USEFUL PLANTS IN THE LOWER BASIN OF LA PALMA RIVER (TRUJILLO, VENEZUELA)

Plantas útiles de la cuenca baja del río La Palma (Trujillo, Venezuela)

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ABSTRACT

The results of an ethnobotanical study in the lower basin of the La Palma River (Trujillo State, Venezuela) are presented. The local knowledge about the use of plants present in forest relicts was registered through participatory surveys, semi-structured interviews, open-ended conversations and field trips. One hundred and seventeen (117) useful species belonging to 61 families were recorded, and 12 use categories were mentioned. Forty-four per cent (44%) of the species are used for construction purposes, followed in descending order for food, medicinal, ornamental, firewood, and timber categories. The plant families with a higher number of useful taxa are Arecaceae, Annonaceae, Rubiaceae, Araceae, Caesalpiniaceae, Heliconiaceae, Meliaceae, and Passifloraceae. The importance of the Andean forests as a plant genetic resources reserve is discussed.

Key words: Ethnobotany, floristics, Trujillo, useful plants, Venezuela

RESUMEN

Se presentan los resultados de un estudio etnobotánico en la cuenca baja del río La Palma (estado Trujillo, Venezuela). Para ello, se documentó el conocimiento local acerca del uso de las plantas presentes en relictos boscosos, a través de sondeos participativos, entrevistas semi-estructuradas, conversaciones abiertas y recorridos de campo. Se registraron 117 especies útiles correspondientes a 61 familias, incluidas en doce categorías de uso. El 44% de las especies es usado para construcción, seguidas en orden decreciente por las alimenticias, medicinales, ornamentales, leña y aserrío. Las familias con mayor cantidad de especies útiles son Arecaceae, Annonaceae, Rubiaceae, Araceae, Caesalpiniaceae, Heliconiaceae, Meliaceae y Passifloraceae. Se discute la valoración de los bosques andinos como reservorio de recursos fitogenéticos.

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INTRODUCTION

Trujillo State is located in the west of Venezuela; it has a mountainous landscape with important rivers that supply water to populations located in this and other neighbouring states. Deforestation and agricultural intensification have resulted in land degradation and reduction in the quality of life (López 2001; Jaimes & Mendoza 2002; Jaimes *et al*. 2006). Specifically, in that area, deforestation, logging, and girdling are common. Although cultural, economic, and environmental strategies are required to solve these environmental problems, the importance of biodiversity as a source of direct or indirect benefits for human populations is well known. Wild forests of Venezuela, namely those of Trujillo State, host many plant genetic resources with actual or potential economic value, including underutilized species and wild relatives of crops (Berlingeri & Crespo 2012). Indigenous plants are part of the cultural heritage and they are well adapted to particular environments; therefore, they show greater advantages for sustainable agriculture.

To define conservation strategies and sustainable use of plant genetic resources is essential to recover the local knowledge about biodiversity, as well as to estimate the degree of threat to taxa and its potential for food security and local development. Based on the aforesaid, this work was oriented toward an inventory of the useful species harvested in the community of Las Pavas (lower basin of La Palma River), in order to establish strategies to help local farming communities for the use and conservation of plant biodiversity.

MATERIALS AND METHODS

The study area is located in the lower basin of the River La Palma, Las Pavas community, Escuque Municipality (09°12’30” - 09°23’20” N, 70°33’00” - 70°48’40” W). It is located in the south-west of Trujillo State, and has a rugged relief and low fertility soils. The predominant vegetation is the montane forest, ranging between 400 and 1600 m altitude (Huber & Alarcón 1988). The more accessible forests have been exploited for agricultural use, the best preserved areas being those of higher slopes. The main agricultural activity is shade coffee, but some producers have recently become involved in cocoa production.

Fieldwork was conducted during 2006 and 2007. Workshops and participatory surveys with the community were made to explain the study objectives, to encourage the participation of local connoisseurs and make a preliminary list of the useful species present in the surrounding vegetation. Local knowledge was registered by means of interviews, open discussions, and field trips, which were always made in company of at least one local person, and taking into account the different agro-ecological zones. During the interviews and field trips, all the useful species,

their local uses, and the plant parts used were registered. Simple categories were proposed for the species classification according to their usefulness, attempting that all participants understood each category, and allowing their modification.

Specimens of useful species were collected following the classic methodology, which consists of collecting, pressing, and drying plants in reproductive or vegetative stages. Voucher specimens were deposited at the Herbarium MY (Facultad de Agronomía, Universidad Central de Venezuela). The taxonomic identification was performed by comparison with herbarium specimens, experts consultation, and relevant literature. The authorship of plant names correspond to those accepted in the IPNI (2011). The acronyms for plant families are in accord with those suggested by Weber (1982): Acanthaceae (ACA), Anacardiaceae (ANA), Annonaceae (ANN), Apocynaceae (APO), Araceae (ARA), Arecaceae (ARE), Asteraceae (AST), Bignoniaceae (BIG), Bombacaceae (BOM), Boraginaceae (BOR), Bromeliacae (BML), Burseraceae (BRS), Caesalpiniaceae (CSL), Campanulaceae (CAM), Caricaceae (CRC), Clusiaceae (CLU), Convolvulaceae (CNV), Costaceae (COT), Cyclanthaceae (CYC), Davalliaceae (DAV), Dennstaedtiaceae (DST), Dioscoreaceae (DSC), Dryopteridaceae (DRY), Ericaceae (ERI), Euphorbiaceae (EUP), Fabaceae (FAB), Flacourtiaceae (FLC), Gleicheniaceae (GLC), Heliconiaceae (HLC), Hippocastanaceae (HCS), Lauraceae (LAU), Loganiaceae (LOG), Malvaceae (MLV), Marantaceae (MRN), Melastomataceae (MLS), Meliaceae (MEL), Menispermaceae (MNS), Mimosaceae (MIM), Moraceae (MOR), Myrtaceae (MRT), Orchidaceae (ORC), Passifloraceae (PAS), Piperaceae (PIP), Poaceae (POA), Polypodiaceae (PLP), Pteridaceae (PTR), Rhamnaceae (RHM), Rosaceae (ROS), Rubiaceae (RUB), Rutaceae (RUT), Sapindaceae (SAP), Schizaeaceae (SCZ), Simaroubaceae (SMR), Smilacaceae (SML), Solanaceae (SOL), Sterculiaceae (STR), Theophrastaceae (TEO), Tiliaceae (TIL), Vitaceae (VIT), Vochysiaceae (VOC) and Zingiberaceae (ZIN). Some species were easily recognized in the field but were of difficult access, therefore not collected.

Species usefulness was estimated by summing the number of different use categories for each species, which is called use value (Boom 1990). However, the results were analyzed cautiously, because this methodology does not distinguish the relative importance of different uses; *i.e*. it does not take into account other indicators about the cultural value of the species, such as use frequency, traditional knowledge, management and preference, among others. Additional information sources were consulted to identify priority species, such as the Mansfeld's World Database of Agricultural and Horticultural Crops (2009), BOLPRIAVEN statistics (2009), FAOSTAT statistics (2009), The IUCN Red List of Threatened Species (2010) and the 'Libro Rojo de la Flora Venezolana' (Llamozas *et al*. 2003).

RESULTS

A total of 117 useful species belonging to 61 botanical families are harvested from natural forest relicts and secondary vegetation in the study area (Annex 1). The families with higher numbers of useful species are: Arecaceae (7), Annonaceae (5), Rubiaceae (5), Araceae (4), Caesalpiniaceae (4), Heliconiaceae (4), Meliaceae (4) and Passifloraceae (4) (Table 1). Species were assigned to 12 use categories: food, medicine, timber, construction, fodder, firewood, ornamental, toxic, craft, tool, dye, and other uses. The knowledge about plant uses is irregularly distributed among the villagers; some people know more about the species used in subsistence activities (food, construction, medicine and tool), while others provided information on plants marketed as ornamental, medicinal and timber.

Most species are used for a single purpose (66), while 51 species (43.59%) have two or more uses (Table 2). The plant families with higher different uses were Boraginaceae (8), Annonaceae (6), Arecaceae (6), Caesalpiniaceae (6), Anacardiaceae (6), Rubiaceae (5), Meliaceae (5), Cyclanthaceae (5), Moraceae (5) and Clusiaceae (5). The Annonaceae are used primarily for construction and firewood. The Arecaceae are important for construction and feeding, while most of the Caesalpiniaceae are used for medicinal purposes. Meliaceae and Boraginaceae species are mainly used for construction and timber. The remaining families are mainly used for construction, with the exception of Cyclanthaceae that is important to produce handicrafts (Table 1).

The species with more than three use categories were: *Cordia toqueve*, *Hymenaea courbaril*, *Spondias mombin*, *Duguetia lucida*, *Rollinia exsucca*, *Attalea butyracea*, *Carludovica palmata*, *Cedrela odorata*, *Gynerium sagittatum* and *Pteris consanguinea*. However, some species with a low number of uses are very important for the community, such as *Cordia alliodora* (Pardillo Blanco), which has only two different use categories, but it is highly prized for its wood.

In general, the most important use of the vegetation is the extraction of wood for construction, which included 52 species. It is followed by taxa used for food (31), medicine (27), ornamental purposes (25), firewood (16), timber (15), craft (10), fodder (10), other uses (10), tool (7), toxic (5) and dye (1) (Fig. 1).

Some plant uses are highly specific to species and families, while others can be satisfied by a wide range of species. The categories with major species-specificity are ornamental, medicinal and food, with 72, 56 and 45% of the species, respectively, with a single use. By contrast, only 23% of the construction species have this exclusive use, since the majority has two or more uses. Similarly, minor specificity is also recorded in categories such as firewood, timber, crafts, fodder, toxic, tool, and dye (Fig. 2).

Table 1. Number of useful species per botanical family and category.

Families	Number of useful species													Use value
	Total	Food	Medicine	Timber	Construction	Fodder	Firewood	Ornamental	Toxic	Craft	Tool	Dye	Other uses	
Arecaceae	7	5	1	0	4	1	0	1	0	0	1	0	0	6
Annonaceae	5	2	0	1	5	0	4	0	0	0	1	0	1	6
Rubiaceae	5	1	0	0	3	1	0	1	0	0	1	0	0	5
Araceae	4	0	1	0	0	0	0	2	2	0	0	0	1	4
Caesalpiniaceae	4	2	4	1	2	0	1	0	1	0	0	0	0	6
Heliconiaceae	4	0	0	0	0	0	0	4	0	0	0	0	0	1
Meliaceae	4	0	1	3	4	0	1	0	0	2	0	0	0	5
Passifloraceae	4	4	0	0	0	1	0	0	0	0	0	0	0	2
Anacardiaceae	3	1	1	1	3	1	0	0	0	1	0	0	0	6
Boraginaceae	3	1	1	2	2	1	1	0	0	0	1	0	1	8
Cyclanthaceae	3	0	1	0	2	0	0	2	0	2	1	0	0	5
Flacourtiaceae	3	0	0	0	3	0	1	0	0	0	0	0	1	3
Marantaceae	3	0	0	0	1	0	0	2	0	0	0	0	2	3
Moraceae	3	1	0	1	3	1	0	0	0	1	0	0	0	5
Bignoniaceae	2	0	0	1	2	0	0	0	0	0	0	0	0	2
Bombacaceae	2	0	0	1	1	0	0	0	0	1	0	0	1	4
Clusiaceae	2	1	0	0	1	1	1	1	0	0	0	0	0	5
Dennstaedtiaceae	2	0	0	0	0	0	0	2	0	0	0	0	0	1
Dioscoreaceae	2	2	0	0	0	0	0	0	0	0	0	0	0	1
Dryopteridaceae	2	0	0	0	0	0	0	2	0	0	0	0	0	1
Euphorbiaceae	2	0	1	1	1	0	0	0	1	0	0	0	0	4

Table 1. Continue.

Families	Number of useful species													Use value
	Total	Food	Medicine	Timber	Construction	Fodder	Firewood	Ornamental	Toxic	Craft	Tool	Dye	Other uses	
Melastomataceae	2	1	0	0	1	1	0	0	0	0	0	0	1	4
Mimosaceae	2	0	1	0	0	1	2	0	0	0	0	0	0	3
Poaceae	2	0	1	0	2	0	0	0	0	2	0	0	1	4
Pteridaceae	2	0	0	0	1	0	0	2	1	1	0	0	0	4
Sapindaceae	2	0	0	0	2	0	1	0	0	0	0	0	1	3
Schizaeaceae	2	0	0	0	0	0	0	2	0	0	0	0	0	1
Solanaceae	2	1	1	0	0	0	0	0	0	0	0	0	0	2
Sterculiaceae	2	1	1	0	1	0	1	0	0	0	0	0	0	4
Acanthaceae	1	0	1	0	0	0	0	0	0	0	0	0	0	1
Apocynaceae	1	0	0	1	1	0	0	0	0	0	0	0	0	2
Asteraceae	1	0	1	0	0	0	0	0	0	0	0	0	0	1
Bromeliacae	1	1	0	0	0	0	0	0	0	0	0	0	0	1
Burseraceae	1	0	1	1	1	0	0	0	0	0	0	0	0	3
Campanulaceae	1	0	0	0	0	1	0	0	0	0	0	0	0	1
Caricaceae	1	1	1	0	0	0	0	0	0	0	0	0	0	2
Convolvulaceae	1	1	0	0	0	0	0	0	0	0	0	0	0	1
Costaceae	1	0	1	0	0	0	0	0	0	0	0	0	0	1
Davalliaceae	1	0	0	0	0	0	0	1	0	0	0	0	0	1
Ericaeae	1	1	0	0	0	0	0	0	0	0	0	0	0	1
Fabaceae	1	0	0	0	1	0	0	0	0	0	0	0	0	1
Gleicheniaceae	1	0	0	0	0	0	0	1	0	0	0	0	0	1

Table 1. Continue.

Families	Number of useful species													Use value
	Total	Food	Medicine	Timber	Construction	Fodder	Firewood	Ornamental	Toxic	Craft	Tool	Dye	Other uses	
Hippocastanaceae	1	0	1	0	0	0	0	0	0	0	0	0	0	1
Lauraceae	1	0	0	0	1	0	0	0	0	0	0	0	0	1
Loganiaceae	1	1	0	0	0	0	0	0	0	0	0	0	0	1
Malvaceae	1	0	1	0	0	0	0	0	0	0	0	0	0	1
Menispermaceae	1	0	0	0	1	0	0	0	0	0	0	0	0	1
Myrtaceae	1	1	0	0	0	0	1	0	0	0	0	0	0	2
Orchidaceae	1	0	0	0	0	0	0	1	0	0	0	0	0	1
Piperaceae	1	0	0	0	0	0	1	0	0	0	0	0	0	1
Polypodiaceae	1	0	0	0	0	0	0	1	0	0	0	0	0	1
Rhamnaceae	1	0	1	0	0	0	0	0	0	0	0	0	0	1
Rosaceae	1	1	0	0	0	0	0	0	0	0	0	0	0	1
Rutaceae	1	0	0	0	1	0	0	0	0	0	1	0	0	3
Simaroubaceae	1	0	1	0	0	0	0	0	0	0	0	0	0	1
Smilacaceae	1	0	1	0	0	0	0	0	0	0	0	0	0	1
Theophrastaceae	1	0	0	0	0	0	0	0	0	0	1	0	0	1
Tiliaceae	1	0	1	0	0	0	0	0	0	0	0	0	0	1
Vitaceae	1	0	1	0	0	0	0	0	0	0	0	0	0	1
Vochysiaceae	1	0	0	1	1	0	1	0	0	0	0	0	0	3
Zingiberaceae	1	1	0	0	1	0	0	0	0	0	0	1	0	3
Total	117	31	27	15	52	10	16	25	5	10	7	1	10	12

Table 2. Numbers and percentages of species by uses number (use value).

Use value	Number of species	Percentages (%)
1	66	56.41
2	24	20.51
3	17	14.53
4	8	6.84
5	0	0
6	2	1.71
Total	117	100

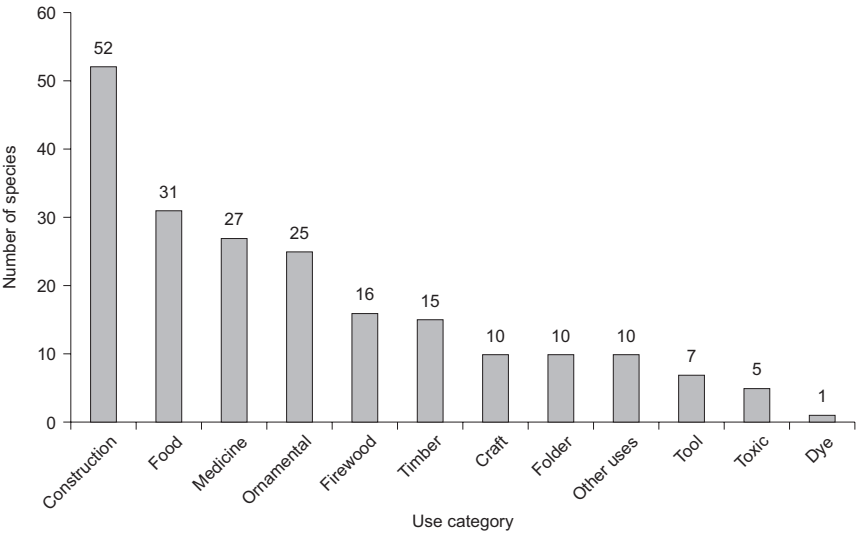

Fig. 1. Number of species per use category.

The 52 species used for construction belong to 28 families, from which Annonaceae, Arecaceae, Meliaceae, Anacardiaceae, Flacourtiaceae, Moraceae and Rubiaceae stand for 48% of the species. Food species belong to 21 botanical families, being better represented in Arecaceae (5 species) and Passifloraceae (4 species), which constitute 29% of the edible plants. The species of Bromeliaceae, Convolvulaceae, Dioscoreaceae, Ericaceae, Rosaceae, and Loganiaceae are exclusively used as food, while Caricaceae, Myrtaceae, Passifloraceae and Solanaceae have only an additional use than food. The 30 species used as medicinal belong

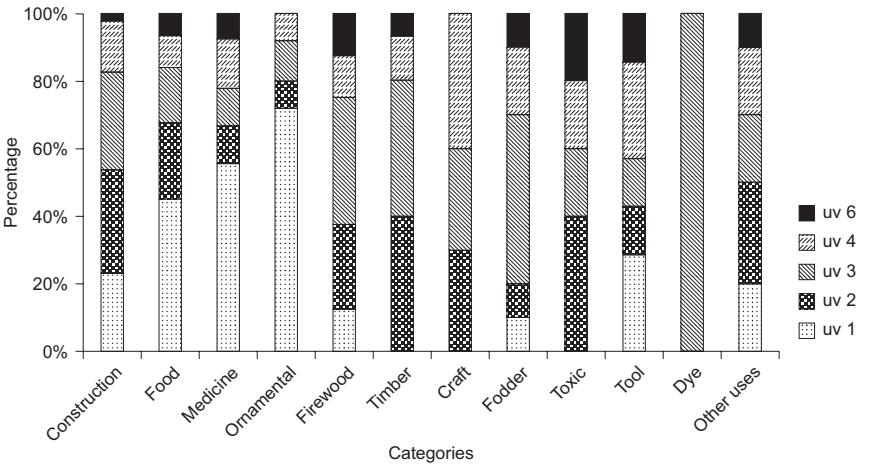

Fig. 2. Number of species (proportion of percentage) per use value (uv) in each category.

to *ca*. 24 families, nearly all represented by a single species, with the exception of Caesalpiniaceae, which includes four species. Acanthaceae, Asteraceae, Costaceae, Hippocastanaceae, Malvaceae, Rhamnaceae, Simaroubaceae, Smilacaceae, Tiliaceae and Vitaceae were exclusive to this category. Heliconiaceae, Araceae, Cyclanthaceae, Marantaceae, and several families of pteridophytes predominate in the ornamental category, constituting 84% of species. Davalliaceae, Dennstaedtiaceae, Dryopteridaceae, Gleicheniaceae, Heliconiaceae, Orchidaceae, Polypodiaceae and Schizaeaceae are unique to this category. Among the plants used as firewood, Annonaceae are dominant, although none of the species has exclusively this use. Only one species of Piperaceae is used with this unique purpose. Finally, the most of valuable timber species belong to Meliaceae and Boraginaceae, while Poaceae, Meliaceae and Cyclanthaceae have an important use in the craft category (Fig. 3, Table 1).

Most of the species are used for their stems. These are mainly used for construction of houses and other infrastructures (49 species), firewood (16), timber for sale (15), crafts (9), medicine (7), tools (6), and food (5). Secondly, the species are used for their fruits, mainly for food and fodder. The extraction of the whole plant occurs primarily in the case of ornamental species, either for cultivation in home gardens or marketing. The flowers are also used to a lesser extent to decorate churches and homes following religious traditions. The use of bark and exudates from some species occurs almost exclusively for medicinal purposes, for either self-medication or the sale to health shops (Fig. 4); these species are *Spondias mombin*, *Hymenaea courbaril*, *Cedrela odorata*, *Quassia amara*, and *Heliocarpus americanus*. The whole plant or certain parts are also used with medicinal purposes.

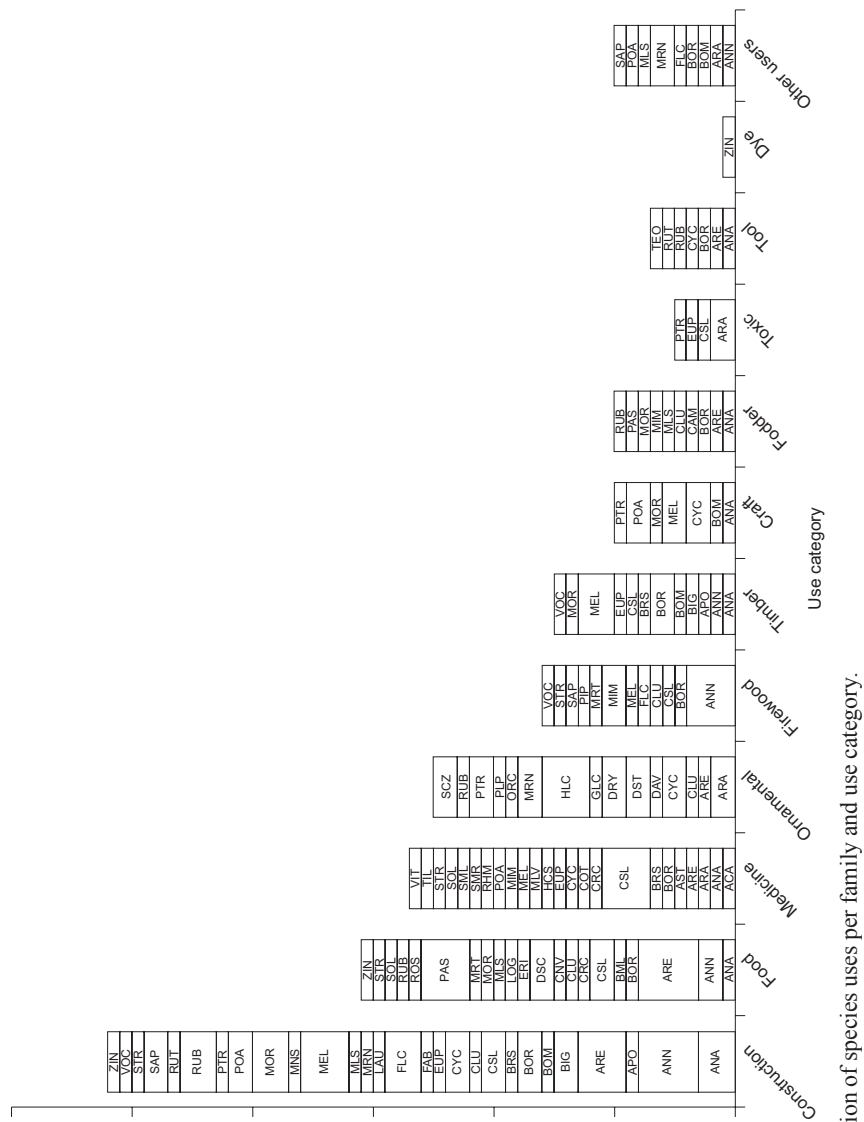

Fig. 3. Distribution of species uses per family and use category.

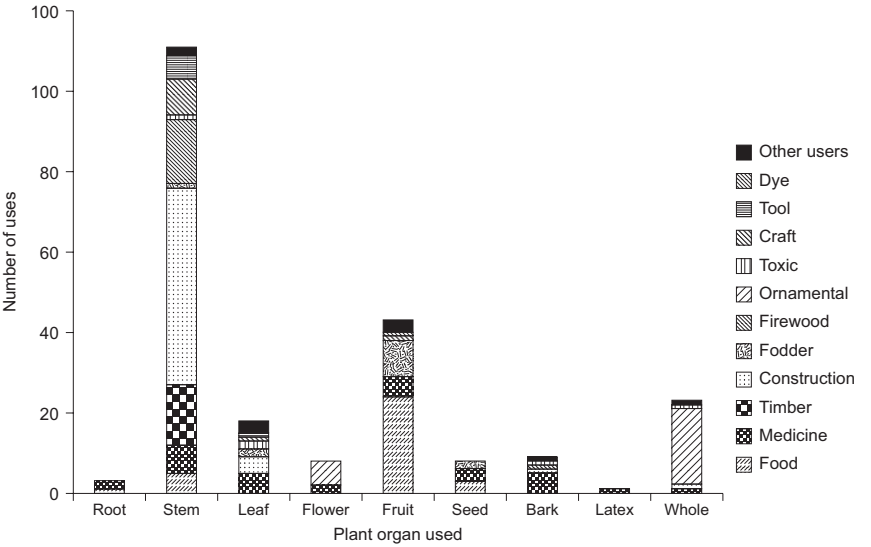

Fig. 4. Distribution of species uses according to plant organ used and category.

DISCUSSION

The popular names of plants, their usefulness, and the heterogeneous knowledge among the people suggest a particular plant usage related with the history of the community. When the local names are compared with the names given to the species in other geographical areas (Steyermark *et al*. 1995-2005; Duno *et al*. 2006) it is noted that a large number of species have particular local names, although some of those are widely known in Venezuela or vary slightly from those used in other regions (e.g. jobo, guayacán, ceiba, balso, pardillo, caujaro). Most of the names appear not to be related to utilitarian criteria, as occurs in a close community where people give descriptive names to the forest resources harvested to obtain economic incomes (Berlingeri *et al*. 2007).

Heterogeneous knowledge may be due to the socio-economic characteristics of the community. Therefore, there are native people who have inherited the knowledge through generations and perceive the benefits of the vegetation from a global perspective. They value the species not only by their direct benefits but also by their indirect ones, such as feeding of wildlife, or pest control, among others. In the community there are also people who arrived more recently (neo-colonist) and, in some cases, increased their farming income by selling timber and non-timber forest resources. In this case the forest is perceived more as a supplier of products than of services.

The analysis of the results shows that the sum of uses methodology has a

bias if it is applied as the only measure of the species value. This approach overestimates species with the highest number of uses regardless the importance degree of each of them. In the community, although the same species can show multiple uses, some of these seem to be more important than others. For example, although people eat fruits of *Bactris gasipaes* var. *chichagui* (macanilla) and *B. major* var. *major* (albarico), stems of these species are mainly used for construction of houses and other infrastructures. Since a quantitative technique was not used to assess the relative usefulness of species (*e.g*. the informant-indexing technique by Phillips & Gentry 1993), it can not conclude about the preferential use of each species. However, this would involve considerable time and money investment to collect information. Besides, being also based on the uses number it would not be sufficient to know which species are most important to people or could be threatened by use pressure. The relative importance of species and threat degree depend on many factors (type, preference and frequency of use, part of the plant and amount used, origin and destination of the harvest, population dynamics, among others), therefore they can not be simplified to only one factor. Due to this fact, this work should be regarded as a preliminary study that will lead to prioritization of species, which must be done according to the criteria and needs of the population.

The importance of the use categories reflects to some extent the management that the community gives to the forest. In this regard, the main use seems to be related to subsistence activities, the construction and food categories being the most important. The selective harvesting of timber, medicinal and ornamental species for marketing purposes was also observed. These results are consistent with other non-indigenous communities, where most forest uses are for subsistence, but also there is a selective removal of certain products or species for sale (Phillips & Gentry 1993; Galeano 2000; Marín-Corba *et al*. 2005).

The inventory reported in this paper is useful to begin species monitoring and to conduct future projects. Therefore, it should be noted that the extraction of forest products may be more dangerous in the case of destructive uses (stems, bark, root or whole plant), since they may affect populations and lead to local disappearance of species. The main uses of the forest involve a destructive harvesting, wood extraction being the most common. For this reason, the 15 species used for timber should be considered in population assessments, as they may be the most severely affected by exploitation. Of these, *Hymenaea courbaril*, *Cedrela odorata* and *Cedrela fissilis* are included in the red-list of endangered species of Venezuela, as Vulnerable, while *Astronium graveolens*, *Aspidosperma megalocarpon*, *Protium heptaphyllum*, *Hura crepitans*, *Guarea guidonia* and *Brosimun alicastrum* are in Lower Risk categories (Llamozas *et al*. 2003; IUCN 2010). Plants consumed as palm heart (*Oenocarpus bataua*, *Attalea butyracea* and *Euterpe precatoria*) should also be evaluated, although this use is very occasional. These three species are listed in the Lower Risk category (Llamozas *et al*. 2003; IUCN 2010); however, the threat degree could increase if extraction of palm heart or any other use that involves the destruction of the whole plant will increase.

In this sense, it is important to indicate that individuals of *A. butyracea* are also pulled down to get the leaves used in roof construction. Medicinal plants used for their stems (*Dracontium polyphyllum*, *Bauhinia glabra*, *Costus* sp., *Gynerium sagittatum*, *Gouania lupuloides* and *Cissus verticillata*), bark (*Spondias mombin*, *Hymenaea courbaril*, *Cedrela odorata*, *Quassia amara* and *Heliocarpus americanus*) and root (*Gynerium sagittatum* and *Smilax* sp.) may be prioritized for population studies in the future, since it is probable that some of these are threatened; *e.g*. according to the opinion of some natives, the population of *H. courbaril* has been reduced because the ring barking causes death of trees. The use of stems for construction, firewood, crafts and tools probably exert little pressure on wild populations, since the inhabitants only collect the needed quantities and these uses seem to be less species-specific. However, it is necessary to study whether there are some preferences or there has been a decrease in species populations.

On the other hand, some wild species may be incorporated into production systems of shade coffee and cocoa, in order to improve the income of farmers. For this, species related to crops of greater economic importance may be initially considered, which would ensure certainty in the market. These could be species of *Ipomoea*, *Dioscorea*, *Xanthosoma*, *Passiflora*, *Psidium*, *Bactris*, *Cedrela*, *Cordia*, and *Tabebuia*. In the study area there are also underutilized species, such as *Euterpe precatoria*, *Oenocarpus bataua*, *Garcinia madruno*, *Inga edulis*, *Bromelia* sp., *Calathea* sp., *Brosimum alicastrum*, *Genipa americana*, *Hymenaea courbaril*, *Vochysia* sp. and *Heliconia* spp., among others.

Finally, this study confirms the importance of this Trujillo State forest as a reservoir of genetic resources of wild crop relatives. This is the case of *Vasconcellea*, *Ipomoea*, *Dioscorea*, *Psidium*, *Passiflora*, *Bactris*, *Rollinia* and *Euterpe*, among others. Among them, *Ipomoea* and *Dioscorea* are included in the Annex I of the International Treaty on Plant Genetic Resources for Food and Agriculture, as prioritary for conservation and access facility (FAO 2001). In Venezuela, there exist only *ex situ* collections of *Ipomoea*, and to a lesser degree also of *Vasconcellea* (Knudsen 2000).

CONCLUSIONS

Traditional ethnobotanical knowledge of the Las Pavas community seems to be related to socio-economic characteristics and history of the community. The proportion of the use categories shows that the forest is mainly used for subsistence activities, although there is a selective removal of some products. Most of uses involve destructive harvesting, wood extraction being the most common. In this respect, the species concerned should be monitored, since their populations may be affected by over-exploitation, especially those marketed. This study also shows the importance of the Andean forest as a reservoir of crop genetic resources of current or potential economic importance. These species may be considered in a plan for sustainable forest management, or for their incorporation in agroforestry systems.

Moreover, it is important to highlight that, for the purposes of this study, the use value technique (quantification of the number of uses), by itself is not a good predictor of the cultural importance of the species and its threat degree. However, this is a quick and inexpensive method to gather basic information to establish priority species, using other indicators related to how and why the resource is used.

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Annex 1. Species used by the community Las Pavas in the Trujillo State, Venezuela.

Family Species	Common Name	Voucher and Herbarium	Plant part used	Food	Medicine	Timber	Construction	Fodder	Firewood	Ornamental	Toxic	Craft	Tool	Dye	Other Uses	Total Use
Acanthaceae																
Justicia secunda Vahl	Sanguinaria	Berlingeri & Medina 111 (MY), Berlingeri *et al*. 188 (MY)	Stem, leaves		x											1
Anacardiaceae																
Anacardium excelsum (Kunth) Skeels	Caracolí	*	Stem				x					x				2
Astronium graveolens Jacq.	Roble	Berlingeri *et al*. 124 (MY)	Stem			x	x									2
Spondias mombin L.	Jobo	Berlingeri *et al*. 47 (MY)	Stem, cortex, Leaves, fruits	x	x		x	x								4
Annonaceae																
Duguetia lucida Urb.	Yaya negra	Berlingeri *et al*. 131, 231 (MY)	Stem			x	x		x				x			4
Guatteria ovalifolia R.E.Fr.	Laurel negro	Berlingeri *et al*. 243, 294 (MY)	Stem				x									1
G. saffordiana Pittier	Guacharaco	Berlingeri *et al*. 292 (MY)	Stem				x		x							2
Rollinia exsucca A.DC.	Anón de montaña	Berlingeri *et al*. 146, 264 (MY)	Stem, fruits	x			x		x					x?	x	4
Xylopia aromatica Mart.	Manga larga, pimientillo	Berlingeri & Medina 110 (MY)	Stem, seeds	x			x		x							3

Annex 1. Continue.

Family Species	Common Name	Voucher and Herbarium	Plant part used	Food	Medicine	Timber	Construction	Fodder	Firewood	Ornamental	Toxic	Craft	Tool	Dye	Other Uses	Total Use
Apocynaceae																
Aspidosperma megalocarpon Müll.Arg.	Cambomboro	Berlingeri *et al.* 280 (MY)	Stem			x	x									2
Araceae																
Caladium bicolor (Aiton) Vent.	Corazón	Berlingeri & Medina 119 (MY)	Whole							x						1
Dieffenbachia sp.	Lengua e' vaca, hoja de lapa	*	Whole							x	x					2
Dracontium polyphyllum L.	Serpentaria	Berlingeri & Medina 295 (MY)	Stem		x											1
Xanthosoma sp.	Simu	*	Leaves, whole								x				x	2
Arecaceae																
Attalea butyracea (Mutis ex L.f.) Wess.Boer	Palma curuba, corozo	Berlingeri *et al.* 143 (MY)	Stem, leaves, fruits, seeds, whole	x	x		x	x								4
Bactris gasipaes Kunth var. *chichagui* (H.Karst.) A.J.Hend.	Macanilla	Berlingeri *et al.* 127 (MY)	Stem, fruits	x			x									2
Bactris major Jacq. var. *major*	Albarico	Berlingeri *et al.* 130 (MY)	Stem, fruits	x			x									2
Euterpe precatoria Mart. var. *precatoria*	Tuca	Berlingeri *et al.* 157 (MY)	Stem, whole	x						x						2
Geonoma simplicifrons Willd.	_	Berlingeri *et al.* 269 (MY)	Stem										x			1

Annex 1. Continue.

Family Species	Common Name	Voucher and Herbarium	Plant part used	Food	Medicine	Timber	Construction	Fodder	Firewood	Ornamental	Toxic	Craft	Tool	Dye	Other Uses	Total Use
Oenocarpus bataua Mart. var. *bataua*	Palma blanca	Berlingeri *et al.* 164 (MY)	Stem	x												1
O. mapora H. Karst.	Mapora	Berlingeri *et al.* 166 (MY)	Stem				x									1
Asteraceae																
Bidens sp.	Cadillo e' perro	Berligeri & Medina 323 (MY)	Leaves		x											1
Bignoniaceae																
Jacaranda sp.	Pata de caballo	*	Stem				x									1
Tabebuia sp.	Guayacán	Berlingeri *et al.* 233 (MY)	Stem			x	x									2
Bombacaceae																
Ceiba pentandra (L.) Gaertn.	Ceiba	*	Stem			x	x									2
Ochroma pyramidale (Cav. ex Lam.) Urb.	Lano, balso	Berlingeri *et al.* 199, 219 (MY)	Stem, fruits									x			x	2
Boraginaceae																
Cordia alliodora (Ruiz & Pav.) Oken	Pardillo blanco	*	Stem			x	x									2
Cordia sp.	Pardillo negro	*	Stem			x	x									2
C. toqueve Aubl.	Caujaro	Berlingeri *et al.* 121 (MY)	Stem, leaves, flowers, fruits	x	x			x	x				x		x	6
Bromeliacae																
Bromelia chrysantha Jacq.	Maya	Berlingeri *et al.* 203 (MY)	Fruits	x												1

Annex 1. Continue.

Family Species	Common Name	Voucher and Herbarium	Plant part used	Food	Medicine	Timber	Construction	Fodder	Firewood	Ornamental	Toxic	Craft	Tool	Dye	Other Uses	Total Use
Burseraceae																
Protium heptaphyllum L.Marchand	Tacamajaca	Berlingeri *et al.* 137 (MY)	Stem, latex		x	x	x									3
Caesalpiniaceae																
Bauhinia glabra Jacq.	Bejuco cadenete	Berlingeri *et al.* 274 (MY)	Stem		x											1
Brownea sp.	Guaramaco	Berlingeri *et al.* 48, 259 (MY)	Stem, flowers		x		x									2
Hymenaea courbaril L.	Algarrobo	*	Stem, cortex, fruits	x	x	x	x		x		x					6
Senna occidentalis (L.) Link	Brusca	Berlingeri & Medina 116 (MY)	Seeds	x	x											2
Campanulaceae																
Centropogon cornutus (L.) Druce	Gallito	Berlingeri *et al.* 210 (MY)	Stem, leaves					x								1
Caricaceae																
Vasconcellea microcarpa (Jacq.) A.DC.	Tapa culo	Berlingeri & Medina 113 (MY)	Fruits	x	x											2
Clusiaceae																
Garcinia madruno (Kunth) Hammel	Mordoño	Berlingeri *et al.* 152 (MY)	Fruits	x				x		x						3
Vismia baccifera Planch. & Triana	Punta de lanza	Berlingeri *et al.* 239 (MY)	Stem				x		x							2

Annex 1. Continue.

Family Species	Common Name	Voucher and Herbarium	Plant part used	Food	Medicine	Timber	Construction	Fodder	Firewood	Ornamental	Toxic	Craft	Tool	Dye	Other Uses	Total Use
Convolvulaceae																
Ipomoea sp.	Batata	Berlingeri & Medina 297 (MY)	Root	x												1
Costaceae																
Costus sp.	Caña India, caña guinea	Berlingeri & Medina 117 (MY)	Stem		x											1
Cyclanthaceae																
Asplundia vagans Harling	Bejuco carache	Berlingeri *et al.* 272 (MY)	Stem, whole				x			x		x				3
Carludovica palmata Ruiz & Pav.	Papito, palmiche	Berlingeri & Medina 112 (MY), Berlingeri *et al.* 141 (MY)	Leaves, whole				x			x		x	x			4
Cyclanthus bipartitus Poit.	Cola e' pato	Berlingeri *et al.* 160 (MY)	Leaves		x											1
Davalliaceae																
Nephrolepis multiflora (Roxb.) Jarrett ex C.V.Morton	Helecho cortina	Berlingeri *et al.* 162 (MY)	Whole							x						1
Dennstaedtiaceae																
Lindsaea lancea (L.) Bedd.	Helecho	Berlingeri *et al.* 186 (MY)	Whole							x						1
Pteridium arachnoideum (Kaulf.) Maxon	Helecho	Berlingeri *et al.* 184 (MY)	Whole							x						1

Annex 1. Continue.

Family Species	Common Name	Voucher and Herbarium	Plant part used	Food	Medicine	Timber	Construction	Fodder	Firewood	Ornamental	Toxic	Craft	Tool	Dye	Other Uses	Total Use
Dioscoreaceae																
Dioscorea sp. 1	Ñame clavo, mapuey bejuco	Berlingeri *et al.* 270 (MY)	Tubers	x												1
Dioscorea sp. 2	Ñame bejuco, ñame nidada	Berlingeri *et al.* 142, 271 (MY)	Tubers	x												1
Lastreopsis exculta (Mett.) Tindale subsp. *exculta*	Helecho	Berlingeri *et al.* 182 (MY)	Whole							x						1
Dryopteridaceae																
Megalastrum subincisum (Willd.) A.R.Sm. & R.C.Moran	Helecho	Berlingeri *et al.* 183 (MY)	Whole							x						1
Ericaeae																
Cavendishia sp.	Coral	Berlingeri *et al.* 174 (MY)	Fruits	x												1
Euphorbiaceae																
Hura crepitans L.	Jabillo	*	Stem, leaves			x	x				x					3
Phyllanthus sp.	Fruto escondido, huevito escondido	Berlingeri & Medina 308 (MY)	Whole		x											1
Fabaceae																
Erythrina sp.	Bucare	*	Stem				x									1
Flacourtiaceae																
Casearia sp. 1	Huesito blanco	Berlingeri *et al.* 125 (MY)	Stem				x									1

Annex 1. Continue.

Family Species	Common Name	Voucher and Herbarium	Plant part used	Food	Medicine	Timber	Construction	Fodder	Firewood	Ornamental	Toxic	Craft	Tool	Dye	Other Uses	Total Use
Casearia sp. 2	Chaparro	Berlingeri *et al.* 244, 266 (MY)	Stem, cortex				x								x	2
Homalium sp.	Huesito negro	Berlingeri *et al.* 193 (MY), Berlingeri & Medina 275 (MY)	Stem				x		x							2
Gleicheniaceae																
Dicranopteris flexuosa (Schrad.) Underw.	Helecho	Berlingeri *et al.* 185 (MY)	Whole							x						1
Heliconiaceae																
Heliconia bihai L.	Platanillo, ñaca	Berlingeri *et al.* 139 (MY)	Flowers							x						1
H. hirsuta L.f.	Platanillo	Berlingeri *et al.* 134 (MY)	Flowers							x						1
Heliconia sp. 1	Platanillo	Berlingeri *et al.* 206 (MY)	Flowers							x						1
Heliconia sp. 2	Platanillo	Berlingeri *et al.* 138 (MY)	Flowers							x						1
Hippocastanaceae																
Billia rosea (Planch. & Linden) C.Ulloa & P.Jørg.	Cobalombo	Berlingeri *et al.* 204 (MY)	Seeds		x											1
Lauraceae																
Nectandra sp.	Laurel blanco	Berlingeri *et al.* 149, 237 (MY)	Stem				x									1

Annex 1. Continue.

Family Species	Common Name	Voucher and Herbarium	Plant part used	Food	Medicine	Timber	Construction	Fodder	Firewood	Ornamental	Toxic	Craft	Tool	Dye	Other Uses	Total Use
Loganiaceae																
Strychnos panamensis Seem.	Papera de mono	Berlingeri *et al.* 197 (MY)	Fruits	x												1
Malvaceae																
Abutilon sp.	Argaria	Berlingeri *et al.* 147 (MY)	Seeds		x											1
Marantaceae																
Calathea inocephala (Kuntze) H.Kenn. & Nicolson	Bihao negro	Berlingeri *et al.* 154 (MY)	Leaves, whole				x			x					x	3
Calathea sp.	Bihao blanco	Berlingeri *et al.* 140 (MY)	Leaves												x	1
Stromanthe jacquinii (Roem. & Schult.) H.Kenn. & Nicolson	Platanillo	Berlingeri *et al.* 135 (MY)	Flowers							x						1
Melastomataceae																
Aciotis purpurascens (Aubl.) Triana	Jabonera	Berlingeri & Medina 109 (MY)	Whole												x	1
Bellucia pentamera Naudin	Manzanito	Berlingeri *et al.* 128, 172 (MY)	Stem, fruits	x			x	x								3
Meliaceae																
Cedrela fissilis Vell.	Cedro blanco	Berlingeri & Medina 316 (MY)	Stem			x	x					x				3
C. odorata L.	Cedro rojo	*	Stem, cortex		x	x	x					x				4
Guarea guidonia (L.) Sleumer	Trompillo	Berlingeri *et al.* 153, 191 (MY)	Stem			x	x		x							3

Annex 1. Continue.

Family Species	Common Name	Voucher and Herbarium	Plant part used	Food	Medicine	Timber	Construction	Fodder	Firewood	Ornamental	Toxic	Craft	Tool	Dye	Other Uses	Total Use
Trichilia sp.	Cedrillo	Berlingeri *et al.* 234 (MY)	Stem				x									1
Menispermaceae																
Cissampelos pareira L.	Bejuco fafa	Berlingeri *et al.* 178, 268 (MY)	Stem				x									1
Mimosaceae																
Inga sp. 1	Guamo rojo	Berlingeri & Medina 329 (MY)	Stem						x							1
Inga sp. 2	Guamo blanco	Berlingeri *et al.* 242 (MY)	Stem, fruits, seeds		x			x	x							3
Moraceae																
Brosimum alicastrum Sw.	Charo	Berlingeri *et al.* 261 (MY)	Stem, fruits	x		x	x									3
Ficus insipida Willd.	Higuerón	Berlingeri *et al.* 207 (MY)	Root, stem, fruits				x	x				x				3
F. obtusifolia Kunth	Matapalo	Berlingeri & Medina 296 (MY)	Stem				x									1
Myrtaceae																
Psidium sp.	Guayaba de monte	Berlingeri *et al.* 173 (MY)	Stem, fruits	x					x							2
Orchidaceae																
Epidendrum secundum Jacq.	Orquídea	Berlingeri *et al.* 159 (MY)	Whole							x						1

Annex 1. Continue.

Family Species	Common Name	Voucher and Herbarium	Plant part used	Food	Medicine	Timber	Construction	Fodder	Firewood	Ornamental	Toxic	Craft	Tool	Dye	Other Uses	Total Use
Passifloraceae																
Passiflora foetida L.	Parcha de monte	Berlingeri *et al.* 221 (MY)	Fruits	x												1
Passiflora sp. 1	Parcha de monte	Berlingeri *et al.* 220 (MY)	Fruits	x												1
Passiflora sp. 2	Parcha de monte	Berlingeri & Medina 276 (MY)	Fruits	x												1
Passiflora sp. 3	Parcha de monte	Berlingeri & Medina 277 (MY)	Fruits	x				x								2
Piperaceae																
Piper sp.	Rodilla de burro, cordoncillo	Berlingeri *et al.* 192, 263 (MY)	Stem						x							1
Poaceae																
Guadua sp.	Guadua	*	Stem				x					x				2
Gynerium sagittatum P.Beauv.	Caña brava	Berlingeri & Medina 278-B (MY)	Root, stem		x		x			x?		x			x	4
Polypodiaceae																
Serpocaulon sp.	Helecho	Berlingeri *et al.* 181 (MY)	Whole							x						1
Pteridaceae																
Pityrogramma calomelanos (L.) Link var. *calomelanos*	Helecho	Berlingeri *et al.* 212 (MY)	Whole							x						1

Annex 1. Continue.

Family Species	Common Name	Voucher and Herbarium	Plant part used	Food	Medicine	Timber	Construction	Fodder	Firewood	Ornamental	Toxic	Craft	Tool	Dye	Other Uses	Total Use
Pteris consanguinea Mett. ex Kuhn	Tirindi	Berlingeri *et al.* 175 (MY)	Stem, whole				x			x	x	x				4
Rhamnaceae																
Gouania lupuloides Urb.	Bejuco rema	Berlingeri *et al.* 190 (MY)	Stem, leaves		x											1
Rosaceae																
Rubus floribundus Kunth	Mora de monte	Berlingeri *et al.* 163 (MY)	Fruits	x												1
Rubiaceae																
Cinchona pubescens Vahl	Azajarito	Berlingeri *et al.* 171, 252 (MY)	Stem				x									1
Genipa americana L.	Jagüito	Berlingeri *et al.* 226 (MY)	Stem, fruits				x	x					x			3
Isertia haenkeana DC.	Coralito	Berlingeri *et al.* 195, 222 (MY)	Stem				x									1
Sabicea colombiana Wernham	Uvita	Berlingeri *et al.* 216 (MY)	Fruits	x												1
Warszewiczia coccinea Klotzsch	Barba de pava	Berlingeri *et al.* 194 (MY)	Flowers							x						1
Rutaceae																
Zanthoxylum sp.	Mapurite	Berlingeri *et al.* 198 (MY)	Stem				x				x?		x			2

Annex 1. Continue.

Family Species	Common Name	Voucher and Herbarium	Plant part used	Food	Medicine	Timber	Construction	Fodder	Firewood	Ornamental	Toxic	Craft	Tool	Dye	Other Uses	Total Use
Sapindaceae																
Cupania americana L.	Cabimbo blanco	Berlingeri *et al.* 148, 227 (MY)	Stem				x									1
C. scrobiculata Rich.	Cambimbo negro	Berlingeri *et al.* 132 (MY)	Stem				x		x						x	3
Schizaeaceae																
Lygodium venustum Sw.	Helecho	Berlingeri *et al.* 202 (MY)	Whole							x						1
Schizaea elegans (Vahl) Sw.	Helecho	Berlingeri *et al.* 180 (MY)	Whole							x						1
Simaroubaceae																
Quassia amara L.	Palo matias	Berlingeri *et al.* 144 (MY)	Cortex		x											1
Smilacaceae																
Smilax sp.	Zarzaparrilla	Berlingeri *et al.* 161 (MY)	Root		x											1
Solanaceae																
Solanum americanum Mill.	Yerba mora	Berlingeri *et al.* 265 (MY)	Fruits		x											1
S. hirtum Vahl	Coquino	Berlingeri *et al.* 209 (MY)	Fruits	x												1
Sterculiaceae																
Guazuma ulmifolia Lam. var. *ulmifolia*	Guasimo	Berlingeri *et al.* 151 (MY)	Stem, fruits		x		x		x							3

Annex 1. Continue.

Family Species	Common Name	Voucher and Herbarium	Plant part used	Food	Medicine	Timber	Construction	Fodder	Firewood	Ornamental	Toxic	Craft	Tool	Dye	Other Uses	Total Use
Herrania albiflora Goudot	Cacao de monte	Berlingeri *et al.* 189, 267 (MY)	Fruits	x												1
Theophrastaceae																
Clavija clavata Decne.	Sierra de iguana	Berlingeri *et al.* 201 (MY)	Stem										x			1
Tiliaceae																
Heliocarpus americanus L.	Majague	Berlingeri *et al.* 200 (MY)	Cortex		x											1
Vitaceae																
Cissus verticillata (L.) Nicolson & C.E.Jarvis	Bejuco uvito	Berlingeri *et al.* 177 (MY)	Stem		x											1
Vochysiaceae																
Vochysia sp.	Cáscara gorda	Berlingeri *et al.* 228 (MY)	Stem			x	x		x							3
Zingiberaceae																
Renealmia alpinia (Rottb.) Maas	Istu, chivo	Berlingeri *et al.* 167 (MY)	Leaves, fruits	x			x							x		3
R. thyrsoidea Poepp. & Endl.	Istu, chivo	Berlingeri *et al.* 122 (MY)	Leaves, fruits	x			x							x		3

* = species without a voucher were easily recognized in the field but were of difficult access, therefore not collected.