A REVIEW AND ASSESSMENT OF THE FLORISTIC KNOWLEDGE OF SAMAR ISLAND

Based on Literature, PNH Records and Current Knowledge[1]

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by

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EXECUTIVE SUMMARY

Samar Island is one of the centers of botanical diversity in the Philippines. Together with Leyte Island, it is a distinct phytogeographic region distinct from the other provinces in the Philippines. Botanical data is still incomplete for the Island at this time, thus the exact number of plant species could not be ascertained. However, based on available records there are more than 2,400 species of flowering plants, 200 genera and 65 families recorded from the Island. Of this number 406 species are endemic to the Philippines and 40 species are found only in the Island.

The presence of six endemic genera of vascular plants, i.e. *Psomiocarpa, Thaumasianthes, Antherostele, Gloeocarpus, Greeniopsis,* and *Villaria* in this island indicates the long isolation of Samar and Leyte from the rest of the Visayan islands during the early geological time. From the conservation point of view, the island is probably the most important site for plant conservation because of the presence of these 6 endemic genera and 406 species.

Twelve (12) endemic species of trees in Samar Island are listed in the **World List of Threatened Trees** and six of these, i.e. *Hopea quisumbingiana, H. samarensis, Gloeocarpus patentivalis, Guioa discolor, Kibatalia puberula,* and *Mangifera monandra* are listed as critically endangered or endangered. Ten species of vascular plants from the island are included in the **1997 IUCN Red List of Threatened Plants** of which the very rare *Rafflesia manillana* is critically endangered or is now probably extinct. Two fern species are also included in the **IUCN Red List** of which *Platycerium grande* is now endangered due to habitat destruction and over-collection.

The forest in Samar harbors numerous economic species, foremost, being important timber trees belonging to the dipterocarp and leguminous families. Several important timber trees, such as *Hopea samarensis* (Dipterocarpaceae) and almaciga (Agathis philippinensis) are now threatened because of over-harvesting. There are also many other minor forest products such as rattans, resins, medicinal plants, ornamental plants, etc. Many of these forest products are exploited in some form or another by the local inhabitants and efforts must be directed to control their harvest and implement measures for their sustained yield. It is imperative that a thorough botanical inventory is undertaken to document and record the species richness and extent of coverage of these species within SIBP not only to contribute to scientific knowledge, but also to serve as basic reference for the protection and management of the SIBP.

A REVIEW AND ASSESSMENT OF THE FLORISTIC KNOWLEDGE OF SAMAR ISLAND

1. Introduction

Samar Island is the third largest island in the Philippines with a land area of 13,429 sq km. It is located at approximately 12°00'0"N latitude and 125°00'0"E longitude.

The island is composed of low, extremely rugged mountains. The highest point in the island is Mt. Capotoan at 896 m. The major streams are Ulut, Catubig, Palapag, Gandara, and Oras. On the south of the island is a long narrow peninsula, Guiuan, which is formed of low-lying coralline deposits. There are gray marls, siltstone, sandstone, and pebble conglomerates in Northern Samar. Volcanic soils characterize the southeastern part of the island. There are also diorite and granitic intrusives, and ophiolites of peridotite-dunite particularly at the eastern and southern portions of the island (BMGS, 1982).

The island is divided into two regions based on the Modified Corona's Climate Classification. The Northeastern part manifests the Type II climate which has no dry season and has a very pronounced rain period particularly during December and January. This side is exposed to tropical cyclonic disturbances and receives very large amounts of precipitation. The Southeastern part manifests the Type IV climate which has rainfall more or less evenly distributed throughout the year. Generally, the island has a humid climatic condition throughout the year (Kintanar, 1984).

The geographic location, climatic, and soil conditions render a mosaic of varied habitats which harbor numerous endemic, rare, and endangered species of plants.

The present study is an overview of existing knowledge of the terrestrial flora of Samar Island. This study specifically aims to:

1. conduct a historical review of botanical activities undertaken in Samar since the 1900s;

2. gather data and information available on the flora of Samar Island from existing publications, records of herbarium specimens, and computerized database of plant collection, historical and archival records, and herbarium indices;

3. produce an annotated list of rare, endemic, and endangered plants of Samar Island based on available publications and references; and

4. identify information gaps and propose recommendations for research priorities on the terrestrial flora of Samar Island.

2. Methodology

1. Herbarium survey

   Herbarium accession books, herbarium database, and collection lists at the Philippine National Herbarium were reviewed for entries on specimen collection from Samar. A list of these specimens is produced with information on locality, collector, date of collection, and collection number.

2. Literature survey

   Historical accounts of botanical expeditions made in Samar were gathered from available publications and records. A list of plant collections from these expeditions were made and were later incorporated in the general taxonomic list.

3. Assessment of conservation status

   The rare, endemic, and endangered species of plants were noted from the general taxonomic list of plants generated from the herbarium and from literature surveys. Their conservation categories were indicated based on the global status of the species in the Red Data Books.

4. Identification of information gaps

   Priority sites and species for research were identified. Strategies for research were likewise proposed.

2.1 Brief Historical Account of Botanical Explorations in Samar (based on records of the Philippine National Herbarium)

The first intensive systematic plant collecting in Samar was conducted by the American botanist, E.D. Merrill, and his field assistant, M. Ramos, of the Bureau of Science from April-May 1914. They collected several hundred specimens which were later deposited at the Bureau of Science Herbarium. Shortly after, an expedition in the island was conducted by Sharfesee, Cenabre, and Cortes of the Bureau of Forestry. The collections of M. Ramos and M. Sulit in 1916 yielded, among others, 32 new species from Catubig River. These collections were recorded in Merrill's **Enumeration of Philippine Flowering Plants** (1923-1926). However, the entire plant collections deposited at the Bureau of Science Herbarium and its botanical library were burned during the Second World War. Fortunately, some duplicates were sent to foreign herbaria and these were later returned to the PNH.

Immediately after 1946, Dr. Eduardo Quisumbing, then Director of the National Museum, sent his field staff to collect plant specimens in various sites of the country including Samar. His intention was to replace specimens burned during the war and

rehabilitate the herbarium. Several sites in Samar were explored including Mt. Aragonoi, Mt. Calbiga, Mt. Malingan, Mt. Purog, etc. These collecting activities intensified in 1946-1948 and 1951-1952.

From 1969-1973, the PNH staff was awarded a research grant to document the flora of the island in connection with the "Ecology of Southern Samar Project". The team was comprised of D.R. Mendoza, H. Gutierrez, D. Madulid, P. Cordero, Jr, E. Reynoso, and F. dela Cruz. During this period, the members of this expedition were able to collect more than 4000 numbers of specimens (including duplicates). The sites covered were mostly lowland evergreen rainforests in Mt. Concord, Mt. Sohoton, Mt. Apoy, Balangiga, and Sta. Rita, Southern Samar.

In 1973, a botanical expedition to the island was conducted by Colina and Jumalon of the University of San Carlos. Around 120 specimens, mostly identified to the genus level, were collected. The results of their expedition were consequently published in two journals.

From 1992-1996, the Philippine Plant Inventory team members of the Flora of the Philippines Project conducted several expeditions to Samar. The collecting sites included Paranas, Campo Uno (Central Samar); Catinloc and Busong-Busong (Balangiga, Eastern Samar); San Miguel (Eastern Samar); Mt. Sohoton Bridge National Park, Marabut, San Juanico, and various localities in Basey. The teams were able to document the flora of the lowland evergreen rainforest, forest over limestone, forest over ultramafic soils, mangrove forest, beach forest as well as secondary forests. A total of at least 900 specimens in duplicates were collected by the PPIP. All of the collections are deposited at the PNH.

In summary, the botanists and technical staff of the Philippine National Herbarium conducted various botanical expeditions in Samar Island. Places botanized include Babasian na Daku, Babasian na Gotti, Bagacay, Balangiga, Bariz, Basey, Basud, Borongan, Buhang, Busong-busong, Cabaguan, Cadapnan, Cahibabago, Cambayan, Campo Uno, Catarman, Catinloc, Concord, Dolores, Gandara, Gisok, Goyam, Guiuan, Guinmaayohan, Hinamok, Inuntan, Kagpulangi, Ilorente, Loquilocon, Mahagna, Marabut, Maslog, Matuginao, Oquindo, Pamamayaon, Paranas, Pinamgasan, Salcedo, San Gabriel, San Isidro, San Juanico, San Miguel, Sta. Rita, Taft, Tagaslian, Tarangan, Ticoco, Tinabanan, Wispal, Wright, Mt. Sohoton, Mt. Alogan, Mt. Purog, Mt. Cabayanon, Mt. Sarawag, Mt. Arangonoi, Mt. Malingan, Mt. Calbiga, Mt. Concord, Mt. Cansayao, Mt. Apoy, and Mt. Capotoan.

As a result of these botanical activities, it can be said that the island of Samar is fairly collected. However, collection was concentrated more on the southern part of the island. The Central and Northern parts, although thickly vegetative, is comparatively less explored. For this reason, botanical work should be targetted to those places.

Table 1
Summary of Botanical Expeditions Conducted in Samar Island (Based on Records from the Philippine National Herbarium)

Locality	Collector(s)	Date Collected
Samar	E.D. Merrill & M. Ramos	Apr-May 1914
Samar	Sharfesee et al	Apr 1914
Catubig River and Mt. Capotoan	M. Ramos, M. Sulit, Sablaya	Mar 1916
Samar	Cortes	Jun-Jul 1916
Salcedo, Guiuan	E. Quisumbing	Jun-Dec 1946
Wright, Loquilocon	M. Sulit	Apr-May 1948
Mt. Arangonoi,Loquilocon	M. Sulit & E. Conese	Apr-May 1948
Mts. Malingan and Calbiga, Taft	M. Sulit	Apr-May 1948
Cadapnan,Tagaslian, Pinamgasan	A.P. Castro et al	May-Jun 1948
Mt. Cansayao, Mahagna, Oquindo, Catarman	M. Sulit	Mar-May 1951
Mts. Purog, Sarawag, Cabayanon, Capotoan; Bariz, Matuginao, Maslog R.	G. Edano	Dec-Jan 50/51
Mts. Purog, Capotoan, Alogan; Bariz	F.S. Gachalian	Dec-Jan 51/52
Samar	E. Conese	Mar-Jun 1952
Basey, Borongan	Rudolfo	Jan 1961
Borongan, Mt. Apoy	H. Gutierrez & E. Reynoso	Jul 1965
	Lomibao	Sep 1967
Bagacay, Mt. Concord	H. Gutierrez et al.	May 1969
Llorente, Mt. Apoy	H. Gutierrez et al.	May-Jun 1969
Basey, Mt. Sohoton	D. Madulid & H. Gutierrez	Mar-Apr 1970
Pamamayaon, Mt. Sohoton	D. Madulid & H. Gutierrez	Mar-Apr 1970
Bo. Sta. Rosa, Balangiga	D. Madulid et al.	May 1971
Guinmaayohan, Balangiga	D. Madulid & H. Gutierrez	May 1971
Bo. Buhang, Dolores	F. Dela Cruz	Dec 1973
Bo. Cabaguan, Dolores	P. Cordero Jr & F. Dela Cruz	May/Dec 1973
Bo. Kagpulangi, Dolores	F. Dela Cruz	Dec 1973
Basey	Colina & Jumalon (USC)	1973
San Isidro, N Samar	L.G. Blobuist	Jun 1977
Gandara	M. Price & B. Hernaez	Aug 1977
Bo. Sta. Rita, Balangiga	E. Reynoso & F. Dela Cruz	Mar 1978
Brgy Inuntan, Basey	E. Barbon et al.	Jan 1992
Mt. Sohoton Bridge NP	E. Barbon et al.	Jan 1992
Wispal, Basey	E. Barbon et al.	Jan 1992
San Juanico	E. Barbon et al.	Jan 1992
Cambayan, Basey	E. Barbon et al.	Jan 1992
Hinamok	E. Barbon et al.	Jan 1992
Brgy. Tinabanan, Marabut	E. Barbon et al.	Jan 1992
Paranas, Campo Uno, C. Samar	R. Majaducon & E. Reynoso	May 1996
Sitio Cantinloc, Brgy 1, Balangiga	F. Gaerlan & R. Chavez	Aug 1996
Sitio Basud, San Miguel	F. Gaerlan & R. Chavez	Aug 1996
Sitio Busong-Busong, Balangiga	F. Gaerlan & R. Chavez	Aug 1996

3. Botanical Significance of Samar Island

Samar Island is one of the centers of botanical diversity in the country and in the Malesian Region. Together with Leyte Island, it is one of the 15 biogeographic regions of the country. Based on Merrill's **Enumeration** (1923-1926), there are around 406 endemic species of flowering plants in at least 200 genera and 65 families in Samar. These figures are not definite and these may change depending on the botanical inventory that will be carried out in the full implementation of the Samar Island Biodiversity Project. Of these at least 40 are found only in the Island. There are about 240 species endemic to both Samar and Luzon. There are also 173 endemic species common to both Samar and Leyte, and 172 species to both Samar and Mindanao. These indicate that Samar shares close floristic affinity with Leyte, Luzon, and Mindanao.

These floristic relationships can be attributed to the geological history of these islands. Samar and Leyte formed one landmass since the late Cenozoic. During the Miocene upheaval the Samar-Leyte was connected to Sorsogon on the north and Surigao del Norte through Dinagat Island on the south. However, Luzon was separated from this large land mass during the Pliocene period. When the sea receded during the Pleistocene period, Samar-Leyte-Northeastern Mindanao was rejoined to Luzon and this time also with Bohol. These land connections were then broken during the post Pleistocene period resulting to independent islands, i.e. Samar, Leyte, Luzon, Bohol, Dinagat, Mindanao (Samson, 1979). Southern Luzon is presently separated from Samar by the San Bernardino Strait. The presence of six endemic genera of vascular plants, *Psomiocarpa, Thaumasianthes, Antherostele, Gloeocarpus, Greeniopsis,* and *Villaria,* indicates the long isolation of the Island.

3.1 Rare, Endangered, Endemic, and Useful Plants of Samar

There are twelve (12) endemic species of trees found in Samar Island which are listed in the **World List of Threatened Trees** (Oldfield, et al., 1998). Six (6) species, i.e. *Hopea quisumbingiana, H. samarensis, Gloeocarpus patentivalis, Guioa discolor, Kibatalia puberula,* and *Mangifera monandra* are listed as critically endangered or endangered. Of these, *Kibatalia puberula, H. quisumbingiana,* and *H. samarensis* are restricted to Samar Island. *Horsfieldia ardisiifolia, Horsfieldia samarensis, Kibatalia merrilliana, Knema stellata* ssp. *stellata, Myristica laevis* ssp. *laevis,* and *Myristica pilosigemma* are considered as vulnerable species (***Table 2***).

The **1997 IUCN Red List of Threatened Plants** (Walter & Gillett, 1998) includes ten (10) species of vascular plants from Samar Island (***Table 3***). Of special botanical interest is the rare parasitic plant *Rafflesia manillana* which was recorded in the island and four other localities in the country. In the book this species is categorized as endangered. This particular species is spectacular because it bears a flower about 20 cm across and is probably the second largest flower in the country next to the Rafflesia species in Mindanao. Although the plant has been recorded to occur in Samar prior to the Second World War, it has not been recollected since. It is probably extinct at this time but search of this plant in the lowland forest may reveal its existence. Other species in Samar which are categorized as vulnerable are *Ficus pseudopalma, Ficus ulmifolia, Diplodiscus paniculatus* (monotypic genus), *Xanthostemon verdugonianus, Macaranga caudatifolia, Celtis luzonica,* and

Mangifera monandra. Except for *Ficus ulmifolia*, all of these species are widespread endemics.

Two fern species are also included in the **IUCN Red List.** These are *Platycerium grande* (endangered) which is a highly ornamental fern found in lowland dipterocarp forests and *Cyathea negrosiana* (rare) which is restricted to the Visayan Islands.

Table 2
List of Some Trees of Critical Conservation Status Found in Samar (Oldfield, 1998)

Family	Sci Name	Description	Status
Sapindaceae	Gloeocarpus patentivalvis	A rare tree restricted to the primary dipterocarp forests of Mindanao, Samar, Leyte, and Luzon.	Endangered
Sapindaceae	Guioa discolor	Known only from 4 herbarium specimens, this small tree is confined to the primary dipterocarp forests of Luzon and Samar.	Endangered
Dipterocarpaceae	Hopea quisumbingiana	Known only from a single collection in Samar	Critically
Myristicaceae	Horsfieldia ardisiifolia	A Philippine endemic found in lowland forests in moist valleys on the islands of Luzon, Mindoro, Sibuyan, Samar, and Leyte	Vulnerable
Myristicaceae	Kibatalia merrilliana	A small tree endemic to the Philippines, so far found only on Samar and Leyte Islands	Vulnerable
Myristicaceae	Kibatalia puberula	Restricted to Samar Island, this small evergreen tree occurs in dipterocarp forest on river banks between altitudes of 100 and 250m. It has been collected only three times	Endangered
Myristicaceae	Knema stellata ssp. Stellata	This subspecies is known from only five collections on Samar Island	Vulnerable
Anacardiaceae	Mangifera monandra	A very scattered and uncommon tree found in wet evergreen lowland forest on the islands of Luzon, Samar, Leyte, Ticao, and Guimaras. The timber is used for interior finish and making furniture.	Endangered

Table 3
List of Some Plants from Samar Cited in the 1997 IUCN Red List of Threatened Plants (Walter and Gillett, 1998)

Family	Scientific Name	Category
Cyatheaceae	Cyathea negrosiana Christ.	Rare
Polypodiaceae	Platycerium grande (J. Sm. Ex Fee) Presl	Extinct/Endangered
Anacardiaceae	Mangifera monandra Merr.	Vulnerable
Euphorbiaceae	Macaranga caudatifolia Elm.	Vulnerable
Moraceae	Ficus pseudopalma Blanco	Vulnerable
Moraceae	Ficus ulmifolia	Vulnerable
Myrtaceae	Xanthostemon verdugonianus Naves	Vulnerable
Rafflesiaceae	Rafflesia manillana Teschemacher	Endangered
Tiliaceae	Diplodiscus paniculatus Turcz	Vulnerable
Ulmaceae	Celtis luzonica Warb.	Vulnerable

There are several indigenous species from Samar listed in the CITES ***Appendix B*** (collectively grouped as Orchidaceae, Nepenthaceae, Cycadaceae, and ferns and fern allies).Of particular conservation concern are those orchids belonging to the genera *Phalaenopsis, Renanthera,* and *Dendrobium.* These orchids are highly ornamental and are collected in big number from the wild by the local people. Among the pitcher plants, *Nepenthes alata* and *N. ventricosa* are recorded in the island. Wild ornamental ferns, i.e. *Pteris, Tectaria, Asplenium, Diplazium, Blechnum, Davallia, Nephrolepis, Pteridium, Dicranopteris, Ophioglossum, Platycerium, Lycopodium, Selaginella,* and *Adiantum,* are potentially threatened. *Cycas rumphii* is found on the limestone shores of the island.

Madulid (1991) considers *Syzygium aqueum,* a fruit tree species locally known as *tambis,* as vulnerable. This species has a very restricted distribution in the country, i.e. Samar, Dinagat, Mindanao and Basilan Islands. Other fruit trees of conservation significance are *Syzygium claviflorus (bolagsong), S. curranii (igot), S. mananquil (kagoko),* and *Anacolosa frutescens (matobato).*

The endemic genus *Thaumasianthes* is found only in Samar Island which has undergone ecological divergence most probably because of intraspecific competition. *Sararanga philippinensis* is an endemic pandan with one other known species found in the Solomon Islands.

Most of these species are found in the lowland evergreen rainforests of Samar which are the most threatened habitats in the island.

3.2 Vegetation Types in Samar Island

Based on the vegetation map produced by the Swedish Space Corporation and NAMRIA (1988), there are four (4) types of forest found in the island, i.e. mangrove forest, closed canopy forest with mature trees covering >50%, open canopy forest with mature trees covering <50%, and mossy forest.

Mangrove forests are found at the northeastern part of the island, particularly south of Calbayog City.

A closed canopy forest with mature trees covering >50% is found in Central Samar, in and around Mt. Capotoan. This forest is surrounded by an open canopy forest. Large tracts of several cultivated and open areas are found within these forests. These forest formations extend to Southern Samar, particular in and around Mt. Asgad. The canopy (open or closed) forest type is equivalent to lowland evergreen rainforests in Whitmore's classification of tropical forests.

Small patches of mossy forest are found on the south and southeast part of the island. This forest type is equivalent to lower montane forest in Whitmore's classification of tropical forests.

Grasslands (with grass covering >70%), cultivated area mixed with brushland and grassland, coconut plantations, croplands, mixed croplands and coconut plantations characterize many parts of the island, particularly around forest areas to the coastlines.

Northern Samar posted the highest forest destruction in the Eastern Visayas Region with a rate of 7.9% annually. Only 34,100 hectares of forest remain. The virgin forests were also depleted to 3,500 hectares in Northern Samar. In Eastern Samar, forests diminished to 152,500 hectares at a rate of 2.3% annually. The largest forest area was accounted to Western Samar where 154,300 hectares remain. At least 6,000 hectares of forest were diminished yearly in this province.

Another way of describing forest types in Samar, is by reference to ecological parameters. Hence, there are six types of forest apparent in the island, i.e. beach, mangrove, lowland evergreen rainforest, forest over limestone (sometimes referred to as semi-deciduous lowland rainforest), forest over ultrabasic rocks, and lower montane forest.

4. Assessment of Botanical Information Available

A preliminary review of botanical records in the island yielded about 2400 entries (taxa). Assuming that these records are individually represented by a voucher specimen, the collecting density index is then 2400/13400 sq km. Based on the convention or standard that a CDI of 100/100 sq km is adequate as a basis for a sufficient inventory for a site, then the CDI for Samar indicates that the island is still insufficiently sampled to provide a good knowledge of the flora of the island. It is more important that botanical collecting expeditions should be undertaken in different sites of the island, preferably in areas representing habitat types, to document comprehensively the flora of the island.

A review of the information on the dipterocarps, the commonly used timber species, recorded in the island illustrates further the need for a botanical inventory of the island. Merrill (1923-1926) lists 12 species of dipterocarps found in the island. In a revision of the dipterocarps of the Philippines, Gutierrez (1983) noted that there are 13 species found in Samar. Of these, four (4) are new species and seven (7) are new records. Two (2) species are recollections. The new species and records are based on intensive collection in the island from 1969-1978.Ten (10) species which were previously documented by Merrill (1923-1926) however were not recollected by the National Museum team in their recent

surveys. This can be attributed to the fact that the species may have become extinct in the island or no specimens have been encountered during the expedition. This information clearly indicate the need for further intensive collection and documentation of the flora as it may yield new species, new records, and additional information on the conservation status of the species.

It could also be noted that the lowland evergreen rainforests have been fairly botanized compared to the other vegetation types. The forest over limestone, particularly in Eastern Samar, represents a biogeographically distinct flora which may yield new species and records for the island.

Geological records show that Samar is part of the Eastern Bicol-Eastern Mindanao Ophiolite Belt which represents elements of tectonics. Ophiolite sequences are found in Southern Samar. Overlying this deposit is a distinct vegetation type, forest over ultramafic soils. Though the belt is continuous to the Dinagat Island Group in the south, which belongs to another biogeographic region, the island's isolation from the Dinagat Island Group should result to a distinct floristic composition. This vegetation type has not been intensively covered in previous collections.

4.1 Plant Diversity Assessment Inside the Forest Resource Assessment Transect Lines

Species diversity of trees and other plants within the transect plots and adjacent areas

Species diversity is rather high within the 3 transects areas and adjoining areas. There are 73 flowering plant families recorded. The large familes are the following: Euphorbiaceae (27 spp.); Palmae (24 spp.), Dipterocarpaceae (22 spp.), Moraceae (22 spp.), Rubiaceae (18 spp.), Leguminosae (15 spp.); Myrtaceae (13 spp.), Annonaceae (11 spp.), Lauraceae (10 spp.), Sterculiaceae (10 spp.).

Of special note and botanical importance is the presence of numerous Dipterocarp species in the transect plots and adjoining areas. Such high species diversity of Dipterocarps is not common in other lowland forests in the Philippines. Samar stands out as one island having a rich resource of diptercarp species in the Philippines. This particular family is popularly known as "Philippine mahogany" in the export trade and is in big demand both in local and international timber trade. Because of heavy exploitation of the Dipterocarps in the island, this family is now threatened with extinction, and should, therefore, be subject to strict logging control by the government.

Another important timber tree found in the areas adjoining the transect lines is almaciga (*Agathis philippinensis*). This tree is rather abundant in forests between 50 to 500 m elevation. In other islands, particularly in Palawan, etc. the species occur in higher elevations. Almaciga are spared from being felled for timber as the local people tap the trees for resin which are then sold in the local markets.

Trees and shrubs belonging to the family Euphorbiaceae are abundant in secondary forests as exemplified by common species such as Macaranga spp., Mallotus spp., Baccaurea spp., Endospermum spp., Claoxylon spp., Cleidion spp., Croton spp. and Phyllanthus spp. As most of these plants are common components of secondary vegetation they are mostly widespread species and are low in species endemism.

The leguminous species are represented by tall trees, shrubs, herbs and vines. Important trees are Pahudia rhomboideaa, Sindora supa, Wallaceodendron celebicum and Pongamia pinnata var. xerocarpa. The ubiquitous liana, Entada phaseoloides, is also common in the area. The exotic species, Acacia mangium, is also found in secondary forests. These are planted as reforestation species and are able to grow faster than the indigenous species.

There are 16 species of wild balete (Ficus spp.) in the area. The fruits of these plants are usually eaten by mammals and birds, hence, they are of ecological and biological importance. Most of the fig trees are able to adapt to various edaphic conditions, but they are particularly adapted to limestone areas. Numerous species of Ficus are endemic to the Philippines but they are less threatened compared to the Dipterocarp species.

4.2 List of Threatened Plants Found in the Transect Plots and Adjoining Areas

The following species are listed in the Threatened Trees of the World (1998):

1. Shorea astylosa (Dipterocarpaceae) - Indeterminate
2. Macaranga bicolor (Euphorbiaceae) – Indeterminate
3. Macaranga caudatifolia (Euphorbiaceae) Vulnerable
4. Garcinia rubra (Guttiferae) – Rare
5. Ficus pseodopalma (Moraceae) – vulnerable
6. Syzygium polycephaloides (Myrtaceae) – rare
7. Tristania decorticata (Myrtaceae) - vulnerable
8. Tristania littoralis (Myrtaceae0 – vulnerable
9. Xanthostemon bracteatus (Myrtaceae) – rare
10. Diplodiscus paniculatus (Tiliaceae) – vulnerable

The **IUCN List of Threatened Trees** cover species of plants that have conservation value at the global level. It is, however, only a preliminary list and not all important threatened trees are included for the Philippines. Thus, the need for a thorough survey and assessment of the current conservation status of the plants of Samar which should be carried out during the full implementation of the Samar Island Biodiversity Project.

4.3 Species Diversity of Economic Plants from the Transect

There are 5 families of non-timber species recorded in the transect areas: Palmae (29 spp.), Gramineae (4 spp.), Pandanaceae (3 spp.), Musaceae (2 spp.) and Aspidiaceae (1 sp). The most abundant of the economic plants in the FRA transects are the rattans, exemplified by ilhian (Calamus discolor) and the erect palm, anibong (Oncosperma gracilipes). The rattan species are represented by various age classes, but many of them are still in the seedling or immature stage. The absence of mature rattans in the area suggests that these plants have already been harvested and sold in the local market. The rattan species belong to 3 genera: *Calamus* (7 spp.), *Daemonorops* (1 sp.) and *Korthalsia* (1 sp.). All of the 9 rattan species are endemic to the Philippines. They are all under serious threat of being overharvested.

The erect palms, i.e. *Areca caliso, A. catechu, Arenga pinnata, Corypha utan, Heterospathe philippinensis, Livistona rotundifolia* var. *luzoniensi, Oncosperma gracilipes, Orania decipiens* var. *montana, Pinanga insignis subsp. loheriana* and an undetermined species, are less threatened since they have more limited use than the rattans (mostly for thatching or

for food). Consequently they are less threatened since the trees are not usually cut down, but only parts of the plants, i.e. leaves, inflorescence, fruits, are harvested.

Wild bamboos also abound in the transect areas. These are represented by 4 species of climbing bamboos belonging to 2 genera, Schizostachyum (i.e. S. lima and S. lumampao) and Dinochloa (i.e. D. scandens and D. sp.). These species occur in areas that have been logged over and are, in fact, indicator species of secondary or open-type of forest. Outside the transect sites there are other bamboo species mostly belonging to the genus Bambusa (i.e. B. spinosa and B. vulgaris). The stems of erect bamboos are utilized for house building and furniture; the young shoots are edible.

The leaves of the wild pandans, i.e. *Pandanus copelandii* and *P. radicans*, are popularly used by the Samarenos in mat and basket making. Both of these species are endemic to the island and are prone to be overharvested. Measures must be taken to ensure sustainable harvesting of these species. Another noteworthy endemic species in the island which is related to the pandans is the wild tree pandan, *Sararanga philippinensis*. This tree grows in clumps occurring along riverside or swampy areas. The leaves are also made into mats and baskets but no effort is made to replant this wild pandan. It is one of the threatened economic plants of the island.

5. Summary and Recommendations

The following are the highlights of the information gathered on Samar Island's plant diversity:

- Samar Island belongs to the Eastern Visayas Biogeographic Region. It shares strong floristic affinities with the islands of Leyte, Luzon, and Northeastern Mindanao.

- The Island is a center of plant diversity in the Philippines and in the Malesian Region.

- The island is one of the centers of plant endemism in the country. There are around 400 endemic species, in at least 200 genera, and 65 families of flowering plants in the island.

- There are 21 species of vascular plants which are at risk in the island. These include *Rafflesia manillana*, 2 dipterocarp species, 10 other tree species, 2 fig species, and 2 fern species.

- There are at least six vegetation types represented in the island, i.e. lowland evergreen rainforest, lower montane forest, forest over limestone, forest over ultramafic soils, mangrove forest, and beach forest.

- Major botanical expeditions to the island were conducted by botanists and field staff of the old Bureau of Science and later the Philippine National Museum as early as 1914 and continued to the present. Activities slowed down during the Second World War but this was resumed immediately after. The expeditions covered more than 50 localities in and around 12 mountains in the island

yielding a collecting density index of 2400/13400 sq km. This is significantly lower than the index of 100 species/100 sq km which indicates that botanical inventories conducted are not sufficient to describe and document the flora of the island.

- The forest in Samar harbors numerous economic species, foremost, being important timber trees belonging to the dipterocarp family. There are also many other minor forest products such as rattans, resins, medicinal plants, ornamental plants, etc. Several important timber trees, such as *Hopea samarensis* (Dipterocarpaceae), are now endangered because of over-harvesting. These must be protected immediately before they get extinct.

- There are numerous rattans in the island. Based on records, there are more than 15 commercial species. Several species, especially those belonging to *Calamus* spp., are now over-harvested and critically endangered.

The information gaps for the flora of Samar Island are as follows:

- A thorough floristic inventory is needed to supplement the available data of the Philippine National Herbarium.

- There is no detailed information on the extent or coverage of the vegetation types of the island. There is also no detailed current vegetation map for the island (i.e. 1998).

- Although we could identify some threatened plants based mostly on secondary sources, there is no sufficient data on the species of conservation significance in the island. The distribution, biology, and ecology of the species are not known. Other locally endangered species must also be assessed and identified.

- There are no diversity studies conducted in the island. Specific areas of high species diversity have to be identified. These information are needed as basis for selection of priority sites for conservation and for identification or designation of conservation zones in the protected area.

- There are no ethnobotanical records available. The uses of the plants in association with the culture of the local people have not been documented.

The following are the plant diversity research programmes recommended for Samar Island:

- *Floristic Inventory*. A thorough floristic inventory should be undertaken to supplement the information available at the Philippine National Herbarium. This should include collection of botanical specimens particularly in Central Samar, identification of back-log botanical specimens stored at the Philippine National Herbarium, and updating of nomenclature of plants based on recent taxonomic revisions. Efforts should also be made to recollect rare species particularly those collected before the last decade. This should be concentrated in the lowland evergreen rainforests on the Central and Western parts of the

Island, in the forest over ultramafic soils on the south, and forest over limestone on the East.

- *Ethnobotanical Inventory*. An ethnobotanical study should be conducted to identify plants with known economic and cultural uses and to document the uses and use-practices of these plants. This inventory must involve collection of voucher specimens, interviews, and observations of actual use-practices by the people.

- *Vegetation Mapping*. The major vegetation types in the island must be delineated and mapped, preferably at various scales. Boundaries of vegetation should be clearly indicated in the map. Ground truthing is necessary to verify the boundaries.

- *Establishment of a GIS on plants*. Data on the distribution of plants, including those of taxonomic, conservation and ethnobotanical significance, and extent of vegetation types must be integrated with geophysical and climatological data of the island in a Geographical Information System. Through this, priority sites for conservation can be identified. Monitoring of conservation status of species will be made based on the GIS.

- *Vegetation Analysis and Species* Diversity Studies. Sampling plots for trees (20x20m), small trees and shrubs (4x4m), and herbs (1x1m) may be randomly established to cover several vegetation types and localities in the island. Through these plots, the following information may be derived:

Diversity indices. These can be calculated and statistically compared. Based on this information, sites can be ranked based on species diversity index.

Dominant species. The dominant species per plot and vegetation type can be identified based on importance values. The importance value of a species can be calculated through the sum of the basal area and density of a species.

Keystone species. A rare species with high ecological value can be also identified.

Conservation category of significant species. The conservation category of species can be determined based on the quantitative data provided from the plots. The data can be extrapolated to derive the total density of the species in the area which is a criterion for determination of IUCN categories of threatened plants.

Demarcation of vegetation types and management zones. Vegetation types can be identified based on the occurrence of indicator and dominant species. Management zones can also be identified based on the presence of significant species and diversity indices.

- *Establishment of Permanent Monitoring Plots*. A one hectare plot (500x20m) divided into 25 subplots (20x20m) should be established in a primary forest where intensive ecological studies can be conducted. This has to be undertaken to gather information on the impact of environmental conditions on the forest ecosystem. In a similar setting in Taiwan, it has been known that typhoons play

an influential force in regulating forest ecosystems, i.e. reducing leaf area index, increasing litter production, changing nutrient cycling, impacting fauna, altering site's light environment and tree mortality (King and Hsia, 1997). The plots will also provide information on species relationships and status of keystone species. This may also be situated in localities where rare species and non-timber species can be monitored. Parameters to be monitored are population number changes (seedlings, adult, reproducing individuals), distribution, and growth (dbh, height). Incremental growth of height and basal area of trees can also be measured through time.

- *Study on the sustainable use of non-timber resources*. A thorough inventory of the economically useful forest products such as rattans, other palms, medicinal and ornamental plants should be made. These should be monitored through yield studies and regeneration inventories.
- *Identification and monitoring of alien species*. Introduced species may or may not affect the integrity of the original vegetation. These species must be identified, their distribution delineated and monitored. The impact of these introduced species to the local people, as well to as to the ecosystem as a whole should be described, assessed and monitored.
- *Monitoring of species in trade/transport*. Efforts should be made to closely monitor trade and transport of species within the island and other islands to prevent depletion of natural populations in the wild. Plants carried or transported to and out of the islands must be accompanied by permits and should be monitored.
- *Ex-situ conservation of species*. Studies should be made on the practicality of conserving endangered species outside of their natural habitats.
- *Assessment of Conservation Status of Threatened Species*. Priority species for conservation must be identified from the threatened plants list. The taxonomy, distribution, population number, reproductive biology, species associations, habitat preference, ecological requirements, uses, and threats to the species must be assessed in detail. These information should be integrated in a species information system.

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