

Threatened Philippine plants in the Makiling Botanic Gardens: A preliminary assessment

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ABSTRACT. The inventory of threatened plants inside the Makiling Botanic Gardens (MBG), Mount Makiling Forest Reserve ASEAN Heritage Park (MMFR AHP) was conducted. The study aims to identify and assess Philippine threatened species based on the DENR Administrative Order 2017-11, including their status, number, and spatial distribution within the area. Following the GIS-Based Assessment, Monitoring, and Evaluation (GAME) Model gridding system, the inventory covered 6.9 ha. The covered area comprises about 2.3% of the 300-ha area of MBG, including the Gardens, the Mudsprings, and the Makiling Rainforest Park (MRP). Trees with a minimum diameter at breast height (DBH) of 5.0 cm were measured and mapped. Vines and orchids were counted and noted. Results of the initial inventory showed a diverse collection of threatened species. A total of 428 species, with 7,657 individuals, were inventoried. Of these, 110 species from 78 genera belonging to 37 families were recorded to be Philippine threatened plant species: 11 are categorized as critically endangered (CR), 21 species are endangered (EN), 53 species are vulnerable (VU), and 25 species are considered other threatened species (OTS). This represents about 11% of the 984 species in the Philippine threatened plant list. About 42% of these threatened species are endemic to the Philippines. Among the MMFR AHP's points of interest, the Gardens has the most significant number of threatened species, followed by the Mudsprings and MRP. The results give the MBG its initial list of documented threatened species. The MBG should prioritize the conservation of its threatened species, including habitats, and implement programs to increase its living collections and develop propagation protocols to make these available for recovery and restoration programs. The study recommends conducting a continuous inventory of all threatened species in MBG.

Keywords: conservation, inventory, living collections, priority species

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INTRODUCTION

Conservation of threatened species is both a national and global concern. Targets 7 and 8 of the Global Strategy for Plant Conservation (GSPC) focus on conserving threatened plants

(Convention on Biological Diversity, 2012). The Philippines, with regards to the conservation of threatened plants, has the Philippine Biodiversity Strategy and Action Plan (PBSAP),

which embodies the 206 conservation priority areas, 228 key biodiversity areas, and 20 targets towards human well-being with Target 1 focusing on the maintenance and improvement on the conservation of threatened plants (DENR-BMB, 2016). Data showed a 30% increase in threatened plants from 686 species (DENR DAO, 2007-01) to 984 (DENR DAO, 2017-11).

These threatened species are mostly found in key biodiversity areas (KBAs). The KBAs were established to prioritize conservation action and develop strategies to protect threatened species, including their representative habitats (Edgar *et al.*, 2008). The Mount Makiling Forest Reserve ASEAN Heritage Park (MMFR AHP) is declared one of the KBAs. Along with other KBAs, there is a need to undertake a range of conservation activities to safeguard threatened species. MMFR AHP is known for its diverse biological resources (Pancho, 1983; Gruezo, 1997; Bantayan *et al.*, 2008; Lapitan *et al.*, 2010; Castillo *et al.*, 2018) and home to many native and endemic species including the popular *Medinilla magnifica* Lindl., *Strongylodon macrobotrys* A.Gray, and *Rafflesia lagascae* Blanco (Fernando *et al.*, 2004).

The Makiling Botanic Gardens (MBG) is a facility within the MMFR AHP. It serves as a show window of MMFR AHP, especially for those unable to go around the reserve. The MBG, as mandated by Republic Act (RA) No. 3523 in 1963, functions mainly to support instruction and research related to forestry and plant sciences and to serve the public's educational, recreational, and tourism needs. Unlike many typical botanic gardens, the MBG houses living collections and a natural forest. It also serves as a repository of important and rare endemic, native, and exotic species.

MBG contains theme gardens and arboreta that showcase a diverse plant collection, including threatened plants. With the establishment of the Philippine red list of threatened species and the inclusion of MMFR to KBA, there is a great need to inventory the plants found within MBG and identify the threatened species to prioritize their conservation and protection. Currently, MBG

has no documented list of threatened species. The list will provide reference material for future germplasm sources, especially for those species in the critically endangered category.

The study aimed to provide MBG's initial list and information on the threatened plants, such as status, their number, and spatial distribution. The results will significantly help as this will complement the conservation efforts in target species, habitats, ecosystems, and priority areas in MBG. Further, this will provide additional information and reference for the global conservation of these crucial species.

METHODOLOGY

Location of the study

The inventory of threatened species composed of vines, shrubs, palms, orchids, climbers, and trees, was conducted in August 2019 – September 2020 as part of the Department of Science and Technology's funded project entitled "Ex-situ Conservation of Threatened Philippine Plants: Restoring Philippines' Plant Resources and Environment." The study is located at MBG, which occupies 300 ha of natural and re-growth forests on the northeastern slope of MMFR AHP. This comprises MMFR's points of interest, such as the Gardens, the Mudsprings, and MRP (Figure 1). Furthermore, the inventory lasted for about a year and covered approximately 6.9 ha of forest floor area, which comprises about 2.3% of the whole area of MBG.

Inventory design and layout

The forest inventory conducted at MBG was guided by GIS-Based Assessment, Monitoring, and Evaluation (GAME) Model gridding system (Bantayan *et al.*, 2008). This model has been the basic unit of field-based assessments in all projects conducted by the Makiling Center for Mountain Ecosystems (MCME). The Center is mandated to conduct research and demonstration programs on mountain ecosystem development and formulate and execute plans for sustainable management of the MMFR.

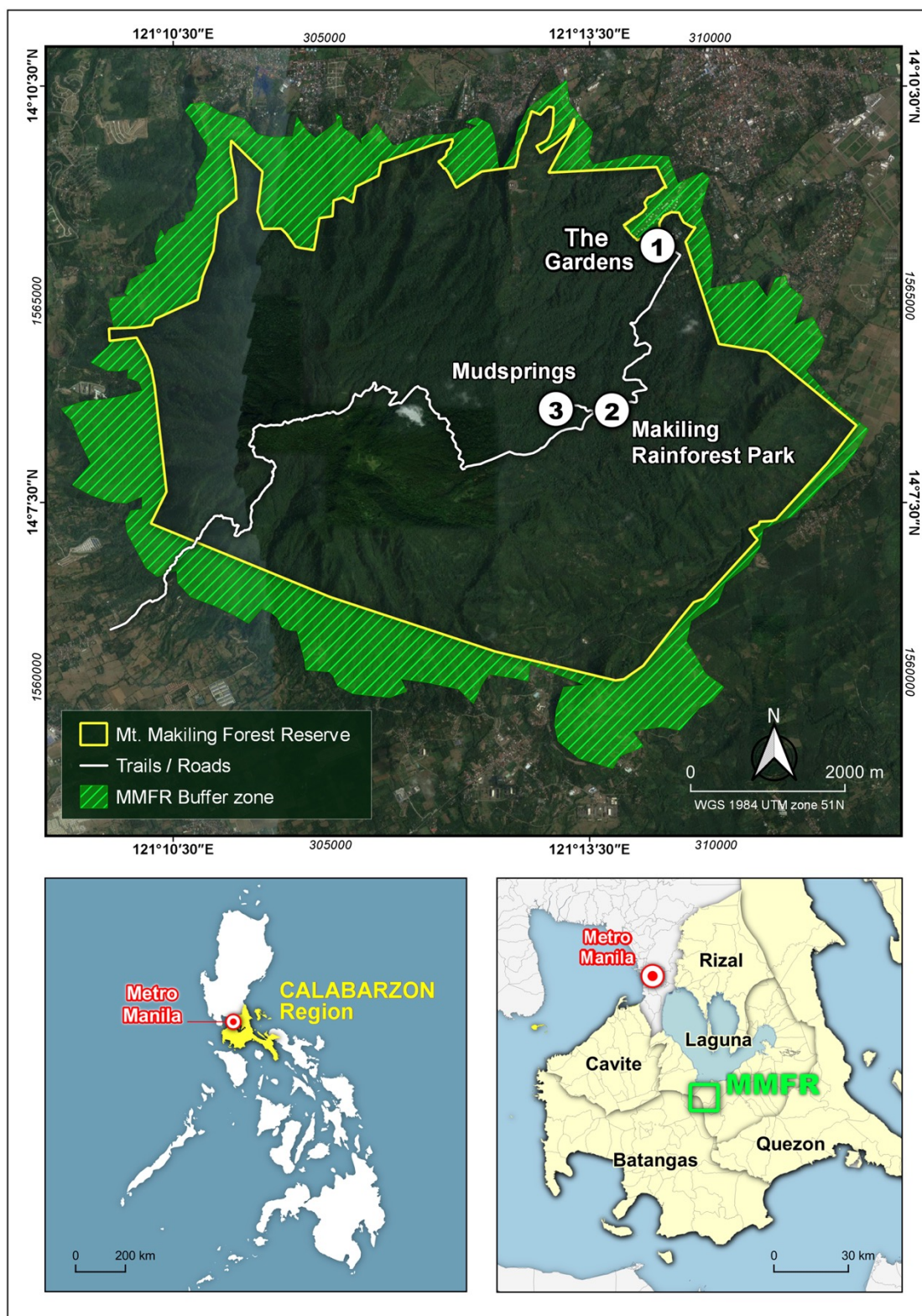


Figure 1. The Makiling Botanic Gardens zone (The Gardens, Makiling Rainforest Park, and Mudspring within the Mount Makiling Forest Reserve ASEAN Heritage Park).

Within the GAME model gridding system, a nested vector grid contains five details ranging from 1 km² to 10 m² (**Figure 2**). Planning fieldwork was carried out on larger grids, while data collected onsite was tagged based on the finer granules of the gridding system. This system allowed MCME to aggregate observations and produce larger-scale analyses such as land cover determination as needed. Contained within the granules were individual point locations of trees inventoried in a portion of MBG.

Inventory of threatened species

All trees with a minimum diameter at breast height of 5.0 cm were measured and recorded, including total and merchantable heights. Vines, orchids, and climbers were counted and noted. Instruments such as diameter tape and range finder were used during the inventory. The relative location of each plant was also determined using Geographic Information System (GIS). Voucher specimens were collected for identification, authentication, and herbarium collection and deposited at the Forestry Herbarium, Department of Forest Biological Sciences (DFBS), College of Forestry and Natural Resources (CFNR), University of the Philippines Los Baños (UPLB).

Species identification

Identification of species was based mainly on morphological characteristics such as leaves, flowers, fruits, seeds, stems, bark, and other characteristics that may help to identify the plant species. Herbarium specimens (including digital images) and DFBS, CFNR, UPLB experts were also consulted.

Categorization of threatened species

From the generated inventory data, threatened species were identified and categorized based on DAO 2017-11 or the Updated National List of Threatened Philippine Plants and their Categories. The study used DAO 2017-11 as the main reference since this is the country's prevailing national red list.

RESULTS AND DISCUSSION

Distribution and status of threatened plants

Results of the initial inventory showed a diverse collection of threatened species. A total of 110 species from 78 genera belonging to 37 families were recorded to be Philippine threatened plant species: 11 species in the critically endangered

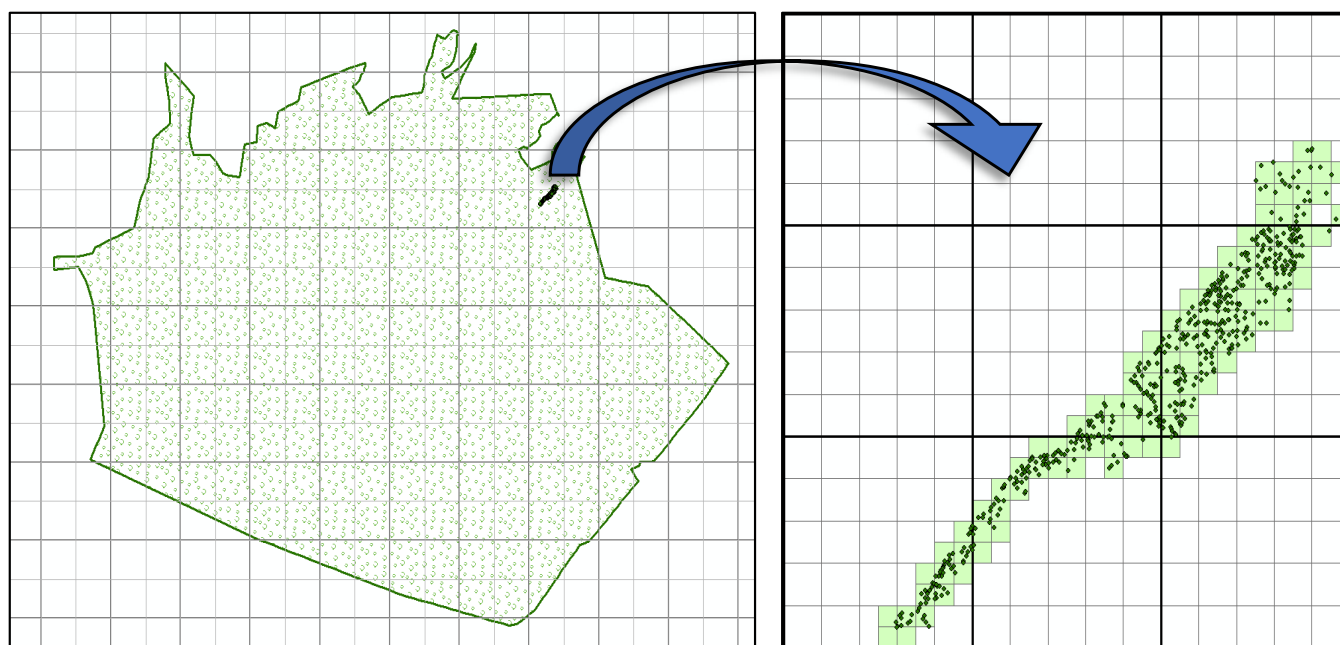


Figure 2. Inventory design and layout using GIS-based assessment, monitoring, and evaluation (GAME) model gridding system.

(CR) category, 21 endangered (EN) species, 53 vulnerable (VU) species, and 25 other threatened species (OTS) (**Table 1**).

About 42% of the identified threatened species are endemic to the Philippines (**Table 1**). Data also revealed that most threatened species fall under the VU category. Among other ASEAN Heritage Parks, MBG has the highest percentage of endemism, followed by Mount Hamiguitan Range Wildlife Sanctuary (MHRWS) (34%), Mount Kitanglad Range Natural Park (MKRNP) (21%), and Mount Malindang Range Natural Park (MMRNP) (16%) (Amoroso *et al.*, 2011). In terms of the number of threatened species, MBG still has the most significant share of threatened species at 110, followed by MKRNP (92 species), MHRWS (35), and MMRNP (34).

Like the MBG, other botanic gardens in Southeast Asia house threatened species in their area. The Queen Sirikit Botanic Gardens (QSBG) in Chang Mai, Thailand, and Singapore Botanic Gardens (SBG) in Singapore keep threatened orchids. SBG recorded 226 species of native orchids. Of these, 178 are considered to be extinct, 40 are CR, one is EN (*Bulbophyllum vaginatum* Rchb.f.), and two are VU (*Vanilla griffithii* Rchb.f., *Bulbophyllum trifolium* Ridl.) (Yam *et al.*, 2010). Meanwhile, the QSBG contains 78 genera and 300 species of Thai native orchids deposited and looking well at their nurseries. Of these, 60 and 20 species are

considered rare and EN, respectively (Nanakorn & Indharamusika, 1997). The Bogor Botanic Gardens (BBG) in Bogor, Indonesia, the oldest botanic garden among them, also shares a list of threatened species (Ariati & Widyatmoko, 2019). BBG listed 36 threatened species belonging to the family Dipterocarpaceae. The list includes *Upuna*, a monotypic genus endemic to Borneo, with its single species *Upuna borneensis* Symington and the rest are mostly *Dipterocarpus*, *Hopea*, and *Shorea* species (BGCI, u.d.). Regarding plant habit, the study documented 86 trees, 10 palms, six orchids, four epiphytes, two herbs, one vine, and one climber (**Figure 3**). The distribution reflects the dominance of trees since about 90% of MBG's natural landscape is forest, and more trees are being planted since they have the most readily available planting materials in the area.

The families of Dipterocarpaceae and Arecaceae have the most threatened species since the living collections comprising these families are among the first established in MBG. Also, the existence of the Dipterocarp Forest at about 600 m elevation of the mountain (Brown, 1919) and the Dipterocarp mix-montane forest zone (Gruezo, 1997) in MMFR provided an excellent and accessible venue for germplasm collection.

The threatened species form part of the natural landscape of MBG. The threatened species are not only used for living collections but also for

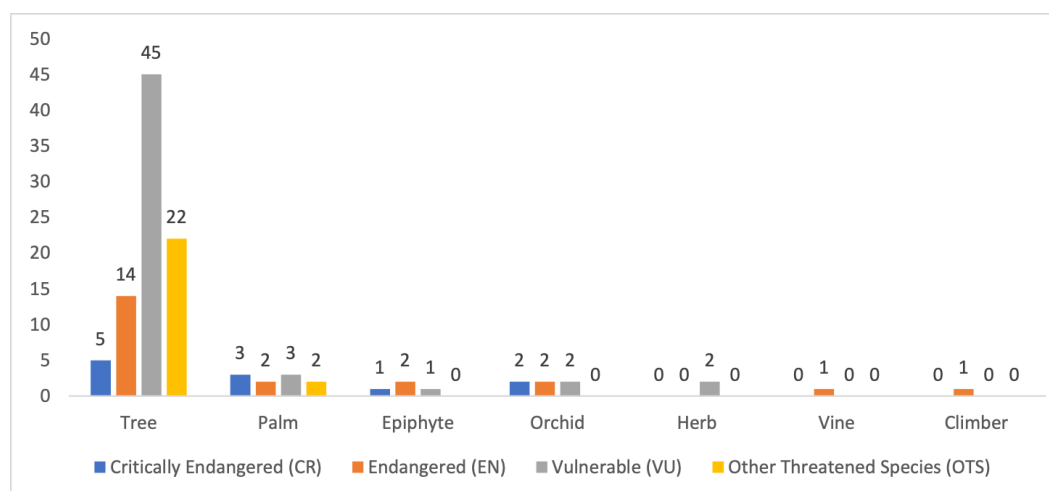


Figure 3. Distribution of threatened plants per plant habit.

communication, education, and public awareness in line with the MBG's function as a training laboratory for instruction, research, and extension. These living collections of threatened plants are being shared with the UPLB community and with all MBG's local and international visitors and plant enthusiasts to increase awareness of the importance of conserving and protecting these threatened species.

List and spatial distribution of threatened species in MBG

The initial list and spatial distribution of 110 threatened plants within the MBG are shown in **Table 1** and **Figure 4**. The Garden recorded the most threatened species since it is the central repository of threatened species in MBG, followed by Mudsprings and MRP (**Figure 4**). As the most accessible among the MMFR's three points of interest, the Gardens is the most frequently visited for education and recreation, hence more activities focusing on plant conservation, interpretation, and appreciation.

Of the 11 species recorded as CR, eight are Philippine endemic. Notable species under this category include *Medinilla magnifica* Lindl., *Heterospathe califrons* Fernando, *Heterospathe scitula* Fernando, *Pinanga bicolora* Fernando, *Hopea malibato* Foxw., *Hopea philippinensis* Dyer, and *Vanda sanderiana* Rchb.f. *M. magnifica* is MBG's emblem since its description was based on collected samples on Mount Makiling in 1800. Most critically endangered species are found within the Gardens' recreation area, nursery, and Dipterocarp arboretum.

Under the EN category, 21 species were listed. Similar to CR species, 13 are Philippine endemic under this category. Notable and rare hardwood species include *Hopea acuminata* Merr., *Sindora supa* Merr., *Tectona philippinensis* Benth. & Hook., and *Litsea leytenensis* Merr. Most of these EN species are found within the Gardens and at higher elevations (300-400 m asl), such as Mudsprings and MRP.

A total of 53 threatened species in MBG fall under the VU category. Notable species include endemic species such as *Areca ipot* Becc., *Cycas riuminiana*

Porte ex Regel, *Dillenia luzoniensis* (S.Vidal) Merr., *Palaquium philippense* (Perr.) C.B.Rob., and *Reutealis trisperma* (Blanco) Airy Shaw. Most of these species are evergreen and commonly growing in low and medium elevations. *P. philippense* is the most widespread species in the Sipit Watershed, one of the major MMFR watersheds, as Brown (1919) reported in Castillo *et al.* (2021).

The OTS also represents 25 species. Under this category are endemic species such as *Artocarpus rubrovenius* Warb., *Canarium ovatum* Engl., *Cinnamomum mercadoi* Vidal, *Mitrephora lanotan* (Blanco) Merr., *Myristica philippensis* Lam., and *Ziziphus talanai* (Blanco) Merr. Most of these OTS species are medium-large trees and used for light construction. Further, they are commonly found at low-medium altitudes, such as *C. ovatum*, widely cultivated and used commercially for making confectionary and bakery products (Fernando *et al.*, 2004).

The number of threatened species in MBG can be attributed to the gardens' natural landscape improvements. These include botanical exploration and germplasm collection, establishing theme gardens, and maintaining natural regenerations as part of MBG's *ex-situ* and *in-situ* conservation programs. Infrastructure development occurred partly in MBG from 1965 to 1967, including plant nursery and foot trail construction. Collections of seeds and seedlings of important endemic trees also commenced. Immediately after that, dipterocarp, palmetum, and leguminous blocks were developed, and intensive research activities focusing on the germination and growth of endemic and native tree species were also undertaken.

Since the garden's establishment in 1963, germplasm collections have been conducted within and outside the MMFR. Its most extensive collection outside the MMFR was in 1997 when the Department of Tourism provided financial assistance in collecting plant species to improve and establish its living collections. The continuous *in-situ* and *ex-situ* conservation programs have managed and conserved these threatened plants inside the garden.

***Spatial Distribution of
Threatened Plant Species
in the Gardens, Mudsprings
and Makiling Rainforest
Park***

- Critically endangered
- Endangered species
- Vulnerable species
- Other threatened species
- Non-threatened species

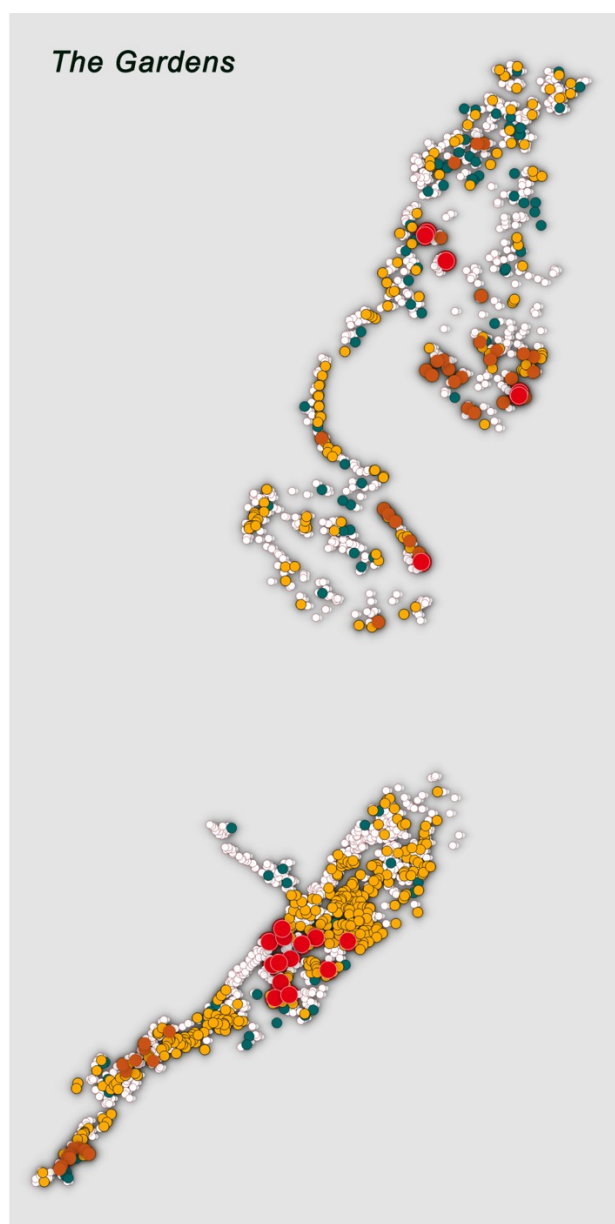


Figure 4. Spatial distribution of Philippine threatened plants found within MBG zone.

Table 1. Initial list of Philippine threatened species recorded in the Makiling Botanic Gardens

No.	Accession code	Family*	Scientific name	Common name	Plant Habit	Threat Category		Endemicity**	N
						DAO 2017-11	IUCN 2022-1		
1	ADEINTFAB2020.00455	FABACEAE	<i>Adenanthera intermedia</i> Merr.	Tanglin	Tree	OTS	VU	Endemic	8
2	ADOMERARE2020.00473	ARECACEAE	<i>Adonidia merrillii</i> (Becc.) Becc.	Manila Palm	Palm	VU	VU	Native	78
3	AFZRHOFAB2019.00386	FABACEAE	<i>Afzelia rhomboidea</i> S.Vidal	Tindalo	Tree	EN	VU	Native	7
4	AGAPHIARA2021.00487	ARAUCARIACEAE	<i>Agathis philippinensis</i> Warb.	Almaciga	Tree	VU	VU	Native	6
5	AGLEDUMEL2019.00413	MELIACEAE	<i>Aglaia edulis</i> (Roxb.) Wall.	Malasaging	Tree	OTS	NT	Native	14
6	AGLRIMMEL2022.00627	MELIACEAE	<i>Aglaia rimosa</i> (Blanco) Merr.	Bayanti	Tree	OTS	NT	Native	9
7	ALALONFAB2021.00484	CORNACEAE	<i>Alangium longi lorum</i> Merr.	Malatapai	Tree	OTS	VU	Native	38
8	ALOZEBARA2021.00558	ARACEAE	<i>Alocasia zebrina</i> Schott ex Van Houtte	Gabing Tigre	Herb	VU	NE	Endemic	1
9	ALPELEZIN2021.00493	ZINGIBERACEAE	<i>Alpinia elegans</i> (C.Presl) K.Schum.	Tagbak	Herb	VU	NE	Endemic	1
10	ANGEVEMAR2021.00770	MARATTIACEAE	<i>Angiopteris evecta</i> (Forst.) Hoffm.	Fern	Tree	OTS	NE	Native	2
11	ANISCADIP2021.00763	DIPTEROCARPACEAE	<i>Anisoptera scaphula</i> (Roxb.) Kurz	Tree	Tree	VU	EN	Native	1
12	APHPOLMEL2020.00462	MELIACEAE	<i>Aphanamixis polystachya</i> (Wall.) R.Parker	Kangko	Tree	OTS	LC	Native	20
13	ARDSQUMYR2019.00369	MYRSINACEAE	<i>Ardisia elliptica</i> Thunb	Tree	Tree	VU	VU	Native	10
14	ARECAMARE2021.00758	ARECACEAE	<i>Areca camarinensis</i> Becc.	Mono	Palm	EN	NE	Endemic	3
15	AREIPOARE2019.00385	ARECACEAE	<i>Areca ipot</i> Becc.	Bungang ipod	Palm	VU	EN	Endemic	2
16	ARTRUBMOR2020.00480	MORACEAE	<i>Artocarpus rubrovenius</i> Warb.	Kalulot	Tree	OTS	NE	Endemic	22
17	BALLUZEUP2020.00459	EUPHORBIACEAE	<i>Balakata luzonica</i> (S.Vidal) Esser	Balakat Gubat	Tree	VU	NE	Native	42
18	CALMERARE2021.00485	ARECACEAE	<i>Calamus merrillii</i> Becc	Palasan	Climber	OTS	NE	Endemic	1
19	CAMLANTHE2021.00767	THEACEAE	<i>Camellia lanceolata</i> (Blume) Seem.	Haikan	Tree	VU	LC	Native	1
20	CANLUZBUR2021.00542	BURSERACEAE	<i>Canarium luzonicum</i> (Blume) A. Gray	Piling liitan	Tree	OTS	NT	Native	39
21	CANOVABUR2021.00500	BURSERACEAE	<i>Canarium ovatum</i> Engl.	Pili	Tree	OTS	LC	Endemic	24
22	CARBRARHI2020.00472	RHIZOPHORACEAE	<i>Carallia brachiata</i> (Lour.) Merr.	Bakauan gubat	Tree	OTS	NE	Native	6
23	CINMERLAU2021.00539	LAURACEAE	<i>Cinnamomum mercadoi</i> S.Vidal	Kalingag	Tree	OTS	LC	Endemic	3
24	CLEQUALAM2021.00489	LAMIACEAE	<i>Clerodendrum quadriloculare</i> (Blanco) Merr.	Bagauak-morado	Tree	VU	LC	Native	1
25	CRYAMPLAU2021.00765	LAURACEAE	<i>Cryptocarya ampla</i> Merr.	Bagarilau	Tree	VU	LC	Native	1
26	CUBCUBSAP2021.00761	SAPINDACEAE	<i>Cubilia cubili</i> (Blanco) Adalb.	Kubili	Tree	EN	LC	Native	2

Table 1. (Cont')

No.	Accession code	Family*	Scientific name	Common name	Plant Habit	Threat Category		Endemicity**	N
						DAO 2017-11	IUCN 2022-1		
27	CYCRIUCYC2021.00486	CYCADACEAE	<i>Cycas riuminiana</i> Porte ex Regel	Bayit	Tree	VU	EN	Endemic	3
28	DILLUZDIL2020.00431	DILLENACEAE	<i>Dillenia luzoniensis</i> (S.Vidal) Merr.	Malakatmon	Tree	VU	VU	Endemic	2
29	DILREIDIL2019.00409	DILLENACEAE	<i>Dillenia reifferscheidia</i> Fern.-Vill.	Katmon Kalabaw	Tree	OTS	NT	Endemic	1
30	DIOCAUEBE2021.00764	EBENACEAE	<i>Diospyros cauliflora</i> Blume	Aponan	Tree	VU	NE	Native	1
31	DIODISEBE2019.00443	EBENACEAE	<i>Diospyros discolor</i> Willd.	Kamagong	Tree	VU	NE	Native	18
32	DIOFEREBE2020.00451	EBENACEAE	<i>Diospyros ferrea</i> (Willd.) Bakh.	Ebony	Tree	VU	NE	Native	6
33	DIOPHIEBE2020.00479	EBENACEAE	<i>Diospyros philippinensis</i> A.DC.	Oi-oi	Tree	VU	NT	Native	1
34	DIPILEBE2021.00506	EBENACEAE	<i>Diospyros pilosanthera</i> Blanco	Bolong eta	Tree	VU	NE	Native	5
35	DIOPONEBE2021.00569	EBENACEAE	<i>Diospyros poncei</i> Merr.	Ponce Kamagong	Tree	CR	EN	Native	1
36	DIOPYREBE2021.00516	EBENACEAE	<i>Diospyros pyrrhocarpa</i> Miq.	Anang	Tree	VU	LC	Native	25
37	DIPALADIP2021.00497	DIPTEROCARPACEAE	<i>Dipterocarpus alatus</i> Roxb. ex G.Don.	Hairy-leaf apitong	Tree	VU	VU	Native	34
38	DIPCAUDIP2021.00581	DIPTEROCARPACEAE	<i>Dipterocarpus caudatus</i> Foxw.	Tailed-leaf apitong	Tree	VU	LC	Native	59
39	DIPGRADIP2019.00392	DIPTEROCARPACEAE	<i>Dipterocarpus gracilis</i> Blume	Panau	Tree	VU	LC	Native	37
40	DIPGRADIP2021.00512	DIPTEROCARPACEAE	<i>Dipterocarpus grandiflorus</i> Blanco	Apitong	Tree	VU	EN	Native	155
41	DIPKerdIP2019.00399	DIPTEROCARPACEAE	<i>Dipterocarpus kerrii</i> King	Malapanau	Tree	EN	EN	Native	7
42	DIPKUNDIP2021.00593	DIPTEROCARPACEAE	<i>Dipterocarpus kunstleri</i> King	Broad-winged apitong	Tree	VU	CR	Native	1
43	DRADAOANA2019.00441	ANACARDIACEAE	<i>Dracontomelon dao</i> (Blanco) Merr.	Dao	Tree	VU	LC	Native	47
44	DRYFALPUT2019.00402	PUTRANJIVACEAE	<i>Drypetes falcata</i> (Merr.) Pax & K. Hoffm.	Gakakan	Tree	OTS	NE	Endemic	4
45	EUSZWALAU2021.00769	LAURACEAE	<i>Eusideroxylon zwageri</i> Teijsm. & Binn	Tambulian	Tree	OTS	VU	Native	2
46	FLUFLEPHY2021.00495	PHYLLANTHACEAE	<i>Flueggea flexuosa</i> Müll.Arg.	Anislag	Tree	OTS	LC	Native	1
47	GLEPHISAP2021.00591	SAPINDACEAE	<i>Glenniea philippinensis</i> (Radlk.) Leenh.	Mamoko	Tree	VU	NE	Native	1
48	GLOPATSAP2021.00501	SAPINDACEAE	<i>Gloeocarpus patentivalvis</i> (Radlk.) Radlk.	Tamaho	Tree	EN	NT	Endemic	1
49	GOMPSISTE2021.00523	STEMONURACEAE	<i>Gomphandra psilandra</i> Schori	Gomphandra	Tree	EN	EN	Endemic	1
50	GRAMULORC2021.00488	ORCHIDACEAE	<i>Grammatophyllum multiflorum</i> Lindl.	Rosa mia	Orchid	VU	NE	Endemic	1
51	GRASPEORC2021.00756	ORCHIDACEAE	<i>Grammatophyllum speciosum</i> Blume	Comely marked orchid	Orchid	CR	NE	Native	1
52	GYMNOBCAS2020.00427	CASUARINACEAE	<i>Gymnostoma nobile</i> (Whitmore) L.A.S.Johnson	Palawan Agoho	Tree	VU	NE	Native	1

Table 1. (Con't)

No.	Accession code	Family*	Scientific name*	Common name	Plant Habit	Threat Category		Endemicity**	N
						DAO 2017-11	IUCN 2022-1		
53	HETCALARE2019.00384	ARECACEAE	<i>Heterospathe califrons</i> Fernando	Yanisi	Palm	CR	CR	Endemic	15
54	HETSCIARE2021.00482	ARECACEAE	<i>Heterospathe scitula</i> Fernando	Malasanakti	Palm	CR	EN	Endemic	21
55	HOPACUDIP2021.00759	DIPTEROCARPACEAE	<i>Hopea acuminata</i> Merr.	Manggachapui	Tree	EN	VU	Endemic	38
56	HOPMALDIP2019.00382	DIPTEROCARPACEAE	<i>Hopea malibato</i> Foxw.	Yakal kaliot	Tree	CR	VU	Endemic	95
57	HOPPHIDIP2021.00577	DIPTEROCARPACEAE	<i>Hopea philippinensis</i> Dyer	Gisok-gisok	Tree	CR	EN	Endemic	29
58	HOPPLADIP2019.00400	DIPTEROCARPACEAE	<i>Hopea plagata</i> (Blanco) S.Vidal	Saplungan	Tree	VU	CR	Native	95
59	HOPQUIDIP2021.00494	DIPTEROCARPACEAE	<i>Hopea quisumbingiana</i> H.G.Gut.	Quisumbing Gisok	Tree	CR	EN	Endemic	1
60	HYDALCACH2021.00484	ACHARIACEAE	<i>Hydnocarpus alcalae</i> C.DC.	Dudua	Tree	OTS	EN	Endemic	1
61	INTBIJFAB2021.00528	FABACEAE	<i>Intsia bijuga</i> (Colebr.) O.Ktze.	Ipil	Tree	VU	NT	Native	35
62	KOOPINANA2020.00465	ANACARDIACEAE	<i>Koordersiodendron pinnatum</i> (Blanco) Merr.	Amugis	Tree	OTS	NE	Native	96
63	LICSPIARE2020.00460	ARECACEAE	<i>Licuala spinosa</i> Wurm.	Balatbat	Palm	VU	NE	Native	2
64	LITCHISAP2020.00452	SAPINDACEAE	<i>Litchi chinensis</i> Sonn. subsp. <i>philippinensis</i> (Radlk.) Leenh.	Alupag	Tree	VU	NE	Native	20
65	LITLEYLAU2021.00510	LAURACEAE	<i>Litsea leytenis</i> Merr.	Batikuling	Tree	EN	NT	Endemic	2
66	MADBETSAP2020.00466	SAPOTACEAE	<i>Madhuca betis</i> (Blanco) Macbr. & Merr.	Betis	Tree	EN	VU	Native	18
67	MANALTANA2019.00401	ANACARDIACEAE	<i>Mangifera altissima</i> Blanco	Pahatan	Tree	VU	DD	Endemic	1
68	MEDCUMMEL2021.00766	MELASTOMATAACEAE	<i>Medinilla cumingii</i> Naudin	Cumingi	Epiphyte	VU	NE	Native	2
69	MEDMAGMEL2019.00410	MELASTOMATAACEAE	<i>Medinilla magnifica</i> Lindl.	Kapa-kapa	Epiphyte	CR	NE	Native	11
70	MEDMINMEL2021.00760	MELASTOMATAACEAE	<i>Medinilla miniata</i> Merr.	Miniata	Epiphyte	EN	NE	Endemic	2
71	MEDPENMEL2021.00545	MELASTOMATAACEAE	<i>Medinilla pendula</i> Merr.	Baladu	Epiphyte	EN	NE	Endemic	5
72	MITLANANN2021.00507	ANNONACEAE	<i>Mitrephora lanotan</i> (Blanco) Merr.	Lanutan	Tree	OTS	NT	Endemic	10
73	MYRPHIMYR2021.00522	MYRISTICACEAE	<i>Myristica philippensis</i> Lam.	Duguan	Tree	OTS	LC	Endemic	20
74	NAGWALPOD2021.00771	PODOCARPACEAE	<i>Nageia wallichiana</i> (C.Presl) Kuntze	Malaaalmaciga	Tree	OTS	LC	Native	1
75	NEPRAMSAP2019.00411	SAPINDACEAE	<i>Nephelium ramboutan-ake</i> (Labill.) Leenh.	Kapulasan	Tree	VU	NE	Native	6
76	ONCPLAARE2021.00540	ARECACEAE	<i>Oncosperma platyphyllum</i> Becc.	Anibong	Palm	EN	CR	Endemic	1
77	PALLUZSAP2020.00454	SAPOTACEAE	<i>Palaquium luzoniense</i> (F. Vill.) S.Vidal	Red Nato	Tree	VU	VU	Native	4
78	PALPHISAP2021.00557	SAPOTACEAE	<i>Palaquium philippense</i> (Perr.) C.B.Rob.	Malak-malak	Tree	VU	LC	Endemic	9
79	PHAAPHORC2020.00463	ORCHIDACEAE	<i>Phalaenopsis amabilis</i> (L.) Blume	Mariposa	Orchid	EN	NE	Native	1

Table 1. (Con't)

No.	Accession code	Family*	Scientific name	Common name	Plant Habit	Threat Category		Endemicity**	N
						DAO 2017-11	IUCN 2022-1		
80	PHAAPHORC2020.00463	ORCHIDACEAE	<i>Phalaenopsis aphrodite</i> Rchb.f.	Mariposa	Orchid	VU	NE	Native	1
81	PHASCHORC2020.00464	ORCHIDACEAE	<i>Phalaenopsis schilleriana</i> Rchb. f.	Tiger orchid	Orchid	EN	NE	Endemic	2
82	PHOLOUARE2020.00439	ARECACEAE	<i>Phoenix loureiroi</i> Kunth.	Voyavoi Palm	Palm	OTS	LC	Native	1
83	PINBICARE2021.00570	ARECACEAE	<i>Pinanga bicolorana</i> Fernando	Bicol abiki	Palm	CR	CR	Endemic	25
84	PLAVILSAP2021.00519	SAPOTACEAE	<i>Planchonella villamilii</i> (Merr.) Swenson	Villamil Nato	Tree	VU	EN	Endemic	1
85	PODCOSPOD2019.00446	PODOCARPACEAE	<i>Podocarpus costalis</i> C.Presl	Igem dagat	Tree	EN	EN	Native	1
86	PREODOLAM2021.00768	LAMIACEAE	<i>Premna odorata</i> Blanco	Alagau	Tree	OTS	LC	Native	1
87	KINALTFAB2019.00444	FABACEAE	<i>Prioria alternifolia</i> (Elmer) Breteler	Batete	Tree	VU	VU	Native	2
88	PTEINDFAB2020.00476	FABACEAE	<i>Pterocarpus indicus</i> Willd. forma <i>echinatus</i> (Pers.) Rojo	Prickly Narra	Tree	VU	EN	Native	66
89	PTEINDFAB2020.00475	FABACEAE	<i>Pterocarpus indicus</i> Willd. forma <i>indicus</i>	Smooth Narra	Tree	VU	EN	Naturalized	86
90	RADCORBIG2020.00426	BIGNONIACEAE	<i>Radermachera coriacea</i> Merr.	Labayanan	Tree	VU	EN	Endemic	1
91	REUTRIEIP2020.00456	EUPHORBIACEAE	<i>Reutealis trisperma</i> (Blanco) Airy Shaw	Baguilumbang	Tree	VU	VU	Endemic	5
92	SARROTARE2020.00474	ARECACEAE	<i>Saribus rotundifolius</i> (Lam.) Blume	Anahau	Palm	OTS	NE	Native	31
93	SHOALMDIP2020.00461	DIPTEROCARPACEAE	<i>Shorea almon</i> Foxw.	Almon	Tree	VU	NT	Native	2
94	SHOASTDIP2021.00538	DIPTEROCARPACEAE	<i>Shorea astylosa</i> Foxw.	Yakal	Tree	CR	EN	Endemic	1
95	SHOCONDIP2019.00396	DIPTEROCARPACEAE	<i>Shorea contorta</i> S.Vidal	White Lauan	Tree	VU	LC	Native	387
96	SHONEGDIP2020.00445	DIPTEROCARPACEAE	<i>Shorea negrosensis</i> Foxw	Red Lauan	Tree	VU	LC	Native	3
97	SHOPOLDIP2021.00762	DIPTEROCARPACEAE	<i>Shorea polysperma</i> (Blanco) Merr.	Tanguile	Tree	VU	LC	Endemic	19
98	SINSUPFAB2019.00403	FABACEAE	<i>Sindora supa</i> Merr.	Supa	Tree	EN	VU	Endemic	2
99	STRMACFAB2020.00469	FABACEAE	<i>Strongylodon macrobotrys</i> A. Gray	Jade vine	Vine	EN	NE	Endemic	5
100	SYMDENFAB2021.00590	FABACEAE	<i>Sympetalandra densiflora</i> (Elmer) Steenis	Kamatog	Tree	EN	NT	Endemic	1
101	SYZNITMYR2021.00488	MYRTACEAE	<i>Syzygium nitidum</i> Benth.	Makaasim	Tree	VU	LC	Native	6
102	TECPHILAM2021.00468	LAMIACEAE	<i>Tectona philippinensis</i> Benth. & Hook.	Philippine Teak	Tree	EN	EN	Endemic	7
103	TOOCALMEL2021.00458	MELIACEAE	<i>Toona calantas</i> Merr. & Rolfe	Kalantas	Tree	VU	DD	Native	8
104	TRIDECMYR2021.00502	MYRTACEAE	<i>Tristaniopsis decorticata</i> (Merr.) Peter G. Wilson & J.T.Waterh.	Malabayabas	Tree	VU	LC	Endemic	1

Table 1. (Con't)

No.	Accession code	Family*	Scientific name	Common name	Plant Habit	Threat Category		Endemicity**	N
						DAO 2017-11	IUCN 2022-1		
105	VANSANORC2021.00757	ORCHIDACEAE	<i>Vanda sanderiana</i> Rchb.f.	Waling-waling	Orchid	CR	NE	Endemic	5
106	VATMANDIP2021.00537	DIPTEROCARPACEAE	<i>Vatica mangachapoi</i> Blanco ssp. <i>mangachapoi</i>	Narig	Tree	VU	VU	Native	1
107	VITPARLAM2019.00408	LAMIACEAE	<i>Vitex parviflora</i> Juss.	Molave	Tree	EN	LC	Native	130
108	WALCELFAB2020.00453	FABACEAE	<i>Wallaceodendron celebicum</i> Koord.	Banuyo	Tree	VU	NE	Native	22
109	XANVERMYR2020.00496	MYRTACEAE	<i>Xanthostemon verdugonianus</i> Naves	Mangkono	Tree	EN	VU	Native	1
110	ZIZTALRHA2021.00772	RHAMNACEAE	<i>Ziziphus talanai</i> (Blanco) Merr.	Balakot	Tree	OTS	VU	Endemic	13
Total								2136	

CONCLUSIONS AND RECOMMENDATIONS

The threatened plants in the Makiling Botanic Gardens represent only 11% of 984 species in the threatened plant list. This gives MBG its first initial list of documented threatened species. There is a need to prioritize these species for national and global conservation and restoration in response to PBSAP and GSPC targets. Long-term programs on conservation and restoration must be developed, which may include regular assessment of threatened plants; the establishment of long-term ecological research plots; conservation biology of selected threatened species; biodiversity education and advocacy; other significant programs that will entail regular monitoring; and updating the conservation status of other important native and endemic species in MBG. The study recommends further conducting an inventory to cover a larger area and possibly more threatened species.

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