

## **Checklist of Threatened and Endemic Plants of Mt. Sinaka, Arakan, North Cotabato, Philippines**

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**ABSTRACT**

Assessment of the threatened and endemic flora was conducted in Mount Sinaka. Transect walks revealed a total of 106 threatened and endemic species. One of this is critically endangered, 12 endangered, 23 vulnerable, nine other

threatened species, and 61 Philippine endemic species, including two Mindanao endemic. The critically endangered species is also recorded as Philippine endemic, *Shorea astylosa* Foxw. The presence of threatened and endemic species in the study site needs to be given high priority for protection and conservation of its remaining biological resources.

**Keywords:** Transect walk, Philippine endemic, Mindanao endemic, critically endangered, vulnerable

## INTRODUCTION

The Philippines is considered as one of the mega-biodiverse countries and biodiversity hotspot of the world due to the presence of 993 threatened and 4795 endemic species of flora, thus given a top priority for conservation (DENR Administrative Order 2017; Pelsler et al., 2011 onwards; Convention on Biological Diversity, 2007). These species were observed and recorded from the different mountain ecosystems of the country. Mount Sinaka is a mountain ecosystem in Central Mindanao which is included in the roster of Key Biodiversity Areas (KBA) and Important Bird Areas (IBA) of the Philippines (Mallari et al., 2001). It is home to different flora and fauna, and Philippine flagship species, a symbol of conservation, and an indicator of environmental health, the Philippine Eagle (*Pithecophaga jefferyi* Ogilvie-Grant) (North Cotabato Disaster Risk Reduction/Climate Change Adaptation Enhanced Provincial Development and Physical Framework Plan of 2013-2019; Salvador and Ibanez, 2006). The Local Government Unit (LGU) of Arakan and Bantay Kalikasan work hand in hand for the declaration of Mount Sinaka as a “Critical Habitat”.

Research on specific plant groups were recorded but an extensive study of its flora and its conservation status is not evident. Quack doctors in the vicinity of the mountain make use of the flora inhabiting the mountain for medicinal purposes. Aside from these, the area has been disturbed due to agroforestry activities. People living in the community reported that there were times wherein wild pigs and other wild life species were already seen in their backyards. With these stories, a study on the flora inhabiting Mount Sinaka is very important. Thus, this paper presents a comprehensive record of threatened and endemic plants of Mount Sinaka, Arakan, North Cotabato Philippines. This paper serves as a basis for the strict conservation of the existing threatened and endemic species of plants in the area.

## OBJECTIVES OF THE STUDY

This paper determined the threatened and endemic species of plants in Mount Sinaka, Arakan, North Cotabato, Philippines.

## MATERIALS AND METHODS

### Species Inventory

Gratuitous permit from DENR Region XII was secured before the conduct of the field work. An inventory of flora was then conducted by the authors from November 2019 to April 2021 through repeated transect walks from the foot of the mountain to the highest point in Mount Sinaka, Arakan, North Cotabato, Philippines (7°29'22" N and 125°15'22" E) (Fig. 1).

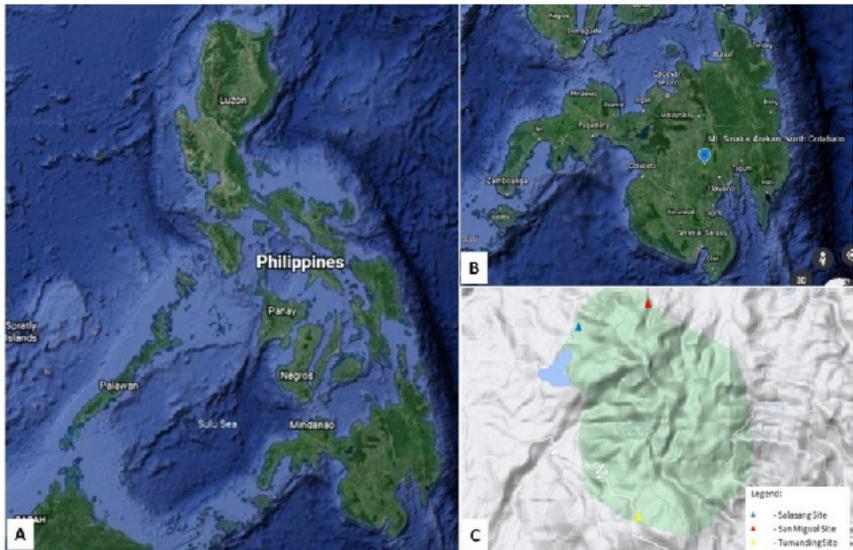


Figure 1. Location map of Mt. Sinaka. A. Map of the Philippines, B. Map of Mindanao Island and C. Sampling routes in Mt. Sinaka.

### Collection, Processing, and Identification of Specimens

Representative specimens of vascular plants were collected, pressed and mounted as herbarium vouchers following standard procedures. Duplicates of the specimens were sent and deposited at the Central Mindanao University. Collected specimens were identified using monographs, e-floras and other

publications like Copeland (1958), the Flora Malesiana Series and digitized plant specimens available in Global Plants on JSTOR (<https://plants.jstor.org/>) and Co's Digital Flora of the Philippines.

### Assessment of the Conservation Status

Conservation status of identified species were assessed based on the updated national list of threatened plants in the Philippines, following the criteria for determination of threatened plant species and their categories of the Department of Environment and Natural Resources (DENR-DAO, 2017-11). The categories are as follows: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) and Other Threatened Species (OTS), which is equivalent to Near Threatened of the International Union for Conservation of Nature (IUCN).

## RESULTS AND DISCUSSION

A total of 106 floras identified at Mount Sinaka, Arakan, North Cotabato, Philippines are recorded to be threatened and endemic. Of this, 61 are endemic, one is critically endangered, 12 are endangered, 23 are vulnerable, and nine are other threatened species (Table 1 & 2).

Table 1

*Conservation status of flora in Mount Sinaka, Arakan, North Cotabato, Philippines*

Conservation Status	Plant Group			Total
	Ferns and Lycophytes	Gymnosperms	Angiosperms	
Critically Endangered	-	-	1	1
Endangered	7	-	5	12
Vulnerable	10	2	11	23
Other Threatened Species	4	2	3	9
Endemic	13	-	48	61

Table 2

*List of Threatened Plants based on DAO 2017-11(Updated list of threatened plants in Family the Philippines)*

Family	Species	Conservation Status			Sampling Site			Altitude
		DENR 2017	IUCN 2020	Endemicity Pelsler et al. (2011 onwards)	Site 1	Site 2	Site 3	
<b>Ferns and Lycophytes</b>								
Lycopodiaceae	1. <i>Phlegmariurus salvinoides</i> (Herter) Ching	EN	-	-	/	/	/	912-1609
	2. <i>Phlegmariurus squarrosus</i> (G.Fors t.) Á.Löve & D.Löve	EN	-	-			/	912-1609
	3. <i>Phlegmariurus banayanicus</i> (Herter) A.R.Field & Bostock	-	-	PE		/	/	912-1609
Selaginellaceae	4. <i>Selaginella negrosensis</i> Hieron.	-	-	PE	/	/	/	912-1609
	5. <i>Selaginella elmeri</i> Hieron.	-	-	PE	/			1070-1348
Aspleniaceae	6. <i>Asplenium persicifolium</i> J.Sm. ex Mett.	EN	-	-			/	912-1609
	7. <i>Asplenium vittaeforme</i> Cav.	VU	-	-	/			1070-1348
	8. <i>Asplenium apoense</i> Copel.	-	-	PE	/	/		1070-1348
Blechnaceae	9. <i>Oceaniopteris egregia</i> (Copel.) Gasper & Salino	VU	-	-		/		1170-1345
Cyatheaceae	10. <i>Alsophila fuliginosa</i> Christ	VU	-	PE	/	/	/	912-1609
	11. <i>Sphaeropteris elmeri</i> (Copel.) R.M.Tryon	VU	-	-	/	/	/	912-1609
	12. <i>Sphaeropteris glauca</i> (Blume) R.M.Tryon	EN	LC	-	/			1070-1348
	13. <i>Sphaeropteris lepifera</i> (J. Sm. ex Hook.) R.M. Tryon	VU	-	-			/	912-1609
Davalliaceae	14. <i>Davallia solida</i> (G.Forst.) Sw.	OTS	-	-	/	/		1170-1345
Dicksoniaceae	15. <i>Dicksonia mollis</i> Holttum	EN	-	-	/	/		1070-1348
Dryopteridaceae	16. <i>Polystichum elmeri</i> Copel.	-	-	PE	/	/	/	912-1609
Lindsaeaceae	17. <i>Lindsaea hamiguitanensis</i> D.N.Karger & V.B.Amoroso	VU	-	ME		/		1170-1345

Table 2 continued.

	18. <i>Lindsaea apoensis</i> Copel.	-	-	PE	/	/		1070-1348
Marattiaceae	19. <i>Angiopteris evecta</i> (G. Forst.) Hoffm. (syn. <i>Angiopteris palmiformis</i> (Cav.) C.Chr.)	OTS	-	-			/	912-1609
Ophiglossaceae	20. <i>Ophioderma pendula</i> (L.) C.Presl	EN	-	-	/	/	/	912-1609
	21. <i>Botrychium daucifolium</i> Wall. ex Hook. & Grev.	VU	-	-	/			1070-1348
Osmundaceae	22. <i>Plenasium banksiifolium</i> (C.Presl) C.Presl	OTS	-	-	/	/		1070-1348
	23. <i>Osmunda banksiifolia</i> (Presl) Kuhn	OTS	-	-	/	/		1070-1348
Polypodiaceae	24. <i>Lecanopteris deparioides</i> (Cesati) Baker	EN	-	-	/	/		1070-1348
	25. <i>Aglaomorpha cornucopia</i> (Copel.) M.C.Roos	VU	-	PE	/	/	/	912-1609
	26. <i>Aglaomorpha heraclea</i> (Kunze) Copel.	VU	-	-	/	/	/	912-1609
	27. <i>Aglaomorpha pilosa</i> (J.Sm. ex Kunze) Copel.	VU	-	-			/	912-1609
	28. <i>Selliguea elmeri</i> Copel.) Ching	-	-	PE	/			1070-1348
Tectariaceae	29. <i>Tectaria athyriosora</i> M.G.Price	-	-	PE		/		1170-1345
	30. <i>Tectaria weberi</i> Copel.	-	-	ME		/		1170-1345
Thelypteridaceae	31. <i>Pronephrium xiphioides</i> (Chr.) Holtum	-	-	PE		/		1170-1345
<b>Gymnosperms</b>								
Araucariaceae	32. <i>Agathis philippinensis</i> Warb.	VU	VU	-		/	/	912-1609
Podocarpaceae	33. <i>Podocarpus philippinensis</i> Foxw. (syn. <i>Podocarpus rumphii</i> Blume)	VU	NT	-	/			1070-1348
	34. <i>Dacrycarpus imbricatus</i> (Blume) de Laub	OTS	LC	-	/			1070-1348
	35. <i>Nageia wallichiana</i> (C. Presl.) Kuntze	OTS	LC	-	/			1070-1348

Table 2 continued.

<b>Angiosperms</b>								
Actinidaceae	36. <i>Saurauia avellana</i> Elmer	-	-	PE	/	/		1070-1348
	37. <i>Saurauia clementis</i> Merr.	-	-	PE	/	/		1070-1348
	38. <i>Saurauia erythrotricha</i> Elmer	-	-	PE		/		1170-1345
Anacardiaceae	39. <i>Mangifera monandra</i> Merr.	VU	NT	PE	/			1070-1348
Annonaceae	40. <i>Mitrephora lanotan</i> (Blanco) Merr.	-	-	PE	/			1070-1348
Apocynaceae	41. <i>Hoya apoensis</i> Kloppenb. & Siar (syn. <i>Hoya cembra</i> Kloppenb.)	-	-	PE		/		1170-1345
Araceae	42. <i>Alocasia sandieriana</i> W.Bull	EN	CR	PE		/	/	1070-1348
	43. <i>Alocasia zebrina</i> Schott ex Van Houtte	VU	-	PE			/	912-1609
Brownlowiaceae	44. <i>Diplodiscus paniculatus</i> Turcz.	-	-	PE			/	912-1609
Chloranthaceae	45. <i>Ascarina philippinensis</i> C. B. Rob.	-	-	PE		/		1170-1345
Clusiaceae	46. <i>Garcinia mindanaensis</i> Merr.	-	EN	PE	/			1070-1348
Dilleniaceae	47. <i>Dillenia philippinensis</i> Rolfe	-	NT	PE		/		1170-1345
	48. <i>Dillenia megalantha</i> Merr	-	VU	PE	/			1170-1345
Dipterocarpaceae	49. <i>Shorea astylosa</i> Foxw.	CR	-	PE	/			1070-1348
	50. <i>Shorea almon</i> Foxw.	VU	NT	-	/		/	1070-1348
	51. <i>Shorea palosapis</i> (Blanco) Merr.	-	LC	PE	/			1070-1348
	52. <i>Shorea polita</i> S. Vidal	-	-	PE	/			1070-1348
	53. <i>Shorea polysperma</i> (Blanco) Merr.	VU	LC	PE	/			1070-1348
Euphorbiaceae	54. <i>Macaranga leytenis</i> Merr.	-	-	PE		/		1170-1345
	55. <i>Croton leiophyllus</i> Mull. Arg	-	LC	PE	/		/	912-1609

Table 2 continued.

	56. <i>Reutealis trisperma</i> (Blanco) Airy Shaw	VU	VU	PE	/			1070-1348
Gesneriaceae	57. <i>Aeschynanthus cardinalis</i> (Copel. ex Merr.) Schltr.	-	-	PE		/		1170-1345
	58. <i>Agalmyla chorisepala</i> (C.B.C larke) Hilliard & Burtt	VU	-	-	/	/	/	912-1609
	59. <i>Cyrtandra decussata</i> Elmer	-	-	PE	/	/		912-1609
	60. <i>Monophyllaea merrilliana</i> Kraenzl	OTS	-	PE		/		1170-1345
Lauraceae	61. <i>Cinnamomum mercadoi</i> S. Vidal	OTS	LC	PE	/		/	912-1609
Melastomataceae	62. <i>Astrocalyx calycina</i> Merr.	EN	NT	PE	/			1070-1348
	63. <i>Astronia apoenses</i> Elmer	-	-	PE	/			1070-1348
	64. <i>Astronia cumingiana</i> S. Vidal var <i>cumingana</i>	-	-	PE	/			1070-1348
	65. <i>Medinilla copelandii</i> Merr.	-	-	PE	/			1070-1348
Moraceae	66. <i>Ficus pseudopalma</i> Blanco	-	-	PE	/			1070-1348
Nepenthaceae	67. <i>Nepenthes truncata</i> Macfarl.	EN	EN	PE	/	/		1070-1348
	68. <i>Nepenthes surigaoensis</i> Elmer	EN	-	PE		/		1170-1345
	69. <i>Nepenthes mindanaoensis</i> Sh.Kurata	VU	LC	PE		/		1170-1345
	70. <i>Nepenthes alata</i> Blanco	VU	LC	-	/	/	/	912-1609
	71. <i>Nepenthes talaandig</i> Gronem., Corotico, Wistuba, Micheler, Marwinski, Gieray & V.B. Amoroso	VU	-	PE		/		1170-1345
Orchidaceae	72. <i>Bulbophyllum alsiosum</i> Ames	-	-	PE		/	/	912-1609

Table 2 continued.

	73. <i>Appendicula irigensis</i> Ames	-	-	PE		/		1170-1345
	74. <i>Crepidium ramosii</i> (Ames) Szlach.	-	-	PE			/	912-1609
	75. <i>Coelogyne candoonensis</i> Ames	-	-	PE			/	912-1609
	76. <i>Gastrodia cajanae</i> Barcelona & Pelsler	-	-	PE			/	912-1609
	77. <i>Dendrobium auriculatum</i> Ames and Quisumbing	-	-	PE	/			1070-1348
	78. <i>Dendrochilum coccineum</i> H.A. Pedersen & Gravend.	-	-	PE			/	912-1609
	79. <i>Dendrochilum serratilabium</i> L.O.Williams	-	-	PE	/			1070-1348
	80. <i>Epigeneium acuminatum</i> Summ erh.	-	-	PE	/	/		1070-1348
Phyllanthaceae	81. <i>Securinega flexuosa</i> (Mull. Arg) ( <i>Flueggea flexuosa</i> Mull. Arg.)	OTS	LC	-	/			1070-1348
Rubiaceae	82. <i>Discospermum reyesii</i> Arriola, Valdez & Alejandro	-	-	PE		/		1170-1345
	83. <i>Praravinia mindanaensis</i> (Elmer) Bremek.	-	-	PE	/	/		1070-1348
Sapotaceae	84. <i>Palaquium luzoniense</i> (Fern.-Villar) Vidal	VU	VU	PE	/	/	/	912-1609
	85. <i>Palaquium philippense</i> (Perr.) C.B. Rob.	VU	VU	PE	/			1070-1348
Zingiberaceae	86. <i>Hedychium philippinense</i> K.Schum	EN	-	PE	/	/		1070-1348
	87. <i>Etilingera philippinensis</i> (Ridl.) R.M.Sm.	-	-	PE		/	/	912-1609

Notes: CR-Critically Endangered; EN-Endangered; VU-Vulnerable; NT-Near Threatened; LC-Least Concern; OTS-Other Threatened Species; PE-Philippine Endemic; ME-Mindanao Endemic

Short description and distribution of some threatened and endemic species, *Shorea polysperma* (Blanco) Merr., *Hedychium philippinense* K.Schum., *Nepenthes truncata* Macfarl., and *Nepenthes surigaoensis* Elmer, are presented below:

***Shorea polysperma* (Blanco) Merr.**

Description

*Shorea polysperma* (Blanco) Merr. Leaves are elliptic, thinly coriaceous with occasionally cream lepidote beneath. Base is cuneate with acumen to 2 cm long and tapering. Nerves are 9-12 pairs. Petiole is 16-22 mm long and slender geniculate (Fig. 2a). It is distinguished from other species by its branchlets which are dark brown and glabrous.

Distribution

This species is Vulnerable (DAO 2017-11) and endemic to the Philippines. It is recorded in BABUYAN ISLS, BASILAN, BILIRAN, CEBU, LEYTE, LUZON: Albay, Bataan, Bulacan, Cagayan, Camarines, Ilocos Norte, Laguna, Nueva Ecija, Pangasinan, Quezon, Sorsogon, Zambales, MINDANAO: Agusan, Bukidnon, Cotabato, Davao, Lanao, Misamis, Surigao, Zamboanga, MINDORO, NEGROS, PANAY, POLILLO, SAMAR. Often common in lowland and medium elevation primary forests, ascending to 1000m to 1200m. (Nooteboom et al., 2021; Pelser et al., 2011 onwards).

***Hedychium philippinense* K.Schum.**

Description

*Hedychium philippinense* K.Schum. Epiphytic and/or lithophytic herb, 0.5 to 1 foot long. Leaves are flat, submembranous, sessile, flattened, glabrous, oblong, with pronounced venation in the adaxial surface, and dull green. It is paler beneath with conspicuous midrib. Apex is acuminate with entire to wavy margin. Leaves are 8 to 17 cm apart and 20–47 cm long by 8–11.5 cm wide. Erect, membranous, and glabrous leaf sheath are 4 to 12 cm wide. Inflorescence are terminal and erect which is 18 cm long by 5 cm wide. It is subterete with basal bracts broad oblong. Apex is acute while, base is broad and clasping measuring 7.5 cm long by 3 cm wide below the middle. It is dull brown when dry with glabrous except the puberulent apex. Flowers 2 from the axils of the Bracts with 3 to 5 cm long floral bract that are broad and boot-like toward the base, thinner in texture, and

gradually tapering to the obtuse usually pubescent apex, which open along the upper ventral side (Fig. 2b).,

#### Distribution

This species is Endangered (DAO 2017-11) and is Philippine endemic. It is recorded in LUZON (Camarines Norte; Rizal; Laguna; Quezon; Sorsogon; Nueva Vizcaya), POLILLO, LEYTE, NEGROS, CEBU, MINDANAO (Bukidnon; North Cotabato; Davao City; Lanao del Sur), JOLO. Lowland and medium elevation humid forests, ascending to 1100m, often epiphytic or pseudoepiphytic (Tobias et al., 2019; Pelsner et al., 2011 onwards)

#### *Nepenthes truncata* Macfarl.

#### Description

*Nepenthes truncata* Macfarl. It is characterized by its heart-shaped (truncate) leaves and huge pitchers reaching up to 40 cm in height. Lower pitchers are up to 24 cm tall and 6 cm wide, and wholly cylindrical or swollen in the bottom half and cylindrical towards the pitcher opening. The wings are up to 2 cm wide. The upper pitchers are typically up to 30 cm tall and 8 cm wide, but can be larger. The pitchers are wholly cylindrical or occasionally the bottom third of the pitcher is slightly swollen and narrowing above before becoming cylindrical or slightly funnel-shaped towards the pitcher opening. The wings are reduced to narrow ridges or indiscernible. The pitchers are usually yellowish green, but may be orange or reddish in full sun.

#### Distribution

This species is Endangered (DAO 2017-11) and is Philippine Endemic. It has been observed in MINDANAO: Agusan del Norte (Mt Hilong-hilong), Surigao del Norte (Cansuran; Samsolang). Wet forests, ridges, and exposed rock cliffs among tall grasses on ultramafics in Surigao del Norte, 225-600m (McPherson & Amoroso, 2011).

#### *Nepenthes surigaoensis* Elmer.

#### Description

*Nepenthes surigaoensis* Elmer. The upper pitchers of this plant are up to 15 cm tall and 6.5 cm wide, but usually more petite and with narrower wings.

The bottom third to half of the pitcher is broadly funnel-shaped, becoming cylindrical and slightly swollen above. The pitchers are typically yellow, green, or light orange, but may suffuse red as the pitchers age. Red blotching may occur on the interior surface of the upper pitcher.

### Distribution

This species is Endangered (DAO 2017-11) and is Philippine Endemic. It is recorded in MINDANAO: Agusan del Norte (Mt. Urdaneta) at 800-1700m. It is also known from the higher slopes of the Mount Masay massif, in the Mabaho Range in northern Mindanao, as well as from a minor peak of the Pantaron Range in central Mindanao (McPherson & Amoroso, 2011).

The Philippines has 9944 species of vascular plants (Pelser et al., 2011 onwards), including 839 species that are noted to be threatened (DAO-2017-11). Of this, 190 threatened species were recorded from selected mountains in Mindanao. This research recorded 45 threatened species of flora in Mt. Sinaka which is 4.5% of the Philippine threatened species. This result is higher than Mt. Hamiguitan Range Wildlife Sanctuary with 35 species (Figure 2A), Mt. Kiamo with 17 species and Mt. Tago with 11 species but lower than those recorded at Mt. Kitanglad Range Natural Park with 92 species and Mt. Malindang Range Natural Park with 56 species (Coritico et al., 2020; Coritico & Amoroso, 2017; Amoroso et al., 2012; Amoroso et al., 2011; and Amoroso et al., 2009).

Species become threatened or endangered due to a variety of reasons. The most significant risks to biodiversity globally include cutting of trees, crop rotation, changes in land use/land cover, environmental pollution, presence of invasive species, grazing grounds, urbanization, hydrological disturbance, and over-utilization of forest resources (Coritico et al., 2020). The leading causes of biodiversity loss are habitat destruction and climate change (Ibrahim et al., 2013). Furthermore, plants become extinct through a series of events, with agriculture, invasions, and urbanization playing as critical drivers in hotspots (Le Roux et al., 2019).

Of the 4745 Philippine endemic species (Pelser et al., 2011 onwards), Mount Sinaka recorded 59 species of Philippine endemic plants and 2 Mindanao endemic species. The result is higher than Mt. Tago range with 16 endemic species and Mt. Kiamo with 12 species (Figure 2B) but lower than Mt. Malindang Range Natural Park with 138 endemic species, Mt. Hamiguitan Range Wildlife Sanctuary with 163 species and Mt. Kitanglad Range Natural Park with 108 species (Coritico et al., 2020; Amoroso et al., 2012).

The spatial distribution of endemism richness in vascular plants is shown to be substantially unequal. As a result, biological characteristics of the mountain, edaphic and forest climate, and underlying geology can all influence the life of a species to some extent (Kiera et al., 2009; Bruchmann & Hobohm, 2014; Krebs, 1994; Tagupa 2006). Thus, the species occur almost anywhere they are capable of growing (Moran, 2008).

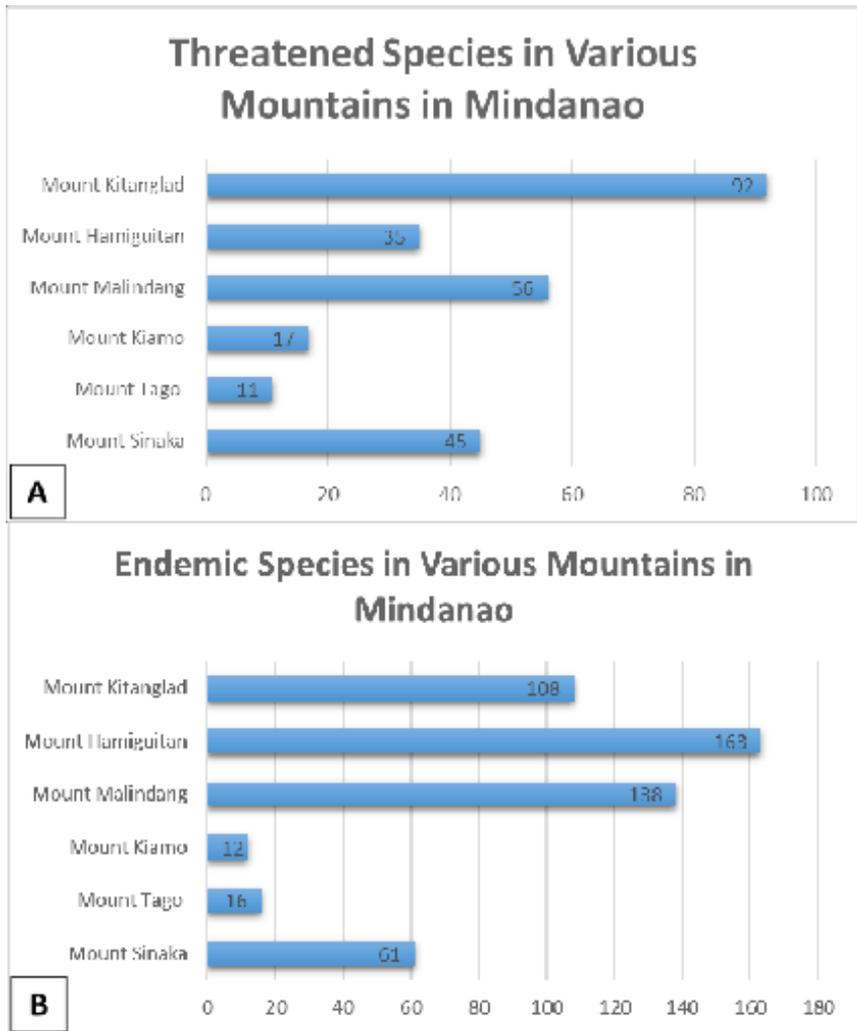


Figure 2. Threatened (A) and endemic (B) species of flora in various mountains in Mindanao.



Figure 3. Some threatened and endemic species of Mount Sinaka, Arakan, North Cotabato. (a) *Shorea polysperma*, (b) *Hedychium philippinense*, (c) *Nepenthes truncata*, (d) *Nepenthes mindanaoensis*, (e) *Nepenthes surigaensis*, (f) *Nepenthes talaandig*, (g) *Bulbophyllum alsiosum*, (h) *Phlegmariurus salvinioides*, (i) *Phlegmariurus squarrosus*, (j) *Ophioderma pendula*, (k) *Lindsaea apoensis*, (l) *Tectaria weberi*.

## CONCLUSIONS

Mount Sinaka is a habitat of 45 threatened and 61 endemic species, including the Mindanao endemic species, *Lindsaea hamiguitanensis* D.N. Karger & V.B. Amoroso and *Tectaria weberi* Copel. Thus, Mt. Sinaka be given high importance for protection and conservation. Further, the presence of numerous threatened and endemic plant species would be additional support for the present effort of the local government unit in the declaration of said mountain into a “critical habitat” due to the presence of the Philippine flagship species, the Philippine Eagle (*Pithecophaga jefferyi*).

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## ACKNOWLEDGEMENTS

The authors gratefully acknowledge the support from the Commission on Higher Education; Central Mindanao University, Musuan, Bukidnon; Municipal Environment and Natural Resources Office, Arakan, North Cotabato; Bantay Kalikasan; and Cotabato Foundation College of Science and Technology, Doroluman, Arakan, Cotabato.