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Inventory of native and mother trees in Key Biodiversity Areas of Cebu Island, Philippines for species selection in local reforestation programs

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Abstract. *Lillo EP, Malaki AB, Alcazar SMT, Rosales R, Redoblado BR, Diaz JLB, Pantinople EM, Buot Jr. IE. 2021. Inventory of native and mother trees in Key Biodiversity Areas of Cebu Island, Philippines for species selection in local reforestation programs. Biodiversitas 22: 4740-4749.* Forest restoration is the counterforce of deforestation and forest degradation. Yet, despite promoting natural recovery after forest harvest, afforestation and reforestation efforts, tropical forest ecosystems still experience a poor ratio of forest loss to forest gain. The study assessed the native tree species and potential mother trees in different Cebu Island Key Biodiversity Areas (KBAs) as well as their distribution and habitat preferences which can be used in local reforestation programs. A vegetation survey was conducted in three KBAs in Cebu Island, namely Nug-as forest, Mount Lantoy and Mount Capayas to inventory all native species. Assessment based on the phenotypic characteristics of adult trees was also conducted for indicating mother trees. This study in Cebu Island KBAs recorded a total of 292 species, categorized into 125 families and 203 genera, which can be classified into native trees (210), vines and lianas (18), shrub (37), and herbs (27). Out of the 292 species, 214 were recorded in Nug-as forest, 172 in Mount Lantoy, and 145 in Mount Capayas. Of the 210 native tree species, Nug-as forest had 145 species, Mount Lantoy 131 species, and Mount Capayas 109 species. A total of 241 mother trees were identified in the three KBAs, corresponding to 77 species in which Nug-as forest had 143 trees correspond to 52 species, Mount Lantoy had 68 trees correspond to 29 species, and Mount Capayas had 31 trees correspond to 6 species. Such native tree species are recommended for reforestation programs as planting materials that could reduce the risks of failure due to its high adaptability to the environment.

Keywords: Elevation, mother trees, Mount Capayas, Mount Lantoy, Nug-as forest

INTRODUCTION

Government programs on reforestation are important activities in solving the degradation problem resulting from many decades of deforestation (Hansen et al. 2013). Tropical forests are disappearing at alarming rates worldwide, reducing annually by 1- 4% of their current area through relatively increased anthropogenic pressures (Anitha et al. 2010). Keenan (2015) reported that the recent results of the Global Forest Resources Assessment indicate that the natural forest area was still declining from 3,961 to 3,721 million hectares between 1990 and 2015. The situation also occurs in the Philippines which suffered forest loss in the past centuries. Based on the revised Master Plan of the Philippines for Forestry Development, the percent forest cover in 1575 was still 92%, and in 2003 it was reduced to 24% (FMB-DENR 2015), meaning that the forest cover declined at an average annual rate of 47,429.91 hectares in 428 years.

There have been various efforts conducted to counterforce deforestation and forest degradation globally. Nonetheless, Hansen et al. (2013) found that from 2000 to 2010 period, tropical forests ecosystems still experience a poor ratio between forest loss and forest gain with ratio of 3.6:1. Chazdon et al. (2015) emphasize that the continuing deforestation and forest degradation with less forest increase have put pressures on biodiversity, ecosystem goods and services, as well as forest-based livelihoods. For example, in Cebu Island, the Philippines from 2001 to 2020 it lost 9,170 hectares of the forest, equivalent to a 4.3% decrease in tree cover and 4.66Mt of CO_2 emissions (Global Forest Watch 2020).

Citing the situation above, forest restoration could be considered as a cornerstone for global biodiversity conservation and sustainable development (Aronson and Alexander 2013; Suding et al. 2015). Taking about forest restoration, the Convention on Biological Diversity through Aichi Target 15, UN REDD+ program and the New York Declaration on Forests have pledged to restore 150 million hectares of deforested and degraded forestland worldwide in 2020, and 350 million hectares by 2030 (Bonn Challenge 2016; Jacobs et al. 2015). In the Philippines, the target area for reforestation is 1.5 million hectares nationwide which are to be planted by 1.5 billion trees of combined forest

species and fruit trees for a period of six years with a total budget of 5 billion pesos (DENR NGP Website).

Van Breugel (2011) and Soejono & Arisoesilaningsih (2013), emphasizing that in forest restoration, there is a need for scientific information on more appropriate tree species selection and species mixtures. However, according to Meli et al. (2017) and Stanturf et al. (2014), the selection of native species for forest restoration is much more complicated and challenging than the selection of plant materials for monoculture plantations. Wingfield (2015) reiterates that monoculture plantations increase risks associated with pest and pathogen outbreaks, and threatens the conservation of many forest-dependent species. Nichols and Vanclay (2012) also emphasize that there have been calls for native rainforest trees to be domesticated and planted as an alternative to the large-scale mixed and monocultures that have dominated in the tropics for decades. Further, Bozzano et al. (2014) state that for large-scale reforestation and landscape restoration projects, native trees are therefore be preferred.

Evaluating and updating data on native tree species are essentials to support conservation plans and programs for local reforestation (Hyvärinen et al. 2011; Lestari et al. 2019). Based on the study of Schneider et al. (2014), reforestation programs under community forestry in the Philippines that used native species combined with some exotic fruit trees as the planting materials have shown great success through the form of "rainforestation farming system" since it supported the livelihoods of the local community by selling the fruits and seedlings. Nonetheless, in some areas in the country, information on the composition and distribution of native trees is inadequate to support such a program, including in Cebu Island. The study aimed to assess the available native tree species and potential mother trees in different Cebu Island Key Biodiversity Area's (KBA) and to investigate their distribution and habitat preferences. The results of this study are expected to serve as baseline information for species-site suitability in local reforestation programs.

MATERIALS AND METHODS

Study area

The study was conducted in the Key Biodiversity Area (KBA's) of Cebu Island Philippines. The site includes: Mt. Lantoy of the Municipality of Argao (09°549' N, 123°329' E), with an elevation ranges from 100-700m, Nug-as forest of the Municipality of Alcoy (09°71'N, 123°44'E) ranges from 500-960m, and Mount Capayas Key Biodiversity Area (KBA), lies at coordinates 10° 38' 34.296" N, and 123° 56' 32.784" E, elevation ranges from 200 to 725m (Figure 1).

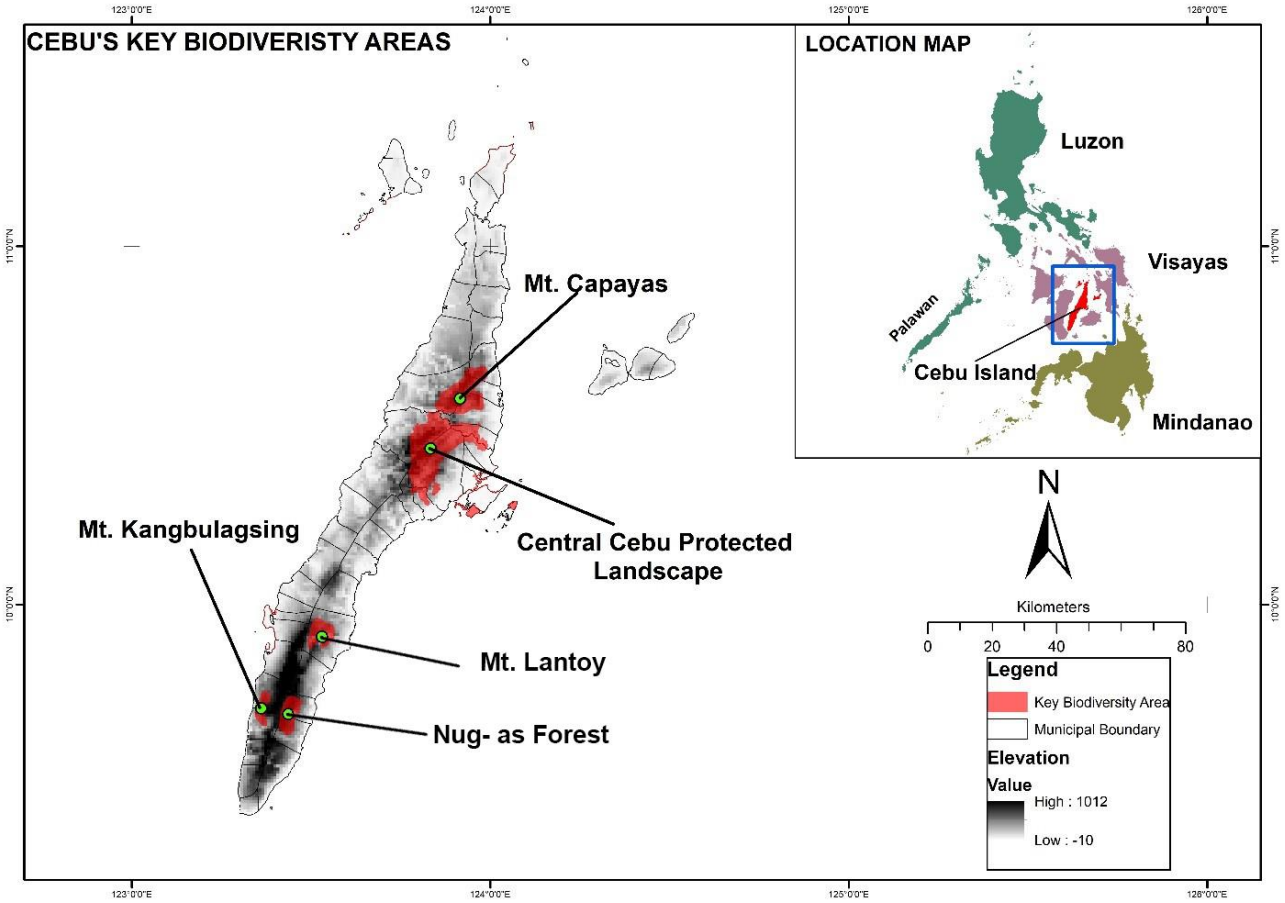

Figure 1. Map of the study location in different Key Biodiversity Areas in the Island of Cebu, the Philippines

Table 1. Criteria and corresponding parameters measured to assess the physical quality of the mother trees (Department Administrative Order No. 95-09 1995)

Criterion	Parameter
Stem growth	Total height (m) Diameter at breast height (cm)
Stem form	Stem straightness Forking Circularity of the stem
Health	Tree health
Branching characteristics	Branch angle Branch thickness Branch persistence

Field data collection

Permanent plots were established in the lower (200 m asl and below), middle (201-500 m asl), and upper elevation (501 m asl and above) areas of the different KBAs. The highest elevation in the three KBAs was 800 m asl in Mount Lantoy, Mount Capayas was 700 m asl, and 900 m asl in Nug-as Forest (Lillo et al. 2020). The size of the plot was 20 m x 100m, and a total of 8 plots were established in each KBA. Each sampling plot was further divided into five equal segments (20m x 20m) to facilitate recording plants in the canopy layer having a diameter at breast height (DBH) of 10 cm and above. On the other hand, a nested subplot of 5m x 5m was laid at the center of each segment for data recording of plants in the intermediate layer having DBH of less than 10 cm. Data recorded in the field were: (i) plant names from family down to species level; and (ii) bio-measurements on diameter at breast height (cm) and total height (m) as one of the criteria in the selection of potential mother trees (Department Administrative Order No. 95-09 1995).

Assessment of the phenotypic characteristics of the mother trees

The selection of phenotypic characteristics for mother trees was based on the method developed by DENR (Department Administrative Order No. 95-09 1995). The evaluation of the phenotypic characteristics was focused on the stem growth, stem form, health and branching characteristics as stipulated in Table 1.

Locations, distribution, and marking of mother trees

The location and distribution of individual native species, as well as the mother trees in each site, were indicated on the map. The ground coordinates as well as the elevation of each plot were determined using GPS. The plot was oriented in the North-East direction to easily estimate the local coordinates of individual trees within the plot. The local coordinates of each native tree and identified mother trees within the plot were determined by adding the X and Y distances (Lillo et al. 2019).

RESULTS AND DISCUSSION

Habitat characteristics

Mt. Lantoy KBA of the Municipality of Argao in general is characterized as mountainous topography dominated by Carcar formation with the forest over limestone at elevation ranges from 100-800 m asl (Lillo et al. 2019). Mount Lantoy has a geological composition of mostly raised sedimentary and metamorphic rocks - a considerable part of it being limestone (Lillo et al. 2019). The habitat type is comparable to the forest over limestone of the Philippines forest formation of Fernando et al. (2008). According to Lillo et al. (2019), Mount Lantoy is also covered by large size outcrop bedrocks with shallow soil and undecomposed organic matters. The site was covered by smaller to larger diameter trees with diameters ranging from 11–80 cm in terms of vegetation. The observation plot was covered by vegetation (50%), canopy cover of 80%, and an understory of 30%. The plot, in general, was characterized as closed canopy cover, allowing less amount of solar radiation to infiltrating into the ground surface

Nug-as Forest KBA of the Municipality of Alcoy is characterized as forest over limestone and tropical lowland evergreen forest with elevation ranges from 200 to 960 m asl. The forest over limestone as described by Lillo et al. (2020) is located in the forest edge as well as in the mountain ridge of the forest. In comparison, the tropical lowland evergreen forest was found dominating in the whole area. According to Lillo et al. (2020), Nug-as forest has a total land area of 1,600 ha, but 800 ha was already covered by established plantations as well as by shrub vegetation. The forest vegetation type can be characterized as secondary forest similar to Mount Lantoy (Lillo et al. 2020). Nug-as forest was covered by trees with a diameter ranging from 15-80 cm which were overall larger and taller among KBAs in the Island of Cebu. The forest was densely covered by vegetation (70%) and a canopy cover of 60%.

Mount Capayas KBA of the Municipality of Catmon was characterized as forest over limestone habitat types at elevation ranges from 200 to 725 m asl or described as mountainous topography. Its geological composition was mostly raised sedimentary and metamorphic rocks and was covered by the large size of outcrop bedrocks with shallow soil and undecomposed organic matters similar to Mount Lantoy KBA. The habitat type description can be characterized as karst topography and conformed to the forest over limestone of the Philippines (Fernando et al. 2008). Mount Capayas KBA was covered by less dense vegetation (40%) with a canopy cover of 50% and small size trees and few large trees ranging from 10-40 cm.

Composition of native trees

A total species of 292, classified into 125 families and 203 genera were recorded in Cebu Island. Out of 292 species, 210 are native trees, 18 vines and lianas, 37 shrub, and 27 herbs. The majority of the species were recorded in Nug-as forest KBA with 214 species, 172 in Mount Lantoy, and 145 in Mount Capayas. Of the 210 native tree species, 145 were recorded in Nug-as forest, 131 in Mount

Lantoy and 109 in Mount Capayas. Native trees were classified as endemic and non-endemic indigenous species. Non-endemic indigenous were those species recorded in the country and other countries, but the method of distribution was due to natural processes (Lillo et al. 2019).

Native trees in Cebu Island were equivalent to 3% of the total number of vascular plant species native to the Philippines with 9,250 species (Conservation International 2021). Comparing the result to Dinagat Island, which is considered one of the most botanically diverse islands in the Philippines with 432 native plant species (Lillo et al. 2019), it was equivalent to 68%. The result implies that Cebu Island also serves as a habitat for endemic native tree species, which need to be conserved and protected.

Among the 292 species, the most recorded genera were *Ficus, Cinnamomum* and *Artocarpus*. For families, the most dominant were Moraceae, Rubiaceae, and Lauraceae. In the case of species, Cebu Island KBAs were dominated by *Ficus ampelas* Burm.f, *Neonauclea calycina* (Bartl. ex DC.) Merr, and *Psychotria gitingensis* Elmer. All the dominant species were considered pioneer species which serve as an indicator of a secondary growth forest (https://www.philippineplants.org/).

Mother trees per Key Biodiversity Area

Based on the phenotypic criteria of mother trees as stipulated in Department Administrative Order No. 95-09 (1995), a total of 241 potential native mother trees were identified in three KBAs, corresponding to 77 species.

Nug-as forest KBA

In Nug-as forest KBA of the Municipality of Alcoy, Cebu, a total of 143 individual native trees correspond to 52 species that passed the criteria as the mother tree. The dominant mother trees in terms of frequency both for large and small trees were the following: *Palaquium foxworthyi* Merr., *Planchonella macrantha* (Merr.) Swenson, *Calophyllum blancoi* Planch. & Triana, *Litsea cordata* (Jack) Hook, *Shorea polysperma* (Blanco) Merr. *Anisoptera thurifera (*Blanco) Blume, *Canarium asperum Benth. Elaeocarpus cumingii* Turcz., *Gomphandra mappioides* Valeton, *Lithocarpus robinsonii* Rehder, *Magnolia liliifera* (L.) Baill., *Magnolia philippinensis* P.Parm., *Myristica nivea* Merr., *Myristica philippensis* Lamk. *Streblus glaber* (Merr.) Corner, and *Syzygium lineatum* (Roxb.) Merr. & Perry (Table 2). The abovementioned species had a diameter ranges from 20 to 80 cm and total height ranges from 15 to 20 m. The trees had merchantable height ranges from 5 to 10m with rounded and monopodial stem characteristics (Figure 2).

Shorea polysperma (Blanco) Merr., *Anisoptera thurifera* (Blanco) Blume, *Palaquium foxworthyi* Merr., *Planchonella macrantha* (Merr.) Swenson, *Tristaniopsis littoralis* (Merr.) Wils. & Waterh., *Lithocarpus robinsonii* Rehder, and *Elaeocarpus cumingii* Turcz. were the species exhibit larger diameter and taller height than other mother trees (Figure 2).

The species of *Palaquium foxworthyi* Merr., *Planchonella macrantha* (Merr.) Swenson, *Calophyllum blancoi* Planch. & Triana, *Litsea cordata* (Jack) Hook, Merr., *Canarium asperum* Benth., *Elaeocarpus cumingii* Turcz., *Gomphandra mappioides* Valeton, *Magnolia liliifera* (L.) Baill., *Magnolia philippinensis* P.Parm., *Myristica nivea* Merr., *Myristica philippensis* Lamk. *Streblus glaber* (Merr.) Corner, and *Syzygium lineatum* (Roxb.) Merr. & Perry were recorded from lower to middle elevation. While *Gymnostoma rumphianum* (Miq.) L.A.S.Johnson was recorded both in lower and middle elevation of the site (Table 2). The result on the location and distribution of the species is confirmed on the records of the species in the Philippine plant database (https://www.philippineplants.org/).

Whereas the species of *Shorea polysperma* (Blanco), *Lithocarpus robinsonii* Rehder, *Anisoptera thurifera* (Blanco) Blume, and *Agathis philippinensis* Warb were recorded in upper elevation (Table 2). The result of the study was confirmed on the records of the species in Philippine plant database (https://www.philippineplants.org/) that *Shorea polysperma* and *Anisoptera thurifera* (Blanco) Blume found as medium-sized trees were distributed mostly in the upper elevation of the forest. In contrast, *Agathis* species grow well in full sunlight unlike most other dipterocarp species and are classified as early-successional species (Schneider et al. 2014).

Shorea polysperma (Blanco), and *Anisoptera thurifera* (Blanco) Blume species belong to *Dipterocarpaceae* family. *Dipterocarpaceae* is one of the plant families that ranked high in community importance (Hamann 2015). The family was also known as the Philippine mahogany group in the Philippines because they were considered the most important tropical timber species. They were primarily used locally for construction and furniture making (Hamann 2015). Nowadays, only a few remnants of dipterocarp forests are left in the Philippine archipelago. The result of the study implies that remnants of the Dipterocarpaceae species were also recorded in the Key Biodiversity Areas of Cebu Island which could be used as the source of planting materials for reforestation. Using highly valued native species in reforestation programs can restore the original economic and ecological potential of the communities (Schneider et al. 2014). In Sarawak, Malaysia *Dipterocarpaceae* species performed high survival rate (86-88%) in forest rehabilitation programs (Wasli 2014).

Dysoxylum pauciflorum Merr., *Garcinia binucao* (Blanco) Choisy, *Lithocarpus robinsonii* Rehder, *Myristica philippensis* Lamk., *Neolitsea intermedia* Elmer, *Palaquium foxworthyi* Merr., *Shorea polysperma* (Blanco) Merr., and *Tristaniopsis littoralis* (Merr.) Wils. & Waterh were categorized as endemic species to the Philippines (Table 2). At the same time, *Cinnamomum cebuensis* Kosterm was endemic to Cebu Island (https://www.philippineplants.org/). Endemic species to be used as planting material for reforestation programs can ensure a higher survival rate because of their high adaptability to the environment (Ostertag 2015).

Table 2. List of identified species, location and endemicity of mother trees in Nug-as Forest KBA, Cebu, Philippines

Identified Mother trees	Frequency	Elevation			Endemicity (https://www.Philippineplants.org/)
		Lower (below 200 m asl)	Middle (201-500 m asl)	Upper (501 m asl)	
Agathis philippinensis Warb.	1			x	NE
Aglaia rimosa (Blanco) Merr.	2			x	NE
*Anisoptera thurifera (*Blanco) Blume	5			x	NE
Arthrophyllum ahernianum Merr.	1	x	x		NE
Artocarpus sericicarpus F.M.Jarrett	1	x	x		NE
Buchanania microphylla Engl.	1	x	x		NE
Calophyllum blancoi Planch. & Triana	6	x	x		NE
Canarium asperum Benth.	4	x	x		NE
Cinnamomum cebuensis Kosterm.	2	x	x		PE (Cebu)
Dysoxylum pauciflorum Merr.	3	x	x		PE
Elaeocarpus cumingii Turcz.	8	x	x		NE
Ficus ampelas Burm.f.	1	x	x		NE
Ficus benjamina L.	1	x	x		NE
Ficus callosa Willd.	2	x	x		NE
Ficus chrysolepis Miq	2	x	x		NE
Ficus variegata Blume	1	x	x		NE
Garcinia binucao (Blanco) Choisy	2	x	x		PE
Garcinia rubra Merr.	1	x	x		PE
Glochidion album (Blanco) Boerl	1	x	x		NE
Gomphandra mappioides Valeton	6	x	x		NE
Guioa koelreuteria (Blanco) Merr.	1	x	x		NE
Gymnostoma rumphianum (Miq.) L.A.S.Johnson	2		x	x	NE
Heritiera sylvatica S.Vidal	1	x	x		NE
Homalanthus populneus (Geisel)	1	x	x		NE
Lepiniopsis ternatensis Valeton	2	x	x		NE
Lithocarpus robinsonii Rehder	5			x	PE
Litsea cordata (Jack) Hook	6	x	x		NE
Magnolia liliifera (L.) Baill.	5	x	x		NE
Magnolia philippinensis P.Parm.	4	x	x		NE
Myristica nivea Merr.	5	x	x		NE
Myristica philippensis Lamk.	4	x	x		PE
Neolitsea intermedia Elmer	1	x	x		PE
Neonauclea calycina (Bartl. Ex DC.) Merr.	2	x	x		NE
Palaquium foxworthyi Merr.	11	x	x		PE
Palaquium obovatum (Griff.) Engl.	3	x	x		NE
Pangium edule Reinw.	1	x	x		NE
Pittosporum pentandrum (Blanco) Merr.	1	x	x		NE
Planchonella duclitan (Blanco) Bakh.f.	2	x	x		NE
Planchonella macrantha (Merr.) Swenson	11	x	x		NE
Pometia pinnata J.R.Forst. & G.Forst.	1	x	x		NE
Shorea almon Foxw.	2			x	NE
Shorea polysperma (Blanco) Merr.	4			x	PE
Streblus glaber (Merr.) Corner	5	x	x		NE
Syzygium calubcob (C.B.Rob.) Merr.	1	x	x		NE
Syzygium lineatum (Roxb.) Merr. & Perry	4	x	x		NE
Syzygium simile (Merr.) Merr.	2	x	x		NE
Syzygium toppingii (Elmer) Merr.	2	x	x		NE
Tristaniopsis littoralis (Merr.) Wils. & Waterh.	1	x	x		PE
Vavaea amicorum Benth.	2	x	x		NE
Total	143				

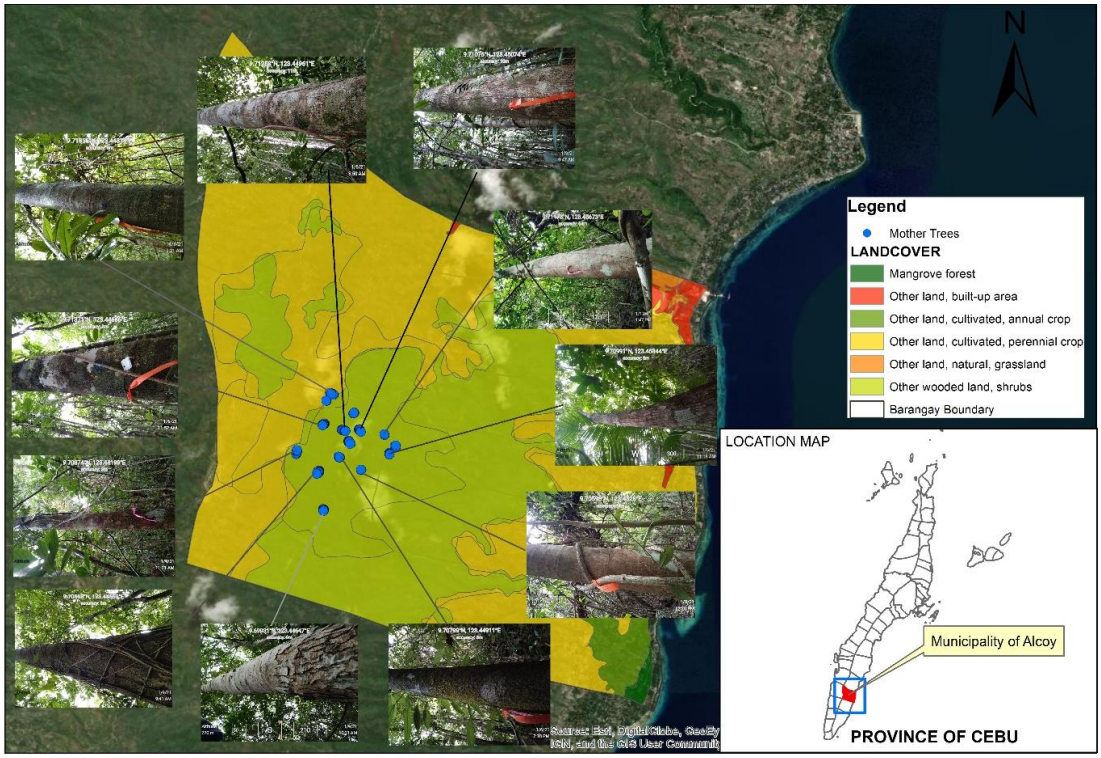

Figure 2. Map of location and distribution of identified mother trees in Nug-as Forest KBA, Cebu, Philippines

Mount Lantoy KBA

In Mount Lantoy KBA of the Municipality of Argao, Cebu, a total of 68 individual native trees correspond to 29 species that passed the criteria as mother trees (Table 3). The dominant mother trees in terms of frequency were *Anisoptera thurifera* (Blanco) Blume, *Buchanania microphylla* Engl, *Canarium asperum* Benth, *Dysoxylum pauciflorum* Merr, *Intsia bijuga* (Colebr.) Kuntze, *Palaquium foxworthyi* Merr., *Parishia malabog* Merr., *Shorea almon* Foxw., *Turpinia sphaerocarpa* Hassk., *Vatica manggachapoi* Blanco, *Shorea contorta* S.Vidal, *Shorea guiso*, and *Wallaceodendron celebicum* Koord. Those species had a diameter ranges from 20 to 70cm and total height ranges from 10 to 15 m. The trees have merchantable height ranges from 4 to 7 m with rounded and monopodial stem characteristics (Figure 3), slightly smaller in diameter and height as compared to Nug-as Forest.

The species of *Canarium asperum* Benth, *Buchanania microphylla* Engl, *Dysoxylum pauciflorum* Merr, *Intsia bijuga* (Colebr.) Kuntze., *Palaquium foxworthyi* Merr., and *Parishia malabog* Merr., were recorded in lower to the middle elevation of the site. Similar species were also recorded in Nug-as forest in the same elevation. Whereas the species of *Anisoptera thurifera* (Blanco) Blume., *Shorea almon* Foxw., *Shorea contorta* S.Vidal, *Shorea guiso* (Blanco) Blume, *Turpinia sphaerocarpa* Hassk., *Vatica manggachapoi* Blanco., and *Wallaceodendron celebicum* Koord were recorded in upper elevation of the site similar to Nug-as forest. The species of *Shorea contorta* S. Vidal, *Anisoptera thurifera* (Blanco) Blume, *Shorea guiso* (Blanco) Blume were common on the upper slope and along the ridge. *Shorea almon* Foxw mostly occurred together with *Shorea palosapis* which preferred ridge and especially upper slope habitats (https://www.philippineplants.org/). Similar habitat preference as *Vatica mangachapui* which is also preferred in ridge and upper slope habitats (https://www.philippineplants.org/).

Shorea contorta S.Vidal, *Anisoptera thurifera* (Blanco) Blume, *Shorea guiso* (Blanco) Blume, *Shorea almon* Foxw, and *Shorea polysperma* (Blanco) species belong to Dipterocarpaceae family (https://www.philippineplants.org/), which also serve as the most important source of timber in Southeast Asia (Hamann 2015). *Dipterocarpaceae* species were also adopted by Indonesia for forest rehabilitation and restoration (Daisuke et al. 2013; Kettle 2010). In addition, Widiyatno et al. (2013) state that *Dipterocarpaceae* species are more resistant to sunlight and hence they could be easily established in open planting that has high heat and temperature stress in the early plantation establishment. *Cinnamomum cebuensis* Kosterm, *Dysoxylum pauciflorum* Merr., *Lithocarpus robinsonii* Rehder, *Palaquium foxworthyi* Merr., *Parishia malabog* Merr., *Shorea contorta* S. Vidal were categorized as endemic species of the Philippines (https://www.philippineplants.org/Families).

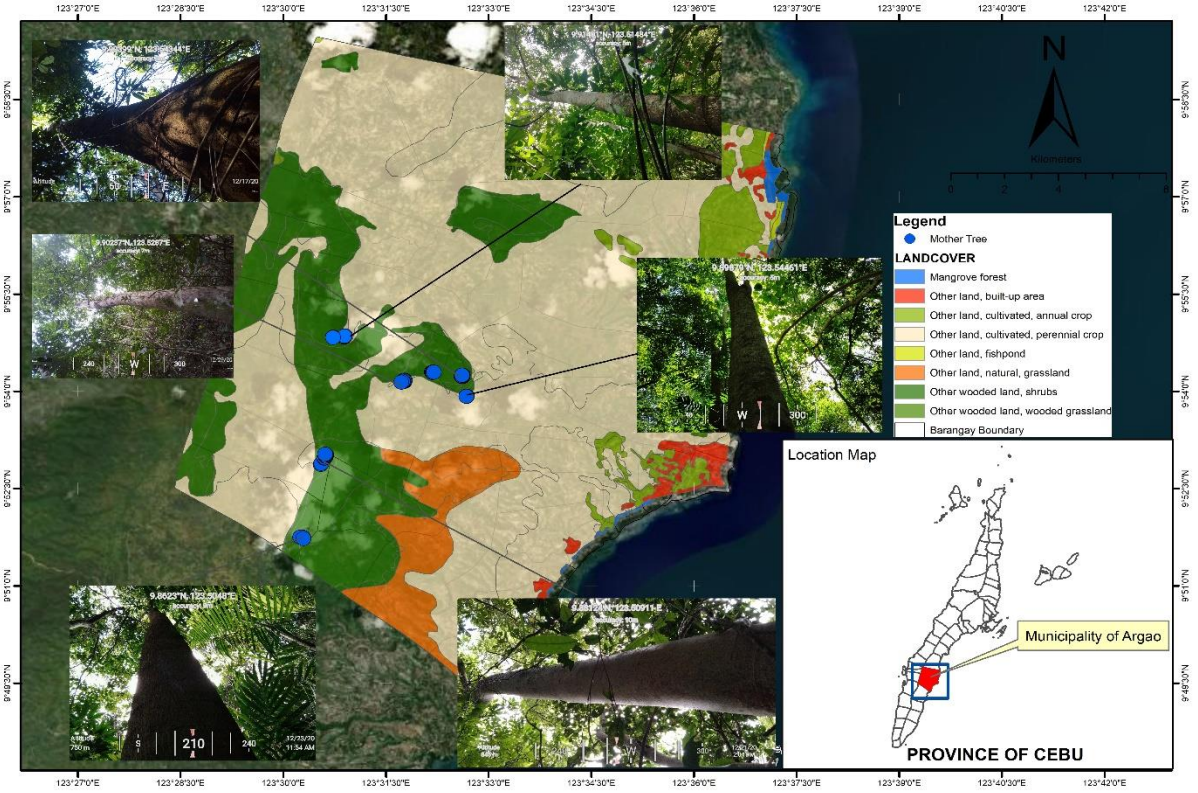

Figure 3. Map of location and ddistribution of identified mother trees in Mount Lantoy KBA, Cebu, Philippines

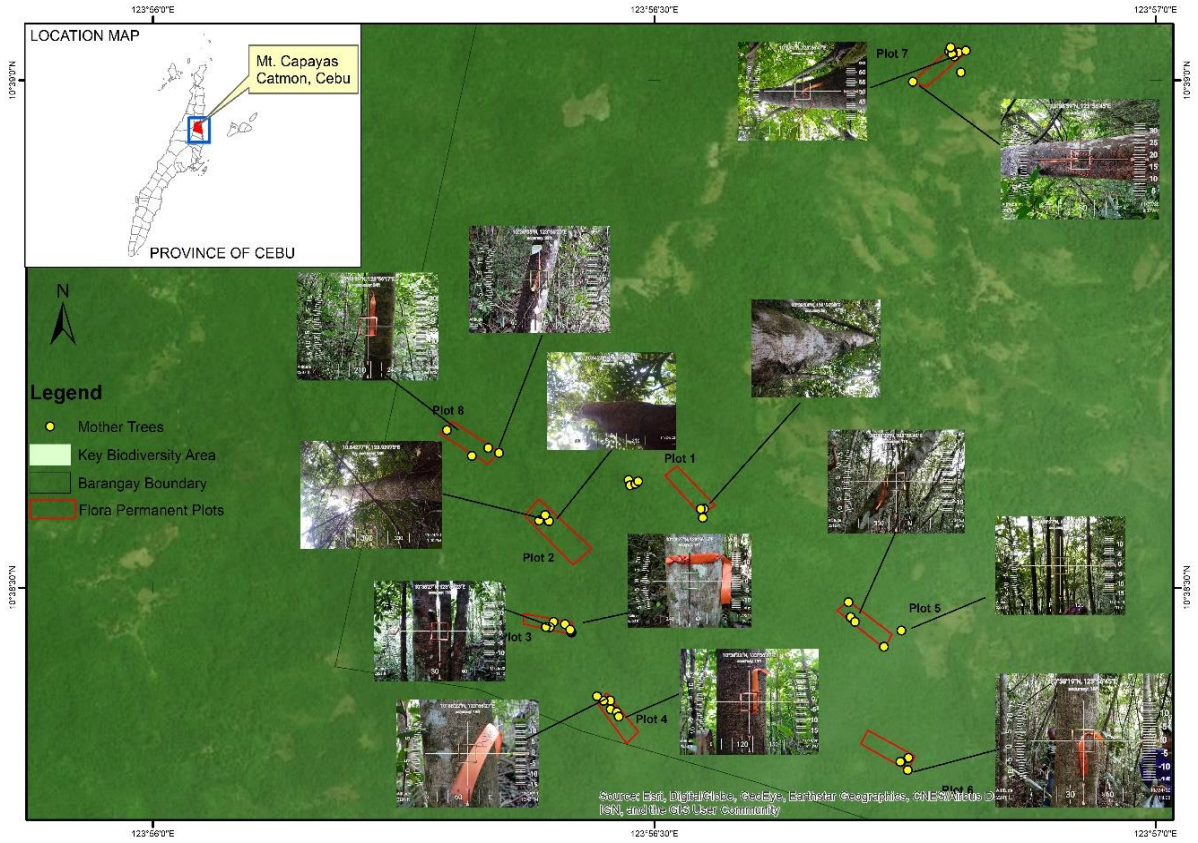

Figure 4. Map of location and distribution of identified mother trees in Mount Capayas, Cebu, Philippines

Table 3. List of identified species, location and endemicity of mother trees in Mount Lantoy KBA, Cebu, Philippines

Identified mother trees	Frequency	Elevation			Endemicity (https://www.philippineplants.org/)
		Lower (below 200m asl)	Middle (201-500m asl)	Upper (501m asl and above)	
Alstonia macrophylla Wall. ex G.Don	1	x	x		NE
Anisoptera thurifera (Blanco) Blume	4			x	NE
Buchanania microphylla Engl.	3	x	x		NE
Canarium asperum Benth.	3	x	x		NE
Cinnamomum cebuensis Kosterm.	1		x		PE
Dysoxylum gaudichaudianum (A.Juss.) Miq.	1	x			NE
Dysoxylum pauciflorum Merr.	5	x	x		PE
Elaeocarpus cumingii Turcz.	1	x	x		NE
Ficus ampelas Burm.f.	2	x	x		NE
Intsia bijuga (Colebr.) Kuntze	6	x	x		NE
Lithocarpus robinsonii Rehder	1			x	PE
Palaquium foxworthyi Merr.	4	x	x		PE
Palaquium luzoniensis (F.-Vill.) Vidal	1	x	x		NE
Parishia malabog Merr	3	x	x		PE
Pittosporum pentandrum (Blanco) Merr.	1	x	x		NE
Pittosporum ramiflorum Zoll. ex Miq	1	x	x		NE
Shorea almon Foxw.	14			x	NE
Shorea contorta S.Vidal	2			x	PE
Shorea guiso (Blanco) Blume	2			x	NE
Syzygium lineatum (Roxb.) Merr. & Perry	1	x	x		NE
Terminalia foetidissima Griff.	2	x	x		NE
Toona calantas Merr. & Rolfe	1	x	x		NE
Vatica manggachapoi Blanco	3			x	NE
Vitex parviflora A.Juss	1	x			NE
Wallaceodendron celebicum Koord.	3			x	NE
Total	68				

Table 4. List of Identified species, location and endemicity of mother trees in Mount Capayas KBA, Cebu, Philippines

Identified mother trees	Frequency	Elevation			Endemicity (https://www.philippineplants.org/)
		Lower (below 200m asl)	Middle (201-500m asl)	Upper (501m asl and above)	
Alstonia macrophylla Wall. ex G.Don	4	x	x		NE
Aquilaria cumingiana (Decne.) Ridl	1	x	x		PE
Artocarpus sericicarpus F.M.Jarrett	2	x	x		PE
Cynometra cebuensis F.Seid	1	x	x		PE
Dillenia philippinensis Rolfe	1	x	x		NE
Elaeocarpus cumingii Turcz.	4	x	x		PE
Guioa acuminata Radlk.	1	x	x		NE
Ormosia calavensis Azaola ex Blanco	1	x	x		NE
Palaquium luzoniensis (F.-Vill.) Vidal	2	x	x		NE
Parishia malabog Merr	3	x	x		PE
Polycias nodosa (Blume) Seem.	1	x	x		NE
Pometia pinnata J.R.Forst. & G.Forst.	1	x	x		NE
Pterocymbium tinctorium Merr.	5	x	x		NE
Radermachera pinnata (Blanco) Seem.	2	x	x		NE
Rhus taitensis Guill.	1	x	x		NE
Streblus glaber (Merr.) Corner	1	x	x		NE
Total	31				

Mount Capayas KBA

In Mount Capayas KBA of the Municipality of Catmon, Cebu, a total of 31individual native trees correspond to 16 species has passed the criteria as mother trees (Table 4). Less number of mother trees were identified in the site as compared to Mount Lantoy and Nug-as forest since Mount Capayas had a smaller area of coverage as compared to other Key Biodiversity Areas.

The dominant mother trees in terms of frequency both for larger trees and wildlings in the site were *Alstonia macrophylla* Wall. ex G.Don, *Artocarpus sericicarpus* F.M.Jarrett, *Elaeocarpus cumingii* Turcz., *Palaquium luzoniensis* (F.-Vill.) Vidal, *Parishia malabog* Merr, *Pterocymbium tinctorium* Merr, and *Radermachera pinnata* (Blanco) Seem. Those species had a diameter ranges from 15 to 40 cm and total height ranges from 9 to 15m. The trees had merchantable height ranges from 3 to 7m, with rounded and monopodial stem characteristics smaller in diameter and height as compared to both Nug-as Forest and Mount Lantoy KBAs (Figure 4).

All the identified mother trees in the site were located or distributed from lower to middle elevation and none in the upper elevation. The species were almost similar to Mount Lantoy and Nug-as forest KBAs (Table 2, 3, and 4). Majority of the mother trees are endemic to the Philippines (https://www.philippineplants.org/), including *Artocarpus sericicarpus* F.M.Jarrett, *Elaeocarpus cumingii* Turcz, *Parishia malabog* Merr *Aquilaria cumingiana* (Decne.) Ridl and *Cynometra cebuensis* F.Seid. The species *Cynometra cebuensis* F.Seid is endemic to Cebu Island and categorized as Critically Endangered Species (DENR 2017-11). The species *Aquilaria cumingiana* (Decne.) Ridl is famous agarwood with potential medicinal value and luxurious perfume (Tropical Plants Data 2021). The species is categorized as Vulnerable (DAO 2017-11) and are mostly distributed in primary forests at low and medium elevation (https://www.philippineplants.org/). The species was only recorded in Mount Capayas and absent in Nug-as forest and Mount Lantoy KBAs. Using this highly valued native species for enrichment planting in a reforestation program could restore the original economic and ecological benefits to local communities (Schneider et al. 2014). The result would imply that once a native species be promoted for a reforestation program it could reduce the risks of failure due to the selection of unsuited habitats.

In conclusion, this study in Cebu Island KBAs recorded a total species of 292, categorized into 125 families and 203 genera. The species were classified into native trees (210), vines and lianas (18), shrub (37), and herbs (27). Out of the 292 species, 214 were recorded in Nug-as forest KBA, 172 in Mount Lantoy KBA, and 145 in Mount Capayas KBA. Of the 210 native tree species, the majority were recorded in Nug-as forest with 145, followed by Mount Lantoy 131, and 109 in Mount Capayas.

Based on the phenotypic criteria of mother trees as stipulated in Department Administrative Order No. 95-09 (1995), a total of 241 potential native mother trees were identified in the three KBAs, corresponding to 77 species. Nug-as forest KBA had 143 individual native mother trees correspond to 52 species, Mount Lantoy KBA had 68 individual native mother trees correspond to 29 species and for Mount Capayas KBA had 31 individual native mother trees correspond to 16 species. We provide list of native species which can be used in the reforestation program as planting material with the rationale that it could reduce the risks of failure due to its high adaptability to the environment. This highly valued native species will also restore the original economic and ecological benefits to local communities.

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