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Traditional Knowledge in a Rural Community in the Semi-Arid Region of Brazil: Age and gender patterns and their implications for plant conservation

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Research

Abstract

The present study documents dynamics and patterns of knowledge about the use of native plants in a rural community, according to the age and gender of its members, in a semi-arid region of Paraíba State, northeastern Brazil. Socioeconomic factors and ethnobotanical data were registered from 123 household heads through semi-structured interviews. Comparisons between the knowledge of males and females, and between age groups about species richness, number of citations mentioned, and species plant use knowledge measures were made to determine intracultural variations. These outcomes show that differentiation of botanical knowledge from a gender and age perspective reinforces the importance of recognizing specific activities and needs in males and females in the design and definition of sustainable management strategies, policies, and economic interventions over vegetation legacy, and act as a priority inclusion indicator of certain species in conservation processes as a contribution to the culture and biodiversity conservation.

Introduction

The biome caatinga is a mosaic of seasonally dry forests typified by a long dry season and irregular rainfall (Leal *et al*. 2005). It is an exclusively Brazilian biome, and it extends over nine states (Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe, Bahia, and Minas Gerais) occupying an area of 800,000 km^2 (Leal *et al*. 2003). This biome is facing ranching expansion that results in the conversion of semi-arid vegetation into pasture (Leal *et al*. 2005). For a long time, the caatinga was undervalued and considered unproductive; this is why its vegetal formation became one of the most threatened semi-arid ecosystems on the planet with little regard for its conservation (Leal *et al*. 2005). Now its importance has been recognized because of its role in maintaining regional macro-ecological processes, such as climate regulation, patterns of endemism and pollination patterns (Lima & Machado 2010), in addition to constituting a significant component of Brazilian biodiversity.

Based on the increasing research interest in the caatinga, 932 plant species are described, 380 of them endemic, which represents a high level of endemism (Silva *et al*. 2003); however, it is estimated that the number of species is potentially greater since 41% of the region has not yet been investigated (Tabarelli & Vicente 2004). There are constant initiatives to understand ecological dynamics in different ecosystems and to suggest strategies for biodiversity conservation (Ayantunde *et al*. 2008, Dovie *et al*. 2008, Sop *et al*. 2012). In the caatinga, all of these initiatives were aimed at recognition and preservation of

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vegetal resources used by the communities for different purposes and culture associated with them (Albuquerque *et al*. 2009, Lucena *et al*. 2008, Oliveira *et al*. 2007).

Considering the dry conditions and the low level of development in rural areas of the caatinga (the Human Development Index can be less than 0.5), it is common to find human populations strongly dependent on local vegetal resources for their livelihoods (Sampaio & Batista 2003). Plants therefore play a fundamental role in these peoples' daily lives to satisfy different household needs such as food, fuel, medicines, fodder, and construction materials for domestic and rural buildings (Höft *et al*. 1999, Sop *et al*. 2012). As stated by Camou-Guerrero *et al*. (2008), in any given community people do not use and value equally all plant species, so, recognizing the more relevant groups of plant species for local people may help to arrange priorities for implementing conservation and sustainable management strategies. However, traditional knowledge has not been properly examined in terms of its utility for supporting plans for biodiversity conservation (Dovie *et al*. 2008). This is partly because the knowledge about vegetal resources is dynamic and subject to several influences and may vary according to demographic attributes such as gender and age (Almeida *et al*. 2012). Several authors have stated that preferences for the use of plant species can be different for males and females, which translates mostly into division of labor at the household level and even at the community level (Dovie *et al*. 2008, Styger *et al*. 1999). All these differences can be found inside the same community. This variation is called "intracultural variation" and occurs among members of the same cultural group due to gender, social, economic, and age differences, etc. (Almeida *et al*. 2012, Dovie *et al*. 2008).

Therefore, harmonizing the demand for resources in the caatinga becomes a task that requires information about vegetation dynamics, ecological processes, and knowledge of culturally relevant plants. In this context, this study documents the patterns and dynamics of knowledge regarding the use of native plants in a rural community of the semi-arid region of Paraíba, northeastern Brazil. In order to contribute with information to conservation and management of the knowledge and the plants of the biome caatinga, the aims of this study were: (1) to identify the diversity of native species and their uses and (2) to evaluate intracultural variations presence within plant knowledge in relation to age and gender parameters. We hypothesized that there are differences in the knowledge of plant use between males and females mediated by the activities that each perform that contribute to the survival of the family. We also hypothesized that elder people know more about plant species and ways to use them than younger ones, which is derived from experience, learning time, and effective use of plants.

Study location

The study was conducted in a rural community called São Francisco, in Cabaceiras municipality of Paraíba State, Brazil (7°29'20"S, 36°17'14"W) (Figure1). The climate is hot and semi-arid (BSh, *sensu* Köpper), and Cabaceiras is the driest municipality in Brazil with a mean annual rainfall of 356 mm that is irregular from February to May and an average annual temperature of 26°C (CEPED 2011).

Cabaceiras municipality has a total area of 452,920 km^2 and a population of 5035 inhabitants, of whom 2217 (44%) live in urban areas and 2818 (56%) in rural areas (Beltrão *et al*. 2005, IBGE 2010). The São Francisco rural community is subdivided into five sets of scattered small farms: Caruatá de Dentro (28 domiciles, 93 dwellers); Alto Fechado (20 domiciles, 66 dwellers); Jerimum (9 domiciles, 30 dwellers); Rio Direito (11 domiciles, 36 dwellers); and Malhada Comprida (19 domiciles, 63 dwellers) (Figure 1). The farms are separated from each other by about 1 km, and Caruatá de Dentro is the main site. The division into farms is a recent event (dated about 50 years ago) mediated by political and family separations. The people of this community survive on agriculture and noncommercial activities. Goat breeding is the main economic activity in the Cabaceiras region followed by subsistence farming of maize (*Zea mays* L.), beans (*Phaseolus vulgaris* L.), grass, and cactus pear (*Opuntia ficus-indica* (L.) Mill.).

The dominant vegetation of the area is the dry forest known as caatinga, composed of xerophytic herbaceous plants, shrubs, and trees. The main plant families found are Fabaceae, Euphorbiaceae, Cactaceae, and Malpighiaceae (Leal *et al*. 2003). *Schinopsis brasiliensis* Engl., *Bauhinia cheilantha* (Bong.) Steud., *Anadenanthera colubrina* (Vell.) Brenan, *Myracrodruon urundeuva* Allemão, *Croton blanchetianus* Baill., and *Ziziphus joazeiro* Mart. are considered typical caatinga tree species (Leal *et al*. 2003).

Methods

Data collection

Socioeconomic aspects and ethnobotanical data were recorded from April 2011 to July 2012, through semi-structured interviews (Alexiades 1996). To evaluate the effects of age and gender on knowledge of local plant species, both male and female household heads were interviewed in each community house. Interviews were conducted individually to avoid direct influences from third parties (Phillips & Gentry 1993a). This study considered the information about native shrub and tree species growing in both cultivated and wild areas. The citations (number of times that each plant is cited by the informants) were registered, and the reported uses were categorized and grouped in use-categories adapted from Ferraz *et al*. (2006) and Lu-

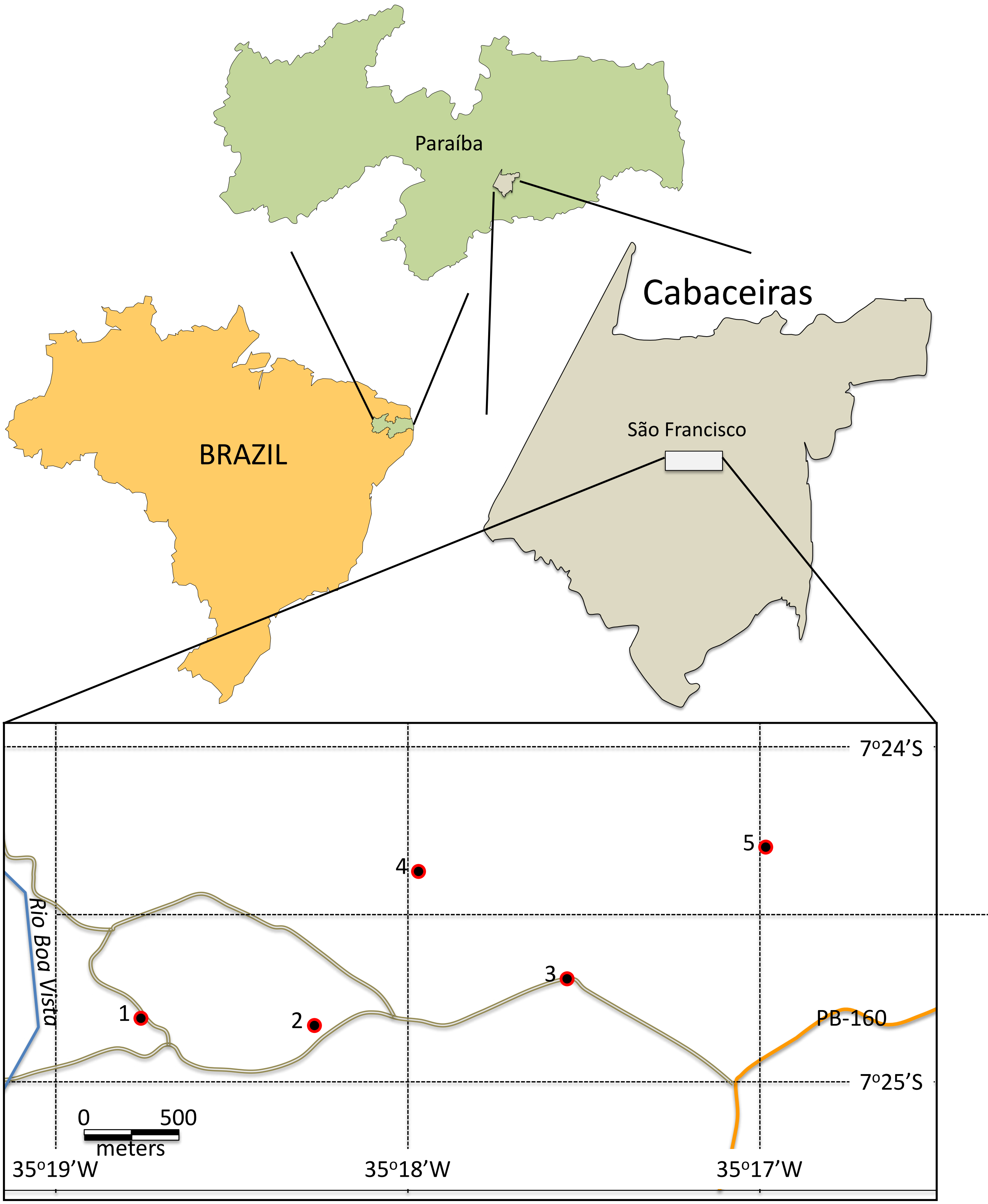

Figure 1. Study region within the community of São Francisco in the city of Cabaceiras, Paraíba, Brazil (1. Rio Direito; 2. Caruatá de Dentro; 3. Malhada Comprida; 4. Alto Fechado; 5. Jerimum).

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cena *et al*. (2008). The use-categories included food, fuel, construction, fodder, medicinal, other, technology, poison-abortive, and veterinary. Species cited for magical-religious and personal hygiene uses were included in the category "other."

The aim of the research was explained to each informant, after which they were asked to sign the Free Consent Term required by the National Health Council through the Committee of Ethics in Research. This study was approved by the Ethics Committee on Human Research (CEP), Hospital Lauro Wanderley, Universidade Federal da Paraíba, registered under the protocol number CEP/HULW nº297/11. Specimens of all plant species mentioned in the interviews were collected with the participation of people using a guided tour technique (Albuquerque *et al*. 2010). Later, the samples were processed according to Alexiades (1996) and identified using a reference collection. Voucher specimens are deposited in the Herbarium Jaime Coelho de Morais (EAN), Universidade Federal da Paraíba, Campus Areia.

Data analysis

The regression coefficient was used to determine the relation between the number of informants and the number of uses reported. To determine the age-related and gender-related patterns of distribution of knowledge about the native plant species used in the community of São Francisco, a quantitative analysis was performed using five different measures of knowledge (Table 1). Their formulas and complete descriptions can be found at Byg and Balslev (2001). These analyses were done for the community as a whole, in different age groups (<42 years old, between 42 and 62 years old, and >62 years old), and by gender. Age categories were determined by difference between lesser age (23 years old) and elder age (92 years old), divided for the number of intervals chosen (3) for this study. 20-year intervals were selected in order to identify differences about knowledge appropriation of native plants.

For each species cited, the use value (UV) was determined. This index measures the importance of a given species by the number of uses it has (Lucena *et al*. 2007, 2013). To test differences between groups, different non-parametric tests were used since the data were not normally distributed (Kolmogorov-Smirnov test). To test the existence of intracultural variations, comparisons were made between the knowledge of males and females and among age groups in two categories: number of species and the number of citations. For these analyses, the non-parametric Mann-Whitney test (comparisons between sexes) and Kruskal-Wallis test (comparisons among age categories) were used. Further intracultural variation analysis was accomplished by comparing knowledge between males and females based on their age. This comparison also used the Mann-Whitney test. All of these analyses were performed using Statistica 8.0 software.

Results

A total of 123 people (70 females and 53 males), with ages ranging between 23 and 92 years old, were interviewed.

Botanical families and use categories

A total of 38 species of native woody plants, belonging to 16 families and 35 genera, were inventoried by local people as useful species (Table 2). Males cited 94% of the plant species (36 species), while females cited 92% (35 species). When knowledge was analyzed by age, the group between 42 and 62 years old cited 94% (36 species) of the species, while 92% and 76% of the species were cited respectively in the >62 years old (35 species) and <42 years old groups (29 species). The most common species for the male group were *Sideroxylon obtu-*

Table 1. Description of indices calculated as measures of the use and knowledge of species (according to Byg & Balslev 2001) of native plants by informants in San Francisco, Cabaceiras, Paraíba, Brazil.

Index	Description
Use diversity values (UDs)	Measures the importance of the use categories and how these contribute to its total use.
Value of Equitability of uses (UEs)	Measures how evenly the different uses contribute to the total use of a species independently of the number of use categories.
Informant diversity value (IDs)	Measures how informants using the species and how their different uses are distributed among them.
Informant equitability value (IEs)	Measures the degree of homogeneity of the informant's knowledge, regardless of the number of informants.
Species diversity value (SDi)	Measures number of species used by an informant and distribution of uses among species.
Species equitability value (SEi)	Evenness of the categories of use of a species by an informant, independently of the number of species used

Table 2. Native plant species used in São Francisco community, Cabaceiras, Paraíba, Brazil. Diversity of use is organized by the largest value in use.

Number of citations	Scientific name [family]	Common name	Category of use									Use value	Diversity of use	Voucher Number
			Food	Fuel	Construction	Fodder	Medicinal	Other	Technology	Poison-Abort	Veterinary			
559	*Myracrodruon urundeuva* Allemão [Anacardiaceae]	**Aroeira**		X	X	X	X	X	X		X	4.54	4.52	17.632
426	*Sideroxylon obtusifolium* (Roem. & Schult.) T.D.Penn. [Sapotaceae]	**Quixabeira**	X	X	X	X	X	X	X		X	3.46	4.78	17.625
425	*Aspidosperma pyrifolium* Mart. [Apocynaceae]	**Pereiro**		X	X	X		X	X	X	X	3.46	3.70	17.566
390	*Ziziphus joazeiro* Mart. [Rhamnaceae]	**Juazeiro**	X	X	X	X	X	X	X		X	3.17	3.72	17.575
310	*Poincianella pyramidalis* (Tul.) L.P.Queiroz [Fabaceae]	**Catingueira**		X	X	X	X	X	X		X	2.52	3.22	17.234
273	*Schinopsis brasiliensis* Engl. [Anacardiaceae]	**Baraúna**		X	X	X	X	X	X		X	2.22	3.29	17.255
257	*Tabebuia aurea* (Silva Manso) Benth. Hook.f. ex S.Moore [Bignoniaceae]	**Craibeira**		X	X	X		X	X	X		2.09	2.5	17.641
251	*Spondias tuberosa* Arruda [Anacardiaceae]	**Umbuzeiro**	X	X	X	X	X	X	X	X	X	2.04	2.5	17.556
232	*Croton blanchetianus* Baill. [Euphorbiaceae]	**Marmeleiro**		X	X	X	X	X	X			1.89	4.17	17.249
230	*Commiphora leptophloeos* (Mart.) J.B.Gillet [Burseraceae]	**Umburana**		X	X	X	X	X	X		X	1.87	4.02	17.642
229	*Mimosa tenuiflora* (Willd.) Poir. [Fabaceae]	**Jurema Preta**		X	X	X	X	X	X	X		1.86	3.22	17.626
136	*Anadenanthera colubrina* (Vell.) Brenan [Fabaceae]	**Angico**		X	X	X	X	X	X	X	X	1.11	3.99	17.630
99	*Jatropha mollissima* (Pohl) Baill. [Euphorbiaceae]	**Pinhão brabo**				X	X	X	X		X	0.8	2.35	17.578
99	*Libidibia férrea* (Mart. ex Tul.) L.P.Queiroz [Fabaceae]	**Jucá**		X	X	X	X	X	X		X	0.8	5.02	17.639
69	*Erythrina velutina* Willd. [Fabaceae]	**Mulungú**			X	X	X	X	X			0.56	2.13	17.563
69	*Piptadenia stipulacea* (Benth.) Ducke [Fabaceae]	**Jurema branca**		X	X	X	X	X				0.56	3.4	17.877
64	*Pseudobombax marginatum* (A.St.-Hil.) A. Robyns [Malvaceae]	**Imbiratã**		X		X	X	X	X		X	0.52	2.22	17.562
58	*Manihot* cf. *dichotoma* Ule [Euphorbiaceae]	**Maniçoba**				X		X		X		0.47	1.59	17.254
50	*Cynophalla flexuosa* (L.) J.Presl [Capparaceae]	**Feijão brabo**		X		X		X	X		X	0.41	0.08	17.583
49	*Combretum glaucocarpum* Mart. [Combretaceae]	**João mole**						X	X		X	0.4	1.23	—

Number of citations	Scientific name [family]	Common name	Category of use									Use value	Diversity of use	Voucher Number
			Food	Fuel	Construction	Fodder	Medicinal	Other	Technology	Poison-Abort	Veterinary			
44	*Aspidosperma* sp. [Apocynaceae]	**Pereiro branco**		X	X	X		X	X	X	X	0.36	2.86	17.564
39	*Hymenaea courbaril* L. [Fabaceae]	**Jatobá**	X		X	X	X	X	X			0.32	4.01	17.582
36	*Maytenus rígida* Mart. [Celastraceae]	**Bom-nome**		X	X	X	X	X	X		X	0.29	4.38	17.615
31	*Bauhinia cheilantha* (Bong.) Steud. [Fabaceae]	**Mororó**		X	X	X	X	X			X	0.25	3.49	17.648
26	*Handroanthus* sp. [Bignoniaceae]	**Pau d'arco**		X	X		X		X			0.21	2.26	—
21	*Ximenia americana* L. [Olacaceae]	**Ameixa**	X				X	X			X	0.17	1.35	17.557
19	*Plumbago scandens* L. [Plumbaginaceae]	**Louro**		X	X				X			0.15	1.55	17.870
17	*Cnidoscolus quercifolius* Pohl [Euphorbiaceae]	**Favela**				X	X				X	0.14	1.44	17.581
8	*Chorisia glaziovii* (Kuntze) E.Santos [Malvaceae]	**Barriguda**				X		X	X			0.07	1.68	—
6	*Eugenia pyriformis* Cambess. [Myrtaceae]	**Ubaia**	X							X		0.05	1.38	—
6	*Amburana cearensis* (Allemão) A.C.Sm. [Fabaceae]	**Cumarú**					X					0.05	1	17.638
6	*Inga* sp. [Fabaceae]	**Ingazeira**		X		X	X		X			0.05	3.6	—
5	*Mimosa ophthalmocentra* Benth. [Fabaceae]	**Jurema de imbira**		X	X	X						0.04	2.27	17.236
3	*Syagrus oleracea* (Mart.) Becc. [Arecaceae]	**Côco-catolé**	X				X					0.02	1.8	17.567
3	*Croton heliotropiifolius* Kunth [Euphorbiaceae]	**Velame**		X	X	X						0.02	3	17.559
2	*Copernicia prunifera* (Miller) H.E.Moore [Arecaceae]	**Carnaúba**							X			0.02	1	17.533
2	*Sapium glandulosum* (L.) Morong [Euphorbiaceae]	**Burraleiteira**		X								0.02	1	—
2	*Senna martiana* (Benth.) H.S.Irwin & Barneby [Fabaceae]	**Canafístula**						X				0.02	1	17.226

sifolium (Roem. & Schult.) T.D.Penn. and *M. urundeuva* (98% and 94%, respectively), and for the female group *M. urundeuva* and *Z. joazeiro* (85% for each species).

In general, Fabaceae was the family with the highest number of cited species (12 spp., 30.7% of the total) followed by Euphorbiaceae with six spp. (15.3%), and Anacardiaceae with three spp. (7.69%). The categories of use with the highest number of citations were fodder (28 species, 71.7%), other uses, and technology (with 27 species, 69.2%, each). The food category received the lowest number of citations (17.9%). Thirty-five species were reported for more than a single use, and in the case of *Spondias tuberosa* Arruda, nine uses were identified (Table 2). Regarding uses, 82% of species had multiple uses (>3), and most species had shared uses (Table 2).

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Use of native plant species

There is a close relationship ($R^2 = 0.94$) between the number of informants and the number of uses reported (Figure 2A). A regression coefficient near 1 implies that the number of uses increases proportionally in relation to the number of informants, and hence the mean number of reported uses per plant species should increase with informant numbers. When the number of uses/informants is plotted against the number of informants (Figure 2B), a threshold point (less than 50 individuals) was found between two different plant knowledge patterns: plant species reported by only a few people (N <50) show no correlation between number of informants and mean number

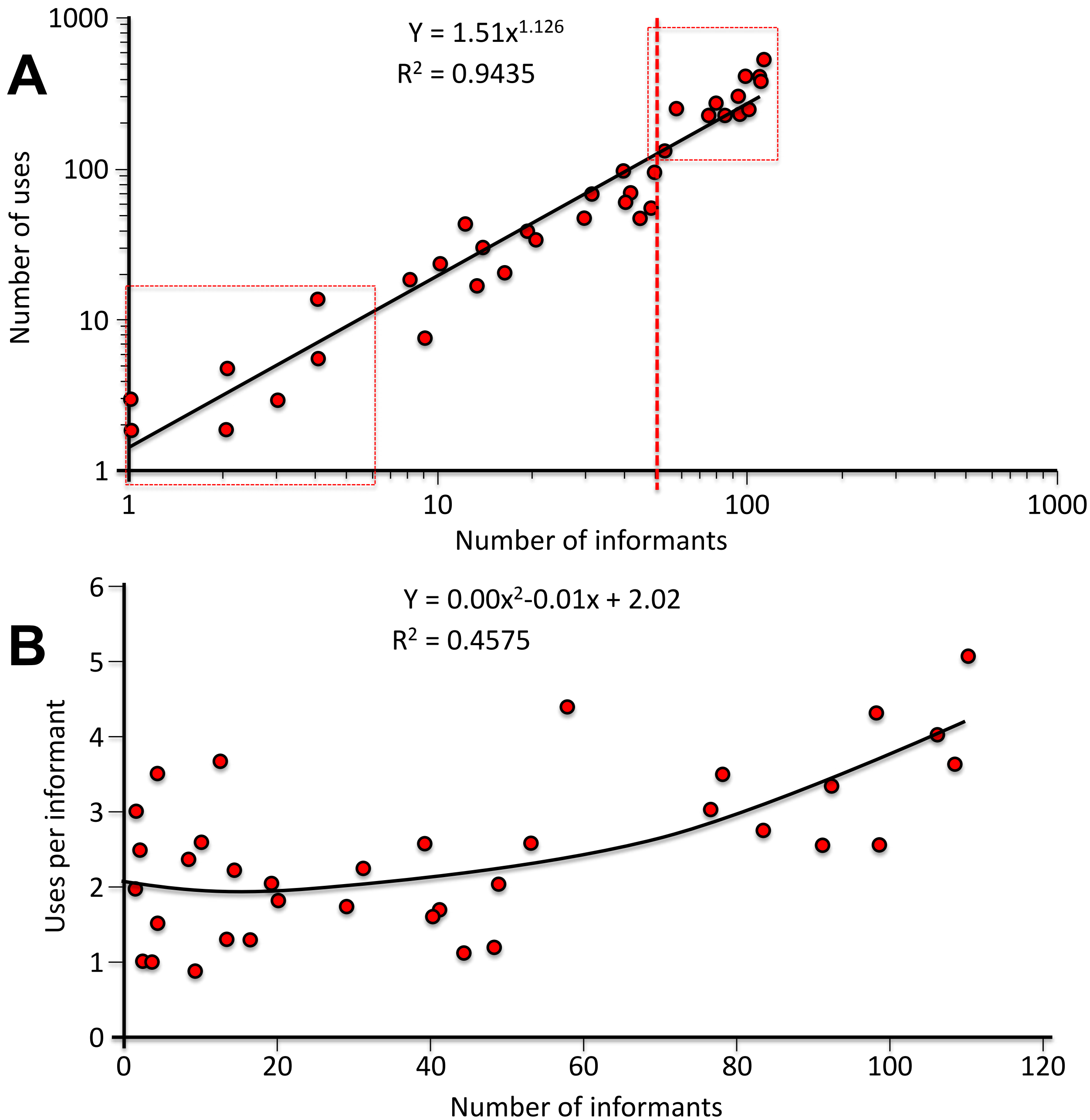

Figure 2. Patterns of plant use knowledge distribution in São Francisco rural community. Plant species are represented as dots. (**A**) The relationship between number of plant uses reported and number of informants allows identification of species at risk of overexploitation (right square) and of species at risk of cultural loss (left square); (**B**) The relationship between uses/informant ratio and number of informants suggests a threshold value (vertical dashed line = less than 50 informants) between two patterns of plant use.

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Table 3. Species with higher use value (UV) in São Francisco community, Cabaceiras, Paraíba, Brazil.

Species	Women	Men	< 42	42–62	>62
Myracrodruon urundeuva Allemão	3.98	5.25	3.78	4.48	5.62
Ziziphus joazeiro Mart.	3.20	—	2.89	3.28	3.31
Sideroxylon obtusifolium (Roem. & Schult.) T.D.Penn.	2.98	4.07	3.36	3.21	4.06
Aspidosperma pyrifolium Mart.	2.95	4.09	2.92	3.92	3.24
Tabebuia aurea (Silva Manso) Benth. Hook.f. ex S.Moore	—	3.31	—	—	—

of uses reported for species (around 2 uses/informant), while widely used plant species (N >50 informants) shows an increasing number of uses/informant ratio as the informant number increases.

Figure 2A may also be used to indicate plant species that deserve conservation priority: (1) a group of plants that are used by few people (< 5% of the community), and hence are at risk of having their uses forgotten by this rural community (cultural diversity loss), such as *Chorisia glaziovii* (Kuntze) E.Santos, *Amburana cearensis* (Allemao) A.C.Sm., *Eugenia pyriformis* Cambess., *Inga* sp., *Mimosa ophthalmocentra* Benth., *Syagrus oleracea* (Mart.) Becc., *Croton heliotropiifolius* Kunth, *Senna martiana* (Benth.) H.S.Irwin & Barneby, *Copernicia prunifera* (Mill.) H.E.Moore, and *Sapium glandulosum* (L.) Morong (extreme left of Figure 2A); (2) plant species that are intensively used, such as *M. urundeuva*, *S. obtusifolium*, *A. pyrifolium*, *Z, joazeiro*, *Tabebuia aurea* (Silva Manso) Benth. Hook.f. ex S.Moore, *S. tuberosa*, and *C. blanchetianus*, reflect the preference that the community has for some species (extreme right of Figure 2A).

Knowledge distribution: Effect of gender and age

Measurements of the use value (UV) and use diversity (UD) differed between all relevant species, suggesting that the specific use of the species determines the degree (intensity) to which a particular species is used and is known by that community (Table 2). The species *M. urundeuva*, *S. obtusifolium*, *A. pyrifolium*, and *Z. joazeiro* showed the highest use value considering gender and age knowledge (Table 3). Of interest, species with high use value also showed high values for diversity of uses. However, species such as *Libidibia férrea* (Mart. ex Tul.) L.P.Queiroz, *Maytenus rigida* Mart., *C. blanchetianus*, and *Commiphora leptophloeos* (Mart.) J.B.Gillet showed low use values (UV) and high diversity values (Table 4), indicating that their uses were reported by a few people in the community (Table 4). The evenness of use (I = 0.53) to the community demonstrates that knowledge is moderately distributed among the informants. Use value also showed high values for diversity of uses. However, species such as *Libidibia férrea* (Mart. ex Tul.) L.P.Queiroz, *Maytenus rigida* Mart., *C. blanchetianus*, and *Commiphora leptophloeos* (Mart.) J.B.Gillet showed low use values (UV) and high diversity values (Table 4), indicating that their uses were reported by a few people in the community (Table 4). The evenness of use (I = 0.53) to the community demonstrates that knowledge is moderately distributed among the informants.

The different measures of plant uses (UV, UD, and ID) did not differ significantly between males and females (P >0.05) (Table 6). Among the age groups, there were no differences in relation to the use value (UV) (H = 2.35; P = 0.30); however, the younger group (<42) presented lower informant diversity (ID) than the intermediate age group (42–62 years) (H = 5.93; P = 0.05), indicating that younger informants know uses for fewer native species (Table 6). Regarding the evenness of the informants in each group analyzed, this indicates that knowledge about the uses of the species is not homogeneously distributed by gender (H = 0.46; P = 0.49) nor by age; knowledge is more heterogeneous for informants over 62 years old (H = 12.42;P <0.05) (Table 6).

The São Francisco community informants know about the use of 12 (±5) species on average. Considering the distribution of knowledge in relation to age, the number of

Table 4. Species with lower use value (UV) and higher diversity use (DU) by gender and age groups in São Francisco community, Cabaceiras, Paraíba, Brazil.

	Women		Men		<42		42–62		>62	
Species	UV	DU	UV	DU	UV	DU	UV	DU	UV	DU
Libidibia férrea (Mart. ex Tul.) L.P.Queiroz	0.51	5.69	1.19	4.43	0.28	4.17	1.05	5.17	1	4.44
Commiphora leptophloeos (Mart.) J.B.Gillet	1.58	4.2	—	—	1.1	4.16	—	—	2.2	4.08
Croton blanchetianus Baill.	1.75	4.05	2.06	4.16	—	—	1.94	4.48	—	—
Hymenaea courbaril L.	—	—	0.43	4.02	0.31	4	—	—	—	—

Table 5. Quantitative measures (sensu Byg & Balslev 2001) discriminated by gender and age of the different use aspects calculated for species used in São Francisco community. The table presents the average values for all species, standard deviations (SD), and minimum and maximum values (in parentheses). Each demographic factor (gender and age) was compared statistically and independently: gender using the Mann-Whitney test and age using the Kruskal-Wallis test. Equal superscript letters in the same row within each demographic factor indicate no significant differences.

	Genders		Ages		
	Women	Men	<42	42–62	>62
	Average ± SD	Average ± SD	Average ± SD	Average ± SD	Average ± SD
Usage value	0.78 ± 1.08^{a} (0.01; 3.98)	1.16 ± 1.37^{a} (0.01; 5.25)	0.76 ± 1.03^{a} (0; 3.78)	1.01 ± 1.22^{a} (0.03; 4.48)	1.08 ± 1.38^{a} (0.03; 5.65)
Diversity of use	2.20 ± 1.44^{a} (0; 5.69)	2.54 ± 1.32^{a} (0; 4.94)	2.00 ± 1.57^{a} (0; 5.15)	2.40 ± 1.42^{b} (0; 5.17)	2.38 ± 1.22^{ab} (0; 4.83)
Equitability of use	0.38 ± 0.25^{a} (0; 1)	0.51 ± 0.26^{b} (0; 1)	0.38 ± 0.30^{a} (0; 1)	0.46 ± 0.27^{a} (0; 1)	0.49 ± 0.25^{a} (0; 1)
Informant's diversity	14.2 ± 14.8^{a} (0; 44.8)	15.2 ± 13.3^{a} (0; 41.7)	7.58 ± 8.02^{a} (0; 25.6)	14.2 ± 12.8^{b} (0; 40.8)	13 ± 21.1^{ab} (0; 104.2)
Informant's equitability	0.31 ± 0.33^{a} (0; 1)	0.36 ± 0.32^{a} (0; 1)	0.29 ± 0.31^{ab} (0; 1)	0.34 ± 0.31^{ab} (0; 1)	0.12 ± 0.20^{a} (0; 1)

plants known by the informants of age <42 is smaller than the other two age groups (H = 11.07; P <0.05) (Table ?). However, to make a more detailed analysis, it should be noted that the difference between the age groups is due mainly to the variation in the knowledge of the youngest female group (Table 6), which showed less knowledge of native species (average species and average citations) than the older group (>62 years). Males did not differ among the age groups (Table 6).

There were significant differences related to the total reported species richness between genders (female vs. male), with males knowing a larger number of plants than females across the São Francisco community (U = 1011.000; p<0.05). A further comparison of species richness between males and females considering each age group showed that the groups <42 and 42–62 years were divergent, maintaining the overall standard of the community in which male informants know more species than females (Table 6).

The residents of São Francisco community cited, on average, 37 (±21) indications of native plant use. Informants over 62 years of age reported greater diversity of citations, which was significantly different from the group under 42 years (H = 7.00; p = 0.05) (Table 6). The difference in citations between these age groups is due to knowledge in the fuel category (H = 13.35; p = 0.001) and construction (H = 7.19; p <0.05). In this study, we found that males and females in the community exhibit differential knowledge about use of plants (U = 1090.00; p <0.05); males have more knowledge about fuel (U = 1291.39; p <0.05), construction (U = 1058.50; p <0.05), fodder (U = 1293.00; p <0.05), and technology (U = 1121.50; p <0.05). In the food, medicine, veterinary, and other categories, both genders have equivalent knowledge.

Considering the number of plant citations by gender and by the effect of age in these citations, there was a similar pattern observed for species richness. The younger female group (<42) knows a lower diversity of citations, and this is statistically different than the older group of informants (<62) (H = 7.33; P <0.05) (Table 6). Males and fe-

Table 6. Distribution of the knowledge of use of native plants by age groups and gender in São Francisco community, Cabaceiras, Paraíba, Brazil. Equal superscript letters in the same column indicate no significant differences using the Kruskal-Wallis test (p <0.05). Results ± standard deviation. *Significant differences using Mann-Whitney test (p < 0.05).

Age groups	Number of informants		Average species number			General average of citations		
			Women	Men	Community	Women	Men	Community
	Women	Men	X ±SD	X ±SD	X ±SD	X ±SD	X ±SD	X ±SD
<42	24	14	$8.9 \pm 3.4^{a*}$	$12.5 \pm 4.3^{a*}$	10.2 ± 4.1^{a}	$23 \pm 12.7^{a*}$	$41.7 \pm 18.9^{a*}$	29.9 ± 17.6^{a}
42–62	28	28	$10.7 \pm 4.0^{ab*}$	$15.1 \pm 5.3^{a*}$	12.9 ± 5.1^{b}	34.1 ± 19.6^{ab}	44.6 ± 22.4^{a}	39.3 ± 21.5^{ab}
>62	17	12	12.8 ± 3.9^{b}	15.9 ± 4.7^{a}	13.8 ± 4.2^{b}	$35.9 \pm 17.1^{b*}$	$50.9 \pm 22.8^{a*}$	42.1 ± 20.6^{b}
Total	69	54	$10.63 \pm 4.06^{*}$	$14.5 \pm 4.9^{*}$	12.3 ±4.8	$30.7 \pm 17.6^{*}$	$45.2 \pm 21.5^{*}$	37.1±20.6

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males showed significant differences in the number of citations between the <42- and >62-year-old groups, where males reported a higher number of citations (Table 6).

Discussion

The number of botanical families and genera identified in this study is similar to that reported in other studies conducted in the caatinga (Almeida *et al*. 2012, Lucena *et al*. 2013, Ramos *et al*. 2008). This shows the relevance of native plants to livelihoods of rural communities who live in this biome. The relevance for fodder category was also recorded by Ferraz *et al*. (2006) and Lucena *et al*. (2012) in rural communities in the Brazilian semiarid region, which can be explained by the tradition of animal breeding such as goats and sheep in this strongly seasonal environment, as registered in São Francisco community. The same pattern was not registered for food plants. In the community, there is no dependence of these native plants for food, because the interviewees have other sources of income, such as pensions and jobs in the city, to supply their needs. Likewise, from 38 native woody species cited in São Francisco community, 13 have between seven and nine uses. However, a high number of useful species reported by the informants showed low use values, demonstrating that the highest values and the potential utility are concentrated in a few species. Thus, one can say that cultural knowledge of the use of a few species with high use value is widely shared within the community, suggesting that these species are often used (Albuquerque & Oliveira 2007, Ladio & Lozada 2009, Sop *et al*. 2012). However, the use values can be dynamic and may decrease for some plants due to some generational interests or due to changes in the patterns of current use in the community (Camou-Guerrero *et al*. 2008). Thus, the low use values reported for a group of species does not necessarily indicate that these are irrelevant in the daily life of the community; these results may indicate that the traditional knowledge of them is in danger of not being transmitted and may gradually disappear (Srithi*et al*. 2009).

Ethnobotany is linked to conservation in two main aspects: the conservation of cultural and biological diversity. The results presented here suggest that conservation plans for plant species could be more successful if they paid more attention to sustainable use and management of species that are highly utilized by the community, such as *M. urundeuva*, *S. obtusifolium*, and *A. pyrifolium*. Likewise, these plans can also help in the maintenance of knowledge about the variety of uses of species such as *L. ferrea*, *C. blanchetianus*, and *C. leptophloeos*, which, at present, remain in the cultural memory of few people in the community. In this regard, there is a risk of this knowledge being lost through generations. Retention could be achieved by promoting interest, knowledge, and hands-on contributions and empowerment of local communities in terms of conservation and management plans for useful native plants.

In the São Francisco community, traditional knowledge systems of useful plant species may exhibit intracultural variations mediated by factors such as age and gender that would be determinants in the perception of the local environment (Almeida *et al*. 2012, Camou-Guerrero *et al*. 2008, Dovie *et al*. 2008, Souto & Ticktin 2012). There are clear differences in diversity of use between the youngest and oldest groups in the São Francisco community. In general, older individuals showed greater knowledge, which coincides with the pattern already registered elsewhere (Almeida *et al*. 2012, Ladio & Lozada 2009, Srithi *et al*.2009). This difference is explained by the accumulation of knowledge in every generation, since older people are more experienced and have more contact with plant resources and more time to exchange knowledge with other informants in the region (Almeida *et al*. 2012, Ladio & Lozada 2009). As reported by Phillips and Gentry (1993b), informants of different ages could have different levels and kinds of ethnobotanical knowledge about the uses of the plants. For instance, these authors found that among mestizos from southeastern Peru the knowledge about edible wild plants is gained early on in life, whilst knowledge of construction and commercial uses appears between 30 and 50 years old. Otherwise, a change in the livelihoods of the community has allowed some species with multiple uses to become more common in the everyday life of the community, which accelerates the loss of knowledge of those plants previously used for a specific purpose. In São Francisco community species such as *C. heliotropiifolius* and *Inga* sp. are being increasingly used (despite reporting uses 3 and 4, respectively) due to the many benefits from species such as *M. urundeuva* or *S. obtusifolium*. The results reflect the complexity of cognitive systems, indicating that knowledge appropriation occurs differently between generations mediated by experiences and particular needs (Toledo & Barrera 2010). The use of more specific analyses allowed us to draw up a detailed profile of how knowledge is distributed, indicating that younger informants have less complete knowledge about useful native plants; however, this pattern is due to the age differences in plant use knowledge among females. This may be related to the short contact period for younger females with the plant resources; however, these differences do not always mean the loss of traditional knowledge throughout time (Voeks 2004). Males also have greater knowledge in another rural community in the Brazilian semi-arid region (Igarassu, PE, Almeida *et al*.2012).

The difference of knowledge between males and females for some categories seems to confirm the occurrence of intracultural variations associated with gender. As pointed out by Kainer and Duryea (1992), males and females have different skills and knowledge about natural resources, usually as a direct result of set specific responsibilities within each household. Other studies highlight these variations in relation to the different roles that each one fulfills in society (Camou-Guerrero *et al*. 2008, Momsen 2007, Voeks 2007). This study documented how the activities that males and females perform influence the knowledge and use of plants. We found that for some categories of use the knowledge of males and females seems to agree with the livelihood tasks according to gender. For instance, males know more plants to be used as fuel and fodder, and they also are more familiar with plants used in construction of houses and fences and for making domestics goods. Males are usually involved in hunting activities, logging, and grazing, all activities that take place away from the house in wilder environments, while females are immersed in activities related to home and family care, using altered environments such as backyards and gardens, among others (Voeks 2007). Following this reasoning, we expected to find differences in food and medicinal plant knowledge; however, the similar knowledge that males and females hold in these two categories is related to male's responsibility in obtaining these species, which occur mainly in wild areas, where males are more experienced. These variations and the fact that greater knowledge is concentrated in males were also seen in studies in other areas of caatinga (Lucena *et al*. 2007) and in steppes and savannas of the sub-Sahel, Burkina Faso (Sop *et al*. 2012). Other social conditions such as education, economic resources, and parental relationships should contribute to the understanding of the structure of knowledge in São Francisco community. For example, Godoy (1994) suggests that between the Sumu of Nicaragua, literacy translates to enhanced opportunities for adopting improved technologies and gaining non-farm jobs. These are associated with cognitive decreasing of uses and practices of plants.

A relationship with native wild plants and with agricultural practices involves personal connections with nature and provides opportunities for praxis of acquired knowledge (Eyssartier *et al*. 2008). Rural societies are currently subjected to strong acculturation pressures, derived from globalization processes, and the process of rural exodus has been happening in recent decades at the national level, represented by a dramatic increase (from 36% in 1950 to 81% in 2000) in the percentage of people living in small cities (IBGE 2006). The most sensitive to these changes are young people, who usually have less interest in the cultural knowledge of their ancestors. The older people retain a pool of qualified knowledge that was appropriate and of great use for survival in a past context, but today is of little practical use or interest to the younger generation (Voeks & Leony 2004). These aspects may lead to the erosion of knowledge regarding the identification of, and processing techniques used for, a given species (Voeks 2000). In this case, this pattern may have resulted from the acquisition of resources such as food and medicine, which constitute crucial practices of daily life, and basic activities for household subsistence are not necessarily divided between genders. Plant resources obtained from these activities are valued equally by males and females, while the plants used for more specific needs (e.g., manufacturing tools, fences) or important needs that require only sporadic actions (e.g., construction, house repair) are valued and performed differentially by males and females (Camou-Guerrero *et al*. 2008). However, an interesting aspect of the gender analyses was that there is no statistical difference between elderly males and females (>62 years old). Rural African females can change their lifestyles because of changes in their domestic needs when males spend a long time working in the cities (Dovie *et al*. 2005). As a result, most females undertook male's responsibilities, controlling the home, changing the culture and plant resource knowledge due to the lack of formal employment in the region. In the São Francisco community, the use of new technologies and the satisfaction of new habits provided by modernization allowed females to work away from the home, and nowadays they contribute more to the family income. As a result, females stay far away from the activities that use plant resources, while males are still developing plant-collecting activities and other work.

Conclusions

This study identified age and gender as factors that interacted to define the knowledge and uses of native plant species by local people. Younger householders knew and used a more restricted diversity of native plants. Also, different forms of use are determined by the specific activities carried out by males and females; for instance, this research showed that males have greater knowledge of use and species for fuel, construction, fodder, and technology, which are found in the harshest environments, thus supporting the hypothesis presented. This demonstrates that gender also shapes knowledge about local flora. However it is important to underline that the knowledge that is relevant to family group survival can be similar for males and females (e.g., plants with medicinal and nutritional uses). The differences in botanical knowledge regarding age and gender strengthen the importance of recognizing specific needs and activities concerning sustainable management strategies and the conservation of the vegetal heritage of caatinga by the locals.

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