbenaceae	5	8
Zingiberaceae	3	3
Total	**195**	**277**

Family Euphorbiaceae is characterized as either trees, shrubs, herbs, or vines, succulent or cactus-like. They have milky or colored sap and are usually poisonous. Many species of Euphorbiaceae are ornamentals such as *Codiaeum variegatum* (L.) A. Juss., or "San Francisco" or croton and *Jatropha pandurifolia* (Andrews), or Shanghai beauty. Some species are important in the industry such as *Ricinus communis* (L.) or castor oil plant and *Hevea brasiliensis* (Willd) or Para rubber tree, from which rubber is sourced. Some species bear edible fruits, such as *Cicca acida* or "karmay" and *Antidesma bunius* (L) Spreng or "bignay" The latter is used to make wine and jam. They are widely concentrated in the Indo-Malaysian region and distributed in the tropics.

Codiaeum variegatum

Euphorbia Lacteal | *Exoecaria cochinchinensis* | *Acalypha wilkesiana*

Figure 2. Some species of Family Euphorbiaceae found in the Campus

There are 40 Families of trees found in the campus composed of 117 genera and 152 species wherein 84 species are found in UM forest area. As shown in Figure 3, the most abundant is Family *Euphorbiaceae* (14 species) followed by Family *Moraceae* (ten - 10 species) then Family *Caesalpinaceae, Dipterocarpaceae* and *Sterculiaceae* (eight - 8 species).

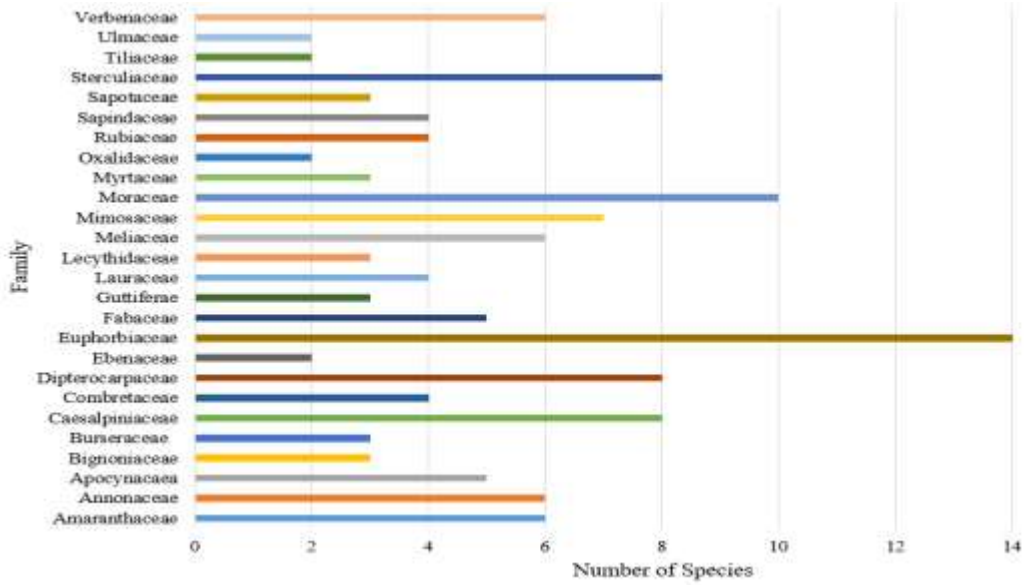

Figure 3. Representative Families of trees of UM.

Some of the species of trees of Family Euphorbiaceae found in the campus as shown in Figure 4 includes *Aleurites moluccana* (L) Willd, *Antidesma pleuricum* Tul., *Bridelia penangiana* (Hook.f.) and *Bridelia glauca* (Blume). On the other hand, the campus also houses some species of trees under Family Moraceae as shown in Figure 5 such as *Artocarpus communis* (J.R. & G. Forst), *Artocarpus heterophyllus* (Lamk.), *Ficus botryocarpa* (Miq. var.), and *Artocarpus blancoi* (Elmer) Merr.

Aleurites moluccana

Antidesma pleuricum

Bridelia glauca

Bridelia penangiana

Figure 4. Some tree species of Family Euphorbiaceae in University of Mindanao.

Family Moraceae is associated with members with life habits as tree, shrubs, lianas, or rarely herbs with milky sap. Many of its members have edible fruits like *Artocarpus heterophyllus* Lamk. or "langka", *A. integrifolia* H. West (Rupr) or "rimas", and some species of *Ficus*. *Morus alba* (L.), or mulberry is an important species for the silkworm industry, while *Cannabis sativa* (L.), or marijuana plant provides hemp fiber and narcotic drugs. Others are ornamental plants such as *F. septic* Burm f. or "hawili" and *F. elastica* Roxb or Indian rubber tree. Distribution is in the tropics and temperate. Figure 5 shows some of the tree species of Family Moraceae found in the University of Mindanao

Artocarpus communis J.R. & G. Forst.

Artocarpus blancoi (Elmer) Merr.

Artocarpus heterophyllus

Ficus botryocarpa Miq. var. *Botryocarpa*

Figure 5. Common tree species of Family Moraceae found in the University of Mindanao

However, due to continued infrastructure development in the campus such as putting up new buildings and landscaping from a natural ecosystem to man-made ecosystem, five (5) species of trees are no longer found in the campus after comparing the data from the works of Montero, et. al. (2013) on mapping of tree species in UM, Matina Campus. These species are *Erythrina subumbrans* (Hassk) Merr., *Artocarpus heterophyllus* Lam, *Broussonetia luzonica* (Blanco), *Ficus ampelas* Burm. f., and *Ficus variegata* Bl.

According to Singh (2012), the destruction of biodiversity may upset the ecological balance such as habitat destruction might affect food chain. Biodiversity is also related with economy, wherein timber, medicines, fuel, fiber, paints, fruits and vegetables, were all obtained in the plant sources. Socially, biodiversity realizes pleasure and happiness such as

the feel of joy and excitement while in a forest. Moreover, biodiversity has great ethical value that establishes the respect for biodiversity and human beings. Such values emphasize that everyone should protect biodiversity as it maintains the balance in nature. Loss of many species threatens the existence of several other species. Lastly, due to its sheer beauty, biodiversity has got great aesthetic value in terms of ecotourism, bird watching, wildlife gardening, and many others. Beautiful landscape and natural ecosystem enhance our emotional and spiritual state of well-being. Aesthetic sense inspire scientist, artist, and students as well.

Taking a look on the geographic distribution of the angiosperms found in the campus, a total of 40 families with 121 species are introduced in the country. This means that plants in the campus are not native to the place and instead has been accidentally or deliberately transported to the area by human activity. Ten plant species are native to the Philippines and other parts of Asia namely: *Aerva sanguinolenta* (L.) Blume*, Euonymus fortune* (Turcz), *Quisqualis indica* L., *Lagerstroemia speciose* (L.) Pers, *Lansium domesticum* (Correa), *Melia azedarach* (Melia), *Parkia timoriana* (DC.) Merr., *Eucalyptus deglupta* Blume, *Nauclea orientalis* (L.), *Musaenda dona aurora* A. Rich*, Vitex parviflora* Juss.

When it comes to the ecological status of the plants (Table 2), it was found out that there are five (5) species considered endemic namely: *Carmona retosa* (Vahl) Masam, *Canarium ovatum* Engl., *Afzelia rhomboidea* (Blanco), *Ficus septica* Burm. f. and *Ixora cv.*. Endemic species are those that exist only in one geographic region. According to Sinha and Heaney (2006), endemic species are considered as good indicators of the status of habitats and ecosystems. The use of endemic species in the campus as indicator of ecosystem status will help the school administration to focus conservation priorities in the areas where these endemic species were found.

Meanwhile, there are five (5) species of plants in the campus considered vulnerable namely: *Aleurite moluccana, Antidesma pleuricum, Mallotus philippinensis, Cratoxylum formosum* and *Dracontomelon dao.* Moreover, a total of five (5) tree species are considered to be facing a very high risk of extinction in the wild or Endangered namely: *Mangifera odorata, Cananga odorata, Afzelia rhomboidea, Shorea astylosa,* and *Shorea malibato* and one (1) tree species the *Pterocarpus indicus* commonly known as Narra is critically endangered which means that it is facing an extremely high risk of extinction in the wild. Narra has been used in the construction and furniture industry, this might be one of the reasons of its being critically endangered.

Table 2. List of plant species in the campus and its IUCN status

Family	Genera	Species	IUCN Status
Boraginaceae	*Carmona*	*retosa*	Endemic
Burseraceae	*Canarium*	*ovatum*	Endemic
Caesalpiniaceae	*Afzelia*	*rhomboidea*	Endemic
Moracea	*Ficus*	*septica*	Endemic
Rubiaceae	*Ixora*	*cv*	Endemic
Anacardiaceae	*Dracontomelon*	*dao*	Vulnerable
Euphorbiaceae	*Aleurite*	*moluccana*	Vulnerable
Euphorbiaceae	*Antidesma*	*pleuricum*	Vulnerable
Euphorbiaceae	*Mallotus*	*philippinensis*	Vulnerable
Guttiferae	*Cratoxylum*	*formosum*	Vulnerable
Anacardiaceae	*Mangifera*	*odorata*	Endangered
Anacardiaceae	*Cananga*	*odorata*	Endangered
Caesalpiniaceae	*Afzelia*	*rhomboidea*	Endangered
Dipterocarpaceae	*Shorea*	*astylosa*	Endangered
Dipterocarpaceae	*Shorea*	*malibato*	Endangered
Fabaceae	*Pterocarpus*	*indicus*	Critically endangered

Mangifera odorata

Cananga odorata

Afzelia rhomboidea

Shorea malibato

Shorea astylosa

Figure 6. Endangered plant species found in the campus

Plant species considered endangered belong to Families Anacardiaceae, Caesalpiniaceae and Dipterocarpaceae. These families of trees are highly important. Family Anacardiaceae and Caesalpiniaceae are composed of economically important species that bear fruits. *Magnifera indica* (L) or 'mangga, *Anacardium occidentale* (L.) or "kasoy" and *Spondias purpurea* (L.) or "sineguelas are some of fruit bearing plants under Family Anacardiaceae. While *Tamarindus indica* (L.) is one of the known fruit-bearing trees in the Philippines. On the other hand, family Dipterocarpaceae is not only known as a source of resin for manufacturing varnish but is also famous because it serves as a source of hardwood timber used in construction. Among the members of this family are *Dipterocarpus grandifloras* (Blanco) Blanco or "apitong", *Shorea contorta* (S. Vidal) or white lauan, *S. gisok* or "gisok", and *Anisoptera thurifera* (Blanco) Blume or "palosapis".

CONCLUSION AND RECOMMENDATION

The green spaces in the University of Mindanao houses significant number of flowering plants with a total of 64 families. The forested areas of the campus hosts threatened, vulnerable and endemic trees. However some of the tree species has been affected by the urbanization and development in UM, Matina Campus and no longer exists. It is highly recommended to preserve the areas hosting threatened, vulnerable and endemic species of plants. Conservation program must be conducted by providing Information, Education and Communication (IEC) materials of biodiversity in University of Mindanao, Matina Campus so that the entire UM community specifically the administration, staff, faculty and students will be aware of the diverse plant species in the campus. Researchers must also host biodiversity symposium, biodiversity exhibit and presentation to scientific conferences.

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