SPATIAL DISTRIBUTION OF THREATENED MOTHER TREE SPECIES IN SELECTED FORESTS OVER LIMESTONE IN SAMAR ISLAND, PHILIPPINES

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Abstract

Inadequate knowledge about forests over limestone ecosystem and understanding on how the threatened plants' mother trees (MTs) are distributed and remained intact despite rugged topography and anthropogenic activities, intrigued the attention of numerous researchers. Rapid assessment and mapping the spatial distribution of mother trees would be of utmost importance, especially in the context of conservation and sustainable protection of threatened species in selected municipalities of Samar Island. A total of 170 mother trees comprising 21 families, 22 genera and 35 species were recorded at sites. Species identified among sites were categorized under critically endangered (CR), endangered (EN) vulnerable (VU) and near threatened (NT) at elevation ranging from 150 to 300 meters above sea level (m asl). Trees tagged in the study sites possess straight cylindrical bole with average diameter at breast height (DBH) of 50 cm. Dipterocarp species were the most dominant in the sites. Hopea samarensis, a species endemic to Samar and also identified as endangered, was recorded in the study. The distribution of MTs was floristically similar among sites. However, anthropogenic small-scale disturbances were observed. The increasing population of locals may increase the demand for timber, thus, in-situ conservation through geo-tagging of MTs is crucial for maintenance and conservation.

Keywords: *Dipterocarpaceae, Hopea samarensis, Forest over Limestone, Samar Island, Threatened species.*

Abbreviations: *Samar Island Natural Park (SINP), Forest over Limestone (FOL), Mother Trees (MTs).*

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PHÂN BỐ KHÔNG GIAN CỦA CÂY MẸ CÁC LOÀI BỊ ĐE DỌA TRONG RỪNG TRÊN NÚI ĐÁ VÔI THUỘC ĐẢO SAMAR, PHILIPPINES

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Tóm tắt

Những hiểu biết chưa đầy đủ về hệ sinh thái rừng trên núi đá vôi, cũng như cách mà các "cây mẹ" của các loài thực vật đang bị đe dọa phân bố và giữ nguyên vẹn mặc cho môi trường khắc nghiệt và các hoạt động của con người đã thu hút sự quan tâm của nhiều nhà khoa học. Việc đánh giá nhanh và lập bản đồ phân bố không gian của các cây mẹ có ý nghĩa quan trọng, đặc biệt đối với công tác bảo tồn và bảo vệ bền vững các loài bị đe doạ trong khu vực nghiên cứu ở đảo Samar. Tổng số 170 cây mẹ thuộc 21 họ, 22 chi và 35 loài được ghi nhận tại khu vực nghiên cứu. Các loài điều tra được trong khu vực nghiên cứu, phân bố ở độ cao từ 150 đến 300 m trên mực nước biển, được phân loại theo nhóm cực kì nguy cấp (CE), nguy cấp (EN), sẽ nguy cấp (VU) và sắp bị đe doạ (NT). Các cây được gắn thẻ có thân hình trụ thẳng đứng với chiều cao ngang ngực trung bình là 50 cm. Các loài Dầu (Dipterocarp) là ưu thế nhất ở khu vực. Hopea samarensis, một loài đặc hữu ở Samar và là loài cực kì nguy cấp cũng được ghi nhận. Sự phân bố của cây mẹ là tương tự nhau về mặt thực vật học giữa các địa điểm. Tuy nhiên, những xáo trộn với quy mô nhỏ do con người gây ra cũng được tìm thấy. Các cây mẹ được tìm thấy chủ yếu được sử dụng để lấy gỗ và làm nhà. Sự gia tăng dân số có thể làm gia tăng nhu cầu khai thác, do đó, bảo tồn tại chỗ thông qua gắn thẻ địa lí các cây mẹ là cần thiết cho bảo vệ và bảo tồn.

Từ khóa: *Đảo Samar, Hopea samarensis, họ Dầu, loài bị đe dọa, rừng trên núi đá vôi.*

1. Introduction

Samar Island Natural Park (SINP) supports various habitats, including a very extensive forest formation which is classified as 'forest over limestone (FOL)'. Samar Island is known to be the third largest island in the Philippines (Fernando et al., 2008). FOL often contain high levels of floral species endemism or 'botanical hotspots' (Clements et al., 2006). SINP has recorded 308 plant species under 181 genera and belonging to 72 families of which are dominantly associated with species under the Dipterocarpaceae (Quimio, 2016). This ecosystem contributes a significant function to the biodiversity and local economy (Patindol, 2016).

Mother trees, also known as hub trees, are the largest trees in the forest and act as a central hub for vast below ground mycorrhizal networks (Simard et al., 2012). These are characterized by having vigorous, straight and cylindrical bole. However, in economic viewpoint, MTs serve as a source of living in some parts of Samar (ERDB, 2012). It was discussed in the 2012 Philippine Country Report on Forest Genetic Resources of the Department of Environment and Natural Resources (DENR) that tapping resins from Dipterocarp species *(Dipterocarpus grandiflorus)*, timber harvesting, and alternative therapeutics for illness are the most common practices that locals do for a living, in association with MTs in the area. It has been highlighted in literatures that unsustainable collection of endemic flora of medicinal and ornamental value can also result in population extinctions (Lim & Cranbrook 2002, as cited by Clements et al., 2006).

Studies on spatial distribution of MTs in the FOL type of ecosystem are limited. In species-rich communities, it is essential to identify potential mechanisms for the maintenance of diversity (Ashton, 1998 as cited by Bunyavejchewin et al., 2003) and discoveries of unknown biota that are endemic to the area (Edwards et al., 2006) are among the several researches conducted in Samar Island. It was always highlighted in literatures that the species distribution in relation to their topography has potential role in explaining the coexistence of tree species (Bunyavejchewin et al., 2003) in the species-rich forest. Analysis on the spatial distribution pattern of individual trees in a population helps to deepen the understanding of population structure and growth of individual trees, and to solve problems of tree allocating and harvesting in reforestation (Gangying et al., 2007). The relationships in local distribution of trees aid to identify the species that are habitat specialist for the particularly edaphic or topographic conditions (Ashton, 1988). The spatial pattern of tree species may provide indirect evidence of the relative influence of large- and small- scale disturbances in structuring forest communities (Duncan & Stewart, 1991).

Developing a better understanding on how the population of these species are distributed along elevational gradient and how plants survived despite the rugged topography are significant bases for sound forest management and silviculture of FOL ecosystem.This study focuses on (1) mapping the distribution of MTs in FOL ecosystem in SINP, (2) determining species characteristics and uses at various elevations, and (3) evaluating the conservation status of the MTs.

2. Research method

2.1. Study area

The study sites were selected from the 333,300 hectares of protected landscape in Eastern Visayas, particularly in Samar Island (Edwards et al., 2006). SINP is the third largest terrestrial protected area in the country that supports contiguous tract of old-growth forests, and is a candidate for inscription in the United Nations Educational, Scientific and Cultural Organization (UNESCO) World Natural Heritage (Recuerdo, 2019). Samar has exceedingly hilly terrain with elevations generally from 100 to 500 feet (100-300 m asl) and slope percentage of 14%, and the rest is rolling to moderately steep (Quimio, 2016).

The identified sites were the municipalities that are nearest to the limestone forest. In terms of climatic classification, type II climate is manifested among the sites, which is characterized by the pronounced maximum rainfall throughout the month of December to January and absence of dry season (ERDB, 2012).

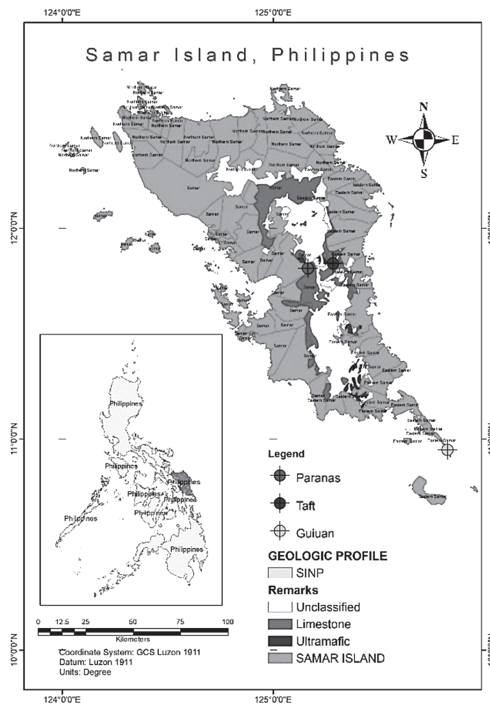

Figure 1. Location of Limestone Areas of the Samar Island Natural Park indicating the sampling sites: point 1 Paranas, Samar (11º49'4.45"N, 125º4'46.76"E), point 2 Taft, Eastern Samar (11º55'8.09"N, 125º22'40.37"E); and point Guiuan, Eastern Samar (11º2'36.53"N, 125º44'53.72"E), DENR R08-SINP, 2004

2.2. Data Collection

2.2.1. Assessment and mapping of MTs

A rapid assessment on threatened, economically important plant species were conducted in the field. MTs encountered were tagged and mapped out. Coordinates extracted from Global Positioning System (GPS) devices were run through ArcGIS 10.4 software for the distribution maps of MTs. Sample MTs were recorded of their respective DBH (Husch et al., 2003). Trees with >30 cm DBH were recorded. Also, economically important species (ERDB, 2012) with <30 cm DBH were tagged.

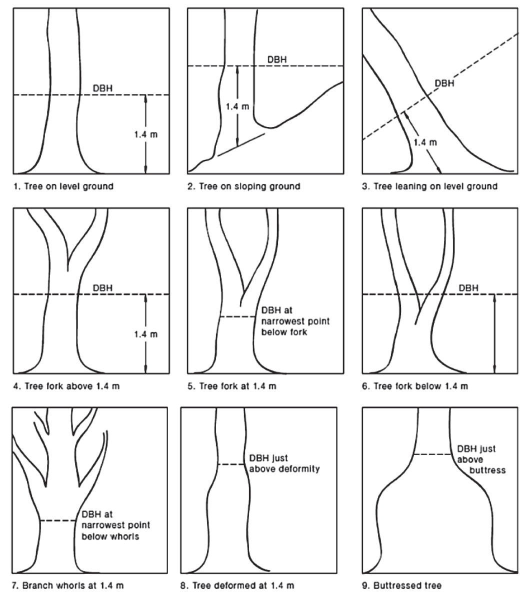

Figure 2. Measurement of diameter at breast height of trees in different situations (Husch et al.**, 2003).**

Leaves, trunk, fruits, buttress, and flowers were used to identify the MTs. Identification of species were verified through manuals, herbarium accounts, and online literature (Pelser et al., 2011). Uses of specified mother trees were also based from available literature (ERDB, 2012; Appanah & Turnbull, 1998).

2.2.2. Evaluating Conservation Status

Conservation status of MTs was determined based on the list of threatened species identified by the DENR Administrative Order No. 11 series of 2017 (DAO No. 2017-11) and the International Union for Conservation of Nature (IUCN 2017).

2.3. Data analysis

2.3.1. Data comparison and correlation

In each site, the values of DBH of trees and elevation per species were assessed using descriptive analysis, together with the mean and standard deviation. The test for normality of the data was conducted by using skewness and kurtosis. Each parameter that showed heterogeneous variance were log-transformed. Pearson's correlation coefficient was conducted to correlate the relationship between DBH of MTs and elevation. And for the comparison of

DBH and elevation among study sites, the test for significant difference was done using Analysis of Variance (ANOVA). Both levels of significance were defined at P ≤0.05. Analyses were done using Analysis ToolPak MS Excel 2019.

2.3.2. Distribution pattern

MTs spatial distribution pattern was analyzed using Spatial Statistic Tools in Arc GIS 10.4 software. Under Spatial Analyst Tools, coordinates of MTs were run using the Multi-distance Spatial Cluster Analysis to get Ripley's K-Function. This process analyzed the spatial pattern of incident point data. For the random distribution of points, 99-permutation was used.

3. Results and discussion

3.1. MTs species zonation

Samar lacks high mountains that usually characterized most of Visayas. This area was characterized to be hilly, with elevations generally from 500 to 1000 feet (150 to 300 meters (Lillo et al., 2018). FOL was described in 2018 to be mostly raised sedimentary and metamorphic rocks; mostly limestone. It was characterized by the occurrence of largesized bedrocks with shallow soil and undecomposed organic matters (Lillo et al., 2018). The vegetation is distinctive, dominated by small-sized trees and a few large trees, with notable species that are endemic. In other studies, it was highlighted that tropical FOL support high floral biodiversity, with dominance of dipterocarps (Kiew, 2001, as cited by Clements et al., 2006).

In this study, the site in Guiuan with elevation from 25 to 150 meters above sea level has recorded species flora. The dominated species were *Ficus callosa* Willd., *Ficus crassiramea* Miq., and *Planchonella duclitan* (Blanco) Bakh.f. At an elevation of 150 to 300 meters above sea level in Paranas, 105 species were recorded (merged Paranas site 1&2) as follows: *Madhuca Oblongifolia* (Merr.), *Xanthostemon philippinensis* (Merr.), *Shorea squamata* (Turcz.) Benth. & Hook.f. ex DC., Shorea negrosensis (Foxw), *Tristaniopsis micrantha* (Merr.) Peter G. Wilson & J.T. Waterh., *Manilkara fasciculata* (Warb.) HJ Lam & Maas Geest, *Balakata luzonica* (Vidal) Esser, T*eijsmanniodendron ahernianum* (Merr.) Bakh, *Hopea samarensis* H.G. Gut. and *Shorea astylosa* Foxw (arranged in ascending manner in terms of increasing frequency). In the site in Taft, Eastern Samar, the area with elevation of 200 to 250 m asl also serve as habitat to some tree species that were found in the preceding elevation range.

Species found in Taft, E. Samar were dominated by small-sized trees, and observed with a few larger trees. The species diversity of woody flora in the site was found to be less dense. This is due to the characterized shallow soil and dominance of limestone karst as growth substrate of the plant species, compared to other sites in the study. Aside from the topographical landscape which is predominantly largesized bedrocks with shallow soil (Lillo et al., 2018), another perspective that is seen to influence the sizes of trees in the area are the anthropogenic activities and its magnitude (Buot & Osumi, 2011).

MTs were mostly of larger sizes at higher elevation versus lower elevation. This observed trend among the study sites is contrasting with accounts from related studies on tropical forests wherein the species in the higher altitudes were smaller in size and shorter in stature compared with the forests in the lower altitudes (Buot & Okitsu, 1998; Coomes & Allen, 2007). Abundance of species were observed at elevations ranging from 150 to 300 m asl. Small-scale disturbances were encountered at the sites, such as abandoned unfinished logging of MTs, timber poaching and collection of Aquilaria spp. for market value (ERDB, 2012).

Dipterocarp trees were noticed growing at an elevation of 200 m asl and higher. Some related studies on species distribution in limestone forest indicated that from lower altitude up to about 800 meters, the forest was dominated by large emergent dipterocarps (Gillieson, 2005).

3.2. MTs composition and uses

High floral richness has been recorded from karsts in Southeast Asia (Clements et al., 2006). Samar Island is dominated by lowland evergreen rainforests and limestone forests (Brearly et al., 2017). A study in the FOL of Dinagat Islands recorded plant species under families Moraceae, Euphorbiaceae, Anacardiaceae, Lauraceae and Apocynaceae (Lillo et al., 2019) – species that were also tagged in among the study sites in this study. In Samar Island, the forests over limestone is dominated by Dipterocarpaceae (Quimio, 2016), wherein 86% of individual trees were Dipterocarps in 14 species and the most frequent of which were *Shorea squamata* and *Shorea polysperma*.

An aggregate of 170 mother trees belonging to 21 families, 22 genera and 35 species were recorded at the identified study sites in the FOL of Samar Island. The highest species percentage was recorded at Paranas, Samar (61%), in which species belong to 16 families with 33 genera. From among the species identified, the most frequently represented families were Dipterocarpaceae, Myrtaceae, Sapotaceae and Sapindaceae. The dominant genera were the *Shorea, Hopea, Tritaniopsis* and *Xanthostemon*. The range of an area also accounts for diverse range of vegetation. It was discussed in related literatures that species composition may also be attributed to the edaphic, climatic and topological factors. Vegetation composition was proposed to be strongly affected by nutrient limitation, which in turn, could be governed by low soil temperatures and influenced by soil moisture conditions. (Drollinger et al., 2017).

Mother trees were commonly used as timber and house construction for Dipterocarp species, fuelwood for nonthreatened species, furniture-making and handicraft for species under the families Anacardiaceae and Moraceae, perfume and medicine from *Aquilaria spp.* (ERDB, 2012). The resources are also economically beneficial to the locals as they serve as a primary source of living for many. With this, the locals have sustained the timber harvesting practice to the point that many tree species are now threatened by depletion, as extraction of resources occur at unprecedented levels (Clements et al., 2006).

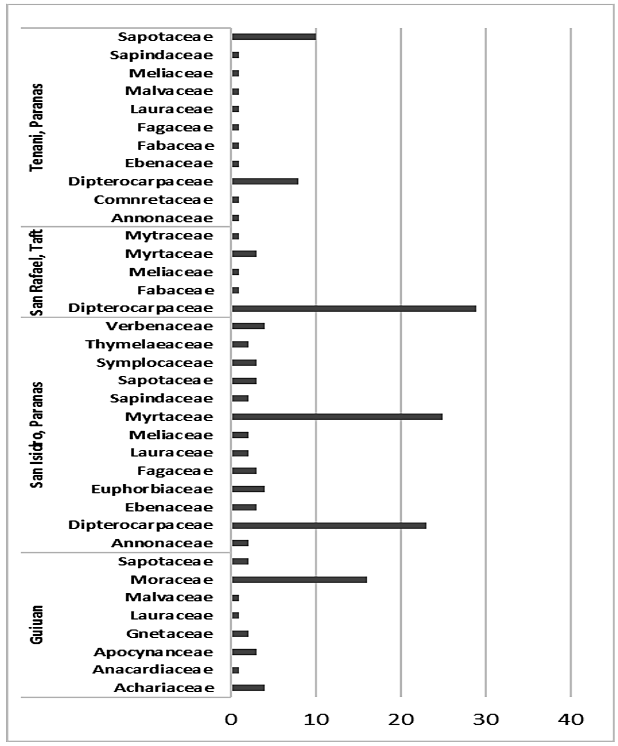

Figure 3. Species counts ranging (0-40) under families per site

3.3. Conservation Status of MTs

The IUCN and DAO No. 2017-11 has listed 984 threatened species of Philippine plants belonging to 112 genera and 50 families. Even with the existence of the IUCN and DENR, local government units still have to have their own local list of endangered species (Lillo et al., 2020). It was emphasized in other literatures that local communities along natural habitats are the most knowledgeable on the conservation status of species as they are on the ground (ERDB, 2012). Locals are the ones who know which species are abundant, which among them are rare, and also those that are threatened. It was also discussed by Lillo et al. (2020) on the Nug-as forest Key Biodiversity Areas in Cebu, Philippines that if at-risk species were not protected, the local communities would be affected most seriously. This resulted from the deterioration of ecosystem services brought about by the declining population of a concerned species. This was also because they were the ones occupying in the area. These aforesaid points are just some of the driving forces on why this study not only aimed to determine species characteristics and uses, but also evaluate the conservation status of the MTs.

Among the three study sites, species recorded were under categories of critically endangered (CE), endangered (EN) vulnerable (VU) and nearly threatened (NT) species. Species identified at the study sites that were categorized as CE were *Vatica mangachapoi* Blanco, *Hopea samarensis* H.G. Gut., *Shorea almon* Foxw., *Shorea astylosa* Foxw. and *Hopea philippinensis* Dyer. - all belong to Dipterocarpaceae and are endemic to the Philippines (DAO No. 2017-11). The country's forest is considered among the richest terrestrial ecosystems in terms of biological diversity (ERDB, 2012). However, according to DENR's Forest Management Bureau (FMB, 2009), only 24% of the identified forest land area are actually covered by forest.

Dipterocarpaceae was identified to have higher risk of extinction in this study because it has been known as a source of good timber marketed as 'Philippine Mahogany'. Timber extraction has been extensive in the past particularly with dipterocarps, transcending generations and lasting decades or hundreds of years (Yamada et al., 2016, as cited by Brearly et al., 2016). Aside from being used as hardwood, dipterocarps also provide non-timber products. The genus Shorea are tapped for resin for a cosmetics, medicine and other variety of uses (Appanah & Turnbull, 1998). It also produces seed kernels as food or for extracting oils that are used for cooking and confectionery (Appanah & Turnbull, 1998).

Hopea samarensis which was tagged in SINP was categorized under as EN in IUCN 2017 (IUCN, 2018). The identification of spatial distribution of plant species, their economic significance for the locals, and their conservation status is essential as a primary step in conservation efforts (Chanthavong & Buot, 2019), especially for the species that were red-listed by the DENR and IUCN.

Figure 4. Photo of *Hopea samarensis* taken at San Isidro, Paranas Samar Forest over Limestone (Photograph by J.T. Adorador)

3.4. Comparison of DBH and Elevation among sites

Diameter at breast height (DBH) is a key factor used in assessing flora biomass (Ensslin et al., 2015). Since forest growth is affected by many environmental factors, such as topography and soil, the DBH of trees of the same age may vary considerably in different environments. (Hu et al. 2007, as cited by Zhou et al., 2019). In this study, the comparison of variables (DBH and elevation) among sites were analyzed using One-Way ANOVA. Regardless of variation of factors influencing variation of tree growth among the three study sites, results showed that the DBH of MTs showed no significant differences. This means samples at the sites have almost the same tree sizes in terms of DBH. Moreover, the study focused on MTs measuring ≥30 cm DBH.

Elevation between sites had statistically significant differences at level $P \leq 0.05$.

Taft and Guiuan of Eastern Samar showed higher significant difference compared to the comparisons made between Paranas - Guiuan and Paranas - Taft sites (Table 1). In relation to Guiuan's average elevation data (33.0±37.7), species that were documented were found at lower elevation of the limestone karst unlike Paranas and Taft. Moreover, correlation between elevation and abundance of species results to have no significant values. This is contrasting to findings of similar studies conducted in tropical forests wherein it was consistently observed that tree growth declined with altitude (Coomes & Allen, 2007).

Table 1. A comparison of variables (DBH and Elevation) between sites using One-Way ANOVA. ***p=0.05***

Variables	Study Sites					
	Paranas		Taft		Guiuan	
	Mean	SEM	Mean	SEM	Mean	SEM
DBH (cm)	54.02	16.36	57.90	16.51	49.56	16.65
Elevation (m)	260.91[a]	37.61	231.42[b]	7.21	33.0[b]	37.77

Note: SEM: Standard Error of the Mean;

Means with different capital letters indicate significant difference (a) and (b) means with higher significant difference.

3.5. MTs distribution in forest over limestone

The spatial distribution pattern refers to the status of horizontal allocation or distribution of individual trees, influenced by multiple actions of the biological characteristics of population, intra-specific and inter-specific relations and environmental conditions (Gangying et al., 2007). In this study, the result on the performed Ripley's K-function analysis (Figure 5) shows the distribution pattern of MTs in all sites.

The resulting K-value is higher compared to the Expected value. This means that MTs were observed to be often clustered in spatial trend, instead of being randomly distributed. MTs were observed to be clustered at distances ranging from small to large. Furthermore, the Observed K-value is higher compared to the Upper Confidence Envelope (HiConfEnv), indicating a statistical significance in spatial clustering. This can be described through species population, coordinates and neighborhood in the sites. Paranas and Taft were adjacent in terms of location, while Guiuan is at farther location from the 2 sites. Taft and Guiuan were recorded to have lesser MTs tagged among study sites. However, the actual number of tagged MTs that were recorded does not directly imply as statistically significant in terms of spatial dispersion. Statistical significance in spatial dispersion and clustering in the study were determined by comparing the Observed-K, HiConfEnv, and LwConfEnv.

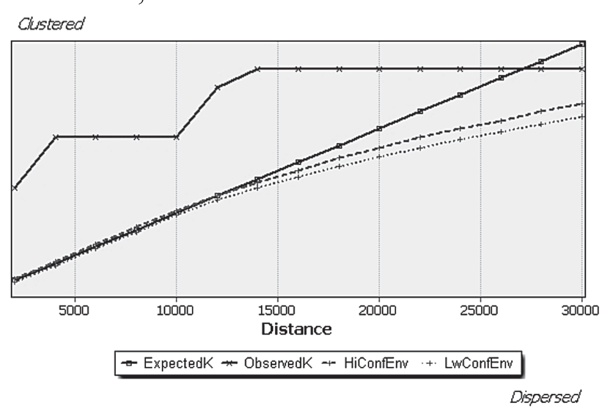

Figure 5. Spatial distribution of MTs at among sites using distance coordinates. X-axis = distance coordinates; Y-axis = L(d) or K-function

4. Conclusions

Samar Island Natural Park (SINP), despite its rugged topography is a mega diverse type of forest. The presence of MTs within the sites indicated that the forest is species-rich. The MTs distribution was found floristically similar among sites. Dipterocarpaceae was the dominant family in Paranas and Taft sites.

Moreover, anthropogenic small-scale disturbances were also observed. Thus, systemizing in-situ conservation through geotagging of mother trees and strategizing propagation techniques for threatened plants are imperative to conservation for the future generations.

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Appendix Table 1. Identified MTs in Paranas, Samar

No. of Genera	Scientific Name	Common Name	Family Name	Conservation Status	Species Abundance
1	*Vatica mangachapoi* Blanco	Narig	Dipterocarpaceae[1]	CR[a1]	2
2	*Hopea samarensis* H.G. Gut.	Samar gisok	Dipterocarpaceae[1]	CR[a2]	2
3	*Hopea philippinensis* Dyer	Gisok-gisok	Dipterocarpaceae[1]	CR[a3]	3
4	*Shorea almon* Foxw.	Almon	Dipterocarpaceae[1]	CR[a4]	3
5	*Shorea astylosa* Foxw.	Yakal	Dipterocarpaceae[1]	CR[a5]	3
6	*Shorea squamata* (Turcz.) Benth. & Hook.f. ex DC.	Mayapis	Dipterocarpaceae[1]	NT	6
7	*Nephelium ramboutan-ake* (Labill.) Leenh.	Kapulasan	Sapindaceae[2]	NT	1
8	*Chisocheton cumingianus* (C.DC.) Harms	Balukanag	Meliaceae[5]	NT	1
9	*Nothaphoebe leytensis* (Elmer) Merr.	Batikuling	Lauraceae[8]	NT	3
10	*Tristaniopsis micrantha* (Merr.) Peter G. Wilson & J.T. Waterh.	Tiga	Myrtaceae[4]	NT	12
11	*Teijsmanniodendron ahernianum* (Merr.) Bakh.,	Kulipapa	Verbenaceae[9]	NT	5
12	*Syzygium simile* (Merr.) Merr.	Panglomboien	Myrtaceae[4]	NT	4
13	*Shorea guiso* Blume	Guijo	Dipterocarpaceae[1]	NT	3
14	*Symplocos odoratissima* (Blume) Choisy ex Zoll. Var. odoratissima	Agosip	Symplocaceae[10]	NT	3
15	*Guioa koelreuteria* (Blanco) Merr.	Alahan	Sapindaceae[2]	NT	1
16	*Cyathocalyx cf. philippinensis* (Merr.) J Sinclair		Annonaceae[6]	NT	1
17	*Dysoxylum mollissimum* Blume	Himamau	Meliaceae[5]	NT	2
18	*Wallaceodendron celebicum* Koord.	Banuyo	Fabaceae[11]	NT	2
19	*Lepisanthes tetraphylla* (Vahl) Raldk.	Sarakag	Sapindaceae[2]	NT	1
20	*Polyalthia* sp.		Annonaceae[6]	NT	1
21	*Lithocarpus* sp.	Ulayan	Fagaceae[12]	NT	4
22	*Madhuca cf. oblongifolia* (Merr.) Merr.	Malabetis	Sapotaceae[3]	EN[c1]	2
23	*Pterospermum* sp.		Malvaceae[13]	NT	1
24	*Diospyros pyrrhocarp*a Miq.	Anang	Ebenaceae[7]	VU[b1]	1
25	*Balakata luzonica* (Vidal) Esser	Balakat-gubat	Euphorbiaceae[13]	VU[b2]	4
26	*Aquilaria cumgiana* (Decne.) Ridl.	Lapnisan; Agar	Thymelaeaceae[15]	VU[b3]	2
27	*Palaquium philippense* (Perr.) C.B. Rob.	Malakmalak	Sapotaceae[3]	VU[b4]	3
28	*Shorea polysperma* (Blanco) Merr.	Tanguile	Dipterocarpaceae[1]	VUb[5]	1
29	*Shorea negrosensis* Foxw.	Red lauan	Dipterocarpaceae1	VUb[6]	9
30	*Diospyros discolor* Willd.	Kamagong	Ebenaceae7	VUb[7]	3

31	*Xanthostemon philippinensis* Merr.	Bagoadlau	Myrtaceae4	VUb[8]	8
32	*Manilkara fasciculata* (Warb.) HJ Lam & Maas Geest	Duyok-duyok	Sapotaceae3	VUb[9]	8
33	*Terminalia macrantha* Rojo	Bongoran	Comnretaceae16	VUb[10]	1

Note. Numbers above in each family names indicates the counts of families in the site. Same as the letters and numbers indicated at conservation status.

CR: Citically Endangered; EN: Endangered; VU: Vulnerable; NT: Near Threatened.

Appendix Table 2. Identified MTs in Taft, Eastern Samar

No. of Genera	Scientific Name	Common Name	Family Name	Conservation Status	Species Abundance
1	*Syzygium simile* (Merr.) Merr.	Panglomboien	Myrtaceae[2]	NT	4
2	*Shorea negrosensis* Foxw.	Red lauan	Dipterocarpaceae[1]	VUb[1]	8
3	*Shorea squamata* (Turcz.) Benth. & Hook.f. ex DC.	Mayapis	Dipterocarpaceae[1]	NT	5
4	*Kingiodendron alternifolium* (Elmer) Merr. & Rolfe	Batete	Fabaceae[3]	VU[b2]	1
5	*Hopea philippinensis* Dyer	Gisok-gisok	Dipterocarpaceae[1]	CR[a1]	2
6	*Shorea guiso* Blume	Guijo	Dipterocarpaceae[1]	NT	4
7	*Shorea astylosa* Foxw.	Yakal	Dipterocarpaceae[1]	CR[a2]	6
8	*Dysoxylum mollissimum* Blume ssp. Mollissimum	Himamau	Meliaceae[4]	NT	1
9	*Shorea almon* Foxw.	Almon	Dipterocarpaceae[1]	CR[a3]	3
10	*Shorea polysperma* (Blanco) Merr.	Tanguile	Dipterocarpaceae[1]	VU[b3]	1

Note. Numbers above in each family names indicates the counts of families in the site. Same as the letters and numbers indicated at conservation status.

CR: Citically Endangered; EN: Endangered; VU: Vulnerable; NT: Near Threatened.

Appendix Table 3. Identified MTs in Guiuan, Eastern Samar

No. of Genera	Scientific Name	Common Name	Family Name	Conservation Status	Species Abundance
1	*Ficus crassiramea* (Miq.) Miq.	Baleteng-kapalan	Moraceae[1]	NT	2
2	*Ficus callosa* Willd.	Kalukoi	Moraceae[1]	NT	13
3	*Planchonella duclitan* (Blanco) Bakh.f.	Duklitan	Sapotaceae[3]	NT	2
4	*Gnetum gnemon* L.	Bago	Gnetaceae[4]	NT	2
5	*Pangium edule* Reinw.	Pangi	Achariaceae[2]	NT	4
6	*Wrightia pubescens* R.Br.	Lanete	Apocynanceae[5]	NT	1
7	*Alstonia scholaris* (L.) R.Br.	Dita	Apocynanceae[6]	NT	2
8	*Nothaphoebe umbelliflora* (Blume) Blume	Malabunga	Lauraceae[7]	NT	1
9	*Artocarpus treculianus* Elmer	Pakak	Moraceae[1]	NT	1
10	*Heritiera sylvatica* Vidal	Dungon	Malvaceae[8]	NT	1
11	*Dracontomelon edule* (Blanco) Skeels	Lamio	Anacardiaceae[9]	NT	1

Note. Numbers above in each family names indicates the counts of families in the site. Same as the letters and numbers indicated at conservation status.

CR: Citically Endangered; EN: Endangered; VU: Vulnerable; NT: Near Threatened.