

DEVELOPING INFORMATION SYSTEM ON INDIGENOUS PLANT RESOURCES IN THE CORDILLERA ADMINISTRATIVE REGION, PHILIPPINES

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ABSTRACT

The Cordilleras of the Philippines is home to a rich diversity of plant species that are used as nutrient source in organic farming and fallow systems; as nutrient source, biocontrol and soil and water conservation agents in sustainable indigenous farming systems; as herbal medicine in community health care; as food supplements; and as offering or symbols in cultural rituals. Written accounts on these plant species in the Cordilleras are fragmented and sporadic. This research study attempted to create a framework to organize information and knowledge system of indigenous plant resources in the Cordillera Administrative Region (CAR), Philippines through the application of bioinformatics (e.g. information systems). Literature survey was conducted in Cordillera Studies Center, U.P. Baguio; Benguet State University (BSU), La Trinidad, Benguet; and Kalinga Apayao State College, Tabuk, Kalinga. Key Informant (KI) interview and Focus Group Discussion (FGD) were also conducted to document additional information particularly on the use of indigenous plants in sustainable farming systems and organic farming and to cross validate the gathered data from published literature, reports, manuscripts and library archives. Open source development tools such as Joomla!, MySQL and PHP: Hypertext Preprocessor (PHP) were used in the development of the website and information system, respectively. The 305 indigenous plant species identified and organized in the Database Information System were used in various purposes: 1) indigenous farming systems, 2) organic farming, 3) food and food supplement, 4) cultural practices, 5) construction and livelihood, 6) ornamentals, gardening and landscaping, and 7) community healthcare system. About 232 indigenous plant species were of multipurpose use mostly dominated by those used for food or as food source (26.29%) and community health care (27.16%). Information system is an important knowledge-base in organic farming system, indigenous sustainable farming systems, health care and family nutrition of the communities in the upland areas of the country. It is the role of extension workers and researchers to bridge the gap on how such information can be transmitted and preserved for upland communities into user-friendly and effective forms (e.g. community brochures, story book, radio programs, posters).

Keywords: Database, information system, indigenous plants, literature survey, indigenous knowledge system

INTRODUCTION

Informal forms of knowledge such as ethnomusicology, ethnomathematics and indigenous science generally pertain to indigenous knowledge (Hortsthemke, 2008). On the other hand, indigenous science covers ethnomedicine and ethnobotany. Odora Hoppers (2005) argued that this knowledge is commonly linked to culture in the form of rituals, songs, dances, medicinal knowledge, food preservation and conservation, and agricultural practices. In general terms, indigenous knowledge covers the local, traditional, indigenous practices and customs (Hortsthemke, 2008). Indigenous knowledge system (IKS) referred to the unique, traditional, local knowledge existing within and developed around the specific conditions, indigenous to particular geographic area is defined by Rajasaken et al. (1992) and Tella (2007) as a systematic body of knowledge acquired by local people through accumulation of experiences, informal experiments and intimate understanding of the environment of a given culture. Appiah-Opoku (1999) noted that IKS includes a system of classification and a system of self-management that governs resource use. It is the basic component of country's knowledge system and it represents the successful ways in which people have dealt with their environment in the past (Puffer, 1995). It is holistic and a basis for self-sufficiency and self-determination. Moreover, it reflects the dynamics of the interrelationship of man with their environment in organizing the folk knowledge of flora and fauna, cultural beliefs to improve their lives (Semali and Kincheloe, 1999).

IKS are stored in memories of people and are shared orally by specific example and culture (Tella, 2007). It is expressed in many forms like stories, songs, dances, cultural beliefs and values and customary laws, among others. These forms of communication are important in the decision making processes at the local level, development and promotion of IKS (Tella, 2007). Moreover, IKS are essential in the contribution to global development of knowledge, problem solving strategies of the local communities, risk to becoming extinct, relevance to any development process and under-utilized resources (Tella (2007). In contrast to formal scientific knowledge, IKS are holistic in approach, communicated orally, taught by experience and observation, and explained based on social values and cultural belief. For any development project to succeed, the IKS of a given community is crucial as it serves as the knowledge-base prior to project implementation. Proper documentation of these indigenous knowledge systems is very limited and quite fragmented.

The recording and documentation of IKS is a major challenge because of its tacit nature. It is commonly exchanged through personal communication and demonstration: from master to apprentice, from parents to children, from neighbor to neighbor, among other things. Tacit knowledge will have to be converted to explicit form using special methods like story telling, interactive conversations, sharing experiences and face-to-face communication. Documentation tools both traditional and modern could be used depending on the availability and situations. Modern tools would include digital audio and video recorders and digital cameras, whereas tape

narrations, drawings, illustrations, field interviews are the traditional tools and approaches (Tella, 2007).

Bioinformatics, an interdisciplinary research area that brings together a diverse group of researchers in biological sciences, agriculture, physical sciences, computer science, and engineering, has now grown to include the use of computing science to organize, compare and analyse biological data generated at all levels, from the molecular level (molecular biology and biochemistry) to the macro level (population genetics, ecosystem). It has tremendous applications in medical research, plant and animal diseases, agricultural research, and natural resource management. Bioinformatics as an interdisciplinary research area combining biological sciences, agriculture, physical sciences and computer science can be used to manage IKS. It enhances access, sharing and conservation of knowledge (Muswazi, 2001). Internet and databases are considered as advanced forms and tools for IKS management. Information and Communication Technologies (ICT) tools such as the internet and databases can be used to organize and manage information and data on IKS. Such information systems when published online reach wider audience worldwide. These modern set of tools enable the dissemination of IKS across the world surpassing the distance and ocean boundaries. ICT can also uplift the presentation of IKS in promoting farmers' success stories and best practices. However, in communities where the availability and accessibility of internet are not yet in place, radio and television broadcasting in local dialects could be tapped in dissemination of IKS (Tella, 2007). Brochures, flyers and story book translated to the local dialect are also among the other forms where IKS can be promoted to the stakeholders and other upland communities effectively.

The study aims to organize the information and knowledge on indigenous plant resources that are used for various purposes in the Cordilleras applying bioinformatics through the development of a Database Information System (DIS).

SCOPE AND LIMITATIONS OF THE STUDY

The data and information sources in this study include published literature, ethnobotanical studies, theses and manuscripts and project reports among others that are stored in SCU libraries, archives and desk literature search. The field visit, Key Information (KI) interview and Focused Group Discussion (FGD) conducted on selected case study sites (Benguet, Kalinga and Ifugao) served as cross validation of the data gathered and information contained in the DIS. The listing of documented indigenous plant resources covers only the Cordillera Region.

METHODOLOGY

The Study Site

The Cordillera is a landlocked region in central part of northern Luzon, Philippines geographically located at 120° 57' 0" east longitude and 17° 19' 60" north latitude with a total land area of 18,300 km² (Fig. 1). It is considered as a major resource base of the Philippines and one of the country's richest regions in natural resources and mineral reserves (<http://www.cpaphils.org>). Metallic ores that can be found in this region are gold, copper, silver, zinc, and non-metallic minerals like sand, gravel and sulfur (<http://www.etravelphilipinas.com>).

The region generally has a rugged terrain and a mountainous topography. About half of the region's total land area has a slope of more than 50% (<http://www.napocor.gov.ph>). The elevation of the region ranges from a minimum of 5 MASL (meters above sea level) in Abra to a maximum of 2,922 MASL in Mt. Pulag, Benguet (www.visitmyphilippines.com).

There are two climatic types (Types I and III) in the region. Type I climate is characterized by dry season from December to May and wet season from June to November which covers the provinces of Benguet, eastern Abra, Ifugao and Mt. Province (www.visitmyphilippines.com). On the other hand, Type III climate has short dry season (one to three months) with no pronounced maximum rain period which covers the provinces of Apayao, Kalinga, Ifugao, Mountain Province and west Abra. The temperature of high elevation areas in the region is generally cooler than the temperature of lowland areas. For example, Baguio City is about 8° C cooler at any month than other lowland areas (www.visitmyphilippines.com).

Documentation Process

Two-stage documentation approach was used in the study (Fig. 2). The first stage include gathering of secondary data from existing literature taken through desk literature search; literature survey in the libraries and departments of the State College and Universities (SCU) in the case study sites; and from past and existing studies and projects reports. Second, KI interviews were conducted with selected local farmers and key informants in Benguet, Kalinga and Ifugao. Key informants were those knowledgeable in indigenous plant species used for various purposes. Indigenous plants are native to a specific area of the country (<http://www.abc.net.au/gardening>). A native plant is a plant which is growing in a particular region having arrived naturally, i.e. without human intervention. (<http://uk.answers.yahoo.com>). The field visit to selected areas in the case study sites during KI interviews also served as the cross validation of the gathered data. In the process of the literature survey, the following usage of the indigenous plants were identified: (a) organic farming system; (b) sustainable indigenous farming systems; (c) food and food supplements; (d) cultural practices; (e) construction and livelihood; (f) ornamentals, gardening and landscaping; and (g) community health care system.

Development and Management of Database Information System (DIS)

Open source tools were employed in the development of the DIS (Fig. 2). In line with this, a website was also developed to serve as portal for online publishing of the DIS. PHP was used in the front end while MySQL database was used for the backend. Cascading Style Sheet (CSS) and javascripts were also used for website and DIS interface. The content of the DIS was subjected to cross validation (after field visit) and data cleaning to remove duplicate entries and data that do not have sufficient descriptions. The final DIS was published in the internet thru the PHP based website.

Data Analysis

The information gathered by the project was of mainly qualitative in nature. Descriptive statistics was done to analyse and present the data.

RESULTS AND DISCUSSION

Project Information System (website and database)

Internet is a valuable tool and venue for publishing any information across the world to the different countries of varying culture and knowledge systems. Thus, the project website (www.infosys.ecoinfolab.com) was developed to promote and disseminate indigenous knowledge on natural resource management as well as an organized indigenous plant database system. The Database Information System (DIS) (www.infosys.ecoinfolab.com/database.html) was developed as a framework to organize the documented indigenous plants used for different purposes in the Cordillera Administrative Region. The DIS was conceptualized and designed based on the projects objective, structure of information from secondary sources and KI interviews. The 7 key areas of documentation served as separate MySQL database tables of indigenous plants in the Cordilleras. Each database table consists of species name, local/common name(s), photo, family, distribution, site description (e.g. topography, soil type, and climate), its usage and description and source of data as reference.

With the availability of open-source tools on web and database (e.g. Joomla!, PHP, MySQL) and the right expertise, development and integration will be a breeze. To date, there are no available online databases on indigenous plants in the Philippines. If there are, their availability is at the governmental or organizational level. Most often, this type of information are stored in library archives, project reports and manuscripts. Website and online database can also be search in popular web search engine such as google and yahoo. Search engines are avenues for search by students, researcher and environmentalist among others interested in studying IK systems on indigenous plants and indigenous natural resource management. However, caution must be taken into account to those indigenous plants located in natural parks and biodiversity critical sites specifically, indigenous plants used in community health care to avoid exploitation and exploration by profit-oriented companies.

Usage of Documented Indigenous Plants Resources in the Region

Results showed that majority of the indigenous plant species was utilized as food, food source or food ingredient (Fig. 3). There were 13 indigenous plants used in indigneous farming system; 5 in organic farming system, 93 utilized for food; 62 for construction and livelihood; 17 identified for use in ornamental, landscaping and gardening; 30 plant species used in local cultural practices; and 85 used for community health care.

Overall, majority of the 305 indigenous plants species identified were used for various purposes. However, after analyzing the data from the DIS, there were actually a total of 167 unique individual indigenous plant species. Out of the 305 indigenous plant species, 232 were of multiple uses. As shown in Fig. 4, multipurpose indigenous plants were dominated by those utilized for community health care (27.16%) and food and food supplements (26.29%). A significant percentage of these indigenous plants were also of importance to construction and livelihood (19.83%) while only about 2% were used in organic farming systems either as organic fertilizer or as botanical pesticide.

The growth habit of about 40% of the 167 indigenous plant species are trees, while 25% and 22% are shrubs and herbs, respectively (Fig. 5). The remaining species are palms (4.79%), vines (3.79%), grasses (2.99%) and ferns (1.80%).

About 32 indigenous plant species were of multipurpose use (3- 5 usage) (Table 1). Most predominantly used multi-purpose indigenous plant is *Bischofia javanica* (Blume) followed by *Caryota rumphiana*, *Garcinia mangostana*, *Erythrina orientalis* L. Meril, *Pinus kesiya* Royle Ex. Gordon, *Wrightia pubescens* R. Br. spp laniti (Blanco) Ngan, *Mangifera altissima* L., *Lagerstroemia speciosa*, *Miscanthus sinensis*, *Ficus balite* Merr., and *Pterocarpus indicus*. All these plant species are of importance in their house construction, livelihood, health care system and cultural practices.

Organic Farming

Organic agriculture is a production system that sustains health of soil, ecosystem and people. It relies on techniques such as crop rotation, green manure, compost and biological pest control to maintain soil productivity and control pests on a farm. Organic farming excludes the use of manufactured inorganic fertilizers, pesticides, plant growth regulators, antibiotics, food additives and genetically modified organisms. The system relies on ecological processes, biodiversity and cycles adapted to local conditions (http://en.wikipedia.org/wiki/Organic_farming).

Tithonia diversifolia (sunflower, “lampaw”) is used as organic fertilizer in the Cordilleras particularly in vegetable and rice farming. In rice farming, the system called “Tapak-tapak” utilizes sunflower as a major organic fertilizer (Magcale-Macandog and Ocampo, 2005). The abundant growth of sunflower in Benguet particularly in La Trinidad may explain its utilization for organic fertilizer in vegetable production. *Bischofia javanica* (“balasang tree”) is used in Kalinga and Central Cordillera as green manure for rice farming (Central Cordillera Agricultural Programme, 2003). On the other hand, the bark, fruits and leaves of *Melia dubia* (“balasang

tree”) and *Albizia procera* (“ahlar”) is believed to have insectidal properties, thus used as a botanical pesticide. Majority of these indigenous plants used for organic farming belongs to different plant families, namely Leguminosae, Euphorbiaceae, Meliaceae, Asteraceae and Verbenaceae (Table 2). Moreover, 4 out of 5 species are classified as tree while sunflower is a shrub.

Sustainable Indigenous Farming System

Sustainable farming system referred in here encompasses agroforestry, afforestation, watershed rehabilitation, mulching, erosion control and shelter belts. Based on the DIS, most of the indigenous plant species classified under sustainable indigenous farming system are used in afforestation, agroforestry, watershed related activities and erosion control purposes (Central Cordillera Agricultural Programme, 2003). An example is the *Albizia Procera* (“ahlar”, “adaan”, “kalai”), a leguminous tree that is used as shelter belt, erosion control and forestry planting in several municipalities of Kalinga and Abra. All throughout the central Cordillera, *Bambusa blumenia* (“kauyan tinik”) is used in afforestation activities, stabilization of unstable and eroding slopes and banks. Two species were identified as potential agroforestry tree species namely a) *Erythrina orientalis* belonging to the family Fabaceae; and b) *Trema orientalis* that belongs to family Celtidaceae. Both species can serve as shade tree for coffee, cacao or other plantation crops. *Ficus nota* (“tibig”, “piwis”, “tabbog”), *Ficus pseudopalma* (“niogniogan”, “adiagi”, “kadiabung”, “tarabang”), *Lithocarpus ilanoisis* (“palayon”, philippine oak, “pallay”, “poschan”, “pallayan”) and *Wrightia pubescens* (“lanete”, “lanoti”) are good tree species for watershed rehabilitation. *Ficus minahasae* (Tejism & de Vr.) Mig locally known in Ifugao as “alimit” is a ‘water producing tree’ commonly found under *Muyong* system (an indigenous forest management system). It is used to conserve water near coffee trees and a source of water for *Muyong*. Almost all of the identified indigenous plant species utilized (and with potential use) in sustainable indigenous farming system are tree and only one species belong to shrub under the family Graminae (Table 3).

Community Health Care

In terms of total number of indigenous plant species, community health care ranked number 2 (85 plant species). The identified indigenous plant species were commonly used to treat common sickness (e.g. diarrhea, dizziness, headaches, cough, sore throat, abdominal pains, wounds, common fever). Some areas in the region claimed that these plants can be used to treat and cure certain diseases like Urinary Tract Infection (UTI), kidney trouble, malaria, chronic bronchitis, asthma, arthritis, hypertension, diabetes, sore eyes, dysentery, scabies, chicken fox, and appendicitis to mention a few (Balangcod, 1998; Abannag et al., 2006; Cardenas, 2000; Cato, 2003; Cordillera Studies Center, 2003; Enkiwe, 1999; Paing et al., 2001; and Paing and Chongsayan, 2001). *Sacandra glabra* for example also known as wild tea or “tsaa” is used to treat colds, cough, kidney diseases, relief stress, stomach trouble, kidney trouble, pneumonia, influenza, acute gastroenteric, bacillary dysentery, appendicitis, post operative infections, cellulitis, diarrhea, ulcerating wounds, bleeding wounds, scalds, burns, traumatic injuries, bone fracture, rheumatism, arthritis and juice is extracted and applied as poultice over the wounded area,. Other species under this category are used for aromatherapy (*Pinus kesiya*), cleansing (*Solanum nigrum*), induce sleep and ease restlessness (*Nepeta cataria*) and drink supplement for

lactating mothers (*Lagerstromea speciosa*). The plant parts used for treating sickness and diseases are leaves, shoots, stem, bark and roots. Leaves are usually crushed, boiled or applied fresh to treat the sickness or diseases. A large number of the species used in health care are shrubs (29.76%), herbs (28.57%) and trees (27.38) (Table 4). In terms of number of species used by plant family, Asteraceae accounted for 11.90%, followed by Moraceae (7.14%), Solanaceae (7.14%) and Araceae (5.95%).

Food and food supplements

This category of utilization of indigenous plant species in the Cordillera ranked number 1 in terms of number of species documented (93 species). The plants or its parts are usually eaten fresh or cooked as vegetable or fruits such as *Amaranthus spinosus*, *A. blitum*, *A. gracilis*, *A. hybridus*, *Antidesma pentadrum*, *Centella asiatica* (Lirio et al., 2006; Marcos et al., 2006). Some species are used in the form of beverage as juice or tea (e.g. *Citrus aurantifolia*, *Gaultheria leucocarpa*, *Sarcandra glabra*, *Vaccinium myrtoides*, *Equisetum ramosissimum*). Leaves, shoots, flowers are the part of the plant commonly used as food or cooked in combination with other food (e.g. *Cestrum nocturnum*, *Artocarpus blancoi*, *Diplazium esculentum*, *Ficus pseudopalma*, *Leptosalenia haenkei*, *Portulaca oleracea*, *Youngia japonica*). Other parts utilized are the tuber of some species like *Manihot esculenta* and *Colocasia esculenta*. The fruits of most tree and shrub species are processed into jams, candies, jellies (e.g. *Saurania bontocensis*, *Rubus rosaefolius*, *R. globiosa*) (Katague et al., 1987). One good example of indigenous plant species which is regarded as a weed is *Portulaca oleracea*. In the uplands of Cordilleras, the young stem, shoot, and leaves of this particular plant is eaten salad form or as condiment with meat and fish. It is also a good soup and excellent source of calcium and iron. *Bidens pilosa* (beggar stick) also a weed, is used in preparation of yeast (bubod) for ricewine (tapoy) making, a viand, salad, an ingredient in sauteed preparations and fish sinigang. The flowers are used as preservative in making rice wines and animal feed. Herbs accounted for 29.03% followed by shrub (26.88) and tree (26.88) in terms of plants growth habit (Table 5). Most of the indigenous plants species belong to the plant family Moraceae (9.68%). This is followed by Rosaceae (8.60%) and Palmae (7.53%) respectively.

Cultural Practices

The indigenous plant species utilized as part of their tradition, belief and indigenous knowledge passed from one generation to another is grouped into the category of cultural practices. Plant parts of indigenous plant species utilized in most of their cultural practices are used as amulets for protection, to drive away spirits, for good fortune and as lucky charm such as *Acorus calamus*, *Acorus gramineous*, *Coix lacryma-jobi*, *Livistona rotundifolia*, *Premna odorata*, *Rubus* spp. (Litilit, 2005;). Other species are commonly used in traditional rituals such as Kalanguya (*Areca catechu*) and "kanyaws" in Aguinaldo, Ifugao (*Pittosporum resintfemon*). Some are part of belief system in making of instruments for rituals: *Wrightia pubescens* is used to make wooden spoons called "aklo" or "idos" used in rituals e.g. chieftains and native healers used wooden spoon to call assistance from the spirits or "anitos" in order to win a tribal war or get an advantage over an opponent. In terms of frequency of indigenous plants used for cultural practices, about 10% of the total number of indigenous species belongs to each of the families of Palmae, Moraceae and Araceae, respectively (Table 5). About (60%) of the indigenous plant

species used in cultural practices are classified as tree (Table 6). Other species are vines, palms, shrubs, grasses and herb.

Construction and livelihood activities

A number of indigenous plant resources were used as source of timber, lumber, post and wall paneling for house construction such as *Agathis philippinensis*, *Albizia procera*, *Antidesma pentadrum*, *Artocarpus blancoi*, *Broussonetia luzonica*, *Dracontomelon dao*, *Pinus kesiya*, *Shorea astylosa*, *Toona calantas* (Central Cordillera Agricultural Programme, 2003). Other species such as *Antidesma pentadrum*, *Areca catechu*, *Bambusa blumeana*, *Calamus spp.*, *Caryota rumphiana* and *Ficus balite* are used as source of firewood, raw material for furniture and instrument making and basket weaving. Some species are also used in the industry such as production of rope (*Colona serratifolia*), raincoat (*Calamus spp.*), source of "manila copal" and oleoresin (*Agathis philippinensis*) and raw material (resin) for making plastic and taurpentine (*Pinus kesiya*). The fibrous material of the bark of *Wikstroemia spp.* for example is an excellent raw material for the manufacture of security and onion skin paper, currency paper for legal documents, certificates and insurance policies, stencil paper, ropes, fish lines, nets, clothesline, sacks, strings, cordage and textile fabrics, cords, strainers, bags, wallet and hats (Table 7b). Moreover, the short fiber in the stem is used for manufacturing high-grade papers. Most of the indigenous species belong to the plant family Moraceae (15.87%) while 9.52% and 7.94% are in the plant family of Dipterocarpaceae and Palmae, respectively.

Ornamental, landscaping and gardening

Almost all of the indigenous plant species are used as ornamental plants for decorating home gardens. These include *Amaranthus hybridus*, *Begonia spp.*, *Catharanthus roseus*, *Cestrum nocturnum*, *Diplazium esculentum*, *Pteridium aquilinum*, *Musa spp.* and *Echinopsis coronata* (Central Cordillera Agricultural Programme, 2003). Some species such as *Brassaia actinophylla* and *Ficus balite* are being dwarfed into bonsai plants. Majority (41.18%) of the indigenous plant species used as ornamental are herbs (Table 8), followed by tree (23.53%), shrub (11.76%) and fern (11.76%), respectively.

SUMMARY AND CONCLUSIONS

Documented indigenous plant resources in the Cordillera Administrative Region were organized using open development source tools. Information and data were gathered from various sources (library archives, project reports, manuscripts, literature) thru literature survey, KI interview, FGD and field visit. Bioinformatics, an interdisciplinary field can be effectively applied in gathering, organizing and managing indigenous knowledge and indigenous plant resources.

Food source and community health care topped the most important utilization of indigenous plant resources in the Cordillera Administrative Region. The traditional culture and belief system in the region is also well-heeled. Thus, indigenous plant resources were also of

prime significance in their cultural practices, belief systems, rituals, house construction and livelihood activities (e.g. wood carving, weaving).

Although few documented indigenous plant resources were used for organic farming and sustainable indigenous farming systems, their importance in the sustainability of natural resources, soil fertility and food production system are seen to be essential. Thus, a deeper study must be undertaken to address issues on indigenous natural resource conservation, management and preservation amidst the effects of climate change, population pressure, policy formulation and implementation, and food security. Nonetheless, the study has provided sufficient baseline information on such utilization of indigenous plant resources in the Cordillera region.

It is envisioned that the DIS will serve as an important knowledge-base in the preservation and management of indigenous plant resources and decision support system in addressing poverty alleviation, degradation of environmental resources and food security of upland communities in the Philippines.

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FIGURES

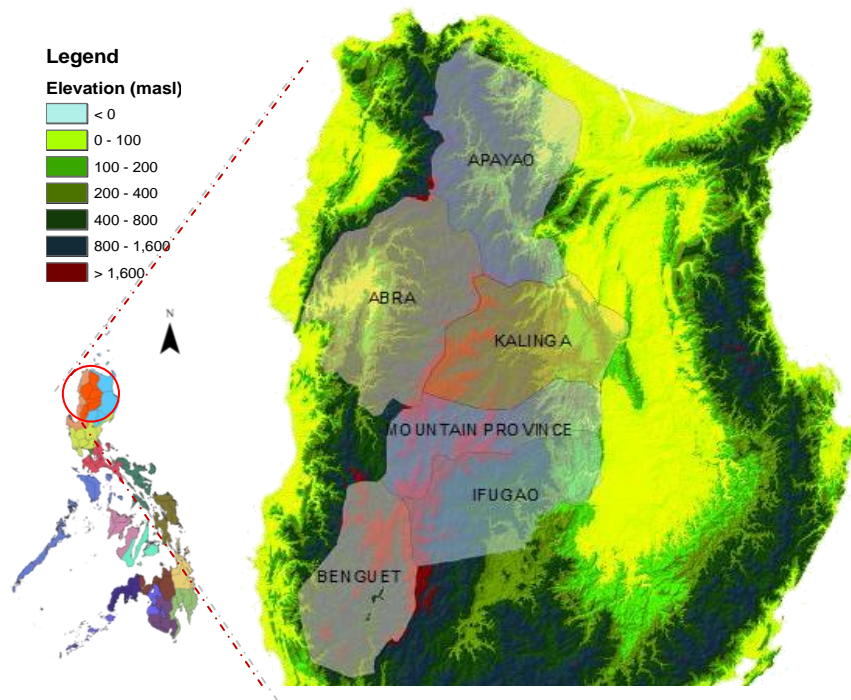


Figure 1 Location map of the Cordillera Administrative Region, Philippines.

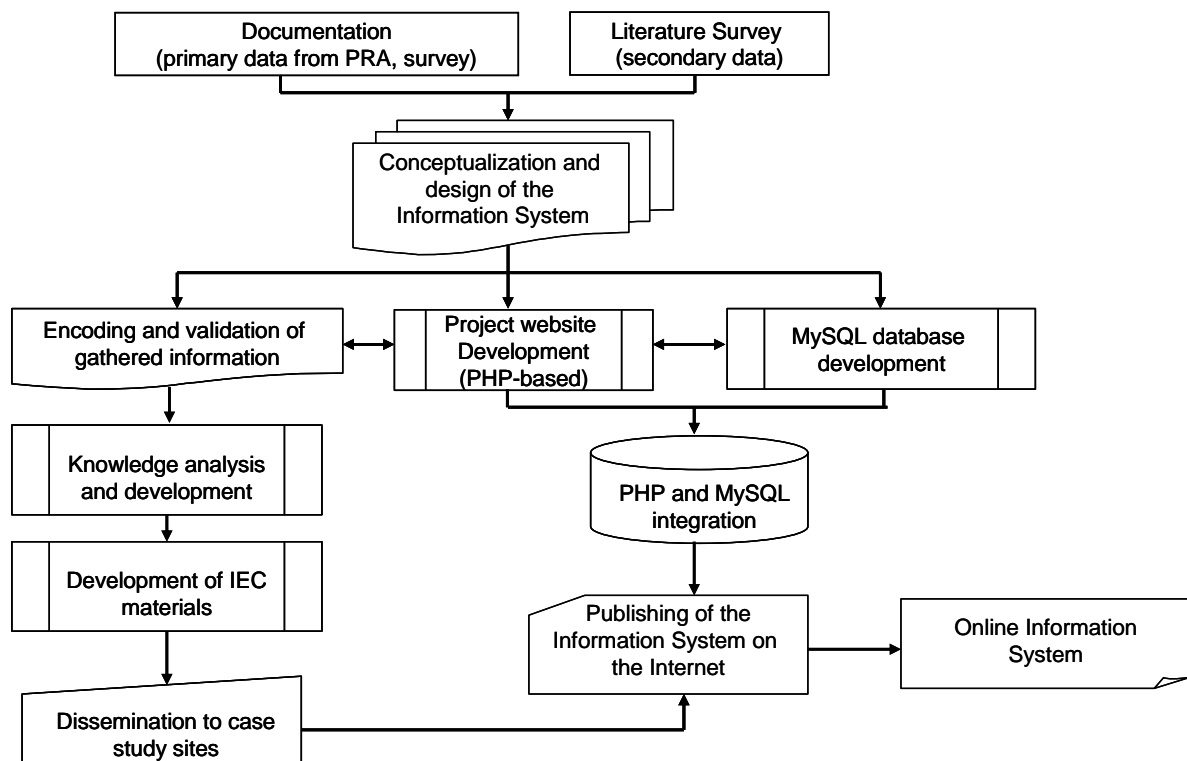


Figure 2 Methodological framework of the study.

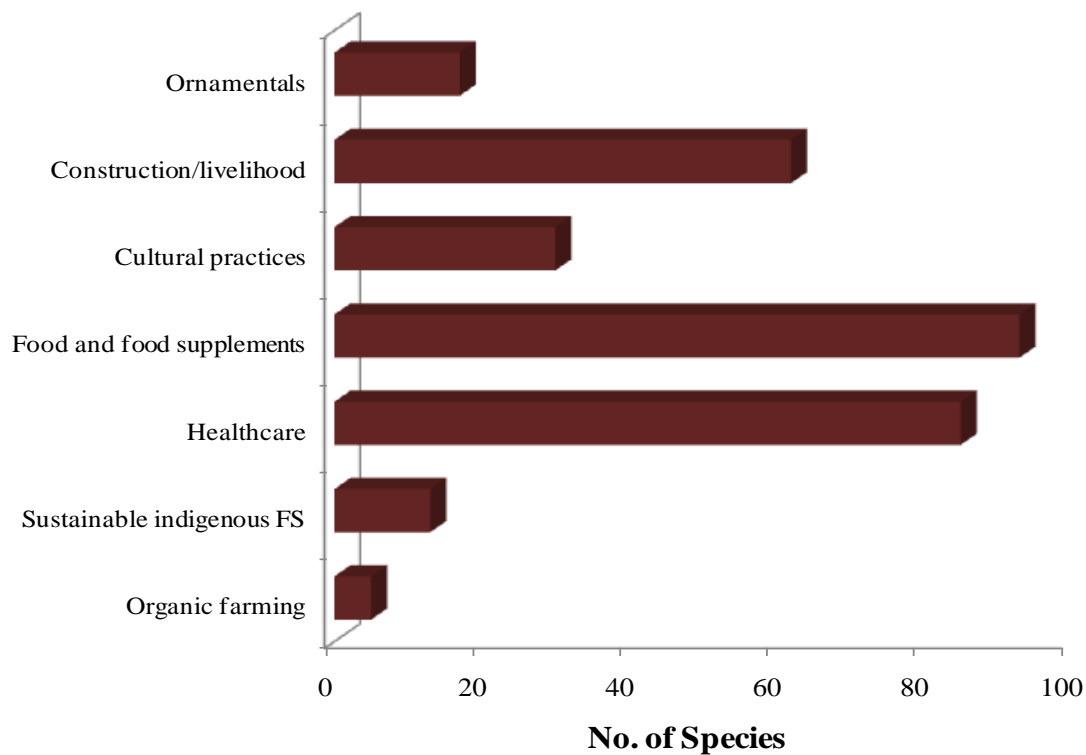


Figure 3 Total number of indigenous plant species in the Cordilleras contained in the INFOSYS DIS.

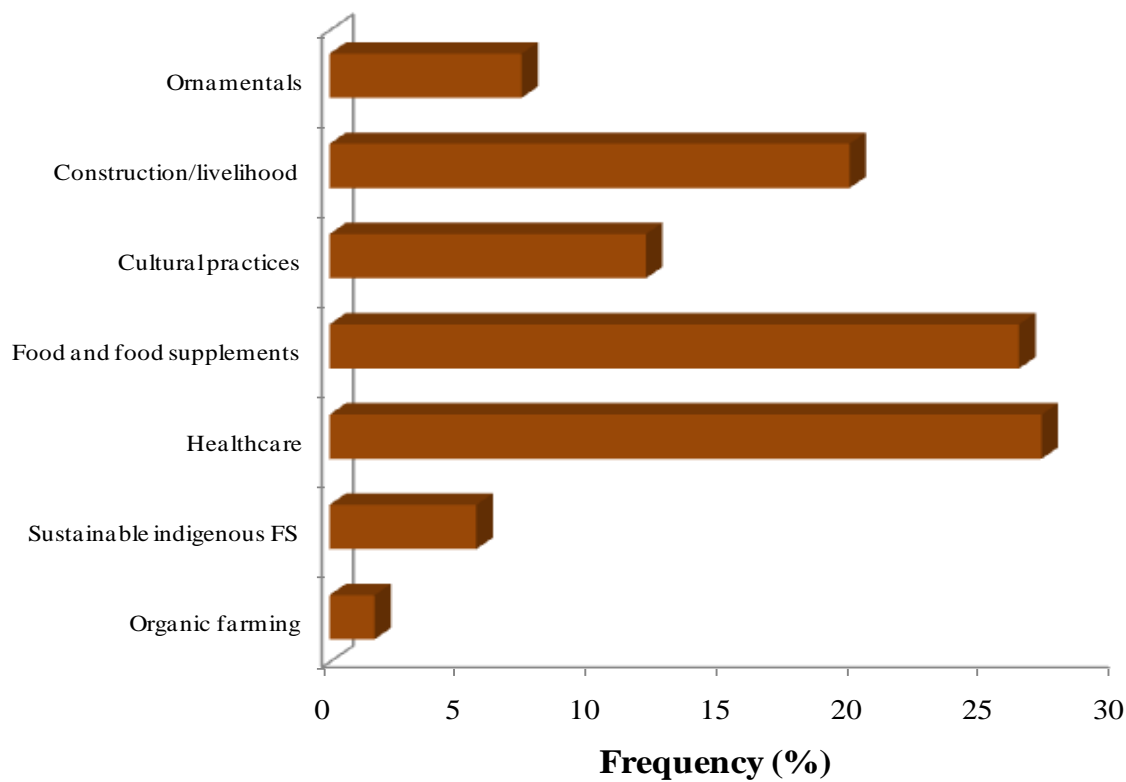


Figure 4 Frequency of multipurpose indigenous plant species in the Cordillera Region.

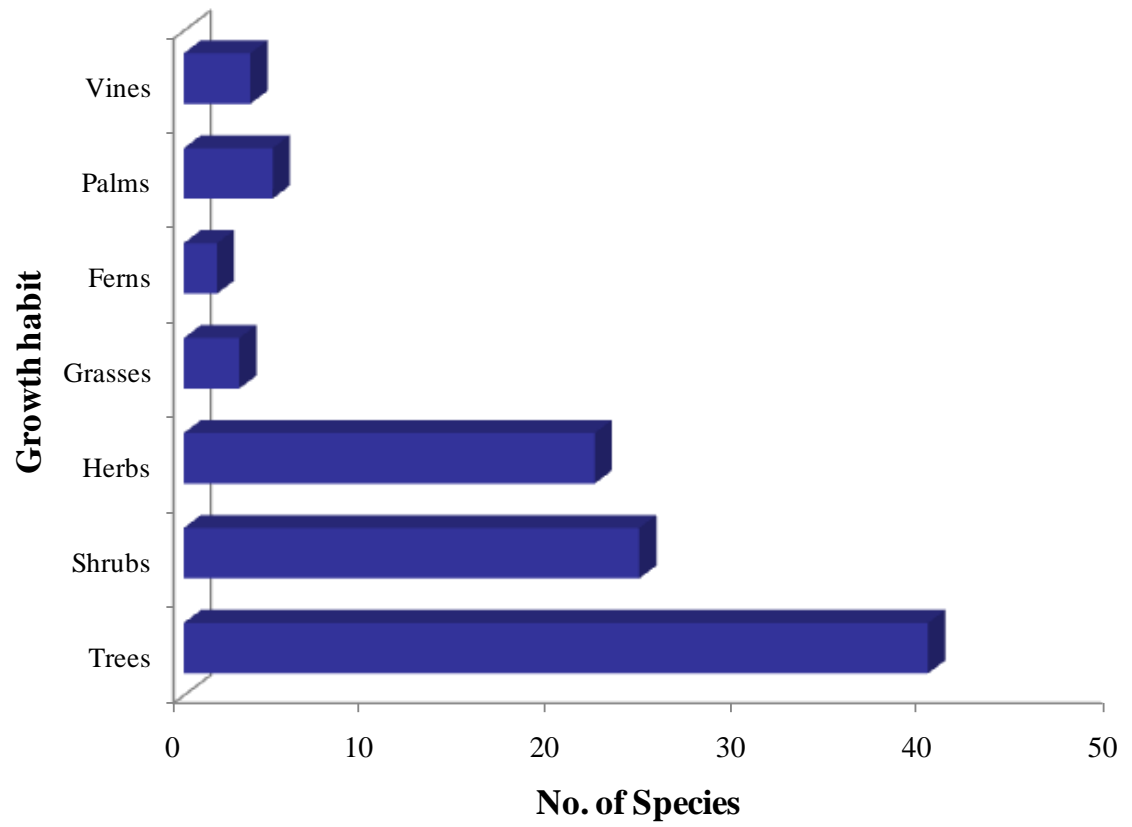


Figure 5 Growth habit of the 167 indigenous plant species in the Cordillera Region.

TABLES

Table 1 Top multi-purpose indigenous plant resources in the Cordillera, Region.

Rank	Species Name	Common/local name(s)	Family	Growth habit	Utilization							Total No. of Use
					Organic farming	Sustainable indigenous farming system	Community healthcare	Food and food supplements	Cultural practices	Construction/ livelihood	Ornamentals, landscaping and gardening	
1	<i>Bischofia javanica</i> (Blume)	tuai, tu-wor, tu-wol, tuwirl, tuwel, towe	Euphorbiaceae	Tree	1	1	1		1	1		5
2	<i>Caryota rumphiana</i>	takipan, bangi, banaue nut	Palmae	Palm			1	1	1	1		4
3	<i>Garcinia mangostana</i>	mangosteen (wild), bili, bulon	Moraceae	Tree			1	1	1	1		4
4	<i>Erythrina orientalis</i> L. Meril	dapdap, bubug, sabbang, sablang, kabkab, sabrang and gabgab	Fabaceae	Tree		1	1		1	1		4
5	<i>Pinus kesiya</i> Royle Ex. Gordon	warong (pine tree), vforvfor, bolbol, halong, saleng, salong, batang, vfatang, verver, fatang	Pinaceae	Tree		1	1		1	1		4
6	<i>Wrightia pubescens</i> R. Br. spp laniti (Blanco) Ngan	lanete, lanoti	Apocynaceae	Tree		1	1		1	1		4
7	<i>Mangifera altissima</i> L.	paho, pahutan, malamanga, pau, appau	Anacardiaceae	Tree		1		1	1	1		4
8	<i>Lagerstroemia speciosa</i>	banaba, ganaba	Thymelaeceae	Tree			1	1		1	1	4
9	<i>Miscanthus sinensis</i>	japanese silver grass, maiden grass/stick, runo, pao, galladaw/segbat, sapsap/lablab/dabidab, falulung, pao rono	Poaceae	Grass			1	1		1	1	4
10	<i>Ficus balite</i> Merr.	balete, baliti, cobal, puspos	Moraceae	Tree			1		1	1	1	4
11	<i>Pterocarpus indicus/vidalianus</i>	narra, Philippine Rosewood, taggay tree, sahhay	Fabaceae	Tree		1	1		1	1		4
12	<i>Albizia procera</i> (Roxb.) Benth.	ahlar, adaan, kalai	Leguminosae	Tree	1	1				1		3
13	<i>Bambusa blumeana</i>	kauayan tinik	Poaceae	Shrub		1		1		1		3
14	<i>Trema orientalis</i> L. Blume	anabiong, arandong, anardong, hubudos, lanai	Celtidaceae	Tree		1		1		1		3
15	<i>Ficus pseudopalma</i>	niogniogan, adiagi, kadiabung, tarabang	Moraceae	Tree		1		1			1	3
16	<i>Tithonia diversifolia</i>	lagpaw, mirasol, marapait, sunflower	Asteraceae	Shrub	1		1				1	3

Table 1 Continued...

Rank	Species Name	Common/local name(s)	Family	Growth habit	Utilization							Total No. of Use
					Organic farming	Sustainable indigenous farming system	Community healthcare	Food and food supplements	Cultural practices	Construction/ livelihood	Ornamentals, landscaping and gardening	
17	<i>Citrus aurantifolia</i>	pelles	Rutaceae	Tree			1	1	1			3
18	<i>Colocasia esculenta</i> (L.) Schott. & Endl.	aba, pihing	Araceae	Herb			1	1	1			3
19	<i>Artocarpus blancoi</i>	antipolo, pakak, patak	Moraceae	Tree			1	1		1		3
20	<i>Calamus</i> spp.	katmon, uey, rattan	Palmae	Palm			1	1		1		3
21	<i>Dracontomelon dao</i>	dao, pole, dalligan, cha-o	Anacardiaceae	Tree			1	1		1		3
22	<i>Piper interruptum</i>	hapal, sapal, wild pamienta	Piperaceae	Shrub			1	1		1		3
23	<i>Solanum tuberosum</i> L.	Irish white potato, papas, patatas	Solanaceae	Herb			1	1		1		3
24	<i>Cestrum nocturnum</i> L.	night cestrum/ lady of the night, dama de noche	Solanaceae	Shrub			1	1			1	3
25	<i>Musa</i> spp.	wild banana, bitog, pintok	Musaceae	Herb			1	1			1	3
26	<i>Pteridium aquilinum</i> L.	tullabang (bracken fern), bracken fern, pakong buwaya, annapat, alam-am	Dennstaedtiaceae	Fern			1	1			1	3
27	<i>Cibotium cumini</i>	giant fern, golden fern, tibanglan, tibbang, palangipang, atibangngan	Cibotaceae	Shrub			1		1	1		3
28	<i>Ficus septica</i> Burrm.	hauili, liwliw	Moraceae	Tree			1		1	1		3
29	<i>Pittosporum resinifemum</i>	hanga/petroleum tree, apihang, sikkaka	Pittosporaceae	Shrub			1		1	1		3
30	<i>Livistona rotundifolia</i> Lam. Mart	anahau, anahaw	Palmae	Palm				1	1	1		3
31	<i>Premna odorata</i> Blanco	alagoy, alagau	Verbenaceae	Tree				1	1	1		3
32	<i>Ficus minahasse</i> (Tejism & de Vr.) Mig	hagimit, alumit, alimit, sabfog	Moraceae	Tree		1		1		1		3

Table 2 Frequency of indigenous plants used for organic farming system in the Cordilleras grouped by family and by growth habit.

Family	Tree	Shrub	Total	Frequency (%)
Leguminosae	1	0	1	20.00
Euphorbiaceae	1	0	1	20.00
Meliaceae	1	0	1	20.00
Asteraceae	0	1	1	20.00
Verbenaceae	1	0	1	20.00
Total	4	1	5	100.00
Frequency (%)	80.00	20.00	100.00	

Table 3 Frequency of indigenous plants used for sustainable indigenous farming system in the Cordilleras grouped by family and by growth habit.

Family	Tree	Shrub	Total	Frequency (%)
Leguminosae	1	0	1	7.69
Apocynaceae	1	0	1	7.69
Moraceae	3	0	3	23.08
Anacardiaceae	1	0	1	7.69
Fagaceae	1	0	1	7.69
Fabaceae	2	0	2	15.38
Pinaceae	1	0	1	7.69
Celtidaceae	1	0	1	7.69
Graminae	0	1	1	7.69
Euphorbiaceae	1	0	1	7.69
Total	12	1	13	100.00
Frequency (%)	92.31	7.69	100.00	

Table 4 Frequency of indigenous plants used for community health care in the Cordilleras grouped by family and by growth habit.

Family	Herb	Grass	Shrub	Tree	Palm	Fern	Vine	Total	Frequency (%)
Araceae	3	1	1	0	0	0	0	5	5.88
Asteraceae	4	1	6	0	0	0	0	11	12.94
Apocynaceae	1	0	0	2	0	0	0	3	3.53
Amaranthaceae	1	0	0	0	0	0	0	1	1.18
Moraceae	0	0	0	6	0	0	0	6	7.06
Meliaceae	0	0	0	1	0	0	0	1	1.18
Poaceae	0	2	1	0	0	0	0	3	3.53
Compositae	3	0	1	0	0	0	0	4	4.71
Euphorbiaceae	1	0	1	2	0	0	0	4	4.71
Palmae	0	0	0	0	2	0	0	2	2.35
Solanaceae	3	0	3	0	0	0	0	6	7.06
Caricaceae	0	0	0	1	0	0	0	1	1.18
Apiaceae	1	0	0	0	0	0	0	1	1.18
Cibotaceae	0	0	1	0	0	0	0	1	1.18
Rutaceae	0	0	0	2	0	0	0	2	2.35
Graminae	0	1	0	0	0	0	0	1	1.18
Dracaenaceae	1	0	0	0	0	0	0	1	1.18
Anacardiaceae	0	0	0	1	0	0	0	1	1.18
Winteraceae	0	0	1	0	0	0	0	1	1.18
Equisetaceae	1	0	0	0	0	0	0	1	1.18
Fabaceae	0	0	0	2	0	0	0	2	2.35
Ericaceae	0	0	2	0	0	0	0	2	2.35
Thymelaeaceae	0	0	1	1	0	0	0	2	2.35
Fagaceae	0	0	0	1	0	0	0	1	1.18
Loranthaceae	0	0	0	1	0	0	0	1	1.18
Schizaeaceae	0	0	0	0	0	1	0	1	1.18
Leguminosae	0	0	1	0	0	0	0	1	1.18
Musaceae	1	0	0	0	0	0	0	1	1.18
N.O. Labiatae	1	0	0	0	0	0	0	1	1.18
Nepenthaceae	1	0	0	0	0	0	0	1	1.18
Passifloraceae	0	0	0	0	0	0	2	2	2.35
Pinaceae	0	0	0	1	0	0	0	1	1.18
Piperaceae	0	0	1	0	0	0	1	2	2.35
Pittosporaceae	0	0	1	0	0	0	0	1	1.18
Podocarpaceae	0	0	0	1	0	0	0	1	1.18
Dennstaedtiaceae	0	0	0	0	0	1	0	1	1.18
Brassicaceae	2	0	0	0	0	0	0	2	2.35
Rosaceae	0	0	3	0	0	0	0	3	3.53
Sacandaceae	0	0	1	0	0	0	0	1	1.18
Actidiaceae	0	0	0	1	0	0	0	1	1.18
Zingiberaceae	1	0	0	0	0	0	0	1	1.18
Total	25	5	25	23	2	2	3	85	100.00
Frequency (%)	29.41	5.88	29.41	27.06	2.35	2.35	3.53	100.00	

Table 5 Frequency of indigenous plants used for food and food supplements in the Cordilleras grouped by family and by growth habit.

Family	Tree	Vine	Palm	Shrub	Grass	Herb	Fern	Total	Frequency (%)
Leguminosae	0	2	0	0	0	0	0	2	2.15
Myrsinaceae	0	1	0	0	0	0	0	1	1.08
Euphorbiaceae	1	0	0	1	0	0	0	2	2.15
Palmae	0	0	7	0	0	0	0	7	7.53
Moraceae	8	0	0	0	0	0	0	8	8.60
Poaceae	0	0	0	1	1	1	0	3	3.23
Podocarpaceae	1	0	0	0	0	0	0	1	1.08
Anacardiaceae	2	0	0	0	0	0	0	2	2.15
Thymelaeaceae	1	0	0	0	0	0	0	1	1.08
Piperaceae	0	0	0	1	0	0	0	1	1.08
Verbenaceae	1	0	0	0	0	0	0	1	1.08
Solanaceae	0	0	0	3	0	3	0	6	6.45
Celtidaceae	1	0	0	0	0	0	0	1	1.08
Araceae	0	0	0	0	0	2	0	2	2.15
Rutaceae	3	0	0	0	0	0	0	3	3.23
Zingiberaceae	0	0	0	0	0	2	0	2	2.15
Rosaceae	0	0	0	8	0	0	0	8	8.60
Asteraceae	0	0	0	1	1	3	0	5	5.38
Amaranthaceae	0	0	0	0	0	4	0	4	4.30
Begoniaceae	0	0	0	0	0	1	0	1	1.08
Compositae	0	0	0	1	0	3	0	4	4.30
Brassicaceae	0	0	0	1	0	1	0	2	2.15
Apiaceae	0	0	0	0	0	1	0	1	1.08
Dilleniaceae	1	0	0	0	0	0	0	1	1.08
Ebenaceae	1	0	0	0	0	0	0	1	1.08
Athyriaceae	0	0	0	0	0	0	1	1	1.08
Cactaceae	0	0	0	0	0	1	0	1	1.08
Equisetaceae	0	0	0	0	0	1	0	1	1.08
Myrtaceae	0	0	0	2	0	0	0	2	2.15
Flacourtiaceae	1	0	0	0	0	0	0	1	1.08
Ericaceae	0	0	0	3	0	0	0	3	3.23
Loranthaceae	1	0	0	0	0	0	0	1	1.08
Melastomataceae	0	0	0	1	0	0	0	1	1.08
Pontederiaceae	0	0	0	0	0	1	0	1	1.08
Musaceae	0	0	0	0	0	1	0	1	1.08
N.O. Labiatae	0	0	0	0	0	1	0	1	1.08
Passifloraceae	0	2	0	0	0	0	0	2	2.15
Portulacaceae	0	0	0	1	0	0	0	1	1.08
Dennstaedtiaceae	0	0	0	0	0	0	1	1	1.08
Sacandaceae	0	0	0	1	0	0	0	1	1.08
Sauraiaceae	1	0	0	0	0	0	0	1	1.08
Actidiaceae	1	0	0	0	0	0	0	1	1.08
Caryophyllaceae	0	0	0	0	0	1	0	1	1.08
Caricaceae	1	0	0	0	0	0	0	1	1.08
Total	25	5	7	25	2	27	2	93	100.00
Frequency (%)	26.88	5.38	7.53	26.88	2.15	29.03	2.15	100.00	

Table 6 Frequency of indigenous plants used for cultural practices in the Cordilleras grouped by family and by growth habit.

Family	Tree	Vine	Palm	Shrub	Grass	Herb	Total	Frequency (%)
Araucariaceae	1	0	0	0	0	0	1	3.33
Apocynaceae	1	0	0	0	0	0	1	3.33
Euphorbiaceae	1	0	0	0	0	0	1	3.33
Palmae	0	0	3	0	0	0	3	10.00
Moraceae	3	0	0	0	0	0	3	10.00
Anonaceae	1	0	0	0	0	0	1	3.33
Cibotaceae	0	0	0	1	0	0	1	3.33
Podocarpaceae	1	0	0	0	0	0	1	3.33
Anacardiaceae	1	0	0	0	0	0	1	3.33
Fabaceae	2	0	0	0	0	0	2	6.67
Caesapiniaceae	1	0	0	0	0	0	1	3.33
Pinaceae	1	0	0	0	0	0	1	3.33
Piperaceae	0	1	0	0	0	0	1	3.33
Pittosporaceae	0	0	0	1	0	0	1	3.33
Araliaceae	1	0	0	0	0	0	1	3.33
Sapindaceae	1	0	0	0	0	0	1	3.33
Verbenaceae	1	0	0	0	0	0	1	3.33
Dipterocarpaceae	1	0	0	0	0	0	1	3.33
Araceae	0	0	0	0	1	2	3	10.00
Rutaceae	1	0	0	0	0	0	1	3.33
Graminae	0	0	0	0	1	0	1	3.33
Zingiberaceae	0	0	0	0	0	1	1	3.33
Rosaceae	0	0	0	1	0	0	1	3.33
Total	18	1	3	3	2	3	30	100.00
Frequency (%)	60.00	3.33	10.00	10.00	6.67	10.00	100.00	

Table 7 Frequency of indigenous plants used for construction and livelihood activities in the Cordilleras grouped by family and by growth habit.

Family	Tree	Vine	Palm	Shrub	Grass	Herb	Total	Frequency (%)
Araucariaceae	1	0	0	0	0	0	1	1.61
Leguminosae	1	0	0	0	0	0	1	1.61
Apocynaceae	2	0	0	0	0	0	2	3.23
Myrsinaceae	0	1	0	0	0	0	1	1.61
Euphorbiaceae	2	0	0	1	0	0	3	4.84
Palmae	0	0	5	0	0	0	5	8.06
Moraceae	9	0	0	0	0	0	9	14.52
Poaceae	0	0	0	2	2	0	4	6.45
Clusiaceae	1	0	0	0	0	0	1	1.61
Anonaceae	1	0	0	0	0	0	1	1.61
Cibotaceae	0	0	0	1	0	0	1	1.61
Tiliaceae	1	0	0	0	0	0	1	1.61
Guttiferae	1	0	0	0	0	0	1	1.61
Podocarpaceae	2	0	0	0	0	0	2	3.23
Anacardiaceae	2	0	0	0	0	0	2	3.23
Fagaceae	4	0	0	0	0	0	4	6.45
Fabaceae	2	0	0	0	0	0	2	3.23
Caesapiniaceae	1	0	0	0	0	0	1	1.61
Thymelaeceae	1	0	0	1	0	0	2	3.23
Lauraceae	1	0	0	0	0	0	1	1.61
Meliaceae	2	0	0	0	0	0	2	3.23
Pinaceae	1	0	0	0	0	0	1	1.61
Piperaceae	0	0	0	1	0	0	1	1.61
Pittosporaceae	0	0	0	1	0	0	1	1.61
Araliaceae	1	0	0	0	0	0	1	1.61
Sapindaceae	2	0	0	0	0	0	2	3.23
Verbenaceae	1	0	0	0	0	0	1	1.61
Dipterocarpaceae	6	0	0	0	0	0	6	9.68
Solanaceae	0	0	0	0	0	1	1	1.61
Celtidaceae	1	0	0	0	0	0	1	1.61
Total	46	1	5	7	2	1	62	100.00
Frequency (%)	74.19	1.61	8.06	11.29	3.23	1.61	100.00	

Table 8 Frequency of indigenous plants used for ornamental, landscaping and gardening in the Cordilleras grouped by family and by growth habit.

Family	Tree	Vine	Shrub	Grass	Herb	Fern	Total	Frequency (%)
Leguminosae	0	1	0	0	0	0	1	5.88
Apocynaceae	0	0	0	0	1	0	1	5.88
Moraceae	2	0	0	0	0	0	2	11.76
Poaceae	0	0	0	1	0	0	1	5.88
Thymelaeceae	1	0	0	0	0	0	1	5.88
Araliaceae	1	0	0	0	0	0	1	5.88
Solanaceae	0	0	1	0	0	0	1	5.88
Asteraceae	0	0	1	0	0	0	1	5.88
Amaranthaceae	0	0	0	0	1	0	1	5.88
Begoniaceae	0	0	0	0	1	0	1	5.88
Athyriaceae	0	0	0	0	0	1	1	5.88
Cactaceae	0	0	0	0	1	0	1	5.88
Musaceae	0	0	0	0	1	0	1	5.88
Dennstaedtiaceae	0	0	0	0	0	1	1	5.88
Caryophyllaceae	0	0	0	0	1	0	1	5.88
Nepenthaceae	0	0	0	0	1	0	1	5.88
Total	4	1	2	1	7	2	17	100.00
Frequency (%)	23.53	5.88	11.76	5.88	41.18	11.76	100.00	