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Floral composition and diversity in Camp 7, Minglanilla, Cebu Island, Philippines with notes on anthropogenic activities

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Abstract

Much attention has been paid to the impacts of floral distribution on resident communities but studies that tabulate and assess floral diversity and composition in secondary forests, particularly in Cebu Island, Philippines, are scarce. As a safe haven for floral species, most secondary forests provide a glimmer of hope in the conservation of wildlife species. We studied the composition, diversity and structure of floral species in Camp 7, Minglanilla, Cebu Island, Philippines. Total abundance, richness, evenness and diversity of floral species were assessed within the study site. A total of 1,719 individuals of floral species, under 58 species and 28 families were found in the study sites. *Sarcandra glabra* (n=437) *Artocarpus odoratissimus* (n=97), and *Donax canniformis* (n=94) constituted the major floral composition. The abundance of alien plant species was higher than that of the native plant species in all study sites. With a recorded species evenness (PE=0.78), all quadrats proved to be hosting a wide array of floral species indicating that no single species is dominating the landscape, thus ensuring a high diversity index (H'=3.168). This high diversity within the site ensures productive ecosystem and well-balanced ecosystem structure and function. Yet, rampant anthropogenic disturbances (i.e., encroachment by informal settlements, timber poaching, and numerous resources extraction activities) were also identified. It is of great concern to protect and conserve the forest reserve, especially for stakeholders who are working on a community-based ecotourism project.

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Introduction

Biodiversity conservation in tropical forests is a critical issue and a foremost challenge in sustainable forest management because of its key role in human welfare, economy and ecosystem services (Barlow *et al.,* 2007; Chazdon *et al.,* 2009). The rapid conversion of tropical forests for timber production, agriculture, and other factors has created a human-dominated landscape, which potentially displace major flora and fauna. Moreover, anthropogenic disturbances and secondary plantation forests are rapidly expanding, leaving very few undisturbed primary forests (Gibson *et al.,* 2011). Although recent literatures have attempted to establish baseline data on floral species, there are only few studies to date that has additionally considered an inventory of flora in Cebu Island, Philippines. This study aimed to determine the floral composition and diversity in Camp 7, Minglanilla, Cebu Island, Philippines. Floristic inventories were conducted which served as firsthand baseline data for plants in the study area.

Camp 7 in Minglanilla, Cebu is considered as one the oldest secondary forests in the Philippines. It was established in 1937 through Proclamation No. 208 as an experimental forest (Shio, 2013). The Department of Natural Resources launched this reforestation program also called as the Osmeña Reforestation Project which continuously restores and preserves the forests from the damage it was able to incur from mining and quarrying activities (Seidenschwarz, 1988). Currently being managed by Department of Environment and Natural Resources- Ecosystems Research and Development Bureau (DENR-ERDB) and Coastal Resources and Ecotourism Research, Development, and Extension Center (CRERDEC), it is still one of the front runners in biodiversity assessments and but has no complete floral species inventory. Per data gathered from DENR-ERDB, they only have few records of tree species. In fact, in February 2018, the management informed the public through an online article that an endemic species of a tree, specifically *Cynometracebuensis* was discovered after a group of students performed a biodiversity assessment in the said experimental forest (Seidenschwarz, 2013).

With this discovery, it suggests that secondary forests indeed might provide a haven for different species of organisms and there is a need to explore its vastness for possible discovery of more endemic and native species. This study aimed to: (a) tabulate floral species found in the experimental forest of Camp 7, Minglanilla, Cebu Island, Philippines (b) identify the species composition (i.e., species richness, abundance, evenness and diversity) of floral species, (c) assess the endemicity and conservation status of floral species and (d) determine the anthropogenic activities rampant in the study site. Information provided in this study could serve as a tool and guide to a sustainable conservation and effective preservation strategies, especially that CRERDEC is working on a community-based ecotourism project.

Materials and methods

Study site and entry protocol

This study was conducted at Camp 7 Experimental Forest Station, Minglanilla, Cebu, Philippines, a secondary forest and one of the oldest in the Philippines. This site is located in Cebu City at 10°19'50" N and 123°46'64" E, with a land area of 123.40 hectares (Fig. 1). It has a Type III climate with relatively dry season from November to April, and wet season during the remaining months of the year (Lagmay *et al.*, 2019). Average annual precipitation in Minglanilla, Cebu is 60 mm (Laymay *et al.,* 2019). As experimental forest, it caters various studies related to biology, forestry and environmental science. Records also showed that 60% of the tree species is composed of mahogany. Other tree species recorded in the DENR VII file included Benguet Pine (*Pinus insularis*), Narra (*Pterocarpus indicus*), Bagtikan (*Parashorea malaanonan*), White Lawaan (*Pentacme contorta*), Tanguile (*S. polysperma*), Lanutan (*S. polysperma*), Banaba (*L. speciosa*), Kalantas (*Toona calantas*), Almaciga (*Agathis philippinensis*), Toog (*Petersianthus quadrialatus*), Teak (*Tectona grandis*), and Almaciga (*Agathis philippinensis* Warb.). Several forest products are also present like bamboos and rattan. There are 14 species of bamboos in which 6 species were planted as part of the reforestation efforts, but only 4 out of 6 species have successfully grown due to human disturbances. The secondary forest also has 7 caves, 2 of which are within the experimental forest station area. Floral sampling within the study site was with written permission by the management of Camp 7, Minglanilla, Cebu Island, Philippines.

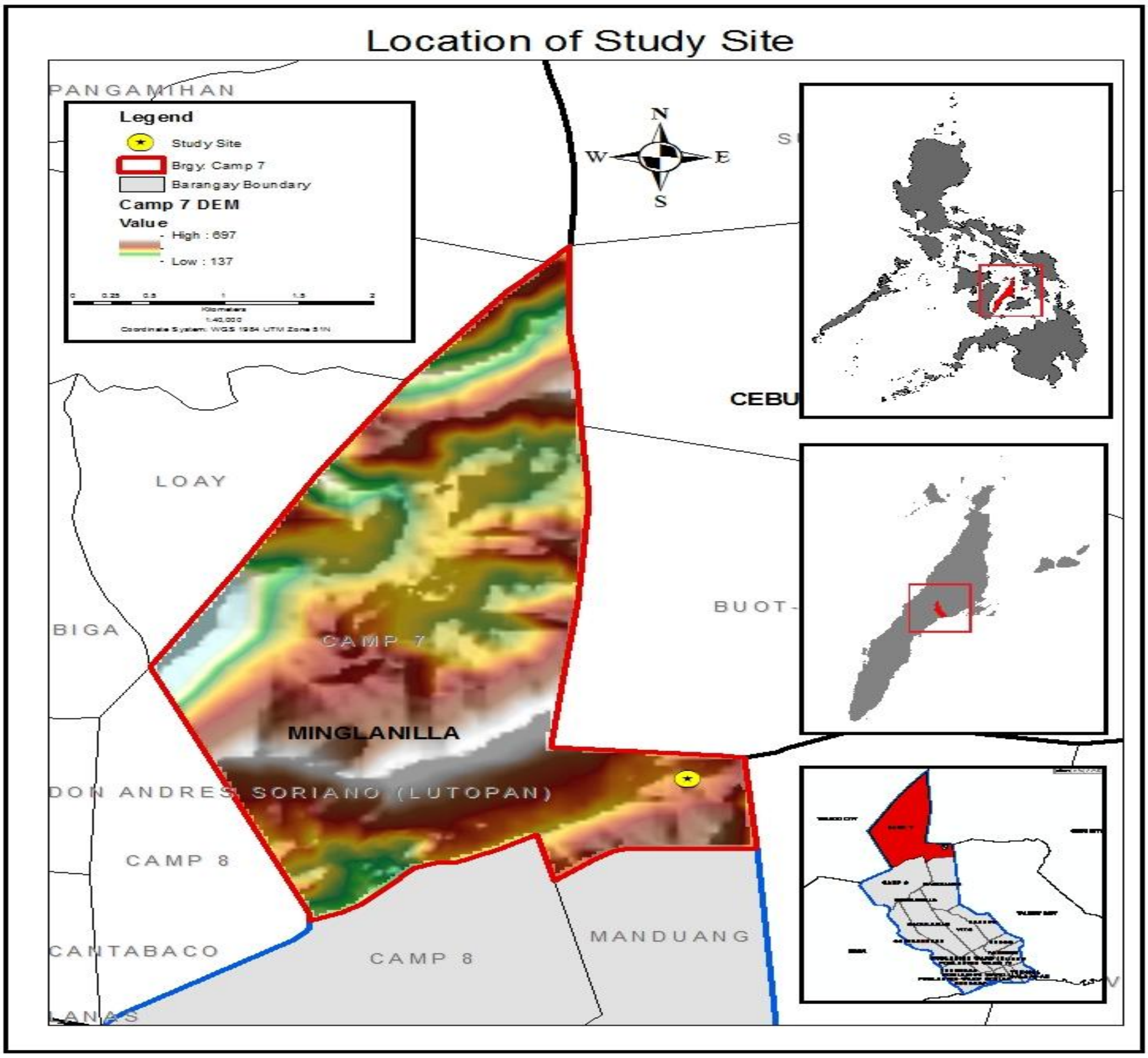

Fig. 1. Map of Camp 7, Minglanilla, Cebu Island, Philippines.

Vegetation sampling

The sampling technique was adapted from Wikum *et al.* (1978). A 20 × 20 m quadrats was randomly established in the study site. It was laid in an area wherein frequent to fewer human activities had been observed. All floral species were collected, counted and listed. The collections were done from January to May of 2019. Residents living within the forest were also interviewed to gather more information and to confirm the observed anthropogenic activities. In order to ensure species richness, abundance, evenness and diversity, opportunistic sampling was considered along the areas outside all transects and quadrats, in accordance to the technique adapted from Ramirez and Mohagan (2012).

Classification and identification

All floral species found in each quadrat were referred to published books, journals and photographs of previously identified specimen. Photos were taken for all floral species for double checking and documentation purposes. In cases of unidentified species, a good example of relevant literatures was utilized such as A Pictorial Encyclopedia of Philippine

Ornamental Plants by Dr. Domingo Madulid, and other digital databases such as Co's Digital Flora of the Philippines (Pelser *et al. 2017*),

The Plant List, Stuartexchange, and PhytoImages. Species conservation status was determined using IUCN and DENR DAO list (2018).

Data analysis

Analysis of data was based on various biological indices by Peet (1975) (i.e., species richness [R], abundance [n],evenness [PE] and diversity (i.e., Shannon-Weiner [H'] and Simpson's diversity [D]) of floral species in Camp 7, Minglanilla, Cebu Island, Philippines. Species richness (R) was determined based on the number of species represented in an ecological community while species abundance (n) was identified on how common a species is relative to other species in an ecological community. Species Evenness (PE), Shannon-Wiener (H'), and Simpson's (D) Diversity Indices were computed for all quadrats with Microsoft Excel spreadsheet analysis. In particular, these formulas were utilized:

To obtain the values of species diversity, H', D and PE were calculated using the Equations 1, 2 and 3, respectively:

Equation (1)

$$H' = \log n - \frac{1}{n}\sum_{i=1}^{k} n_i \log n_i$$

Where, H' = diversity index; ni = number of individuals; In = natural logarithm; and N = total number of species.

Equation (2)

$$D' = \frac{\sum_{i=1}^{k} n_i(n_i - 1)}{n(n-1)}$$

Where, D = Simpson's index; ni = number of individuals; N = total number of species

Equation (3)

$$J = \frac{H}{\ln(S)}$$

Where H=Shannon's Index; ln (S)= natural logarithm and S is the number of species encountered (Smith and Smith, 2000)

Results and discussion

Floral composition and diversity

A total of 1,719 individuals of floral species were recorded in Camp 7 Experimental Forest Station (Fig. 1).

Out of these, 1,719 individuals from 58 different plant species and 28 number of families had been recorded. On the species level, *Sarcandra glabra* (n=437) was the most dominant plant followed by both *Artocarpus odoratissimus* (n=97), and *Donax canniformis* (n=94). Several species namely *Acer pensylvanicum, Aglaonema commulatum, Mimosa pudica, Pterocarpus indicus, Khaya anthotheca, Artocarpus altilis, and Ficus callosa* had the lowest count, n=1 for each species. On the family level, Araceaeis the most abundant family, consisting ofn=10 plant species followed by both Aracaceae and Moraceae (n=6) and Fabaceae/Leguminosae (n=5). Other families had only 1 species each (Table 1, Fig. 2).

Araceae family is said to be one of the most dominant families in the tropics and the result of this study showed its dominance (Zuluaga *et al.,* 2019).

The species richness observed in the study site was relatively high considering that it is a secondary forest (Garces and Flores, 2018; Garces, 2019). Although the study site was previously disturbed with natural and anthropogenic activities at a given time, it could bounce back and host a variety of species to thrive (Kupers *et al.,* 2019).

The importance of secondary forests can be taken into account with this result. This is in congruence with the study of Letcher and Chazdon (2009), where the species richness of secondary forests in Costa Rica is similar with that of old growth forests in a period of 30 years. With Camp 7 being an 82-year-old secondary forest, different floral species to bounce back and populate as years passed by.

Table 1. Biological Indices of Floral Species in Camp 7 Experimental Forest Station, Minglanilla, Cebu Island, Philippines.

Families	Genus species	Total Abun	Relative Abun	Quad	Rel % Freq	H'	D
Aceraceae	*Acer sp.*	1	0.00058	1	20	0.0043336	0
Apocynaceae	*Alstonia scholaris*	8	0.00465	4	80	0.0249915	1.89622E-05
Araceae	*Aglaonema commutatum*	1	0.00058	1	20	0.0043336	0
	Alocasiaatro purpurea	25	0.01454	1	20	0.0615274	0.000203167
	Alocasia brisbanensis	14	0.00814	2	40	0.0391775	6.16272E-05
	Alocasia macrorrhizos	7	0.00407	1	20	0.0224114	1.42217E-05
	Monstera deliciosa	20	0.01163	4	80	0.0518181	0.000128672
	Photos scandens	3	0.00175	3	60	0.0110836	2.03167E-06
	Schismatoglottis calyptrate	38	0.02211	1	20	0.0842656	0.000476087
	Scindapsus pictus	68	0.03956	4	80	0.1277716	0.001542711
	Syngonium angustatum	40	0.02327	1	20	0.0875071	0.000528233
Araliaceae	*Schefflera sp.*	10	0.00582	3	60	0.0299413	3.0475E-05
Arecaceae	*Arenga pinnata*	25	0.01454	5	100	0.0615274	0.000203167
	Calamus deerratus	54	0.03141	5	100	0.1087072	0.000969104
	Caryota furfuracea	8	0.00465	4	80	0.0249915	1.89622E-05
	Caryota mitis	3	0.00175	2	40	0.0110836	2.03167E-06
	Caryota nana	5	0.00291	2	40	0.0169868	6.77222E-06
	Saribus rotundifolius	2	0.00116	1	20	0.0078608	6.77222E-07
Asteraceae	*Blumea balsamifera*	7	0.00407	3	60	0.0224114	1.42217E-05
Chloranthaceae	*Chloranthu serectus*	437	0.25422	5	100	0.3481674	0.064516216
Commelinaceae	*Tradescantia zebrina*	13	0.00756	3	60	0.0369396	5.28233E-05
Costaceae	*Chamaecostus cuspidatus*	12	0.00698	5	100	0.0346568	4.46966E-05
Cyperaceae	*Cyperus esculentus*	50	0.02909	5	100	0.1028934	0.000829597
Dipterocarpaceae	*Hopea philippinensis*	11	0.00640	5	100	0.0323256	3.72472E-05
	Parashorea malaanonan	88	0.05119	5	100	0.1521525	0.002592405
	Shorea polysperma	19	0.01105	5	100	0.0497941	0.000115805
Euphorbiaceae	*Macaranga grandifolia*	3	0.00175	1	20	0.0110836	2.03167E-06
Fabaceae	*Archidendron clypearia*	16	0.00931	4	80	0.0435314	8.12666E-05
	Bauhinia acuminata	17	0.00989	3	60	0.0456526	9.21022E-05
	Bauhinia aherniana	13	0.00756	4	80	0.0369396	5.28233E-05
	Mimosa pudica	1	0.00058	1	20	0.0043336	0
	Pterocarpus indicus	1	0.00058	1	20	0.0043336	0
Lamiaceae	*Gmelina arborea*	2	0.00116	1	20	0.0078608	6.77222E-07
Loganiaceae	*Strychnos ignatii*	22	0.01280	5	100	0.0557801	0.000156438
Marantaceae	*Donax canniformis*	94	0.05468	5	100	0.1589198	0.002960137
Meliaceae	*Khaya anthotheca*	1	0.00058	1	20	0.0043336	0
	Sandoricum koetjape	3	0.00175	2	40	0.0110836	2.03167E-06
Moraceae	*Artocarpus altilis*	1	0.00058	1	20	0.0043336	0
	Artocarpus blancoi	10	0.00582	5	100	0.0299413	3.0475E-05
	Artocarpus	2	0.00116	1	20	0.0078608	6.77222E-07

	heterophyllus						
	Artocarpus odoratissimus	97	0.05643	5	100	0.1622189	0.003153145
	Ficus callosa	1	0.00058	1	20	0.0043336	0
	Ficus pumila L.	59	0.03432	5	100	0.1157334	0.001158727
Nephrolepidaceae	*Nephrolepis exaltata*	8	0.00465	2	40	0.0249915	1.89622E-05
Ophioglossaceae	*Ophioglossum flexuosum L*	3	0.00175	1	20	0.0110836	2.03167E-06
Pandanaceae	*Pandanus amaryllifolius*	35	0.02036	5	100	0.0792875	0.000402947
Poaceae	*Olyra sp.*	40	0.02327	3	60	0.0875071	0.000528233
Polypodiaceae	*Drynaria quercifolia*	43	0.02501	2	40	0.0922611	0.000611531
	Dryopteris oligodonta	21	0.01222	3	60	0.053813	0.000142217
Rubiaceae	*Ixora philippinensis*	41	0.02385	5	100	0.0891059	0.000555322
	Mycetia javanica	10	0.00582	2	40	0.0299413	3.0475E-05
Selaginellaceae	*Selaginella delicatula*	7	0.00407	2	40	0.0224114	1.42217E-05
Vitaceae	*Tetrastig maloheri*	2	0.00116	2	40	0.0078608	6.77222E-07
Zingiberaceae	*Alpinia sp.*	19	0.01105	5	100	0.0497941	0.000115805
	Amomum elegans	12	0.00698	5	100	0.0346568	4.46966E-05
	Etlingera sessilanthera	43	0.02501	5	100	0.0922611	0.000611531
Taxa Families (R)	28	Total No. of Individuals (n)		1719			
Species richness (R)	58	Species Evenness (PE)		0.78		H' = 3.168	D = 0.086

The study also determined the individual species abundance of all the flora recorded in the study site. *Sarcandra glabra* has the highest species abundance (0.25%), followed by *Artocarpus odoratissimus* (0.05%). *Sarcandra glabra*, which accounts a quarter of the entire number of samples' species abundance, has a potential for pharmaceutical importance.

The plant has a potential to decrease susceptibility and severity of influenza in mice (Cao *et al.,* 2012). So, apart from the regrowth of flora, secondary forests also provide sources for plants with medical potential and it is good to know that it is abundant in a secondary growth forest.

Species diversity (H'=3.168) was high in Camp 7, Minglanilla, Cebu Island, Philippines. As an advanced secondary disturbed forest, diversity and distribution of floral species across different sites can be influenced by both environmental factors and anthropogenic activities (Garces, 2019). Variation of plant species indicated that the climatic condition for this forest is suitable for various kinds of flora. In contrast, PE=0.78 recorded in the study site and shown in Table 1 posits that there is no single plant species dominating within all the quadrats, thus, resulting to a value close to 1.

Similar study was also conducted in the forest of Republic of Congo, wherein only one plot in the 3.75 ha study area recorded PE ≤ 0.5 (Ifo, 2016).

In the present study, this also holds true in the current study because even if *Sarcandra glabra* (Herbasarcandrae) is the most abundant plant observed in the area, there are quadrats wherein other plants species is greater in number.

Case on point is in Quadrat 1 where in *Parashorea malaanonan* (Bagtikan) has 47 individuals compared to just 33 counts of *Sarcandra glabra*. With a total of PE=0.78 as shown in Table 1, this means that each species is evenly distributed, and the area has low floral diversity.

Table 2. Current Conservation Status of Floral Species in Camp 7 Experimental Forest Station, Minglanilla, Cebu Island, Philippines.

Families	Genus species	Common Name	IUCN (2017)	DAO (2017)
Aceraceae	*Acer sp.*	NA	LC	NA
Apocynaceae	*Alstonia scholaris*	White Cheese Wood	LC	NA
Araceae	*Aglaonema commutatum*	Philippine Evergreen	NA	NA
	Alocasiaatro purpurea	Giant Taro	CR	NA
	Alocasia brisbanensis	Cunjevoi Lily	NA	NA
	Alocasia macrorrhizos	Elephant Ears	NA	NA
	Monstera deliciosa var.	Monstera / Dragontail	NA	NA
	Photos scandens	Climbing Aroid	NA	NA
	Schismatoglottis calyptrate	Painted Tongue	NA	NA
	Scindapsuspictus	Stain Photos	NA	NA
	Syngonium angustatum	Arrowhead Vine	NA	NA
Araliaceae	*Schefflera sp.*	Umbrella Plant	NA	NA
Arecaceae	*Arenga pinnata*	Black Sugar Palm	NA	NA
	Calamus deerratus	Rattan	LC	NA
	Caryota furfuracea	Clustering Fishtail Palm	LC	NA
	Caryota mitis	Fishtail Palm	LC	NA
	Caryota nana	Many-stemmed Fishtail Palm	LC	NA
	Saribus rotundifolius	Footstool Palm	NA	OTS
Asteraceae	*Blumea balsamifera*	Blumea Camphor	NA	NA
Chloranthaceae	*Chloranthus erectus*	Chloranthus	NA	NA
Commelinaceae	*Tradescantia zebrina*	Wandering Jew	NA	NA
Costaceae	*Chamaecostus cuspidatus*	Insulin Plant	NA	NA
Cyperaceae	*Cyperus esculentus*	Yellow Nutsedge	LC	NA
Dipterocarpaceae	*Hopea philippinensis*	Gisok-Gisok	CR	CR
	Parashorea malaanonan	White Seraya	CR	NA
	Shorea polysperma	Tanguile	CR	VU
Euphorbiaceae	*Macaranga grandifolia*	Parasol Leaf Tree	VU	NA
Fabaceae	*Archidendron clypearia*	Archidendron	CR	NA
	Bauhinia acuminata	White Bauhinia	LC	NA
	Bauhinia aherniana	Bauhinia	NA	NA
	Mimosa pudica	Sensitive Plant	NA	NA
	Pterocarpus indicus	Rosewood / Narra	VU	VU
Lamiaceae	*Gmelina arborea*	Gmelina	NA	NA
Loganiaceae	*Strychno signatii*	St. Ignatius Bean	NA	NA
Marantaceae	*Donax canniformis*	Donax	NA	NA
Meliaceae	*Khaya anthotheca*	Mahogany	VU	NA
	Sandoricum koetjape	Sentul	LC	NA
Moraceae	*Artocarpus altilis*	Bread Fruit Tree	NA	NA
	Artocarpus blancoi	Antipolo	VU	NA
	Artocarpus heterophyllus	Jack Fruit	LC	NA
	Artocarpus odoratissimus	Johey Oak	NT	NA
	Ficus callosa	Ficus	NA	NA
	Ficus pumila L.	Climbing Fig	NA	NA
Nephrolepidaceae	*Nephrolepis exaltata*	Sword Fern	NA	NA
Ophioglossaceae	*Ophioglossum flexuosum* L.	Maidenhair Creeper	NA	NA
Pandanaceae	*Pandanus amaryllifolius*	Pandan	NA	NA
Poaceae	*Olyra sp.*	Carrycillio	NA	NA
Polypodiaceae	*Drynaria quercifolia*	Basket Fern	LC	NA
	Dryopteris oligodonta	Canarian Male Fern	NA	NA
Rubiaceae	*Ixora philippinensis*	Wild Santan	NA	NA

	Mycetia javanica	Mycetia	NA	NA
Selaginellaceae	*Selaginella delicatula*	Moss Fern	NA	NA
Vitaceae	*Tetrastigma loheri*	Tetrastigma	NA	NA
Zingiberaceae	*Alpinia sp.*	Alpinia Ginger	NA	NA
	Amomum elegans	Amomum Ginger	NA	NA
	Etlingera sessilanthera	Torch Ginger	NA	NA

*NA- Not assessed, LC-Least concerned, CR-Critically endangered, VU-Vulnerable.

Notes on conservation and ecological status

Most of the plant species had no IUCN classification (63.79%) and DENR-DAO conservation status (93.10%). Of the identified plants, 18.97% is considered as least concern while 6.90% and 8.62% of the plants are classified as vulnerable and critically endangered by the IUCN, respectively (2017). Vulnerable species include *Pterocarpus indicus* (Roosewood/Narra), *Khaya anthotheca* (Mahogany), and *Macaranga grandifolia (*Parasol Leaf Tree).

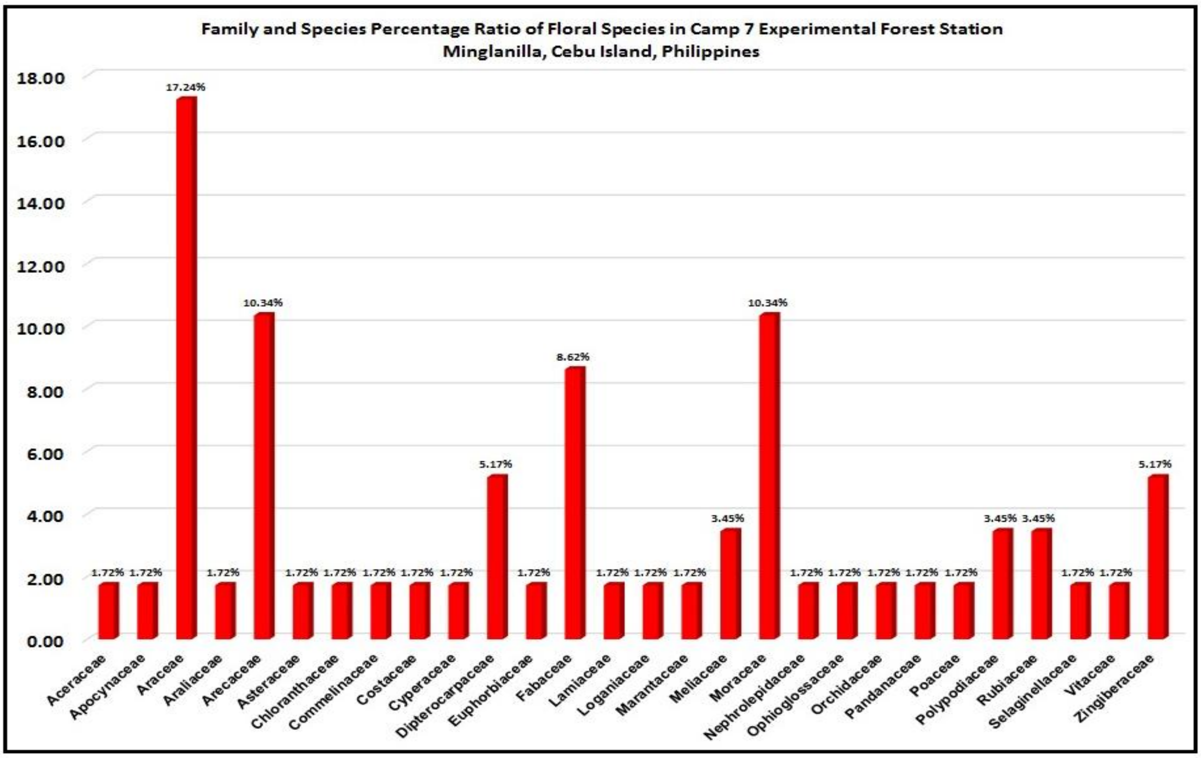

Fig. 2. Family and Species Richness of Floral Species in Camp 7, Minglanilla, Cebu Island, Philippines.

Critically-endangered species include *Parashorea malaanonan* (Bagtikan), Tanguile (*S. polysperma*), and *Hopea philippinensis* (Gisok-gisok). On the case of *Gmelina arborea* (Gemelina), a common tree native to the Philippines that is used for timber, it is quite surprising that an economically valuable tree species' conservation status is not present in the reports of both organizations. Another key information about the conservation status observed was that one plant species' conservation status might be reported in the IUCN Red List but not in the DENR – DAO report, e.g. *Khaya anthotheca* (Mahogany) which is vulnerable in the IUCN Red List but not recorded in the DENR – DAO report. This is also surprising since DENR at some point was promoting the planting of Mahogany trees in their reforestation projects. Both scenarios were observed on the data tabulated on Table 2; Fig. 3. This showed that there is lack of information exchange of both organizations. Although they are independent from each other, the exchange of information should be established at a high rate to determine how we can better protect the different organisms found in different areas of the world.

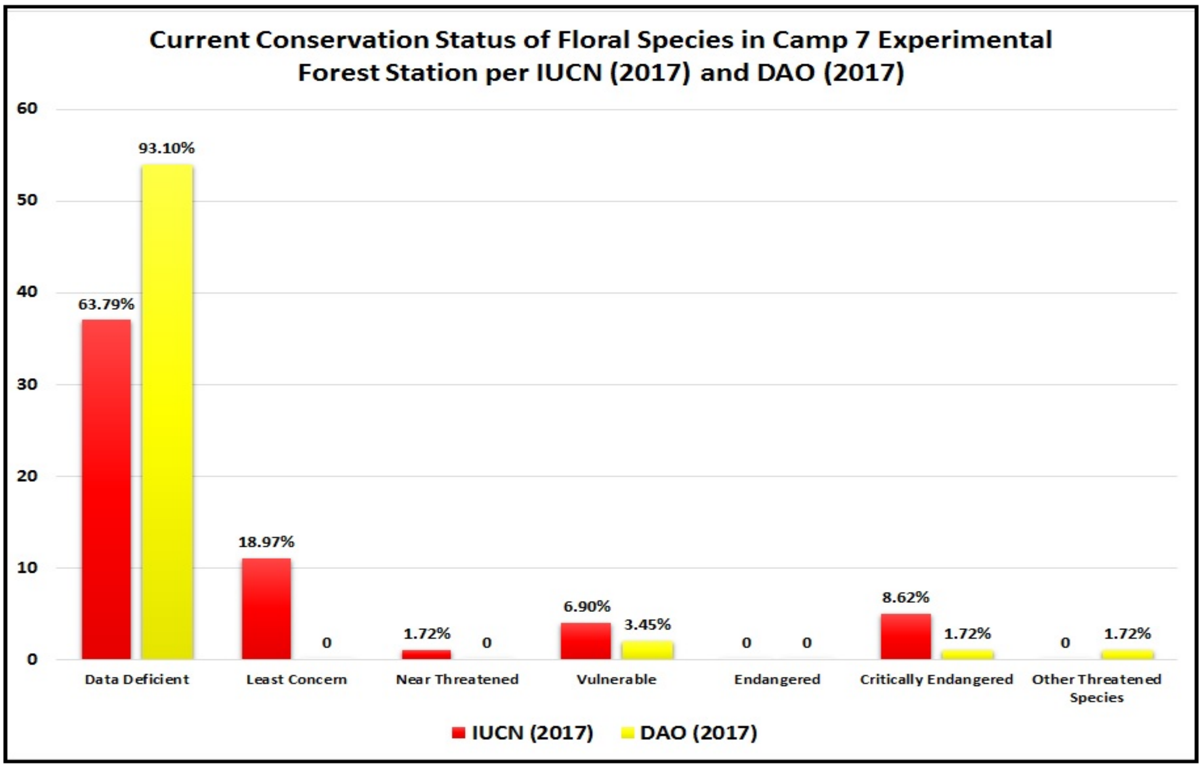

Fig. 3. Current Conservation Status of Floral Species in Camp 7, Minglanilla, Cebu Island, Philippines.

Anthropogenic activities of Camp 7, Minglanilla, Cebu Island, Philippines

The Philippines, being one of the megadiverse and biodiversity hotspots of the world, is currently losing its forest cover at a very alarming rate (Domingo *et al.,* 2019). Various human interventions had been pointed out because of interviews and ocular investigation conducted in Camp 7, Minglanilla, Cebu Island, Philippines. In Camp 7, human disturbances have been identified which might impact the existence of floral species. Anthropogenic activities observed include encroachment by informal settlers, timber wood and firewood collection, forage, improper waste disposal, and trekking, where timber and firewood collection, encroachment by human settlements, and foraging are the most prevalent anthropogenic activities identified within the site. This is the same with the study conducted by Garces (2019) in the disturbed areas of Mount Manunggal, Cebu Island, Philippines.

In Figure 4, human settlements are observed within the forest jurisdiction, few meters from the study site. Some were already living there since decades ago. Moreover, timber collection is identified as one of the most destructive anthropogenic activities in the forest. Most of the settlers have no regular source of income which resorted them to timber collection. Some were sold as whole timber while others were made as charcoal first before getting sold. Informal settlers, especially those who are living in the area for decades already, are clearing some parts of the forest for agricultural purposes. Settlers are also cutting small tree species for house-building materials, domestic product resources such as brooms, sticks and as their source of livelihood (Fig. 4). Aside from timer products, bamboos and rattans are the most exploited resources. Rattan is known for its industrial (furniture making and decorations) and domestic use. Invaders were collecting rattan and remains were just left scattered carelessly. Same thing was observed in Kudremukh National Park, South India, wherein the residents of the area exploited the resources like timber, green foliage, and other forest products (Nagaraja *et al.,* 2011).

Another anthropogenic activity observed in Camp 7 was timber poaching (Fig. 4). Cutting down of timber products both have positive and negative effects. Economically, this provides a source of income to the people involved. Ecologically, this often result to loss of habitat and biodiversity. Rasmussen *et al.* (2019) emphasized the discovery of a new species of monkey in Tanzania (kipunji) that was threatened with extinction, 3 years after discovery because of habitat degradation due to illegal logging. Epiphytic plants (i.e., ferns and orchids) can be greatly affected in this disturbance. However, timber logging through responsible forest management allows new plants to grow because of nutrients and energy availability (Bowd *et al.* 2019). Cutting trees also helps in the reduction of leaf litter decreasing the risk of forest fires (Both *et al.,* 2019).

Fig. 4. Anthropogenic activities rampant in Camp 7, Minglanilla, Cebu Island, Philippines. (A) Human settlements; (B) Trekking and tourist visits; (C) Timber poaching; (D) Illegal logging; (E) Bamboo and Rattan making and (F) Dumping of wastes.

Another important thing to take note is the effect of human paths, including waste disposal) to floral species. Ironically, according to Root-Bernstein and Svenning (2018), human trails and human paths provide habitat for plants and animal species, and these serve as movement corridors and scavenging sites for generalist species (Coffin, 2007). However, it is undeniable that along climate change, anthropogenic activities contribute to the decline in the species abundance, richness and evenness. For example, illegal logging can reduce a tropical forest's biomass which causes the above ground carbon to diminish over time, this in return favors weeds and vines that caused slowing down of the succession (Cazzola *et al.,* 2015). Anthropogenic activities dictate the way a secondary forest performs its ecological functions. As a mining site in the past, Camp 7 have eventually recovered through effectivce restoration efforts which allowed old and new species of organisms to flourish. Forest resources had been of interest and benefited people especially when most of the people of the community have no regular source of income. A resident acknowledged that the forest had been of great use since time immemorial even when they knew that it was, and it is prohibitable to enter and exploit the forest.

The rate of speciation of a secondary forest could be affected by human activities. People living in the area will now try to harvest or make use of the plant species that is most beneficial to them. This will now allow plant species not deemed useful by the populace to thrive in the forest as there is now less competition with the resources. But these results are the common ideas of the studies focusing on species richness or diversity. According to Rebecca-Morris (2010) in her study regarding the effects of anthropogenic activities on tropical forests, it is also important to take note how species interact with each other and how they are organized in networks and yet perform their specific functions. Anthropogenic activities that give out the most damage to the forests should be noted and be halted. The study of Elgueta *et al.* (2014) about differential influences of anthropogenic activities on tree regeneration showed that cattle grazing are a much more devastating human induced activity compared to selective logging. It is suggested that being able to identify which anthropogenic activity causes the most harm can create conservation policies and actions that is geared to address the main disturbing factors. In Camp 7, it would be best to account all the impacting activities to protect, preserve, and conserve the diverse ecosystem without compromising the welfare of the people who depend on it.

Conclusion

This study site, Camp 7, Minglanilla, Cebu Island, Philippines showed distinct floristic composition and diversity. However, five of the listed floral species in the study sites (i.e., *Alocasiaatro purpurea, Hopea philippinensis, Parashorea malaanonan, Shorea polysperma* and *Archidendron clypeari*) were classified as critically endangered and four vulnerable species (*Macaranga grandifolia*, *Pterocarpus indicus*, *Khaya anthotheca* and *Artocarpus* blancoi) based on IUCN. In this regard, further research needs to be carried out on available knowledge and synthesis of acquired knowledge in order to develop effective forestry management measures. Successful reforestation programs should be promoted to help in the diversification of floral species in Cebu Island, Philippines. Threatened by various anthropogenic activities, DENR and stakeholders must take actions to regulate human interventions. These results obtained from the study can be used as a tool to come up with a sustainable and concrete community-based ecotourism project they are currently working on.

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