MACROFLORAL BIODIVERSITY CONSERVATION IN IFUGAO

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Abstract

Any biodiversity conservation effort starts from baseline information. A biodiversity study was then conducted in the province of Ifugao, Philippines to provide first hand information on the status of macrofloral biodiversity in the area. Rapid assessment using plot method was used in the inventory of macrofloral species. Ethnobotanical survey of key informants was also conducted to record knowledge of community members on the uses of plant species found in the locality.

Results revealed 69 families 134 genera and 214 species of macroflora. Shannon's diversity index for trees and shrubs showed 3.59 to 3.7 corresponding to relatively high diversity. Of the species recorded, 36 were endemic to the Philippines, 4 vulnerable based on the 2010 IUCN red list and under CITES Appendix II. Forest areas with lower elevation showed higher species diversity than those with higher elevation. Description of species importance values, dominance, similarity index and floristic checklist were provided.

Ethnobotanical survey revealed 38 species used as food plants, 25 species used as medicinal plants, 26 species with socio-cultural importance, 2 species identified as source of strong fiber, 5 species with pesticidal properties, and 1 species utilized as organic fertilizer. Issues and problems related to macrofloral biodiversity and suggested solution actions were described.

The forest areas in Ifugao are still rich in macrofloral diversity and can serve as a vital source for re-vegetation activities in areas with low plant density and diversity status. Leaving the remaining forest untouched and restoration of denuded forest cover in the other parts of Ifugao is vital in supporting macrofloral diversity conservation while mitigating climate change.

Keywords: Macrofloral biodiversity, Ethnobotany

Introduction

Rationale

Biodiversity plays various important roles beneficial to human being that extends far beyond mere sources of raw materials (Selliers 2005). Despite this fact, human actions caused loss of biodiversity at steadily increasing rate. Human activities cause the decline of animal and plant populations everywhere to the extent that extinction of some species could be due to such human activities.

Fortunately, concern on biodiversity loss is increasing worldwide because of its negative effects in almost all human wellbeing like health, energy and food security, vulnerability to climate change and calamities, access to clean environment, water and raw materials. It is believed that limiting biodiversity loss while promoting human wellbeing is possible.

Since direct actions towards limiting or reducing biodiversity loss are undertaken at the local level, it is important to strengthen the institutional capabilities at the local level for

successful planning and implementation of sustainable biodiversity conservation programs. Planning for biodiversity conservation program requires baseline information on existing biological resources. Such information will serve as input during the planning process for biodiversity conservation and for effective implementation, management and monitoring. Biodiversity assessment is thus the stepping stone towards biodiversity conservation.

The foregoing justifies the need for macrofloral biodiversity assessment in Ifugao as input in the proper management and conservation of its biological resources. Information on the current status of biological resources is limited and must be enhanced so that the kind and realistic level of biodiversity in the area can be established.

Macrofloral biodiversity assessment will provide first hand scientific knowledge on species richness and diversity of the resources in the area. Further, the results will provide a deeper understanding on these parameters to serve as guide for biodiversity advocates, communities, and institutions in designing protection and conservation strategies of macrofloral resources such as possible sustainable use of the resources without depleting their population in their natural habitat.

Objectives

In support to biodiversity conservation efforts at the local level, a macrofloral biodiversity assessment was conducted to provide first hand information on the status of biodiversity and conservation issues in the province of Ifugao, Philippines. Specifically, it aims to:

1. Provide data on the species richness and diversity of macroflora in selected sites in Ifugao,
2. Record knowledge of community members on the uses of plant species found in the locality,
3. Document issues and problems and suggested action solutions related to macrofloral biodiversity conservation.

Methodology

Location of Study Sites

The study was conducted in the province of Ifugao, one of the provinces of the Cordillera Administrative Region in Northern Philippines, specifically located at longitude between 120°50’ and 121°32’ and latitude between 16°35’ and 17°01’. It has a total land area of 251,778 hectares of which, about 90% or 226,369 hectares were forestland and 25,409 hectares were classified certified Alienable and Disposable land. The province is generally mountainous except in the eastern part which has hilly and rolling topography. Ifugao is about 330 kilometers from Manila and is accessible by land transportation. It has eleven municipalities and 175 barangays with a total population of about 165 thousand.

Macrofloral biodiversity assessment was conducted in three municipalities of Ifugao particularly in Alfonso Lista, Kiangan, and Mayoyao representing low (<500 m asl), medium (500-100 m asl) and high (>1000 m als) elevation forest ecosystems, respectively.

Macrofloral survey

Rapid assessment of macrofloral species (trees and shrubs) using plot method was employed in the inventory. Three main inventory plot of 20 x100 m along the slope was established per study site. Within the main plot, three (3) 20x20 m quadrats were established for tree profiling, and 3 5x5m subquadrats per quadrat were established for the inventory of trees and shrubs. Tree identification was done at each 20 x 20m quadrat and in the 5 x 5 m subquadrats. The process includes locating, identifying and measuring diameter at breast height, total height and crown cover of all trees with a diameter at breast height (dbh) of 5 cm

and above. Nomenclature and classification were based on Rojo, (1999) and Fernando (2004).

Ethnobotanical interview using key informants (10 respondents per municipality) were also conducted to ascertain the socioeconomic and cultural uses of the plant species, the factors and activities related to the macrofloral biodiversity loss, and suggested action solutions to floral biodiversity conservation. This was followed by a focused group discussion to verify the findings.

Results and discussions

Macrofloral Biodiversity in Ifugao

The inventory of macroflora in Ifugao revealed a total of 69 families, 134 genera and 214 species. There were 191 species of trees and shrubs belonging to 54 families and 121 genera. All the species surveyed were angiosperms except for Benguet Pine (*Pinus Kesiya*). Of the 54 families of trees and shrubs, Euphorbiaceae had the most number of genera (15) and individuals (24) followed by Rubiaceae with 7 genera and 9 species, and Meliaceae with 6 genera and 11 species. Family Moraceae had only 3 genera but with 21 species. Of the 121 genera, *Ficus* had the most number of species (17) followed by Syzygium with 9 species. Of the species recorded, 37 were endemic to the Philippines, and 4 species (*Lithocarpus ovalis, Ziziphus talanai, Sandoricum vidalii, Dillenia philippinensis*) were vulnerable under IUCN red list of 2010. Six species of palm was recorded in the inventory. One rattan species known as Lituko (*Calamus manillensis*) with edible fruits was recorded in the sampling plots at Kiangan, and another locally known as Barit (*Calamus sp.*) was recorded in Alfonso Lista, Ifugao. There were 8 species recorded belonging to the fern family and 8 species belonging to grasses, herbs and vines. The giant fern (*Cyathea contaminans*) is under CITES Appendix II.

Table 1 shows the number of species and the diversity indices for the forest ecosystems in the three municipalities of Ifugao. The diversity index ranges from 3.59 to 3.7 indicating relatively high species diversity. Of the 191 species of tree and shrubs recorded, forest in Alfonso Lista, a remnant of a Dipterocarp forest and representing low elevation had the highest number of species (89) followed by forest in Kiangan representing medium elevation with 86 species. Forest in Mayoyao representing high elevation had the least number of species (74). A total of 3,466 individuals were surveyed distributed to 1197, 1535 and 734 individuals for Alfonso Lista, Kiangan, and Mayoyao forests, respectively. Forest in Kiangan had the highest species density and total number of individuals. This could be explained by the fact that 'muyong" or private woodlot owners ensure that their respective "muyong" are adequately stocked with trees, shrubs and other perceived important plant species. Owners also practice cultural management practices to ensure best growth of their preferred plants (Daniels & Cabute, 2010). The result supports the finding of Rondolo (2001) who found out that the "muyong" contained 264 species of plants of all kinds, mainly indigenous, belonging to 71 plant families with *Euphorbiacea, moraceae and Meliaceae* as the most dominant families. The findings was also in agreement with Taguiling (2011) wherein "muyong" in Banue, Ifugao had the highest diversity index and with the highest number of species compared to communal and mossy forests.

Table 1. Number of species and diversity indices for tree and shrubs.

Indicators	Namnama, A. Lista	Nagacadan, Kiangan	Bato, Mayoyao	Grand Total
No. of Species (S)	89	86	74	191
Total No. of Individuals	1197	1535	734	3466
Shannon's Index				
Shannon's Index $_{observed}$	3.59	3.7	3.6	4.48
Shannon's Index $_{max}$	4.49	4.45	4.30	5.25
Evenness'	0.8	0.83	0.84	0.85

Species Similarity and Differences Between Study Sites

Table 2 shows the quantitative and qualitative species similarity analysis. The quantitative and qualitative measures indicate that species found in Kiangan were more similar to species found in Mayoyao. This findings could be explain by the fact that the elevation of the sampling sites in the forest areas of Kiangan and Mayoyao has only a difference of 313 m, thus, many species that will thrive in the forest areas of Kiangan will also thrive in the forest areas of Mayoyao. On the other hand, many species found in A. Lista may not be able to thrive in Kiangan and Mayoyao due to their relatively high difference elevation.

Table 2. Percent similarity matrix among study sites (%)

Jaccard measure (qualitative data)			
	A. Lista	Kiangan	Mayoyao
A. Lista	1	0.129	0.101
Kiangan	0.051	1	0.26
Mayoyao	0.029	0.165	1
Morisita- Horn measure (quantitative data)			

Further data analysis showed that there were 40 out of 191 species that were singletons or represented by one individual. This indicates the rarity of the species at least at the study sites.

There were 159 species that were found unique in each project site. That is, 64 species out of 191 species were only found in Alfonso Lista, 52 species found only in Kiangan and 43 species found only in Mayoyao. Data further revealed that there were 10 species that occur in all sites, 10 species common to A. Lista and Kiangan, 5 species common to A. Lista and Mayoyao and 14 species common to Kiangan and Mayoyao (Table 3). The information provides what species can be grown in the different project sites.

Table 3. Species of Trees and Shrubs Common to study sites

Species Common to All Study Sites

Name of Species	A. Lista	Kiangan	Mayoyao	Grand Total
Eurya amplixicaulis	1	9	54	64
Pygeum sp.	1	43	15	59
Turpinia ovalifolia	4	41	7	52
Canarium asperum	24	6	21	51
Litsea perrottetii	17	12	15	44
Ficus glaberrima	3	10	16	29
Semecarpus cuneiformis	3	23	3	29
Linociera philippinensis	12	7	3	22
Leea aculeate	11	7	1	19
Wikstroemia lanceolata	1	13	4	18

Species Common to A. Lista and Kiangan

Name of Species	A. Lista	Kiangan	Mayoyao	Grand Total
Syzygium santosii	21	86		107
Ervatamia ecarinata	60	3		63
Syzygium polycephaloides	17	32		49
Canthium dicoccum	34	7		41
Clerodendrum minahassae	4	16		20
Artocarpus ovata	2	15		17
Pterospermum niveum	7	9		16
Pterocarpus indicus	8	8		16
Mangifera altissima	6	6		12
Garcinia benthami	1	5		6

Species Common to A. Lista and Mayoyao				
Name of Species	A. Lista	Kiangan	Mayoyao	Grand Total
Grevia setacea	12		6	18
Ficus irisana	3		9	12
Eurya obovata	1		10	11
Pipturus arborescens	2		8	10
Ficus septica	1		6	7
Species Common to Kiangan and Mayoyao				
Name of Species	A. Lista	Kiangan	Mayoyao	Grand Total
Lithocarpus ovalis		123	11	134
Garcinia rhizoporoides		34	40	74
Palaquium luzoniense		69	2	71
Litsea quercoides		27	30	57
Macaranga bicolor		42	11	53
Calicarpa formosana		6	46	52
Elaeocarpus argenteus		8	18	26
Viburnum luzonicum		20	2	22
Palquium sp.		7	13	20
Evodia benguetensis		3	9	12
Evodia dubia		5	7	12
Bridelia glauca		6	2	8
Premna integrifolia		3	1	4
Viburnum odoratissimum		3	1	4

Species Dominance

Species dominance in a forest may indicate its succession stage. Since dominance is dependent on the basal area, tree species with high diameter and density values also had high dominance values. In the forest of A. Lista, *Cleistanthus ovatus* showed the highest dominance at 0.832 m^2 followed by *Dysoxylum arborescens* with a basal area of 0.490 m^2. The locally known Palayon (*Lithocarpus ovalis*) with a basal area of 0.620 m^2 was the most dominant species in Kiangan followed *Sandoricum vidalii* and *Evodia benguetensis* at 0.376 m^2 and 0.348 m^2, respectively. The *Cynometra sp.*,*Deutzia pulchra* and *Astronia williamsii* had the highest dominance value at 0.710, 0.375, and 0.371 m^2, respectively in Mayoyao.

The higher dominance values observed for foregoing species was due to the greater number of bigger sizes compared to the other species. The very few numbers of big trees in Mayoyao and A. Lista was due mainly to the continued utilization the bigger diameter trees for domestic use by the community. It was further known through key informant interview that the study sites in the two areas were considered communal forest, thus everyone has the access, unlike in Kiangan in which the sampling sites were "muyong" or private woodlots owned by certain family, thus the utilization of trees therein is regulated by the owner and nobody can use the resources found therein without permission from the owner.

In Alfonso Lista, the first 20 species with the highest dominance value has a total of 4.414 m^2 and accounts for 80% of the total dominance value of all species. Similarly in Kiangan, the total dominance value (5.082 m^2) of the first 20 species with the highest dominance also accounts for 80% of the total dominance value of all species. The total dominance value (3.926 m^2) of the first 20 species in barangay Bato, Mayoyao accounts for 85% of the total dominance value of all species therein.

Species Importance Values

The top 10 species with the highest Species Importance Value (SIV) in the three municipalities is shown in Table 4. Results showed that Palayon (*Lithocarpus sp*.) had the highest species importance value (12.45%), followed by *Dysoxylum arborescens* with SIV of 10.82 and *Laportea* sp. at 9.74. Generally the result of the analysis showed similar or lower SIV values when compared to SIV values obtained by Taguiling (2009) and relatively lower

compared to other tropical tree inventories for both lowland and upland forests, which range from 12.5 to 52.4 as cited by Arances et al. (2004).

The species importance value is dependent on the number of tree per sampling area (density), the degree of occurrence of species per sampling site (relative frequency), and the relative dominance of each species which is derived from the data on diameter of each species. Of these factors, the low species importance value obtained from this assessment can be attributed most to the few number of large-diameter trees in the sampling sites resulting to low relative dominance.

Table 4. Top 10 lists of species with the highest Species Importance Value (SIV)in all the barangay project sites.

	Species	RD	RF	Rdom	SIV
1	*Lithocarpus ovalis*	3.99	4.02	4.44	12.45
2	*Dysoxylum arborescens*	3.69	3.72	3.41	10.82
3	*Laportea sp.*	4.43	4.47	0.83	9.74
4	*Canarium asperum*	1.52	1.53	6.01	9.06
5	*Cleistanthus ovatus*	0.98	0.99	5.78	7.75
6	*Dasymaschalon oblongatum*	3.33	3.36	0.55	7.24
7	*Syzygium santosii*	3.18	3.21	0.49	6.89
8	*Garcinia rhizoporoides*	2.20	2.22	2.28	6.71
9	*Deutzia pulchra*	1.96	1.98	2.60	6.55
10	*Cynometra sp.*	0.77	0.78	4.93	6.49

RD – Relative Density RF - Relative Frequency Rdom – Relative Dominance
SIV – Species importance Value

Ethonobotany of Floral Species

Ethnobotanical survey was conducted purposely to record knowledge of community members on the uses of plant species found in the locality. Results showed 38 food plants, 25 species of medicinal/pesticidal plants, and 26 species with socio-cultural importance. Most of the inventoried trees are generally used as firewood/charcoal making but 21 species were specifically identified purposely for handicraft and furniture, and 45 species use as source of lumber and for housing construction. Two (2) species (*Grevia setacea, Wikstroemia lanceolata*) were identified as source of strong bark fiber for tying and four (4) species (*Pittosporum ramosii, Linociera philippinensis, Homalanthus alpines, Sandoricum vidalii*) were identified with pesticidal properties. The leaves of "tukbo" (*Croton colubrinoides*) are being used to control rats in rice fields. Succulent leaves and stems of "fuloh" (*Baccaurea philippinensis*) are being utilized as organic fertilizer.

Food Plants

A total of 38 plant species were identified as food plants. Most of the food plants encountered in the sampling plots were wild fruit-bearing trees and most of the fruits are eaten raw. Trees and shrubs bearing edible fruits include *Sauraia bontocensis, Evodia meliaefolia, Vaccinium jagori , Morinda bracteata, Antidesma pentandrum, Syzygium polycephaloides, Saurauia elegans, Antidesma bunius, Garcinia benthami, Syzygium samarangense, Pterospermum niveum, Bischofia javanica,* and others. Shoots of palm species and species of grasses, ferns and herbs are used as vegetables and often cooked. The fruit of Lituko (*Calamus manillensis*) is the only fruit sold in commercial scale and is considered the most economically important food plant species as it gives additional income to farmers. Of the wild vegetable food plants, species now popular in the market as organic vegetables include the locally known *Amti* (*Solanum nigrum)*, Kunde or wild petchay (*Rorippa indica*), wild ampalaya (*Momordica* sp.) and pako (*Diplazium esc*ulentum). While community people do not depend so much on wild food plants, they have high knowledge on these plants and some of which are becoming good additional source of income to some farmers.

Medicinal Plants

There were 25 plant species identified as medicinal and often used as alternative medicine. Species used to cure wound and scratches include *Neonauclea media, Streblus asper, Mallotus Philippinensis, Cyathea contaminans, and Pterocarpus indicus.* The species *Ficus pseudopalma* is used to treat kidney stone and diabetes. Cough is often treated with sour fruit of *Syzygium polycephaloides, Garcinia, Medenilla pendulla,* and leaves of *Prema odorata.* Skin infection is treated using *Pittosporum ramose.* Internal parasites are eradicated using decoction of *Mallotus Philippinensis and Garcinia benthami*. Hypertension is remedied using leaf decoction of *Trema orientalis* and *Syzygium polycephaloides*. Dysentery is treated with bark and root decoction of *Macaranga tanarius* or *Premna odorata, Zanthoxylum ovicennae,* and *Lithocarpus sp.* The locally known plant "pukag" (*Kleinhovia hospital*) is used as eyewash and to treat irregular menstruation. *Ficus septica* is used to treat asthma and headache. Malaria is treated with decoction of "Halahala" (*Zanthoxylum ovicennae*). Boil is treated with *Timonius arboreus* and *Ficus septica*. Scabies is treated with *Artocarpus communis , Bischofia javanica* and *Mallotus Philippinensis.* There are ailments that can be cured by more than one species and there are species that can cure more than one kind of illness. Key informants revealed that there is a decreasing interest and knowledge on the use of medicinal plants among the younger generations. They use to ask the older folks what species can be used to treat a certain illness. When asked why, they prefer to refer their illness to health workers and use commercial drugs.

Socio-culturally Important Species

There were 26 plant species identified to have high socio-cultural importance. A particular species is used depending on the socio-cultural occasion such as during feast, wake & burial, marriage, birth, and the like. The plant or its parts are either used directly during sociocultural rites or serve as a raw material in making items used in such rites. To mention a few, the leaves of "dongla" *(Cordyline fruiticosa)* and *Macaranga sp.* are often used in most indigenous religious rites. The hard wood of "palayon" (*Lithocarpus sp.)* and *Evodia meliaefolia* are used in making "punhib-at" or wooden stick use to beat the gongs during ceremonies while the wood of "tobah" *(Artocarpus ovata)* is used in making "pattung" a wooden instrument used during "Him-ung" rites. The wood of *Pterocarpus indicus* (Udyo) is used to make 'bulol' – a human-like wood carving used in indigenous religious rites and *Hagabi*, a large wooden chair indicating the high social status of a family. The species of *Ficus variegata, Pavetta parvifolia, Pometia pinnata* and other species are used make wooden containers and images used in indigenous religious rites. *Calamus manillensis* is used to make various handicrafts such as "gamugamun" - a birth ritual material, and "innanga, halichong, and pallongan"- all useful during various activities, ceremonies and festivities. In settling disputes, succulent stem of runo (*Miscanthus chinensis*) is used during the ceremony. After a lot of prayers, two competing individuals will throw runo shoots one against another. The one hit is the sinner/offender. Sharing the fruit of "moma" (*Areca cathecu*) is used as a sign of greetings and courtesy, vital in maintaining unity between and among community members.

Issues and Problems on Floral Biodiversity Conservation

All key informants believed that biodiversity contributes directly or indirectly to many aspects of human welfare by providing raw materials, food and health-related benefits and conducive environment.

Despite the wide range of benefits from biodiversity, key informants revealed that in general, there is a decreasing trend in biodiversity in terms of species and population of

species. Key informants were asked what factors that leads to decline in floral biodiversity. The factors mentioned are grouped into the following:

1. Overexploitation. Continued utilization especially those preferred species leads to overexploitation of floral resources. Harvest of macrofloral resources as raw material for general construction, handicraft and other uses are the direct causes of decline in floral biodiversity population. This is propelled by increasing demand for these resources as population of community increases. The most affected floral species include all trees with large diameter, and species most preferred for handicrafts, lumber, and furniture.

2. Land use alteration. Clearings of portion of forest for agriculture is the most serious problem in Alfonso Lista, where direct observation showed that slash and burn is being practiced in the forested areas of barangay Namnama. Slash and burn was also observed in Mayoyao. Land use alteration is considered not a serious problem in Kiangan.

3. Forest fire. Forest fire occurs due to burning of clearings for agriculture and usually it is not done intentionally. The effect is similar to land use alteration where almost all species of plants and animals are affected. Open grassland areas and areas undergoing natural revegetation are usually the areas susceptible to forest fire especially during summer or prolonged drought.

4. Limited Knowledge on the global value of floral biodiversity. Except for soiocultural and economic values, key informants revealed that most members of the community had limited knowledge on other values of macrofloral biodiversity in a wider perspective such as environmental protection, carbon sequestration, climate change mitigation, and the like. Limited information dissemination was undertaken in their respective barangays.

5. Limited capacity of barangay government units. Though national environmental laws and even local government ordinances for biodiversity protection were existing, the barangay government units cannot implement such laws due to their limited financial, physical, and manpower resources. They cannot even guard their territory from outsiders who would do illegal cutting of timber.

6. Lack of sustainable livelihood and alternative source of income. Key informants revealed that due to absence of sustainable livelihood and source of income, people tend to look up into the available natural resources as source of their subsistence and income.

Suggested Action Solutions for Macrofloral Biodiversity Conservation

On action solutions for macrofloral biodiversity conservation, key informants suggested the following potential interventions at the local level as ranked by the respondents:

1. Assistance on the sustainable use of macrofloral resources
2. Capacitating local residents to take active role in protecting the remaining forests and its biodiversity from outsiders
3. Information campaign on permanent demarcation between agricultural and forest zones and implementing strictly no encroachment laws and policies.
4. Individual/Family protection and management of claimed forest areas
5. Planning and implementation of community concerted efforts in restoring poorly vegetated areas.
6. Inculcating to one's self the value of sustainable use of macrofloral resources
7. Information education campaign on the importance of floral biodiversity at the local and global scale
8. Information campaign on controlled burning

Verification made to the number one suggestion above showed that the community needs technical and financial support for sustainable livelihood options to include:

1. Technical and financial support to the community for the establishment of sustainable community nursery using indigenous species. Community people are in need of technical and financial support for them to establish a sustainable community nursery as a potential livelihood option and as a sustainable source of planting material for reforestation and enrichment planting activities. They need technical assistance on the appropriate propagation and management practices for some indigenous species.

The suggested action solution is possible since ethonobotany interview revealed a number of macrofloral species that were observed to be fast-growing and are economically important. Such species can be used for handicraft making, wood carving, and cheap source of food, medicine, pesticide, and fiber. The species can therefore be grown in nursery to be used by the community in reforestation and enrichment planting in the "muyong" or private woodlots and communal forests. As a potential livelihood option, seedling production of indigenous species for sale can provide the needed planting materials for reforestation and related activities. The used of indigenous species in reforestation and similar activities is being promoted by various government agencies like the DENR and other environment-concern institutions promoting biodiversity conservation.

2. Technical and financial support to community for the establishment of agroforestry. Key informants disclosed that they lack the necessary technical and financial resources needed in the establishment of sustainable agroforestry farms.

During the interviews, key informants identified macrofloral species that could be managed as additional source of income. Such species include wild food plants, medicinal and pesticidal plants, source of fiber, or raw materials for handicraft making. With appropriate technical and financial supports, these economic plants can be mass-propagated as additional source of income for the community. Organic farming of wild food plants such as Apaku (*Diplazium esculentum*), amti (*Solanum nigrum*), wild petchay *(Rorrrippa indicia),* and the like could serve as short term or cash crops, and establishment of multistorey agroforestry of wild fruit plants, medicinal, pesticidal and fiber plants; including fast growing species for wood carving and handicraft could serve as long-term crops of farmers and the community. The foregoing will not only serve as an additional sustainable livelihood option because it allows the use of plant resources without depleting their natural population, but will also serve as an ex situ conservation strategy for the remaining macrofloral biodiversity resources in the forest.

Conclusions

Ifugao forests are still rich in macrofloral biodiversity which could be source of resources for in situ and ex situ conservation in Ifugao and other parts of the Cordillera region.

Higher macrofloral species richness is located at lower elevation with warmer climate. Species density is highest in forest areas where "muyong" or private woodlot system of forest ownership and management is widely practiced. Floral species composition differs in terms of elevation and only few species are common to all study sites and between municipalities with different elevations.

Aside from the common uses of macrofloral species, ethno-botany of most plants is known to the community.

Local threats to floral biodiversity loss include continued utilization of resources, slash and burn agriculture, forest burning, limited capabilities of barangay local government, and lack of sustainable livelihood and additional sources of income leading to dependence of some community members to natural resources.

Sustainable livelihood using macrofloral resources can be developed with adequate technical and financial support to the community.

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Appendix Table 1. Master list of macrofloral species found in Ifugao

	Trees and Shrubs				
	Family Name	**Scientific Name**	**Common Name**	**Local Name**	**Ethno-botany**
1	Aceraceae	*Acer laurinum* Hassk.	Baliag/Phil. Maple	Balakawon	L
2	Actinidiaceae	**Sauraia bontocensis* Merr.	Deguai	Dogwe	F,M, Fg
3	Actinidiaceae	*Saurauia clementis* Merr.	Kalimug-usa	Uniden.(Like dogwe)	
4	Actinidiaceae	**Saurauia elegans* (Choisy) F.-Vill.	Uyok	Bfenor	F
5	Amygdalaceae	*Pygeum sp.*	Lagong buhukan	Bini/Kalacheng	L
6	Anacardiaceae	*Buchanania arborescens* Blume	Balinghasai	Falehangay	L
7	Anacardiaceae	*Dracontomelon dao (Blanco)* Merr. & Rolfe	Dao	Dao	L
8	Anacardiaceae	*Mangifera altissima* Blanco	Pahutan	Malabutnu/Maramangga	L
9	Anacardiaceae	*Semecarpus cuneiformis* Blanco	Ligas	Kamiling	
10	Anacardiaceae	*Semecarpus sp.*		Lobhong	
11	Annonaceae	*Dasymaschalon oblongatum* Merr.	Sagot	Laphi	
12	Annonaceae	*Goniothalamus gigantifolius* Merr.	Bigus-laparan	Uniden. (Like Lobhatan)	
13	Annonaceae	*Goniothalamus trunciflorus* Merr.	Bigus-silangan	Lobhatan (bl)	
14	Annonaceae	*Polyalthia elmeri* Merr.	Bangar	Bangar	
15	Anonaceae	*Mithrepora sp.*		Ananaseng	
16	Apocynaceae	*Ervatamia ecarinata* (Merr.) Pich.		Busbusilak	
17	Apocynaceae	*Wrightia laniti* (Blanco) Merr.	Lanete	Liho-lihod	L
18	Betulaceae	*Alnus japonica*	Alnus	Arnos	H, Fg

19	Burseraceae	*Canarium asperum* Benth.	Pagsahingin	Kantong	L
20	Caprifoliaceae	*Viburnum luzonicum* Rolfe	Atalba	Atolba	
21	Caprifoliaceae	*Viburnum odoratissimum* Ker-Gawl.	Idog	Laglagim/Manmanuk	
22	Celtidaceae	**Celtis luzonica* Warb.	Maikmo	Maragawed	
23	Combretaceae	*Terminalia foetidissima* Griff.	Talisai-gubat	Bunut	
24	Cunonciaceae	*Weinmannia luzoniensis* Vid.	Itangan	Uniden. (Like Tafangawon)	L
25	Dilleniaceae	***Dillenia philippinensis* Rolfe	Katmon	Ukapon	F, L
26	Dipterocarpaceae	*Dipterocarpus validus* Blume	Hagakhak	Holog	L,H
27	Dipterocarpaceae	*Shorea contorta* (Vid.) Merr. & Rolfe	White lauan	Apnit	L
28	Dipterocarpaceae	*Shorea guiso* (Blanco) Blume	Guijo	Kuriwit	L
29	Ebenaceae	**Diospyros philippinensis* (Desr.) Gurke	Kamagong	Amagong	H,L
30	Ebenaceae	*Diospyros sp.*		Palegonggong	SC,H
31	Ebenaceae	*Diospyrus longiciliata* Merr.	Itom-itom	Unden. (like Laphi)	
32	Ebenaceae	*Diospyrus pilosanthera* Blanco	Bolong-eta	Ngititan	H
33	Ehretiaceae	*Ehretia polyantha* A. DC. (Merr.)	Tanaua	Tungtungar	
34	Ehretiaceae	*Ehretia sp.*		Tungtungar (Bigger leaf)	
35	Elaeocarpaceae	**Elaeocarpus argenteus* Merr.	Bakani	Adawe	SC, H, Fg
36	Elaeocarpaceae	**Elaeocarpus bontocensis* Merr.	Kalumbaya	Hawili	F,M,
37	Elaeocarpaceae	*Elaeocarpus sp.*		Fitugan	
38	Ericaceae	*Vaccinium cumingianum* Vid.	Gutung	Luhung	
39	Ericaceae	*Vaccinium jagori* Warb.	Gatmo	Gutmo	F,L
40	Euphorbiaceae	*Antidesma bunius* (Linn.) Spreng.	Bignai	Bignay/Bunne	F,
41	Euphorbiaceae	*Antidesma pentandrum* (Blanco) Merr.	Bignai- pogo	Arusip	F
42	Euphorbiaceae	**Baccaurea philippinensis* Merr.	Baloiboi	Fuloh/Buluh	SC, Fe
43	Euphorbiaceae	*Bischofia javanica* Blume	Tuai	Tuwol	F,M,SC,H
44	Euphorbiaceae	*Breynia rhamnoides* (Retz.) Muell.-Arg.	Matang-hipon	Mugmugog	
45	Euphorbiaceae	*Bridelia minutiflora* Hook f.	Subiang	Putukan	L
46	Euphorbiaceae	**Calophyllum whitfordii* Merr.	Pamintaogen	Pamiklaten	
47	Euphorbiaceae	*Claoxylon purpureum* Merr.	Anot-ot	Marasili	
48	Euphorbiaceae	**Cleistanthus ovatus* C. B. Rob.	Aniatam-initlog	Ngarusangis	L
49	Euphorbiaceae	*Croton colubrinoidesMerr.*	Tukbo	Tukbo	SC,P
50	Euphorbiaceae	*Glochidion gigantifolium* (Vid.) Merr.	Bagnang-laparan	Podpod	SC,
51	Euphorbiaceae	*Glochidion longistylum* C. B. Rob.	Nigad	Gopgopak	
52	Euphorbiaceae	*Glochidion mindorense* C. B. Rob.	Litok	Churnuwan/dulnuan	L
53	Euphorbiaceae	*Homalanthus alpinus* Elm.	Buta	But-buta	P, Fg
54	Euphorbiaceae	**Macaranga bicolor* Muell.--Arg.	Hamindang	Almumuhung	
55	Euphorbiaceae	Macaranga grandifolia (Blanco) Merr.	Takip-asin	Bolwang	SC, Fg
56	Euphorbiaceae	*Macaranga ramiflora*	Ginabang	Samak 1(Red petiole)	Fg
57	Euphorbiaceae	*Macaranga sinensis*	Binungang-pula	Anablon	SC,
58	Euphorbiaceae	*Macaranga tanarius* Muell.-Arg.	Binunga	Samak	M
59	Euphorbiaceae	*Mallotus multiglandulosus* Hurus.	Alim	Alim	Fg
60	Euphorbiaceae	**Mallotus Philippinensis* (Lam.) Muell.-Arg.	Banato	Anitap (bl)	M,
61	Euphorbiaceae	*Mallotus sp.*		Uniden.(Like banato)	
62	Euphorbiaceae	**Neotrewia cumingii* Pax & K. Hoffm.	Apanang	Hayaput	F
63	Euphorbiaceae	*Phyllanthus curanii*	Baluha	Faloy/baluha	Fg
64	Fabaceae	*Afzelia rhomboidea* (Blanco) Vid.	Tindalo	Tindalo	L,H
65	Fabaceae	*Erythrina orientalis* Merr.	Dapdap	Gabgab	L, Fg
66	Fabaceae	*Pithecellobium subcoriaceum* Thw.		Kupitan	L
67	Fabaceae	*Pterocarpus indicus* Willd.	Narra	Udyo	M, SC,L,H
68	Fagaceae	*Lithocarpus benettii* (Miq) Rehd.	Pangnan	Palayon balawan	SC,L
69	Fagaceae	*Lithocarpus luzoniensis* (Merr.) Rehd.	Kilog	Uniden. (Like Palayon)	

70	Fagaceae	***Lithocarpus Ovalis* (Blanco) Rehd.	Maggasiriki	Palayon/Palajon	M, SC,L
71	Guttiferae	*Cratoxylum formosum* Benth. & Hook. F.	Salinggogon	Aligguy/aliguyon	L
72	Guttiferae	*Garcinia benthami* Pierre	Bunog	Bili/Bulon	F,M, L
73	Guttiferae	*Garcinia rhizoporoides* Elm.	Bogaiat	Duple/Dalayon	
74	Guttiferae	*Garcinia venulosa* (Blanco) Choisy	Gatasan	Gatasan	L
75	Icacinaceae	*Gomphandra apoensis*	Marumai	Uniden. (Like anabiong)	
76	Lamiaceae	*Clerodendron sp*		Igwa	
77	Lamiaceae	*Premna integrifolia* Blanco	Alagau-gubat	Atingol (sl)	
78	Lamiaceae	*Premna odorata* Blanco	Alagau	Atingol (bl)	M,SC,
79	Lamiaceae	*Vitex parviflora* Juss.	Molave	Amugawon	L
80	Lauraceae	*Litsea glutinosa*	Sablot	Gugu	
81	Lauraceae	*Litsea perrottetii (Blume)* F.-Vill.	Marang	Bakan	L,H, Fg
82	Lauraceae	*Litsea quercoides Elm.*	Klamagan	Umug	H
83	Lauraceae	**Machilus philippinensis* Merr.	Kulilisiau	Balakawon (2)	L
84	Lauraceae	*Neolitsea Vidalii* Merr.	Puso-puso	Tempo	L
85	Lauraceae	*Nothaphoebe malabonga* (Blanco) Merr.	Malabunga	Uniden.(like avocado)	H
86	Leeaceae	*Leea guinensis* G. Don	Amamali	Anga-ang	
87	Leguminosae	*Abarema clypearia* Koaterm. forma prainiana (Merr.)	Kamanigum	Aplit	
88	Leguminosae	*Cynometra sp.*		Fahog/Bahug	H, Fg
89	Leguminosae	*Cynometra warburgii* Harms	Siping	Fagwaloy	
90	Magnoliaceae	**Talauma angatensis* (Blanco) F. -Vill.	Malapinya	Kaklaang	H
91	Malvaceae	*Urena lobata* Linn.	Dalupang	Payyukut	
92	Melastomataceae	*Astronia candolleana Cogn.*	Talanak	Talanak	
93	Melastomataceae	**Medenilla clementis*	Bayangbong	Fallangfang (not eaten)	M,
94	Melastomataceae	**Medenilla pendulla*		Fallangfang (eaten)	S
95	Melastomataceae	*Memecylon lanceolatum* Blanco	Digeg	Fugi	
96	Meliaceae	**Aglaia diffusa Merr.*	Malasaging	Uniden.(like Buhila)	
97	Meliaceae	*Aglaia llanosiana* C. DC.	Bayanti	Balanti/Falanti	SC,
98	Meliaceae	*Aphanamixis perrottetiana* A. Juss.	Kangko	Buhakal	
99	Meliaceae	**Chisocheton benguetense* Elm.	Katong-matsin	Bataukan	
100	Meliaceae	*Chisocheton sp.*		Uniden.(Like Kalantas)	
101	Meliaceae	**Dysoxylum arborescens* (Blume) Miq.	Kalimutain	Uniden.(like Alinaw)	
102	Meliaceae	*Dysoxylum octandrum* (Blanco) Merr.	Himamau	Luwit	H
103	Meliaceae	*Dysoxylum revolutum* Elm.	Buntog	Palobfan	
104	Meliaceae	*Dyxoxylym sp.*		Halapadon	
105	Meliaceae	*Epicharis triangularis* (Merr) Harns	Bitog	Uniden. (Rhomboid leaf)	
106	Meliaceae	***Sandoricum vidalii Merr.*	Malasantol	Bakuwog	L,P
107	Moraceae	*Artocarpus communis* J.R. & G. Forst.	Rimas	Pakak	V,M,L
108	Moraceae	*Artocarpus ovata* Blanco	Anubing	Tobak	SC, Fg
109	Moraceae	*Artocarpus rubrovenia* Warb.	Kalulot	Tobak (smaller leaf)	
110	Moraceae	*Artocarpus sp.*		Uniden. (like Tobak)	
111	Moraceae	*Ficus balete* Merr.	Balete	Balite	
112	Moraceae	**Ficus benguetensis* Merr.	Tabul	Chaga	
113	Moraceae	*Ficus botryocarpa* Miq.	Basikong	Rafe	M
114	Moraceae	*Ficus congesta* Roxb.	Malatibig	Upah	
115	Moraceae	*Ficus cumingii* Miq.	Is-is ibon	Ba-e	
116	Moraceae	*Ficus cumingii Var. worcesteri* Corner	Kalapak	Pewe (2)	
117	Moraceae	*Ficus glaberima* Blume	Baleteng linis	Ihit	
118	Moraceae	*Ficus gul* Laut. & K. Schum.	Butli	Palahipa	
119	Moraceae	**Ficus irisana* Elm.	Aplas	Apla	SC,
120	Moraceae	*Ficus minahassae (*Teijsm. & de Vr.) Miq.	Hagimit	Alimit	SC,
121	Moraceae	**Ficus nota* (Blanco) Merr.	Tibig	Labfoy	
122	Moraceae	*Ficus pseudopalma* Blanco	Niog-niogan	Niniog	V,M

123	Moraceae	**Ficus septica* Burm. F.	Hauili	Liwliw	M
124	Moraceae	*Ficus sp.*		Attabong	
125	Moraceae	*Ficus ulmifolia* Lam.	Is-is	Latbang	
126	Moraceae	*Ficus variegata* Blume	Tangisang-bayauak	Ludping/Loppeng	SC, Fg
127	Moraceae	*Streblus asper* Lour.	Kalios	Akikid	M,
128	Myrsinaceae	*Ardisia castaneifolia* Mez.	Bayoktoan	Koloklong (bl)	L
129	Myrsinaceae	*Ardisia zambalensis* Merr.	Pamutul	Koloklong (sl)	
130	Myrsinaceae	*Maesa sp.*		Olaggit	
131	Myrtaceae	*Syzygium calcicola* (Merr.) Merr.	Kalogkog	Uniden (Like Apatot)	
132	Myrtaceae	*Syzygium ebaloii* Merr.	Arinaya	Uniden. (Like Bultik)	L
133	Myrtaceae	*Syzygium jambos* (L.) Arst.	Tampui	Tampoy	H
134	Myrtaceae	**Syzygium polycephaloides* (C. B. Rob.) Merr.	Lipote	Atu-ang/Bulinayo	F, M
135	Myrtaceae	**Syzygium samarangense* Merr. & Perru	Makopa	Bulinayo (big)	F,
136	Myrtaceae	*Syzygium santosii* (Merr.) Merr.	Bultik	Bultik (orig)	L
137	Myrtaceae	*Syzygium sp.*		Muh-ning	L
138	Myrtaceae	*Syzygium sp.*		Parunapin	
139	Myrtaceae	*Syzygium sp.* (Elm.) Merr.	Lamutong-linis	Bultik (bl)	F,L
140	Oleaceae	**Linociera philippinensis* Merr.	Kurutan	Dol-ak	P
141	Pinaceae	*Pinus insularis* Endl.	Benguet pine	Halong/Bolbol	L,H
142	Pittosporaceae	*Pittosporum ramosii* Merr.	Albon	Poh-wi (bl)	M,SC,L,P
143	Proteaceae	*Helicia robusta (Roxb.)* Blume	Salimai-lakihan	Ulatton	H
144	Rhamnaceae	*Ziziphus sp.*		Uniden. (Prickly young trunk)	
145	Rhamnaceae	***Ziziphus talanai* (Blanco) Merr.	Balakat	Dir-an	L
146	Rosaceae	*Ariobotrya luzonensi* (Mer.) Nakai	Bitgi	Uniden. (Like butgi)	
147	Rubiaceae	*Canthium dicoccum* (Gaern.) Merr.	Malakape	Marakape	
148	Rubiaceae	*Canthuim subcapitatum* (Merr.) Merr.	Apaipai	Buhila (bl)	
149	Rubiaceae	*Coffea arabica* L.	Kape	Kape	F
150	Rubiaceae	*Morinda bracteata* Roxb.	Noni	Apatot	F,M
151	Rubiaceae	**Neonauclea media* (Havil.) Merr.	Wisak	Analtap	M,
152	Rubiaceae	*Neonauclea sp.*		Anitap (sl)	
153	Rubiaceae	**Pavetta parvifolia* Vid.	Gusokan-liitan	Lajo	SC,
154	Rubiaceae	*Praravinia sp.*		Uniden. (Leaf pointed)	
155	Rubiaceae	*Timonius arboreus* Elm.	Mabalod	Tikom	M,
156	Rutaceae	*Evodia benguetensis* Elm.	Sidi	Kurdadannum (bl)	H
157	Rutaceae	*Evodia dubia* Merr.	Sidi-sidi	Kurdadannum (ml)	
158	Rutaceae	**Evodia meliaefolia (Hance) Benth.*	Galiguian	Galiwgiwon	F,SC,L
159	Rutaceae	*Micromelum curanii* Elm.	Alas	Pangimbulawon	
160	Rutaceae	*Severinia retusa* (Merr.) Swingle	Malarayap-kutab	Marakaburaw	F,
161	Rutaceae	*Zanthoxylum ovicennae* (Lam.) DC.	Kangai	Hala-hala	M,
162	Sapindaceae	**Aphania philippinensis* Radlk.	Onaba	Uhiyan (bl)	
163	Sapindaceae	*Aphania sp.*		Uhiyan (sl)	
164	Sapindaceae	**Pometia pinnata* Forst & Forst	Malugai	Tabfangagon	SC,L
165	Sapindaceae	*Sapindus saponaria L.forma microcarpa* Radlk.	Kusibeng	Banaba	
166	Sapotaceae	*Madhuca Betis* (Blanco) Macbr. & Merr.	Betis	Uniden. (Like Alim)	
167	Sapotaceae	**Manilkara merillianna* H. J. Lam	Duyok-duyok	Kala-otet	F, L
168	Sapotaceae	**Palaquium luzoniense* (F.-Vill) Vid.	Nato	Dalakan/Chala-an	L, Fg
169	Sapotaceae	*Palquium sp.*	Benguet Dungaw	Bakallung	
170	Sapotaceae	*Pouteria macrantha* (Merr.) Baehni	White nato	Jessa	
171	Saxifragaceae	*Deutzia pulchra* Vid.	Alatin	Hana'-ti	M,
172	Staphyleaceae	*Turpinia ovalifolia* Elm.	Anongo	Kurdadannum	H
173	Sterculiaceae	*Kleinhovia hospita* L.	Tan-ag	Pukag	M

174	Sterculiaceae	*Pterospermum diversifolium* Blume	Bayok	Faluy (small leaf)	H
175	Sterculiaceae	*Pterospermum niveum* Vid.	Bayok-bayokan	Kunakun	F, L
176	Sterculiaceae	**Sterculia brevipetiolata* Merr.	Panakitin	Botoptok	
177	Sterculiaceae	**Sterculia philippinensis* Merr.	Banilad	Ludjungan	
178	Symplocaceae	**Symplocos luzonensis* Rolfe	Balokbok--gulod	Hoghog	
179	Symplocaceae	*Symplocos sp.*		Hangachan	
180	Theaceae	*Eurya amplixicaulis* Moore	Halinghingon	Halinghingon (sl)	
181	Theaceae	**Eurya obovata*	Tabsik	Halinghingon (bl)	
182	Thymelaeaceae	**Wikstroemia lanceolata* Merr.	Salagong sibat	Huka/Hu-a	SC, Fi
183	Tiliaceae	*Grevia setacea* Merr.	Anilau	Alinaw	Fi, Fg
184	Ulmaceae	*Trema orientalis* (L.) Blume	Anabiong	Analdung	H, Fg
185	Urticaceae	*Laportea sp.*		Uniden. (White flowers)	
186	Urticaceae	*Leucosyke capitellata* (Poir.) Wedd.	Alagasi	Ulahi	
187	Urticaceae	*Leucosyke sp.*		Lahi	
188	Urticaceae	*Pipturus arborescens* (Link) C. B. Rob.	Dalunot	Layjon	L
189	Urticaceae	*Villebrunea trinervis* Wedd.	Alilaua	Langahinga	
190	Verbenaceae	*Clerodendrum minahassae* Binn.	Bagauak	Kutbabangul	M
191	Verbenaceae	*Melastoma bensonii*		Butgi/Bfogtayyon	F
Palms					
	Family Name	**Scientific Name**	**Common Name**	**Local Name**	**Ethno-botany**
192	Agavaceae	*Cordyline fruiticosa* L.	Tungkod-pare	Dongla	SC,
193	Arecaceae	*Areca cathecu*	Bunga	Moma	F,V,SC
194	Arecaceae	*Areca macrocalyx*		Gatile	V,
195	Arecaceae	*Calamus Manillensis* H. Wendl.	Lituko	Lituko	V,SC
196	Arecaceae	*Calamus sp.*		Barit	V,
197	Arecaceae	*Caryota cumingii* Lodd.	Takipan	Bangi	V,SC,
Ferns					
198	Aspleniaceae	*Asplenium macrophyllum*		Itang	
199	Aspleniaceae	*Asplenium nidus*	Pakpak-lawin	Hawing	
200	Athyriaceae	*Diplazium esculentum* (Retz.) Sw.	Pako	Pako (sl)	V,
201	Athyriaceae	*Diplazium sp.*		Pako/apapat (big leaf edible)	V,
202	Cyatheaceae	****Cyathea contaminans*	Giant fern	Katibanglan/Atibfanglan	M,
203	Cyatheaceae	*Cyathea fuliginosa*	Giant Fern	Tifanglan 2	M, SC,
205	Dennstaedtiaceae	*Pteridium sp.*		Pako (ml)	V,
206	Polypodiaceae	*Crypsinus glaucus*		Patpatitig	
Grasses/Herbs/Vines					
207	Brassicaceae	*Rorippa indica*		Kunde/Wild petchay	V,
208	Cucurbitaceae	*Momordica balsamina*	Ampalayang ligaw	Parya	V, M,
209	Poaceae	*Miscanthus chinensis*	Runo	Bila-u/Runo	F, SC,
210	Rosaceae	*Rubus rosaefolius* Hayata	Wild strawberry	Pinit	F
211	Smilaceae	*Smilax sp.*	Banag	Luktu/Tugi	F
212	Solanaceae	*Solanum nigrum* Linn.	Kama-kamatisan	Amti	V,
213	Vitaceae	*Vitis flextosa*		Ariwat	F,
214	Zingeraceae	*Alpinia sp.*	Tagbak	Kallawag	F

* Endemic species ** Vulnerable *** CITES Appendix II
Ethnobotany: F – Food plant, V- vegetable, M - Medicinal, SC – Sociocultural,
Fi – Fiber plant, L – Lumber, P – Pesticidal plant, H – For Handicraft
Fe – Organic fertilizer Fg – Fast-growing