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Hamiguitan Range: A sanctuary for native flora

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Mindanao Island;
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Abstract Hamiguitan Range is one of the wildlife sanctuaries in the Philippines having unique biodiversity resources that are at risk due to forest degradation and conversion of forested land to agriculture, shifting cultivation, and over-collection. Thus, it is the main concern of this research to identify and assess the endemic and endangered flora of Hamiguitan Range. Field reconnaissance and transect walk showed five vegetation types namely: agro-ecosystem, dipterocarp, montane, typical mossy and mossy-pygmy forests. Inventory of plant species revealed 163 endemic species, 35 threatened species, and 33 rare species. Assessment of plants also showed seven species as new record in Mindanao and one species as new record in the Philippines. Noteworthy is the discovery of *Nepenthes micramphora*, a new species of pitcher plant found in the high altitudes of Hamiguitan Range. This species is also considered site endemic, rare, and threatened. The result of the study also showed that the five vegetation types of Mt. Hamiguitan harbor a number of endangered, endemic, and rare species of plants. Thus, the result of this study would serve as basis for the formulation of policies for the protection and conservation of these species and their habitats before these plants become extinct.

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1. Introduction

Hamiguitan Range, located between 6° 40' 01" to 6° 46' 60" N and 126° 09' 02" to 126° 13' 01" E in the Province of Davao Oriental in Mindanao Island, is the largest pygmy 'bonsai'

forest in the Philippine archipelago. Covering 6834 hectares, the peak of Hamiguitan towers to an altitude of 1600 m asl. The area is generally a rough terrain with a very steep slope gradient. It is the major headwaters of the different major rivers, which are observed to be clear and of good quality that support freshwater aquatic life. The area lies in a typhoon-free region of the Philippine archipelago. It has no pronounced wet or dry season and the weather remains mild all year round that is characterized by a uniform distribution of rainfall, temperature, humidity and air (Protected Area Suitability Assessment, 1998).

Due to the presence of varied ecosystems with many endangered, endemic, and rare species of flora and fauna, the Conservation International has declared the area as one of the Philippine "hotspots" needing conservation and protection (Protected Area Suitability Assessment, 1998). On 30th July

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2004, it was declared by the President, Gloria Macapagal Arroyo, as a protected area under the category of wildlife sanctuary in the Republic Act 9303.

Endemic and endangered flora in the Philippines is currently facing threats due to forest degradation and conversion of forested land to agriculture, shifting cultivation and over-collection. As a result some of these species may be lost before they are recorded, studied and conserved.

It is therefore the main concern of this study to identify and assess the endemic and endangered floral species of Hamiguit-

an Range and determine their habitat and distribution for conservation.

2. Methodology

2.1. Identification of the vegetation types

Field reconnaissance and transect walks were conducted to identify and describe the vegetation types occurring in the

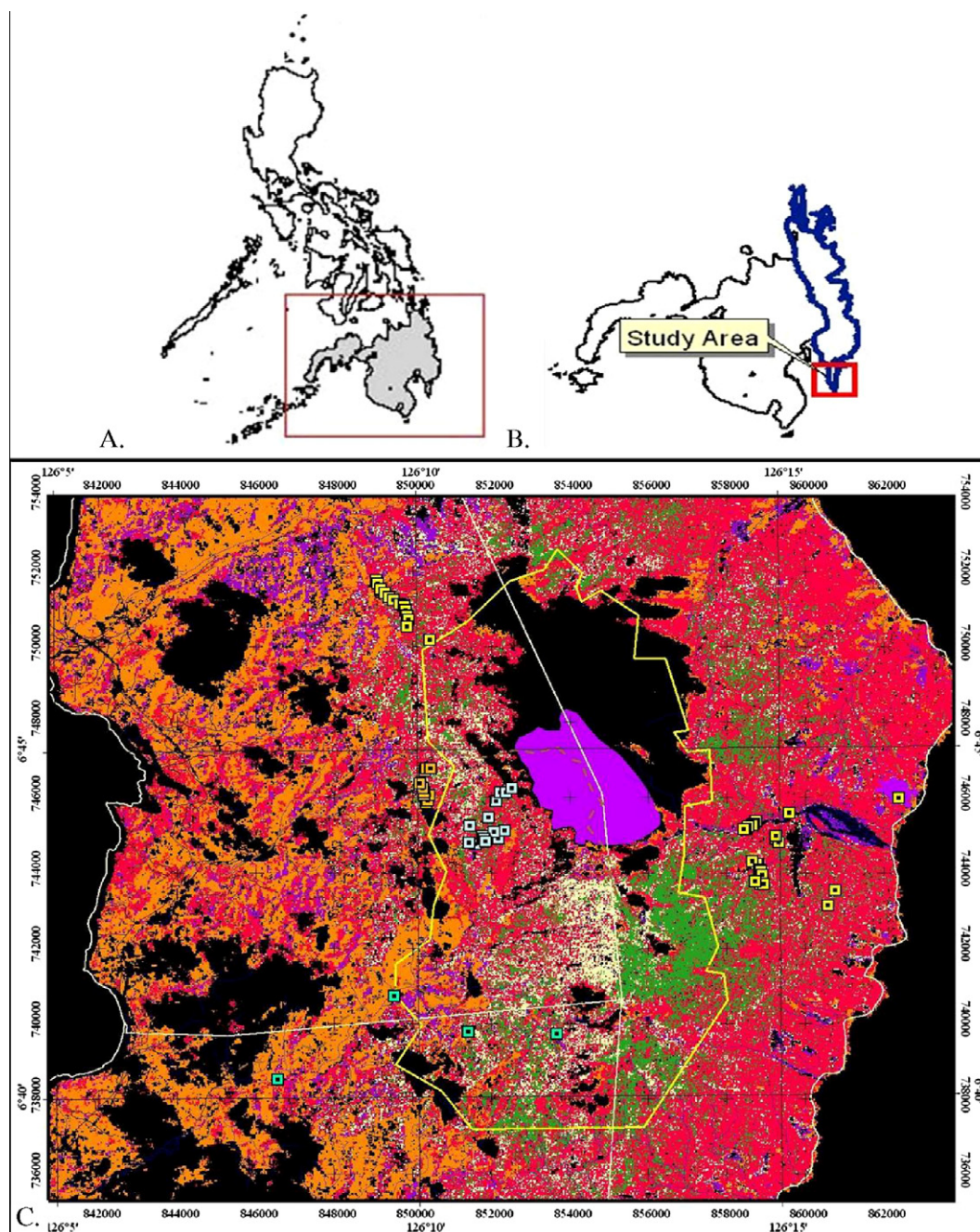


Figure 1 (A–C) Philippine map showing the location of Hamiguitan Range Wildlife Sanctuary. (A) Map of the Philippines showing Mindanao Island in the southern portion of the archipelago. (B) Mindanao Island showing the location of the study area. (C) Sampling research sites (■ ■ ■ ■ ■) and vegetation types (● mossy-pygmy forest; ● montane and mossy forests; ● dipterocarp forest; ● agro-ecosystem).

Hamiguitan Range. On the basis of species composition, altitude, and other ecological indicators, the study identified five vegetation types viz., mossy-pygmy forest, typical mossy forest, montane forest, dipterocarp forest, and agro-ecosystem. In addition, the term agro-ecosystem is used to refer to the cultivated areas around the villages (Fig. 1A–C).

2.2. Identification of collected specimens

The collected plants were identified using available floras and monographs (Merrill, 1912, 1923–1926; Valmayor, 1981; Ashton, 1982; Van Steenes, 1987; Rödl-Linder, 1987; Zamora, 1991; Brummitt, 1992; Madulid, 1995a,b; Pipoly and Madulid, 1996; Amoroso et al., 1996; Barcelona et al., 1996; Rojo, 1996; Huang, 1996, 1997; Hovenkamp, 1998; Nooteboom, 1998; De Wilde, 2000; Jebb and Cheek, 2001; Cootes, 2001; Berg and Corner, 2005; Middleton, 2007; Kurata, 2008; McPherson et al., 2009). Mr. Leonardo L. Co (Conservation International) and Dr. Paul Kessler (National Herbarium Nederland, Leiden branch) confirmed the identification of some species.

2.3. Assessment of floral species

Identified floral species were assessed as endemic, threatened and rare using the data from Merrill (1912, 1923–1926), Zamora and Co, 1986a; Zamora and Co, 1986b; Zamora (1991), Gruezo (1990), Johns (1995), Madulid (1991, 1995), Tan et al. (1996), Wong (1998), Rojo (1996), Arances et al. (2004), Flora Malesiana Series (1995–2007) and DENR Administrative Order (2007).

2.4. Identification of threatened and endemic floral species' habitats for conservation

The type of vegetation, altitude, and location of endemic, endangered and rare species and their habitats were recorded whenever encountered. Transect diagrams were prepared to identify the location and distribution of the threatened and endemic species. The result of this method will be the basis for *in situ* conservation of the threatened species and their habitats.

3. Results and discussion

3.1. Description of the vegetation types

The Hamiguitan Range, with a total surface area of 6834 hectares, has been a protected area since July 30, 2004. The forest covers the higher portion of the mountain (up to 1600 m asl) and the steep slopes at lower altitudes. Hamiguitan Range is characterized by five vegetation types, viz., the agro-ecosystem, the dipterocarp forest, the montane forest, the typical mossy forest and the mossy-pygmy forest (Fig. 2A–F). These vegetation types are described below:

- (1) The agro-ecosystem is situated at 06° 43' 15" N and 126° 07' 22" E and in an altitude ranging from 75–420 m asl. Coconut and banana plantations dominated this type of ecosystem. However, remnants of dipterocarp trees were also found within the vegetation indi-

cating that the area used to be a dipterocarp forest but was logged in 1980's. Noteworthy are the presence of the critically endangered species such as *Shorea guiso* and *Shorea polysperma*.

- (2) The dipterocarp forest is situated at 06° 43' 30" N and 126° 09' 01" E and in an altitude ranging from 420–920 m asl. *Shorea* spp., *Medinilla* spp. and vines (*Smilax* spp.) also dominated the area. Within this forest type, secondary forests are commonly observed adjacent to logging roads as a result of the destruction of the primary forest from logging in 1980's or shifting cultivation. This type of forest has an average height of trees of 14 m that ranges from 5–30 m.
- (3) The montane forest is situated at 06° 44' 08" N and 126° 20' 08" E and in altitude ranging from 920–1160 m asl. This type of forest is characterized by the presence of numerous species of mosses, lichens and epiphytes. *Agathis philippinensis* and other gymnosperms, *Nepenthes* spp. and epiphytes dominated the area. The average height of trees in this forest is 12 m that ranges from 5–25 m.
- (4) The typical mossy forest is situated at 06° 42' 16" N and 126° 11' 52" E and in an altitude ranging from 1160–1350 m asl. Mosses, which cover roots and tree trunks, are observed to be very thick in this vegetation type. *Calophyllum blancoi*, *Dacrydium elatum*, *Calamus* spp. and *Pinanga* spp. were observed to be dominant in the area. *Freycinetia* spp. often festooned over large trees were observed to be the dominant epiphytes. The average height of trees in this forest is 11 m that ranges from 6–15 m.
- (5) The mossy-pygmy forest is situated at 06° 43' 24" N and 126° 11' 11" E and distributed from 1160–1200 m asl and 1460–1600 m asl, and 75–275 m asl at 06° 43' 44" N and 126° 13' 27" E. This forest type occupies approximately 225 hectares in the higher altitudes of Hamiguitan Range. Very old and stunted trees with twisted trunks and branches having an average height of 1.4 m (0.5–2.5 m) dominated the area. The average diameter of the trees is 8 cm. The forest is dominated by *Leptospermum* spp., *Weinmania* spp., *Elaeocarpus* spp. and *Dacrydium* spp. An abundance of mosses could be observed on the forest floor.

3.2. Assessment on the conservation status of floral species

Assessment on the conservation status of the 477 identified species of Hamiguitan Range Wildlife Sanctuary revealed that 163 species (18.56%) are endemic, 35 species (3.99%) are threatened and 33 species (3.75%) are rare (Tables 1–3).

The Philippines is the home of 3557 endemic species and 26 endemic genera. Of these, 3200 species are angiosperms, 6 gymnosperms and 351 are pteridophytes (ferns and fern allies) (Amoroso et al., 2006, 2009; Madulid, 1991). The Hamiguitan Range has a total of 163 (36.69%) endemic species of vascular plants, which corresponds to 5.09% of the total number of endemic plants in the Philippines. Of these, the angiosperms with 153 endemic species has the highest share of endemism with 41.92%, followed by gymnosperms 7.69% (1 species) and pteridophytes 9.09% (9 species) (Table 1). Generally, flowering

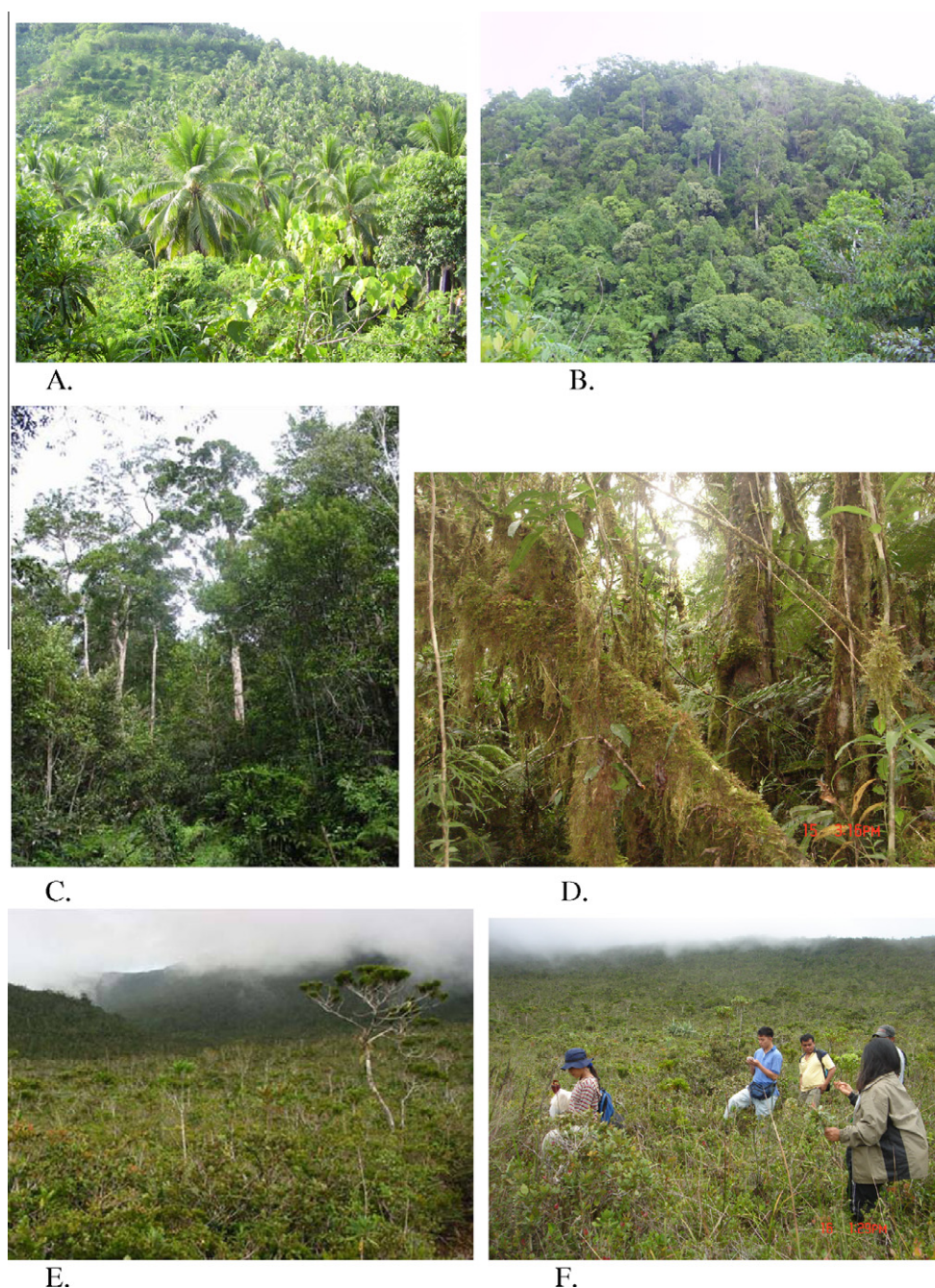


Figure 2 (A–F) Vegetation types of Hamiguitan Range. (A) The agro-ecosystem dominated by coconut trees. (B) The dipterocarp forest dominated by *Shorea* species and other dipterocarp trees. (C) The montane forest dominated by *Agathis philippinensis*. (D) The mossy forest dominated by *Calophyllum blancoi* and *Dacrydium elatum*. (E and F) The unique mossy-pygmy forest dominated by *Leptospermum flavescens*.

plant endemism in the Philippines ranges from 45% to 60% (DENR-UNEP, 1997; Mittermeier et al., 1999).

The Hamiguitan Range Wildlife Sanctuary has a total of 35 threatened species which is 6.60% of the national list of threatened plants. Among which are the 6 critically endangered vascular plants which is against the 5.94% of the national critically endangered plant species (Tables 2 and 3). The critically endangered plant species found in Hamiguitan Range are *Nepenthes copelandii*, *Paphiopedilum adductum*, *Platycerium*

coronarium, *Rhododendron kochii*, *Shorea astylosa* and *S. polysperma*. Noteworthy is the discovery of *Nepenthes micramphora*, a new species of pitcher plant which is site endemic, rare and threatened. This species is growing at 980–1560 m asl. Identified formerly as *Nepenthes bellii* because of the morphological similarities in the stem, lamina, and inflorescence, now, it is formally described as a new species (McPherson et al., 2009). The description was published in McPherson's *Pitcher Plants of the Old World* (volume 2). The herbarium specimen

Table 1 Total number and percentage of endemic species in Hamiguitan Range.

Plant group	Total number and percentage of endemic species					
	Philippines		Mindanao		Hamiguitan	
	Species	Endemism	Species	Endemism	Species	Endemism
Angiosperms	8000 +	3200	No data	No data	698 (365 ^a)	153 (41.92%)
Gymnosperms	33	6	No data	3	25 (13 ^a)	1 (7.69%)
Pteridophytes (Fern and Fern allies)	1027	351	632	183	155 (99 ^a)	9 (9.09%)
Total	9060 +	3557	632	186	878 (477 ^a)	163 (36.69%)

^a Based solely on the specimens identified up to species level.**Table 2** Total number and percentage of threatened and rare species in Hamiguitan Range.

Plant group	Philippines		Hamiguitan		
	Species	Threatened	Species	Threatened	Rare
Angiosperms	8000 +	440	698 (365 ^a)	25 (6.85%)	15
Gymnosperms	33	5	25 (13 ^a)	1 (7.69%)	3
Ferns	1027	68	141 (88 ^a)	6 (6.82%)	13
Fern Allies		17	14 (11 ^a)	3 (2.73%)	2
Total	9060 +	530	878 (477 ^a)	35 (7.34%)	33

^a Based solely on the specimens identified up to species level.**Table 3** Assessment of the threatened species observed in Hamiguitan Range.

Plant group	Threatened species				
	CES	ES	V	OTS	Total
Angiosperms	5	5	13	2	25
Gymnosperms			1		1
Ferns	1	1	4		6
Fern Allies		1	2		3
Total	6	7	20	2	35

CES – critically endangered species; V – vulnerable; ES – endangered species; OTS – other threatened species.

V. Amoroso and *R. Aspiras* CMUH 00003545 is the designated holotype, and is deposited at the Central Mindanao University Herbarium in Musuan, Bukidnon, Philippines. It was collected on 31st of January 2005 from Mount Hamiguitan, on the trail at an altitude of 1300–1560 m asl.

Another noteworthy finding is the discovery of the endemic genus *Greeniopsis*. Of the 6 Philippine species of *Greeniopsis*, 2 species namely *Greeniopsis euphlebia* and *Greeniopsis megalantha* from agro-ecosystem to the mossy forest were found common in the area.

Table 4 Assessment of the status of floral species per vegetation type.

Conservation status	Total no. of species	Vegetation types				
		Agro-ecosystem	Dipterocarp	Montane	Mossy	Mossy-pygmy
<i>Endemic</i>	163	44	78	86	49	66
<i>Threatened</i>						
CES	6	2	2	4	1	2
ES	7	2	4	6	1	2
V	20	9	14	10	8	5
OTS	2	2	2			
<i>Rare</i>	33	3	16	23	23	22

CES – critically endangered species; ES – endangered species; V – vulnerable; OTS – other threatened species.

3.3. Distribution of endemic and threatened species across vegetation types

Of the 163 endemic plants identified, the montane forest was found to be the habitat of 86 endemic species, which is the highest among the different vegetation types followed by the dipterocarp forest having 78 endemic species and the mossy-pygmy forest having 66 endemic species. The lowest number of endemic species could be observed in the typical mossy forest having 49 endemic species and the agro-ecosystem having 44 endemic species. On the other hand, out of the 35 species considered being threatened in Hamiguitan Range, 22 threatened species were found growing in the dipterocarp forest, 20 in the montane forest, 15 in the agro-ecosystem and least were growing in the typical mossy and mossy-pygmy forest with 10 and 9 species respectively. Rare species were observed starting from the montane up to the mossy-pygmy forest ranging from 22–23 species followed by those found in the dipterocarp forest having 16 species. The least number of rare species was observed in the agro-ecosystem (Table 4).

Table 5 showed the habitat of endangered, endemic and rare species that must be given high priority for protection and conservation. The images on some of these plants are shown in

Fig. 3. Transect walk and inventory showed that the mossy-pygmy forest “bonsai field” having an area of 225 hectares and located at 06° 43' 24" N and 126° 11' 11" E in an altitude of 1200 m asl is a unique and interesting feature of Hamiguitan Range. Species of *Agathis*, *Lithocarpus*, *Falcatifolium*, *Leptospermum*, and *Cinnamomum* having a height of more than 15 meters in the dipterocarp forest become stunted when observed in the mossy-pygmy forest having a height of only 3 m or less due to the ultramafic conditions of the soil. This forest type has a substrate predominated by ultrabasic rocks which leaves the soil with high concentration of Fe and Mg and only a specialized group of plants grow & oftentimes dwarf. *Nepenthes alata*, a facultative ultrabasic, as well as obligate ultrabasic species of *Nepenthes* were found to be numerous in the area. Other ultrabasic indicator species such as *Scaevola micrantha*, *Scaevola* sp., *Suregada glomerulata* and *Ochrosia glomerata* were also found thriving in the vegetation.

Another “bonsai field” having the same soil conditions was observed at an altitude of 75–275 m asl at 06° 43' 44" N and 126° 13' 27" E. A habitat of many endemic and rare species such as *Schizaea* spp., *Nepenthes* spp., *Hoya* spp., *Pyrrhosia* spp., *Medinilla* spp., *Platynerium coronarium*, *Psilotum nudum*, and species of orchids, this bonsai field is currently facing high

Table 5 List of endangered, endemic and rare species of plants that must be given high priority for protection and conservation.

Species	Family	Conservation status	Vegetation types	Altitude (m asl)
<i>Nepenthes copelandii</i>	Nepenthaceae	CES, E, R	M, Mo, M-P	1160–1200
<i>Paphiopedilum adductum</i>	Orchidaceae	CES, E	M, M-P	920–1200
<i>Rhododendron kochii</i>	Ericaceae	CES, E	D, M	540–980
<i>Shorea astylosa</i>	Dipterocarpaceae	CES, E	A, D, M	120–1060
<i>Shorea polysperma</i>	Dipterocarpaceae	CES, E	D	320–620
<i>Alocasia zebrina</i>	Araceae	ES, E	D	685
<i>Diospyros philippinensis</i>	Ebenaceae	ES, E	A, D	240–820
<i>Medinilla magnifica</i>	Melastomataceae	ES, E	D, M	420–980
<i>Nepenthes micramphora</i>	Nepenthaceae	ES, E, R	M, M-P	980–1560
<i>Paphiopedilum ciliolare</i>	Orchidaceae	ES, E	M, Mo, M-P	920–1220
<i>Agalmyla persimilis</i>	Gesneriaceae	V, E	A, D	380–860
<i>Aeschynanthus miniaceus</i>	Gesneriaceae	V, E	A, D	380–740
<i>Cinnamomum mercadoi</i>	Lauraceae	V, E	M, Mo	920–1100
<i>Dendrobium sanderi</i> var. <i>surigaense</i>	Orchidaceae	V, E	M, Mo, M-P	920–1200
<i>Shorea contorta</i>	Dipterocarpaceae	V, E	A, D	360–740
<i>Shorea guiso</i>	Dipterocarpaceae	V, E	A, D, M	240–960
<i>Shorea negrosensis</i>	Dipterocarpaceae	V, E	A, D	180–540
<i>Mangifera altissima</i>	Anacardiaceae	V	A, D	120–540
<i>Myristica philippinensis</i>	Myristicaceae	OTS, E	A, M	320–940
<i>Calamus merrillii</i>	Arecaceae	R, E	D, M, Mo	540–1350
<i>Calamus ornatus</i> var. <i>philippinensis</i>	Arecaceae	R, E	D, M, Mo, M-P	540–1200
<i>Nepenthes alata</i>	Nepenthaceae	R, E	A, D, M, M-P	360–1200
<i>Nepenthes argentii</i>	Nepenthaceae	R, E	M, M-P	920–1145
<i>Nepenthes peltata</i>	Nepenthaceae	R, E	D, M, M-P	870–1600
<i>Agathis philippinensis</i>	Araucariaceae	E	D, M, Mo, M-P	905–1235
<i>Buchanania nitida</i>	Anacardiaceae	E	A, D, M, Mo, M-P	140–1200
<i>Dillenia philippinensis</i>	Dilleniaceae	E	A, M	120, 920–1160
<i>Medinilla cumingii</i>	Melastomataceae	E	D	540–820
<i>Medinilla malindangensis</i>	Melastomataceae	E	D	420–540
<i>Gnetum latifolium</i>	Gnetaceae	R	M, M-P	920–1145
<i>Nepenthes maxima</i>	Nepenthaceae	R	M, Mo, M-P	1060–1200
<i>Psilotum nudum</i>	Psilotaceae	R	D, M, Mo, M-P	540–1200
<i>Psilotum complanatum</i>	Psilotaceae	R	M, M-P	920, 1160–1200
<i>Schizaea inopinata</i>	Schizaeaceae	R	D, M	280, 920–1160
<i>Schizaea malaccana</i>	Schizaeaceae	R	D	280

A – agro-ecosystem; D – dipterocarp forest; M – montane forest; Mo – mossy forest; M-P – mossy-pygmy forest; CES – critically endangered species; ES – endangered species; VS – vulnerable species; OTS – other threatened species; E – endemic species; R – rare species.



Figure 3 (A–L) Some endemic, threatened and rare plants of Hamiguitan Range. (A) *Paphiopedilum ciliolare*, endemic, endangered and rare: montane forest at 922 m asl. (B) *Ceratostylis retisquama*, endemic: mossy-pygmy forest at 1145 m asl. (C) *Dendrobium uniflorum*, endemic: dipterocarp forest at 735 m asl. (D) *Bulbophyllum cumingii*, endemic: mossy-pygmy forest at 165 m asl. (E) *Hoya incrassata*, endemic: dipterocarp forest at 530 and 815 m asl. (F) *Hoya meliflua*, endemic: montane forest at 1150 m asl. (G) *Hoya mindorensis*, endemic: agro-ecosystem at 270 m asl. (H) *Calamus merrillii*, endemic: dipterocarp forest at 540 m asl. (I) *Nepenthes alata*, endemic and rare: agro-ecosystem to mossy-pygmy forests at 360 to 1200 m asl. (J) *Nepenthes copelandii*, endemic, critically endangered: mossy-pygmy forest at 1170 m asl. (K) *Nepenthes micramphora*, endemic, endangered and rare: montane to mossy-pygmy forest at 980 to 1560 m asl. (L) *Nepenthes peltata*, endemic and rare: dipterocarp to mossy-pygmy forest at 870 to 1600 m asl.

risk of extinction due to the newly established road for the anticipated mining activities. Alongside this bonsai field is a tract of dipterocarp forest dominated by the threatened large-sized *Shorea astylosa* (Yakal) with dbh over 120 cm. In the upper part of the dipterocarp forest many endangered *Shorea* spp. (*S. polysperma* and *S. contorta*) and rare *Agathis philippinensis* with dbh over 300 cm were noted. This dipterocarp forest is also the habitat of the endemic species of *Greeniopsis*, *Paphiopedilum*, *Freycinetia*, *Hoya*, *Medinilla*, *Alocasia*, *Buchanania* and rare species of *P. nudum*, *P. coronarium*, *Schizaea inopinata* and many unidentified and potential new species of plants.

Other rare and endemic plants observed in the Hamiguitan Range are *Calamus merrillii*, *Calamus ornatus* var. *philippinensis*, *N. alata*, *N. argentii*, *N. peltata*, *N. micramphora*, and *N. copelandii*. The presence of the rare species such as *Gnetum latifolium*, *S. inopinata*, *Schizaea malaccana*, *P. nudum* and *Psilotum complanatum* are noteworthy. However, there is a need to protect and conserve the habitat of *N. copelandii* and *N. micramphora* since these species are threatened, endemic, and rare (Table 5). It was found out that this mountain range is the habitat of the six (6) species of pitcher plants which could not be observed in the other forests in Mindanao. It could also be noted that five (5) species of *Shorea* were also observed in the dipterocarp forest. Ashton (1982) mentioned that *Shorea* spp. are one of the major timber species found in the dipterocarp forest in Malaysia and other Southeast Asian countries. While these species are common in the Philippine nearby countries, these five (5) endemic dipterocarps are critically endangered and vulnerable in the Philippines.

Of the 4 species of *Schizaea* in the Philippines, 3 (75%) were found in the Hamiguitan Range, viz; *Schizaea dichotoma* (L.) Smith, *Schizaea inopinata* Sell. and *Schizaea malaccana* Bak. The last two species are of equal botanical importance as these are new records in Mindanao and collected only once or twice in the Philippines (Table 6). *S. inopinata* was collected only once in Bohol, last 1923 while *S. malaccana* was recently collected only in Mindoro and Sibuyan, last 1993 (Barcelona et al., 1996).

Another important finding is the discovery of new record of plants in the Philippines and in Mindanao (Table 6). Seven new records of plant species in Mindanao include *Elaeocarpus argenteus*, *Elaeocarpus verticillatus*, *Patersonia lowii*, *Astronia lagunensis*, *N. argentii*, *S. inopinata* and *Schizaea malaccana*. *Nepenthes maxima*, on the other hand, is a new record in the Philippines being reported to occur in Sulawesi, New Guinea and Mollucas. A higher number of *Nepenthes* spp. was observed due to the ultramafic soil condition of the Hamiguitan Range. Facultative like *N. alata* and other obligate ultramafic species of *Nepenthes* can only be found common in this type of forest.

4. Conclusion

From the findings of the study the following conclusions are hereby given:

- (1) Hamiguitan Range revealed five (5) vegetation types namely the agro-ecosystem, dipterocarp forest, montane forest, mossy forest and the mossy-pygmy forest. The montane forest revealed to have the highest endemic species among the different vegetation types while the lowest number could be observed in the mossy forest

Table 6 New records of plants in the Philippines and in Mindanao.

Family/species	New record	
	Philippines	Mindanao
I. Elaeocarpaceae		
<i>Elaeocarpus argenteus</i>		/
<i>Elaeocarpus verticillatus</i>		/
II. Iridaceae		
<i>Patersonia lowii</i>		/
III. Melastomataceae		
<i>Astronia lagunensis</i>		/
IV. Nepenthaceae		
<i>Nepenthes argentii</i>		/
<i>Nepenthes maxima</i>	/ ^a	
V. Schizaeaceae		
<i>Schizaea inopinata</i>		/ ^b
<i>Schizaea malaccana</i>		/
Total	1	7

^a Earlier reported in Sulawesi, New Guinea and Mollucas.

^b Second collection since 1923.

and agro-ecosystem. The number of threatened species was found the highest in the dipterocarp forest while the lowest was found in mossy and mossy-pygmy forests. Rare species were observed higher in number in the montane up to the mossy-pygmy while the least in number was observed in the agro-ecosystem.

- (2) Flora of Hamiguitan Range revealed a total of 878 species, 342 genera and 136 families. Of these, 698 are angiosperms, 25 gymnosperms, 141 ferns and 14 are fern allies.
- (3) Hamiguitan Range is the habitat of 163 endemic species, 6 critically endangered species, 7 endangered species, 20 vulnerable species, 33 rare species and 2 other threatened species. It is also the habitat of *N. micramphora*, a new species, site endemic, rare and threatened species of pitcher plant.

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