



Cultural Importance and Use of Medicinal Plants in the Shipibo-Conibo Native Community of Vencedor (Loreto) Peru

Pío Tudela-Talavera, María de los Ángeles La Torre-Cuadros, and Native Community of Vencedor

Research

Abstract

The main objectives of this research were to determine which medicinal plants are culturally most important for the native community of Vencedor as well as testing a new measure of the cultural importance of medicinal plants that can be used outside of this one particular case. Data were collected through participant observation, informal conversation, and semi-structured and structured interviews to 31 heads of family. According to the Cultural Significance for Conservation Index (CSCI) developed, significant species were *Petiveria alliacea* L., *Jatropha gossypifolia* L., *Mansoa alliacea* (Lam.) A.H.Gentry, *Hura crepitans* L., and *Banisteriopsis caapi* (Spruce ex Griseb.) C.V.Morton. Our index showed a significant correlation with the other indices considered in this paper. We conclude that CSCI is a good indicator of the cultural importance of medicinal plants and that it can be useful in cases where there is a need to recognize which culturally important plants are more vulnerable.

Introduction

Ethnobotany has developed dramatically in recent decades and has now become a widely recognized scientific discipline after the adoption of quantitative methods (Hoffman & Gallagher 2007, Phillips 1996). A first challenge in this quantitative trend is to produce values from less tangible qualitative data that are reliable and comparable measures (Hoffman & Gallagher 2007, Phillips 1996). A common application of quantitative methods in ethnobiology is to analyze the cultural importance of plant species. Hunn (1982) defined cultural significance of a plant as "importance of the role within a particular culture," in other words, the usefulness of a plant taken in its broadest context. Borrowing from the social sciences and ecology, considerable advances have been made through the

development and implementation of relative cultural importance indices that produce numeric scales or values for each plant species (Alexiades & Sheldon 1996, Friedman *et al.* 1986, Kvist *et al.* 1995, Lykke *et al.* 2004, Martin 2004, Phillips 1996, Phillips & Gentry 1993a, 1993b, Phillips *et al.* 1994, Prance *et al.* 1987, Reyes-García *et al.* 2006, Turner 1988). These indices have incorporated variables according to the amount of data obtained, acquiring various applications and a growing interest among researchers to the point of actually becoming key tools in ethnobotanical research (Hoffman & Gallagher 2007).

Numerous quantitative methods with a varying degree of subjectivity have been used in ethnobotanical research (da Silva *et al.* 2006). Phillips (1996) classified these techniques into three broad categories: consensus among informants, in which the importance of a species is directly calculated from the degree of consensus derived from the responses of the informants (Johns *et al.* 1990, Phillips & Gentry 1993a, 1993b, Trotter & Logan 1986); subjective allocation, in which the relative importance of each appli-

Correspondence

Pío Tudela-Talavera, María de los Ángeles La Torre-Cuadros, Facultad de Ciencias Forestales. Universidad Nacional Agraria La Molina. Av. La Universidad S/N La Molina Apdo. 456, Lima 1, PERÚ.
pio.tudela@hushmail.me

Pío Tudela-Talavera, María de los Ángeles La Torre-Cuadros, Foro Etnobiología Perú, PERÚ.
Native Community of Vencedor, Contamana, Department of Loreto, PERÚ.

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cation is evaluated according to the view of the researcher (Berlin *et al.* 1966, Stoffle *et al.* 1990, Turner 1988); and finally, uses totaled, in which the number of uses is simply the sum of the categories of use of the species (Balée 1987, Prance *et al.* 1987, Toledo *et al.* 1995).

Among the techniques that analyze the value or importance of a particular species—where subjective allocation prevails—there is the Cultural Importance Index or Cultural Significance Index (CSI), developed by Turner (1988) to observe the role of plants within a culture. This technique incorporates the number of uses of each plant, with different values according to the contribution of each use to survival in traditional cultures, as well as elements that are extremely important to assess whether a plant is important for a given population, such as the frequency of use, management, and actual use of the resource. The abstract use of plants, such as spells or religious objects, can be constituted as “uses” in a broader sense, as well as the mythical role of some plants (Turner 1988). Individual variation in the perception of the cultural importance of a plant must be considered, as there may be specialized groups of individuals within a culture for which a plant may be relevant and useful even if not used or known by the general population. This is the case of herbalists, shamans, hunters, and others who may have a particular and limited knowledge of certain plants. In some cases such plants may be more important than is evident taking the total population into account. Thus, even plants known only by a few members of a particular culture should be considered important. Turner’s CSI was later modified by da Silva *et al.* (2006), among others, who included the consensus among informants in order to reduce the subjectivity of this index.

Authors such as Friedman *et al.* (1986) and Bennet and Prance (2000) created cultural importance indices adapted to the particular case of medicinal plants in the past. Friedman *et al.* (1986) based their Rank Order Priority (ROP) index on the consensus among informants, while Bennet and Prance (2000) gave more importance to the number of properties for each species when creating their Relative Importance (RI) index.

Finally, researchers such as Zent (1999, 2001), Ross (2002), Zarger and Stepp (2004), Zent and Lopez-Zent (2004), and others are contributing to the development of quantitative methods for investigating the acquisition and transmission of ethnobotanical and ethno-ecological knowledge and the identification of factors (such as age, formal education, bilingual ability, residence time, the change in the practice of subsistence, etc.) that can affect the retention or loss of Traditional Ecological Knowledge (TEK). As more of these studies are available, there certainly will be an increasingly important source of data for the development of more refined indicators of the conditions and trends of cultural diversity to support a better un-

derstanding of the situation of biocultural diversity and the development of appropriate policies (Maffi 2005).

For the particular case of Vencedor—an isolated community deficient of any form of official healthcare, where we suppose they depend mainly on medicinal plants for their well-being and due to the lack of an index of cultural importance of medicinal plants that considers which of the culturally important species might require greater efforts of conservation—we felt the need of creating a new measure of cultural importance that also includes variables related with the possible vulnerability of these species.

The purpose of this paper was to determine the most important medicinal plants for the native community of Vencedor and their implications for conservation. The specific objectives were: (1) to identify existing medicinal plants in the community setting, (2) to characterize the use of the different species mentioned as important by the participants, and (3) to test a new measure of the cultural importance of medicinal plants that can be used outside of this particular case and that considers which of these species might require greater efforts of conservation according to local perception.

Methods

The research was conducted in the Shipibo-Conibo native community of Vencedor (7°47'35.26"S, 75°19'01.00"W) located a day and a half away from the city of Pucallpa by boat, on the banks of Pisqui River, a tributary of the lower part of the Ucayali River. Politically it is located in the district of Contamana, province of Ucayali, department of Loreto in Peru (Figure 1).

This community consists of 31 families, among which there are members of different ethnic groups belonging to the Pano family, who arrived from different communities located in the lower part of the Ucayali River. The Shipibo-Conibo have been fairly well-studied in the past (Behrens 1989, Follér 1995, Hern 1992, Martin 1982, Tournon & Reategui 1983, Tschopik 1958). They inhabited the Ucayali region long before the city of Pucallpa was built, and the vast majority possess bilingual skills (Tournon 2002). Vencedor is an example of a community lacking medical services such as a health post. The main economic activity is logging of **bolaina blanco** (*Guazuma crinita* Mart.) and **capirona** (*Calycophyllum spruceanum* (Benth.) Hook.f. ex K.Schum.), both species located in the secondary forest surrounding the community, producing boards for sale in the city of Pucallpa.

According to the life zones classification system of Holdridge (1967), the study area corresponds to tropical rainforest. The distribution of rainfall in the area is biseasonal, one dry season and another wet. The total annual rainfall reaches 1600 mm³. The annual average temperature is

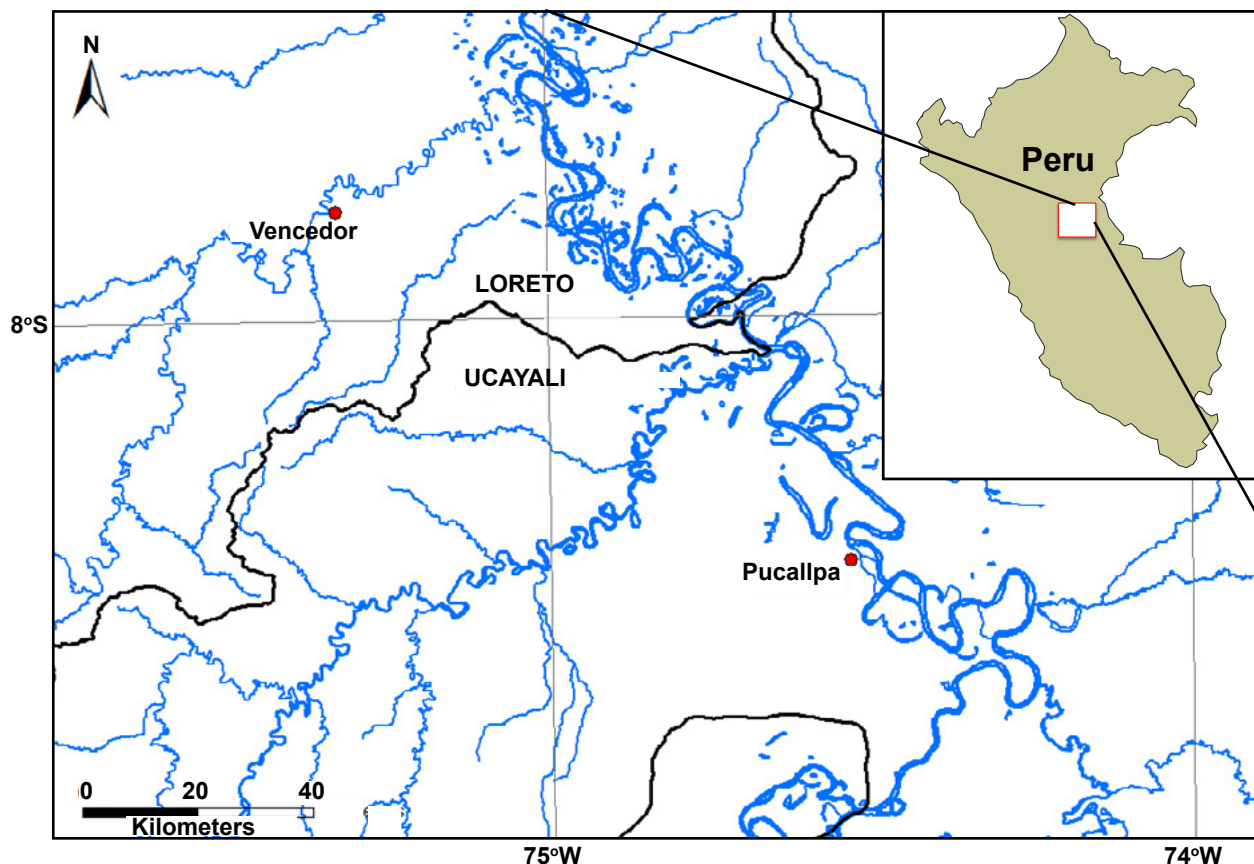


Figure 1. The Shipibo-Conibo native community of Vencedor (7°47'35.26" S, 75°19'01.00" W), Loreto, Peru, located a day and a half away from the city of Pucallpa by boat.

25.7°C. The altitude in the community ranges around 140 m above sea level.

Data collection and analysis

The research project was presented to the community of Vencedor at a community meeting, where informed consent was obtained from each interviewee and a form of compensation to members of the participating community was agreed. To access the emic point of view and understand processes that can't be addressed quantitatively, the qualitative approach of participant observation was applied. Once bonds of trust were established, unstructured interviews with open questions to introduce the topic of interest and semistructured interviews (free-listings) were made, accompanied by a Shipibo-Conibo assistant who helped translate the few answers given in Shipibo language, as interviews were conducted mainly in Spanish and all disease names were given by the participants in this language.

The sample unit was the head of household, male or female, present in the community and willing to participate in the research. This sample represented approximately

50% of the total population of heads of family in the community. From each interviewee sociological variables such as age, sex, origin, ethnicity, length of stay, and role in the community were recorded. Free-listings were made on the most important medicinal plants for each participating member of the community and the most common diseases within each family. In addition structured interviews were conducted, collecting detailed information on the plants cited in the free-listings, and ethnobotanical walks were carried out in the company of specialists to confirm the data gathered in interviews regarding the availability of most culturally important medicinal plants according to local perception. Taking as a control the information provided by the specialists of the community, 40 photos of various medicinal plants commonly used and present in home gardens or areas of the community that are frequented daily by its inhabitants were shown to the participants, who were asked to identify these species with local names in order to measure the consistency of local recognition of medicinal plants (Sheil *et al.* 2004). There were five participant specialists in the community, and all defined themselves as shamans or **unayas** in Shipibo language, meaning they all diagnosed patients making use of the **ayahuasca** brew in traditional medicine cer-

emonies. The **unaya** is in charge of healing all kinds of diseases, especially those caused by witchcraft or spirits (Cárdenas 1989). In the context of Shipibo-Conibo traditional medicine we also find other specialists such as the **raomi** or herbalist who stand out for his/her knowledge of the uses and preparation of medicinal plants, the **tobi una** or bonesetter, whose function is to massage patients in order to heal muscular or bone conditions, and the **baquibiai** or midwife (Cárdenas 1989). Further information was collected by recall on the percentage of every ten times the participants get sick whether they use plants or pharmaceutical medicines. A Shipibo-Conibo **unaya** from San Francisco of Yarinacocha native community as well as another mestizo shaman and psychotherapist who received his training in traditional Amazonian medicine from a Shipibo-Conibo **unaya** and a Quechua Lamisto or Llak-wash shaman were interviewed in order to contrast the information collected in Vencedor and better understand the worldview and cultural context of Shipibo-Conibo traditional medicine. Each of the mentioned species was collected and determined in collaboration with the Herbarium IVITA-UNMSM and the Forestry Herbarium MOL-UNALM. The spelling of scientific names and abbreviations of the authors of the collected species as well as their habit and origin were verified with a catalogue of the Angiosperms and Gymnosperms of Peru (Brako & Zarucchi 1993) and the website of Missouri Botanical Garden (www.tropicos.org).

For the interpretation of the results obtained in free-listings and detailed questionnaires, a quantitative ethnobotanical index designated Cultural Significance and Conservation Index (CSCI) was developed. To construct our index the Cultural Significance Index (CSI)—proposed by Turner (1988) and later modified by Stoffle *et al.* (1990), Lajones and Lemas (2001), and da Silva *et al.* (2006)—was taken as reference. Some modifications were included, such as the introduction of new variables constructed from the consensus among informants and others adapted to this research, which add an approach related to the priority for conservation of these important species:

$CSCI = SI [\sum (m*pr*f) + \sum (QMU+pp+d)]$, where:

- SI = Smith's index. The most important plants were detected according to the consensus among informants, combining the frequency and order or average range of mention of the different plants (Martin 1995).
- m = resource management, i.e., if the species is grown or managed in any way: m = [2; 1].
- pr = preference of use. This variable represents the preference given to the use of a species compared to others for a particular purpose: pr = [2; 1].
- f = frequency of use. Plants used regularly are more important than those that are occasionally used: f = [2; 1].

- QMU = quality of medicinal use. This variable was obtained from the consensus among informants regarding the most common diseases registered through free-listings and was calculated making use of Smith's index adapted to most frequent diseases, taking higher values for those uses that treat more recurrent conditions according to the view of the respondent: QMU = [3–0.5].
- pp = part of the plant used. Considering the impact that the harvest may have on the resource, higher values were assigned to uses requiring parts of the plant whose harvest means a greater impact on the resource (e.g., roots): pp = [3–0.5].
- d = availability of the resource. It was given more importance to species less available, considering that they require greater conservation efforts. The perception of the respondents on the availability of the resource contributed to the creation of this variable: d = [1–5].

We created emic and etic versions of the variable “quality of medicinal use” as we found that many of the common conditions mentioned by the participants seemed to be symptoms rather than diseases. Grouping into body systems or western medicinal use categories the conditions most frequently cited in free-listings, we created the etic version of this variable. Accordingly, most common medicinal use categories were gastrointestinal tract, antipyretics, witchcraft or metaphysical conditions, painkillers, and respiratory tract, respectively, followed by the rest that all acquired the lowest value (0.5).

An assumption of normality was not satisfied in most of the variables, and therefore we chose to conduct non-parametric statistical tests such as Wilcoxon, Mann-Whitney, Kruskal-Wallis, and Spearman tests, according to the needs of the investigation. Spearman's correlation test was used to determine the relationship between our Cultural Significance and Conservation Index (CSCI), the variables that shape it, and different cultural importance indices created in the past by different authors. For this purpose we considered the CSI as well as both the ROP and the RI, which were specifically created in the past for the category of use of medicinal plants. The variables involved in each of these indices are shown in Table 1.

Results

Cultural significance of medicinal plants in the native community of Vencedor

The (CSCI) identified five species as the most important medicinal plants: *Petiveria alliacea* L., *Jatropha gossypifolia* L., *Mansoa alliacea* (Lam.) A.H.Gentry, *Hura crepitans* L., and *Banisteriopsis caapi* (Spruce ex Griseb.) C.V.Morton (Table 2).

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Table 1. Formulas and variables involved in each of the cultural importance indices considered.

Indices	Formula(s)	Variables
Rank Order Priority (ROP) Friedman <i>et al.</i> (1986)	ROP = FL*RP	FL = fidelity level
		RP (Relative Popularity) = number of citations of a species divided by the number of citations of most mentioned species
	FL = Ip/Iu*100%	Ip = number of informants that mention the principal use of a species
		Iu = number of informants that mention a species for any purpose
Relative Importance (RI) Bennet & Prance (2000)	RI = NSC + NP	NSC = number of corporal systems
		NP = number of properties
	NSC = NSCE / NSCEV	NSCE = number of corporal systems treated by a given species
		NSCEV = number of corporal systems treated by most versatile species
	NP = NPE / NPEV	NPE = number of properties attributed to a given species
		NPEV = number of properties attributed to most versatile species
Cultural Significance Index (CSI) da Silva <i>et al.</i> (2006)	CSI = S (i*e*c)*CF	i = species management (1 = not managed; 2 = managed)
		e = preference of use (1 = non-preferential; 2 = preferential)
		c = frequency of use (1 = rarely used; 2 = frequently used)
		CF (Correction Factor) = number of citations of a species divided by the number of citations of most mentioned species

Table 2. Culturally important medicinal species with a value greater than 10 according to the emic version of the Cultural Significance and Conservation Index (CSCI) (\bar{x} =14.56, σ =18.86, p =0.006). In parentheses is detailed the code of each informant that mentioned the species as important. *Uses not reported in consulted literature. Life forms: herb (H), shrub (S), vine (V), and tree (T). Origins: native (N) or introduced (I).

Names						
Scientific	Shipibo (Spanish)			Collection code		
Uses	Life form	Origin	CSCI			
Asteraceae						
<i>Tagetes erecta</i> L.	inin joa panshin (rosa sisa)					
Treat diarrhea, vomiting, gases, "bad air," fever, bronchitis (1B, 3B, 5B, 7B, 8A, 14B, 15A, 15B, 16B)	H	I	25.12	P044		
Bignoniaceae						
<i>Mansoa alliacea</i> (Lam.) A.H.Gentry	non ajo (ajo sacha)					
Treat fever, flu, cough, diarrhea, body aches, colic, rheumatism, isula bite*, saladera (bad luck)*; purgative; protection against witchcraft*; stimulating against laziness; for better hunting*; master plant* (1A, 7A, 10A, 11A, 13B, 19A)	V	N	61.40	P067		
Celastraceae						
<i>Maytenus macrocarpa</i> (Ruiz & Pav.) Briq.	chuchuwashi (chuchuhuasi)					
Treat anemia, body aches, rheumatism, diarrhea; revitalizing; antibiotic (4A, 10A)	T	N	23.22	-		
Euphorbiaceae						
<i>Hura crepitans</i> L.	(catahua)					
Antibiotic*; treat AIDS*, toothache, body aches; poison for hunting and fishing; protection against witchcraft*; for cultivating the farm better; antidote against snake bite; master plant* (3A, 4A, 14A, 20A)	T	N	55.17	P030		

Names					
Scientific	Shipibo (Spanish)			Collection code	
Uses	Life form	Origin	CSCI		
<i>Jatropha curcas</i> L.	isin tapon (piñón blanco)				
Treat fever, postpartum pain; heal wounds (6A, 3B)	S	I	10.23	-	
<i>Jatropha gossypifolia</i> L.	joshin isin tapon (piñón colorado)				
Treat fever, cough, diarrhea, body aches, stomachache, postpartum pain, rheumatism; heal wounds; protection against witchcraft; master plant* (1B, 2A, 2B, 3B, 4B, 5B, 6A, 6B, 7B, 10B, 11A, 12B, 13B, 14B, 15A, 15B, 16B, 16A, 17A, 19A, 20A)	S	N	77.48	P002	
Fabaceae					
<i>Inga edulis</i> Mart.	xenan (shimbillo)				
Treat diarrhea in babies, sore throat; to be a warrior (revitalizing); master plant (14B, 3A, 20A)	T	N	12.49	P089	
Indeterminant					
Indet. 33	ni toe (toé de monte)				
Diagnosis; against witchcraft; treat body aches; master plant (14A, 14B)	T	N	12.92	P081	
Lamiaceae					
<i>Mentha piperita</i> L.	(menta)				
Treat fever, vomiting, stomachache, sore bronchi (5B, 7A, 7B)	H	I	15.64	-	
Malpighiaceae					
<i>Banisteriopsis caapi</i> (Spruce ex Griseb.) C.V.Morton	oni (ayahuasca)				
Diagnosis; treat energy blockages, pains, fever, "mal aire" (inflicted by spirits); against witchcraft; master plant; for treating addictions* (1A, 11A, 14A, 14B)	V	N	38.51	P021	
Malvaceae					
<i>Gossypium barbadense</i> L.	waxmen (algodón)				
Cleansing of the uterus; treat rashes, colic, diarrhea (2B, 7B, 15A)	S	N	17.16	P012	
<i>Malachra alceifolia</i> Jacq.	maraba (malva)				
Treat fever, cough, headache, rheumatism, conjunctivitis; to force child-birth (2B, 3B, 5B, 9B, 10A, 10B, 12B, 16B, 16A, 17B, 19A)	H	N	21.15	P181	
Myrtaceae					
<i>Psidium guajava</i> L.	binpish (guayaba)				
Treat diarrhea, postpartum pain (2A, 2B, 6A, 9B, 10A, 13B, 14B, 15B, 16B, 16A, 17B, 19A, 20A, 20A, 18B)	T	N	16.27	P024	
Phytolaccaceae					
<i>Gallesia integrifolia</i> (Spreng.) Harms	(ajosquiro)				
Treat flu, saladera (bad luck); stimulant against laziness; for better hunting; master plant (14A, 19A)	T	N	10.37	P066	
<i>Petiveria alliacea</i> L.	boens (mucura)				
Treat fever, flu, cough, diarrhea*, headache, colic, rheumatism, isula bite*, saladera (bad luck)*; purgative; protection from witchcraft; stimulant against laziness; for better hunting*; master plant* (2A, 3A, 4B, 8A, 10A, 10B, 19A, 20A)	H	N	79.33	P016	

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Names						
Scientific	Shipibo (Spanish)				Collection code	
Uses	Life form	Origin	CSCI			
Plantaginaceae						
<i>Plantago major</i> L.	(llantén)					
Treat flu, fever, cough, rheumatism, bronchitis (8A, 10A, 14B, 16A)	H	I	25.58	P179		
Rubiaceae						
<i>Psychotria viridis</i> Ruiz & Pav.	kawa (chacuruna)					
Diagnosis; treat witchcraft; master plant (11A, 14A, 14B)	S	N	15.42	P032		
Rutaceae						
<i>Citrus aurantiifolia</i> (Christm.) Swingle	rimon (limón)					
Treat diarrhea, vomiting, fever, postpartum pain, rheumatism of timber workers (3B, 4B, 6A, 8A)	T	I	20.34	P134		
<i>Citrus sinensis</i> (L.) Osbeck	(naranja)					
Treat fever, vomiting, bronchitis, postpartum pain, rheumatism of timber workers (5B, 6A, 8A)	T	I	12.10	P011		
Solanaceae						
<i>Brugmansia suaveolens</i> (Humb. & Bonpl. ex Willd.) Sweet	toé					
Diagnosis; treat witchcraft, body aches; master plant (1A, 14A, 14B)	T	N	14.75	P184		
Verbenaceae						
<i>Lippia alba</i> (Mill.) N.E.Br.	banaa, bana tipo (oregano)					
Treat diarrhea, vomiting, gases, "bad air" (3A, 5B, 7B, 9B, 11A, 16A, 18B)	H	N	29.29	P178		
<i>Verbena litoralis</i> Kunth	(verbena)					
Treat fever, cough, diarrhea, vomiting, stomachache; to calm babies that cry too much (2A, 8A, 9B, 10B, 16A)	H	N	29.92	P180		
Zingiberaceae						
<i>Zingiber officinale</i> Roscoe	bona (jengibre)					
Treat diarrhea, vomiting, postpartum pain, stomachache, rheumatism (4B, 6A, 7A, 12B, 1a4B, 18B)	H	I	31.98	P182		

Both emic and etic versions of this index acquired very similar values for each species aforementioned by respondents in free-listings (Figure 2). Even though statistical analysis didn't show any differences in the distribution of the results obtained according to the indices considered ($p = 0.475$), when representing the results obtained for each index we could see a few species that stood out as most important (Figure 2). According to the Cultural Significance Index (da Silva et al. 2006), the most culturally important species were *J. gossypifolia* (CSI = 80.00), *P. alliacea* (CSI = 26.67), and *H. crepitans* (CSI = 15.24), while according to the Rank Order Priority index (Friedman et al. 1986) results showed *J. gossypifolia* (ROP = 76.19), *Inga edulis* Mart. (ROP = 66.67), *Malachra alceifolia* Jacq. (ROP=57.14), *Tagetes erecta* L. (ROP = 42.86), *P. alliacea* (ROP = 33.33), *Lippia alba* (Mill.) N.E.Br. ex

Britton & P.Wilson (ROP = 33.33), and *Zingiber officinale* Roscoe (ROP = 28.57). The Relative Importance index (Bennet & Prance 2000) identified *P. alliacea* (RI = 2.00), *M. alliacea* (RI = 1.92), *J. gossypifolia* (RI = 1.85), and *H. crepitans* (RI = 1.52) as the most culturally important species in the community.

Number of species, life forms and their relationship to CSCI values

Informants mentioned 59 species as important, 30 of which were trees, 18 herbs, seven shrubs, three vines, and one palm tree. However, when adding the values of the CSCI obtained for the species listed as important and grouping them in each life form, herbs were the life form most culturally important within the category of medicinal

plants inside the community. If we consider only native species we notice that trees are the most important life form according to our index. Among introduced species we found seven herbs, seven trees, two shrubs, and one palm (Figure 3).

Influence of gender, age, and community role in traditional knowledge of medicinal plants

The number of recognized medicinal plants and the number of plants mentioned as important by each respondent, as well as the percentage of times the participants make

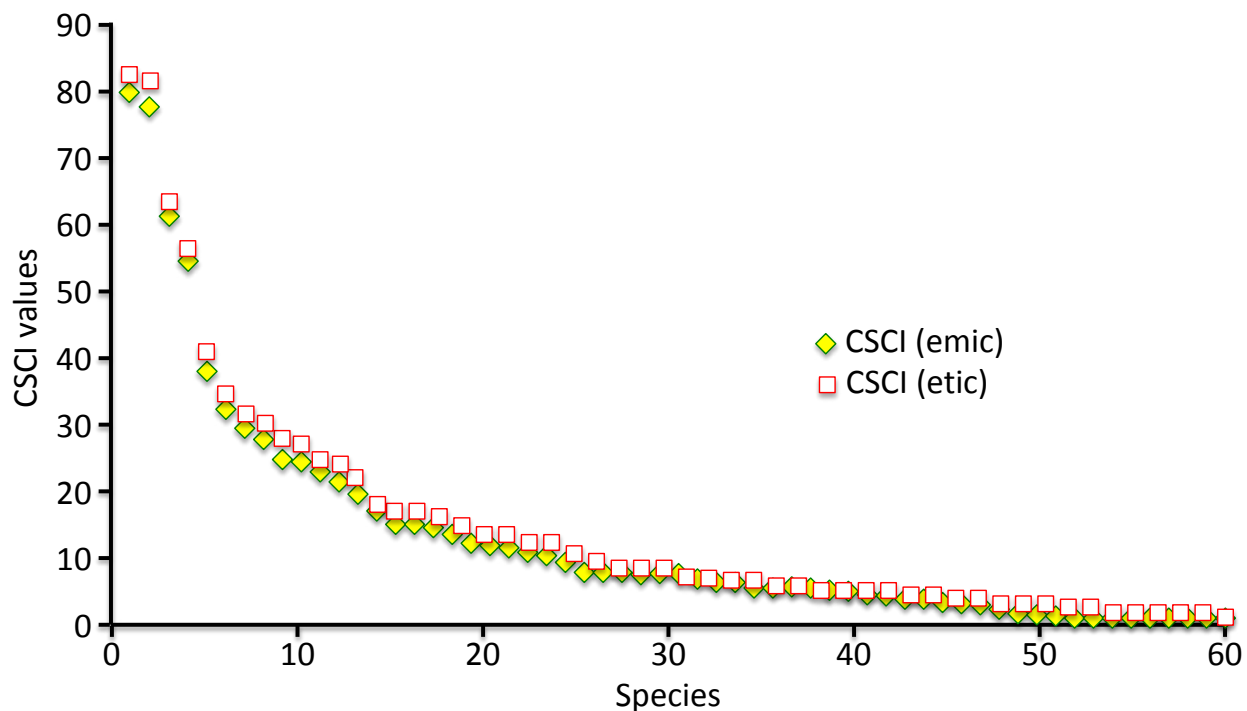


Figure 2. Cultural Significance and Conservation Index (CSCI) for emic and etic responses in the Shipibo-Conibo native community of Vencedor, Loreto, Peru.

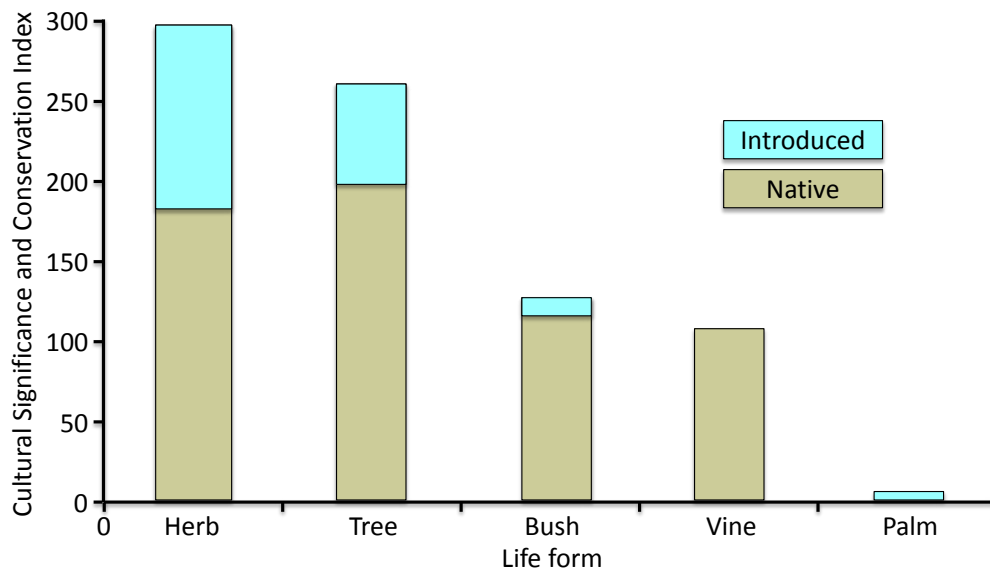


Figure 3. Total values of the Cultural Significance and Conservation Index grouped by life form and origin of the species from the Shipibo-Conibo native community of Vencedor, Loreto, Peru.

use of plants when they get sick, were considered as variables on the local knowledge regarding medicinal plants. The results of the Spearman rank correlation test showed there is a significant positive correlation ($R^2 = 0.1889$, $r_s = 0.437$, $p = 0.05$) between the variables age and percentage of times that the respondent uses plants when sick (Figure 4).

The Kruskal-Wallis test to see how the variables related to the knowledge of medicinal plants were distributed along the category of role in the community (**unaya**, housewife, storekeeper, farmer/lumberman, and school teacher) led us to reject the null hypothesis stating that the distribution of the number of plants cited as important by each respondent is the same between the categories of role in the community ($p = 0.010$; $p = 0.05$). Even if there weren't significant differences, when representing the number of recognized plants versus the variable role in the community we noted the tendency of shamans to recognize more medicinal plants than others in the community (Figure 5). The result of the Mann-Whitney U test (to see how the variables related to the knowledge of medicinal plants along the category of respondent gender are distributed) showed that the distribution of the results for these variables was the same throughout this category ($p = 0.093$; $p = 0.05$).

Relationship between the cultural importance of medicinal plants and the frequency of use, preference of use, management, availability and quality of medicinal use

The Spearman rank correlation test considering as variables Smith's index (SI) and the different indices of cultural significance (CSCI, CSI, ROP, RI) showed a significant positive correlation ($r_{sCSCI} = 0.899$; $r_{sCSI} = 0.819$, $r_{sROP} = 0.903$, $r_{sRI} = 0.417$, $p = 0.01$, $n = 59$). This test was also significant between the variables preference of use (pr) ($r_s = 0.31$, $p = 0.01$), frequency of use (f) ($r_s = 0.425$, $p = 0.01$), and quality of medicinal use (QMU) ($r_s = 0.591$, $p = 0.01$), as well as between all the different indices of cultural importance considered, including the CSCI proposed in this research paper. The variable related to the local perception of the resource's availability (d) only demonstrated a significant negative correlation with the variable of resource management (m) ($r_s = -0.370$), while this variable demonstrated a significant positive correlation ($r_s = 0.312$, $p = 0.05$) with Smith's index (SI) and Rank Order Priority index (ROP) of Friedman *et al.* (1986) ($r_s = 0.328$, $p = 0.05$).

Local knowledge of medicinal plants and its application

In addition to the results obtained by analyzing the relationship between the knowledge of medicinal plants and variables such as age and role in the community, the **unayas** of the Shipibo-Conibo community of Vencedor re-

ported on the existence of a progressive loss of traditional knowledge in open interviews during the first visit to the community in 2009. They reported how they themselves did not know as much as their **murayas** grandparents—shamans of the highest level—who knew much better the uses of plant species from their environment as well as being much more powerful and capable of unthinkable things such as becoming invisible at will. This matches the information provided by Don Herminio Vasquez Mejía, a Shipibo-Conibo **unaya** from the native community of San Francisco of Yarinacocha, who commented that his father and grandfather were **murayas**. Don Herminio explained how nowadays there are no more **murayas**, and the great majority of the initiates reach only the degree of **unayas**—or common shamans in the Shipibo-Conibo culture's context. Don Herminio explained that the knowledge of traditional medicine is being lost with the introduction of western culture in the communities, as generations of young people perceive as more attractive the western lifestyle images they see on television, thus losing interest in the traditional knowledge and Shipibo-Conibo worldview (pers. comm. 2010).

Discussion

Cultural significance of medicinal plants

The five most culturally important species for the native community of Vencedor are important species not only for ethnic groups in the Peruvian Amazon but also for various South American and Central American cultures, among others (Forzza *et al.* 2010, IIAP 2010, Lemus-Rodriguez *et al.* 2004, Liogier 1978, Luna 1986, Seth & Sarin 2010). These species have accumulated a lot of traditional knowledge that has been transmitted through direct experience over time both in regions where they grow originally, as well as where they have been introduced (Alegre & Clavo 2007, Francis 1990, Luna 1986, Seth & Sarin 2010). These species were considered "plant teachers" for each of the interviewed shamans. The concept of plants as "teachers" or "doctors" was initially introduced by Luna (1984) when interviewing four mestizo shamans from the city of Iquitos in the Peruvian Amazon. Jauregui *et al.* (2011) referred to these plants as **plantas con madre** in a more intercultural context in the East-Central Peruvian Amazon that included several interviews to Shipibo-Conibo **unayas**. Plants considered as "teachers" are very important in the cultural context of Shipibo-Conibo traditional medicine, as they are indispensable for the initiate in the process of becoming **unaya**. These plants contain uses that go beyond the Western medicinal use categories, such as protection against witchcraft and evil spirits and healing wounds of the soul, among others. A deeper review of these plants, the cultural context of their use, and the relationship between the cultural models of disease and the pharmacopeia is being addressed in a separate paper.

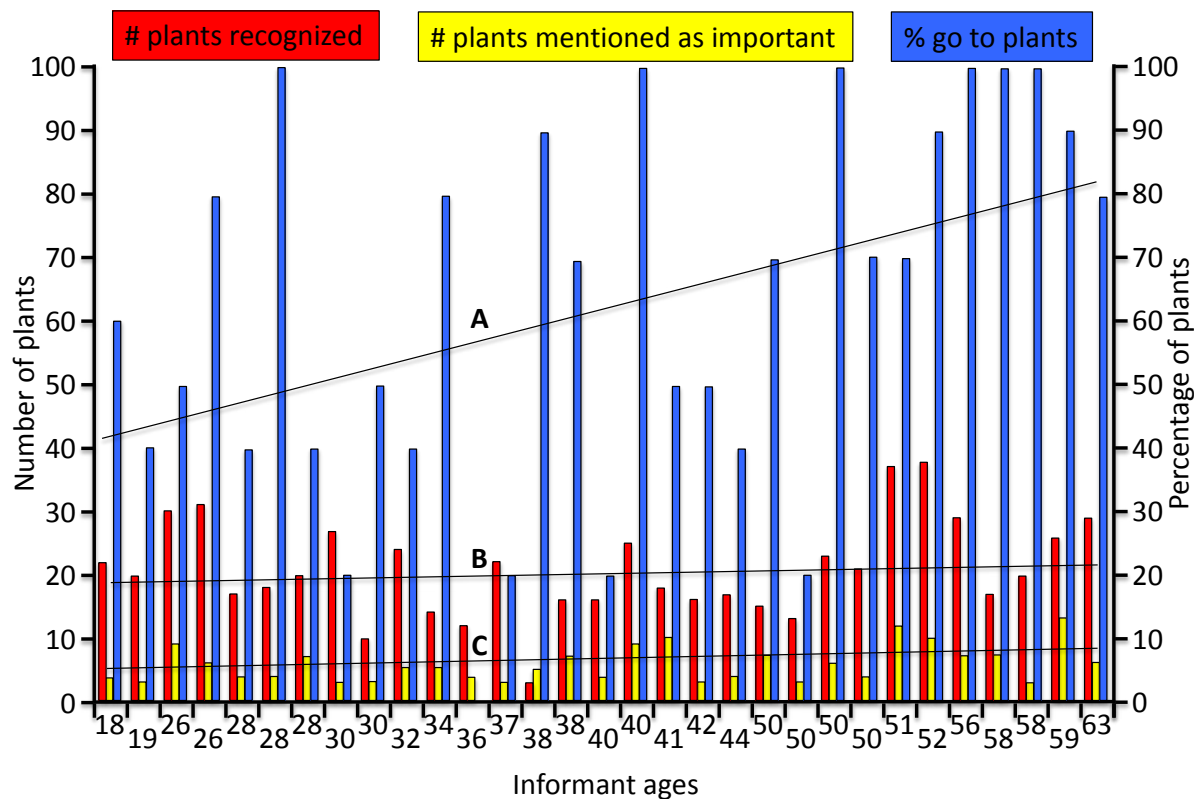


Figure 4. Variables (number of plants recognized, number of plants mentioned as important, and percentage of times the informant goes to [go to] plants when sick) related to local knowledge on medicinal plants versus informant age in the Shipibo-Conibo native community of Vencedor, Loreto, Peru. Trend lines: (A) go to plants, $R^2 = 0.1889$ (significant), (B) plants recognized, $R^2 = 0.0364$ (not significant), and (C) plants mentioned as important, $R^2 = 0.1367$ (not significant).

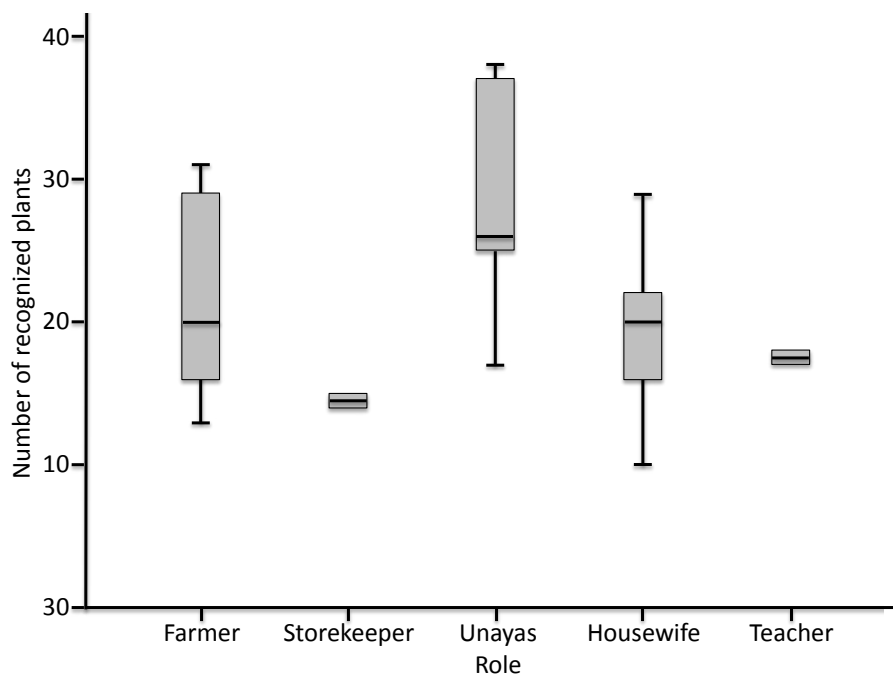


Figure 5. Number of recognized medicinal plants versus the variable role in the Shipibo-Conibo native community of Vencedor, Loreto, Peru.

Cultural Significance and Conservation Index (CSCI)

The CSCI was created specifically for this type of research, where it was considered as giving importance to the priority of conservation of each species as well as incorporating variables for this purpose. Variables of resource availability and plant part used for each of the uses that could have the species concerned were incorporated to the index. These variables took higher values both when the availability of the resource decreased and when the parts of the plant used had a greater impact the resource, thus species more vulnerable to harvest or less available according to local perception obtained higher values than equally important but less vulnerable species. Smith's index, used to represent the consensus among informants, considered not only the frequency but also the order of mention of medicinal species cited by each interviewee. The variable quality of medicinal use (QMU), based on the consensus among informants regarding the most common diseases in the community, indirectly contributed information on important species in the community, if we assume that species that treat more common conditions should be more important. This variable not only provides indirectly useful information about the relevance of each medicinal species from the point of view of the participant, but also highlights species that might suffer greater pressure derived from an increased incidence in the community of the condition they treat. The variables resource management, frequency of use, and preference of use, despite being part of a more subjective perspective from the point of view of the interviewer, also provide information about the cultural importance of a species.

When looking at the different species identified by each of the indices considered in this paper, we find that no other index but the CSCI highlights both of the species that showed to be most vulnerable due to the pressure derived from their use and their availability according to local perception. These species were *B. caapi* and *M. alliacea*. When carrying out ethnobotanical walks to confirm the information collected in the interviews, we observed that *B. caapi* wasn't found anywhere in the wild; the individuals cultivated were very few, and they were poorly preserved. *M. alliacea* wasn't cultivated and was very hard to find in the wild; it took one hour and a half to find a few individuals, and those just seedlings next to a road destined to the extraction of timber. Roots and stem were the main parts used for *M. alliacea* and *B. caapi*, respectively, implying a greater harvest impact for these species.

The CSI and ROP indices left out both *B. caapi* and *M. alliacea* in the analysis of most culturally important medicinal species in the community, while the RI index left out *B. caapi*, which in addition is the only indispensable species in the preparation of the **ayahuasca** brew, used by the **unayas** for the diagnosis of diseases and harm inflicted by evil spirits. The rest of the species highlighted by the

indices considered were cultivated and abundant in the home gardens of the community.

The local perception of resources corresponded with what we observed in ethnobotanical walks, and results were very helpful in order to save time when confirming the information collected in interviews. This result agrees with La Torre-Cuadros and Ross (2003) and Brown *et al.* (2004), who also suggest that incorporating local perception can complement, strengthen, and facilitate biological assessments and conservation planning processes.

The most important life forms of medicinal plants for the community of Vencedor proved to be herbs, followed by trees. Although participants most frequently cited tree species as important, the results obtained when adding all the values of the CSCI for each life form were higher for herbs. This result could have been due to the greater availability of organic herbs which most often abound in anthropogenic areas (Rhoades & Cates 1976). The fact that herbs are easily available may have favored experimentation with them, thus increasing their cultural significance, although according to other research that primarily considered the category of medicinal plants, the fact that plants with a short life cycle predominate in the repertoire of many societies seems to indicate that these people are mostly attracted to plants containing strongly bioactive compounds (Stepp 2004, Stepp & Moerman 2001).

Some of the culturally important medicinal plants were introduced species, which indicates there has been a trans-culturation process with mestizos and people from other areas of Peru where the Shipibo-Conibo have travelled or migrated in the past, learned about these species, introduced them into the community, and adopted them as culturally important for themselves over time. This is more obvious in the case of introduced herbs, since many of them were among the most important medicinal species according to the ROP index of Friedman *et al.* (1986). If only native species were considered, trees became the most important life form according to the CSCI. Introduced medicinal trees and palms are mainly species that might have been initially introduced to the community due to their edible properties.

Cultural importance of plants and variables of the CSCI

The variables preference of use, frequency of use, and quality of medicinal use proved to represent the cultural importance of medicinal plants in the community by being positively correlated to each and every one of the cultural significance indices considered in this research. The variable resource availability was related to the variable resource management, as when a species is managed, grown in home gardens or nearby farms to the community, it becomes more available. The fact that the resource availability according to local perception is not related to

any of the cultural importance indices would be in disagreement with the hypothesis of “apparency,” initially proposed by Feeny (1970), who broadly defined it as the likelihood of a plant being found by herbivores. Other authors such as Phillips and Gentry (1993a, 1993b) and Albuquerque and Lucena (2005) among others applied this concept to humans; finding that the more available a species is to users of a community it becomes more important. The results obtained according to local perceptions in this research are consistent with other authors who examined the hypothesis of “apparency” locally and concluded that not all species are used according to their availability (La Torre-Cuadros & Islebe 2003) and that the visibility of a plant does not completely explain its relative importance (Cunha & Albuquerque 2006). Other studies suggest a weak or lack of relationship between visibility and use; in fact one of the most important plants tended to be the most vulnerable or rare locally (Albuquerque *et al.* 2005).

The variable resource management is related to Smith's index and Rank Order Priority index (Friedman *et al.* 1986). This could be explained by the fact that these variables are based on consensus among informants, and it would be logical to think that those species that community residents consider most important are usually grown.

When comparing the values of the Cultural Significance and Conservation Index with the values obtained by calculating the indices of da Silva *et al.* (2006; Cultural Significance Index or CSI), Friedman *et al.* (1986; Rank Order Priority or ROP), and Bennett and Prance (2000; Relative Importance or RI), we saw there was a significant positive correlation between our index and the others, which supports the validity of our index as representative of the cultural importance of medicinal plants in the native community of Vencedor. This is because although these indices were created in other contexts and for different purposes, they are able to determine the cultural significance of the species mentioned by respondents, considering as determining factors either the consensus among participants, the total number of uses of each species, or both.

Traditional knowledge of medicinal plants in the native community of Vencedor

When visualizing how each variable related to local knowledge of medicinal plants is distributed according to age of respondents, we can observe an increasing trend of each variable along with the age, although this tendency is very subtle in the case of the number of recognized plants and those mentioned as important. The increase with age of the percentage of times the participant uses plants when sick could be due to the fact that data were gathered by recall instead of direct observation. In this way elders could have idealized their behavior in order to adhere to tradition. The few participants that stood out among the young for their knowledge of medicinal plants are offspring of the

unayas of the community and have thus been exposed to this traditional knowledge from a young age. When examining the connection of the variables related to local knowledge of medicinal plants with role of informant in the community, we were able to see how the number of plants cited as important varied widely according to community role. This is due to a tendency of the **unayas** of the community to know more about medicinal plants than other informants, a phenomenon that could also be observed when visualizing the interrelationship between community role and the number of medicinal plants recognized by them.

The information provided by the participant **unayas** on the progressive loss of knowledge of medicinal plants among the Shipibo-Conibo agrees with other research that confirms the erosion and change of traditional ecological knowledge due to the dynamics of acculturation suffered in communities of different ethnic groups such as the Mapuche in Argentinian Patagonia (Eyssartier *et al.* 2008, Lozada *et al.* 2004), the Piaroa and Joti in Venezuela (Zent 2009), the Tsimané in Bolivia (Reyes-García *et al.* 2009), and the Ese'ejá of Madre de Dios in Peru (Perez-Ojeda del Arco *et al.* 2011), among others. This phenomenon could be observed more clearly in the Shipibo-Conibo native community of San Francisco of Yarinacocha, near the city of Pucallpa, which is the most populated Shipibo-Conibo community with about 2500 inhabitants. In each house of the community there is a television, and the entire family sits together to watch it every night before bed. Younger ones try to dress fashionably, and some speak of leaving the community to move to other major cities where leisure attractions, jobs, and opportunities to adapt to western culture multiply.

Conclusions

Most culturally important medicinal plants in the native community of Vencedor proved to be species about which a lot of traditional knowledge has accumulated and been transmitted through direct experience over time both in regions where they grow originally, as well as where they have been introduced. The Cultural Significance and Conservation Index has proved to be a good measure of the cultural importance of medicinal plants and possesses advantages over the other cultural importance indices considered in research requiring additional information on culturally important resources that are less available or suffer greater pressure. There was no relationship in the community between the cultural importance of medicinal plants and the resource availability according to local perception. The **unayas'** knowledge of medicinal plants was greater than that of other members of the community.

Conducting research deepening the sustainable use of the most culturally important medicinal species is recommended, collecting the information needed to calculate

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the index of ecological importance of each species, thus allowing a resolution regarding the actual state of conservation of the resource. The diversity and structure of the different types of forest in the native community of Vencedor must be investigated in depth using a map based on the local perception of the resources, in order to detect the relative abundance of the most culturally important species in all the available forest in the community. It would also be advisable to increase the sample size in the collection of sociological information, including other Shipibo-Conibo communities, to discern whether the lack of statistically significant differences in the trends we observed in the present research could be due to sample size, as this is a community with few inhabitants.

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