Local Uses of Native Plants in an Area of Caatinga Vegetation (Pernambuco, NE Brazil)

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Research

Abstract

The present work sought to identify the utilitarian potential of woody plant species in a fragment of **caatinga** (semi-arid) vegetation located in the "Agreste" region of Pernambuco State, NE Brazil. The study was undertaken in two stages: a floristic inventory was made of a forest fragment adjacent to the community examined in order to identify the species present in the area; this being followed by an ethnobotanical survey employing semi-structured interviews with 98 informants of both sexes in order to gather information concerning the uses attributed to each of those species. A total of 43 woody species were encountered in the forest fragment area, of which 36 were considered to be useful by the local population. These 36 species were distributed among eight use-categories, among which the most important were fuel, construction, and medicinal uses, with more than 20 species among them. The wood and the bark are the most utilized plant parts, reinforcing the importance that forest products have for the community. The community examined demonstrated a significant knowledge of the woody species in the area that can be used to satisfy local needs, and especially for wooden materials. In spite of the total plant diversity observed, utilitarian potential was concentrated in a reduced number of species demonstrating high relative importance values.

Resumo

O presente trabalho buscou registrar o potencial utilitário das espécies lenhosas de um fragmento de caatinga, localizado na região do Agreste do estado de Pernambuco (Nordeste do Brasil). O estudo foi desenvolvido em duas etapas: na primeira foi feito um inventário florístico em um fragmento de vegetação próximo a comunidade, no intuito de conhecer as espécies presentes na área; e na segunda foi realizado um levantamento etnobotânico, por meio de entrevistas semi-estruturadas, com 98 informantes, homens e mulheres, para se conhecer os usos atribuídos a cada uma das espécies. Foram encontradas no fragmento 43 espécies lenhosas, 36 delas úteis, distribuídas em oito categorias, destacando-se como mais expressivas as categorias combustível, construção e medicinal, com mais de vinte 20 espécies. O tronco e a casca do caule são as partes mais utilizadas reforçando a importância dos recursos madeireiros para a comunidade. A comunidade estudada possui um expressivo conhecimento do uso das espécies lenhosas da área, voltado para o suprimento das necessidades locais, especialmente de produtos madeireiros. Apesar dessa diversidade, o potencial utilitário parece se concentrar em um número reduzido de espécies que apresentaram altos valores de importância relativa.

Introduction

The **caatinga** (semi-arid) biome of northeastern Brazil occupies an area of approximately 800,000 km², and it is typified by a long dry season and irregular rainfall. The **caatinga** region occupy 11% of the territory of Brazil

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and has a relatively dense human population of approximately 25 million people (Araújo *et al*. 2007, Drumond *et al*. 2000). At least 30% of this region has already been severely altered through anthropogenic interventions, including the destruction of the native vegetation for pasture formation, agricultural activities, as well as road construction and habitation (Castelletti *et al*. 2003).

Ethnobotanical surveys within local communities have revealed a tremendous utilitarian and economic potential of the native plant species (Toledo *et al*. 1995). Important quantitative studies have already been undertaken, covering a wide range of investigations (Aguilar & Condit 2001, Cunha & Albuquerque 2006, Mutchnick & McCarthy 1997, Phillips & Gentry 1993a,b, Phillips *et al*. 1994, Tacher *et al*. 2002, Toledo *et al*. 1995, Voeks 1996), but few ethnobotanical studies have been published concerning **caatinga** communities (for example, Albuquerque *et al*. 2005, 2006, Almeida *et al*. 2005, Lucena *et al*. 2007a,b, Monteiro *et al*. 2006a), and little is actually known about the potential use of the native plant species found there. Most of the recent studies undertaken in the region represented initial efforts to investigate the potential uses of the **caatinga** vegetation, and to elucidate the use patterns of those natural resources (Araújo *et al*. 2007).

As such, the present work sought to contribute to the ethnobotanical studies undertaken within the **caatinga** biome by conducting an inventory of the useful native woody plants in an arboreal **caatinga** fragment within the state of Pernambuco, Brazil. Our analysis concentrated on local plant uses and the numbers of species citations. Additionally, we attempted to determine if there were differences between wood and non-wood uses of arboreal species, and to establish if certain categories of use are potentially more important in detriment to others.

Materials and Methods

The work presented here was carried out in the municipality of Caruaru, in the **agreste** region of Pernambuco State, Brazil (8º14'19" S and 35º55'17" W). Caruaru is located 136 km from the state capital of Recife and has a population of approximately 254,000 inhabitants, 15% of which live in rural areas (IBGE 2000). The regional climate is semi-arid, and has an average annual temperature of approximately 22° C. Annual precipitation levels average near 609 mm, and rainfall is usually concentrated in the months of June and July (IBGE 2000).

The study area was located in the "Empresa Pernambucana de Pesquisa Agropecuária" (IPA) experimental station (Pernambuco Agricultural Research Company 8°14'18" S and 35°55'20" W), 9 km northwest of the city of Caruaru by way of the PE-095 State Highway (Alcoforado-Filho *et al*. 2003). The station is located in the Riachão de Malhada de Pedra village at an altitude of 537 m, in an area of 190 ha with an **agreste caatinga** physiognomy (of which 20 ha are forest). Agricultural experiments are being undertaken at the research station on sorghum (*Sorghum* sp., Poaceae), corn (*Zea mays* L., Poaceae), herbaceous cotton (*Gossypium* sp., Malvaceae), beans (*Phaseolus vulgaris* L., Fabaceae), potatoes (*Solanum tuberosum* L., Solanaceae), and *Opuntia* sp. (Cactaceae) (a species of cactus used as forage), and research efforts include silviculture, food and animal improvement, and natural resource evaluation and usage. The average rainfall at the station is 674.4 mm/year, based on data from the last 42 years (Empresa Pernambucana de Pesquisa Agropecuária 2003).

In a survey of a 0.6 ha forest tract within the study area, 105 plant species belonging to 43 families were recorded, including herbs, vines, shrubs, and trees (Alcoforado-Filho *et al*. 2003). The best represented families were Euphorbiaceae (13 species), Mimosaceae (9 species), Fabaceae (7 species), Asteraceae (4 species), and Myrtaceae (4 species). The average plant height was approximately 4.70 m (maximum 19 m) and the average stem diameter 7.2 cm (maximum 47 cm). Alcoforado-Filho *et al*. (2003) pointed out that even though the area belongs to a state research station, the neighboring communities continue to selectively cut useful species such as *Caesalpinia pyramidalis* Tul., *Solanum* sp., *Myracrodruon urundeuva* Allemão, and *Anadenanthera colubrina* (Vell.) Brenan. Some of these species (*C. pyramidalis* and *Croton blanchetianus* Baill.) are used for firewood as well as for charcoal production (Araújo 1998).

A more detailed description of the study area can be found in the works of Albuquerque *et al*. (2006), Albuquerque and Oliveira (2007), Florentino *et al*. (2007), Lucena *et al*. (2007a,b), Monteiro *et al*. (2006a,b), and Oliveira *et al*. (2007).

The community studied

The community of "Riachão de Malhada de Pedra", investigated in the present study, is located near a forest fragment in the IPA experimental station (Empresa Pernambucana de Pesquisa Agropecuária), in the municipality of Caruaru, Pernambuco State. Cattle raising and subsistence agriculture (especially corn and beans) predominate in this community. Income is principally derived from work offered at the IPA, on larger neighboring farms, or sometimes in Caruaru and other nearby towns. "Riachão de Malhada de Pedra" is located approximately 9 km from the city of Caruaru, and has 123 residences and approximately 493 inhabitants. This community has been the focus of various systematic ethnobotanical studies during at least four years (Albuquerque *et al*. 2006, Florentino *et al*. 2007, Monteiro *et al*. 2006a,b, Oliveira *et al*. 2007). The community is established near a 20 hectare fragment of hypoxerophytic arboreal **caatinga**, which is nominally under the protection of the IPA experimental station. The

arboreal component of this forest fragment is dominated by the families Euphorbiaceae, Mimosaceae, and Anacardiaceae, with expressive populations of the species *Schinopsis brasiliensis* Engler. (Anacardiaceae), *C. pyramidalis*, *M. urundeuva* and *Maprounea guianensis* Aubl. (Alcoforado-Filho *et al*. 2003).

Floristic Inventory

Two areas were delimited in forest fragments at the IPA, each with 50 contiguous, semi-permanent 10 x 10 m plots (total 100 plots), for a total area of 1 ha. One of the two areas was adjacent to the community, while the other located about 2 km farther away. The semi-permanent plots were always placed at least 10 m from the forest boundary in order to minimize edge effects.

All of the woody individuals with a diameter at soil level (DSL) ≥3 cm were surveyed, except for cacti, vines, and small herbaceous plants (Araújo & Ferraz 2004), and the heights of those plants were recorded. The species collected were identified with the aid of analytical keys, by comparison with material deposited in the Vasconcelos Sobrinho Herbarium (PEUFR) of the Federal Rural University of Pernambuco), and by consultation with specialists. Collected material was mounted and added to the PEUFR herbarium collection.

Ethnobotanical inventory

Interviews were carried out between January 2003 and July 2004 during visits to 98 of the 123 homes in the community (5 family heads chose not to participate; while 14 other houses were either closed or abandoned). The person responsible for the household at the time of the visit was interviewed, regardless of their sex or age. Once the person responsible for the household was identified, a complete explanation of the objectives of the research was made in an effort to obtain that individual's consent to participate in the interviews and data collection procedures. If it was not possible to carry out an interview during an initial visit, up to two more attempts were made. Even so, it was not possible to survey all of the households. Ninety-eight informants were interviewed: 55 men (age 17-81 years) and 43 women (age 19-83 years). This sample included all of the people indicated by the community members themselves as local experts and specialists in the use of the local natural resources. The five household heads that declined to participate in the surveys represented only 4% of the sample.

The interview form (Albuquerque & Lucena 2004) included questions concerning the informants' knowledge about the use of regional plants (Albuquerque & Andrade 2002a,b, Amorozo 2002, Gomez-Beloz 2002, Mutchnick & McCarthy 1997, Phillips & Gentry 1993a,b), as well as the individual's social-economic status, schooling, age, profession, monthly income, family composition, time of residence, and marital status. Interviews were conducted individually whenever possible, in an attempt to avoid any direct influences from third parties, and to assure that the data supplied by the informant was as direct and reliable as possible (Phillips & Gentry 1993a). Interviews were supplemented with other investigative techniques, such as participant observation and guided tours (Albuquerque & Lucena 2004). Plants cited in the interviews were included in use-categories adapted from Phillips and Gentry (1993b) and Galeano (2000). Subcategories were created within each use-category, and were defined more precisely and objectively as the interviews progressed. The use-categories included: technology, medicines, food, construction, fuel, forage, ethnoveterinary, and others. Species cited for magical-religious, poisonous, and personal hygiene uses were included in the category "other".

Data analysis

A use-value (UV) was calculated for each species, and use-category employing the following equations: $UV = \sum U_i/n$, $UV_f = \sum UV/n_f$, and $UV_c = \sum UV/n_c$, respectively, as modified by Rossato *et al*. (1999) and Silva and Albuquerque (2004), where: U_i = number of uses mentioned by each informant; n = total number of informants; UV_f = use-value for each species in the plant family; n_f = number of species in the family; UV_c = use-value of each species in the category; n_c = number of species in the category. The chi-square test (χ^2) was set at a 5% probability level, and was used to compare the uses of wood and non-woody products. Differences between the use-categories were compared using the Kruskal-Wallis test based on use-value data. The Spearman correlation coefficient was employed to compare the species citations offered by the men and women interviewed. The use-value technique was chosen as it is considered objective, reproducible, and appropriate for statistical analyses (Hoffman & Gallaher 2007).

Results

The floristic survey undertaken in the **caatinga** forest fragment identified a total of 43 species, or which 36 were considered useful. These species were placed into eight use-categories, with 28 species being included in the fuel category, 26 species in the construction category, 22 species in the category "other", 21 species in the medicinal category, 15 species in the technology category, 14 species in the forage category, 7 species in the ethno-veterinary category, and 5 species in the food category (Figure 1, Table 1). The average number of uses per species was 5.4.

A total of 1,428 uses were registered, which represents an average of 14.6 use-citations per informant. Of this total number of use-citations, 944 uses (34 species) were

Table 1. Woody plants with diameter at soil level ≥3cm useful for the rural community of "Riachão de Malhada de Pedra", municipality of Caruaru (Pernambuco, Northeast of Brazil). Use categories: Ct = construction; Fd = food; Fl = fuel; Fr = forage; Me = medicine; Ot = other; Tc = technology, Vt = veterinary. Parts used: Ap = all part; Ba = bark; Eb = embryo; Fl = flower; Fr = fruit; Ib = inner bark; La = latex; Lf = leaf; Re = resin; Ro = root; Se = seed; Tk = trunk.

Family/Species	Common name	Voucher	Uses	Part (s) used
Anacardiaceae				
Myracrodruon urundeuva Allemão	**Aroeira**	46171	Ct, Fl, Fr, Me, Ot, Vt	Ba, Ib, Lf, Ro, Tk
Schinopsis brasiliensis Engl.	**Brauna**	47988	Ct, Fl, Fr, Me, Ot, Tc	Ba, Ib, Fr, Re, Tk
Bombacaceae				
Chorisia glaziovii Santos	**Barriguda**	48189	Me, Ot	Lf, Fr
Boraginaceae				
Cordia trichotoma (Vel.) Arráb. ex Steud.	**Frei Jorge**	44266	Ct, Fl, Ot, Tc	Tk
Cordia globosa (Jacq.) Kunth	**Maria Preta**	44238	Ct, Fl, Ot	Tk
Burseraceae				
Commiphora leptophloeos (Mart.) J.B.Gillett	**Umburana**	43840	Ct, Fl, Fr, Me, Ot, Tc	Ap, Fr, La, Lf, Tk
Caesalpiniaceae				
Bauhinia cheilantha (Bong.) Steud.	**Mororó**	43839	Ct, Fl, Me	Fl, Lf, Tk
Caesalpinia pyramidalis Tul.	**Catingueira**	44239	Ct, Fl, Me, Ot	Ap, Ba, Fl, Lf, Ro, Tk
Capparaceae				
Capparis jacobinae Moric. ex Eichler.	**Incó**	43823	Fd, Fl, Fr, Me, Tc	Ba, Fr, Tk
Capparis hastatta Jacq.	**Feijão-de-boi**	43822	Ct, Fl, Fr, Tc	Lf, Tk
Clusiaceae				
Clusia sp.	**Gameleira**	45765	Fl, Ot	Tk
Euphorbiaceae				
Croton argyroglossus Baill.	**Velame Branco**	44267	Fl, Me	Ba, Lf, Ro, Tk
Croton blanchetianus Baill.	**Marmeleiro**	43833	Ct, Fl, Fr, Me, Ot, Tc, Vt	Ba, Lf, Ro, Se, Tk
Croton rhamnifolius Willd.	**Velame**	43804	Ct, Fl, Fr, Me, Ot, Tc	Ba, Lf, Se, Tk
Jatropha curcas L.	**Pinhão Manso**	43838	Me, Ot, Vt	Ap, Eb, Se, Tk
Jatropha mollissima (Pohl) Baill.	**Pinhão Brabo**	43809	Ct, Me, Ot, Vt	Ap, La, Se, Tk
Manihot cf. *dichotoma* Ule.	**Maniçoba**	43816	Ct, Ot	Fl, Lf, Tk
Sapium lanceolatum (Mull. Arg.) Huber.	**Burra Leiteira**	45746	Ct, Fr, Ot	Fr, La, Tk
Sebastiana jacobinensis (Müll. Arg.) Müll. Arg.	**Leiteiro**	44245	Ct, Fl, Me, Tc	Ba, Tk
Malpighiaceae				
Malpighiaceae 1	**Rama Branca**		Ct, Fl, Tc	Tk
Meliaceae				
Cedrela odorata L.	**Cedro**	44265	Ct, Me, Ot, Tc	Ap, Ba, Tk
Mimosaceae				
Acacia sp.	**Rapadura**	45766	Fl	Tk
Acacia farnesiana (L.) Willd.	**Jurema Branca**	44262	Ct, Fl, Me, Ot	Tk
Acacia paniculata Willd.	**Unha-de-gato**	43811	Fl, Fr, Ot	Ib, Lf, Tk

Family/Species	Common name	Voucher	Uses	Part (s) used
Acacia piauhienses Benth.	**Calombi Branco**	44241	Ct, Fl, Ot	Tk
Anadenanthera colubrina (Vell.) Brenan var. cebil	**Angico**	43824	Ct, Fl, Fr, Me, Ot, Tc, Vt	Ba, Ib, Fl, Fr, Tk
Parapiptadenia sp.	**Miguel Correia**	45771	Ct, Fl, Ot	Ap, Tk
Piptadenia stipulacea (Benth.) Ducke.	**Calombi**	44268	Ct, Fl, Fr	Lf, Tk
Myrtaceae				
Eugenia sp.	**Batinga**	46128	Ct, Fd, Fl, Fr	Fr, Tk
Eugenia uvalha Cambess.	**Ubaia**	45773	Ct, Fd, Fl, Fr, Tc	Fr, Tk
Myrciaria sp.	**Jaboticaba**	45774	Ct, Fl, Fr, Me, Tc	Ba, Ec, Fl, Fr, Tk
Nyctaginaceae				
Guapira laxa (Netto) Furlan	**Piranha**	44264	Ct, Fl, Fr, Me, Tc	Ba, Fl,Tk
Rhamnaceae				
Ziziphus joazeiro Mart.	**Juazeiro**	45761	Ct, Fd, Fl, Me, Vt	Ba, Fr, Lf, Tk
Solanaceae				
Capsicum parvifolium Sendtn.	**Pimentinha**	43844	Fl,Fr,Tc	Fl, Fr, Se, Tk
Verbenaceae				
Lantana camara L.	**Chumbinho**	43851	Fl, Me	Fl, Lf, Se, Tk
Lippia sp.	**Camarazinha**	46124	Me, Tc	Fl, Tk

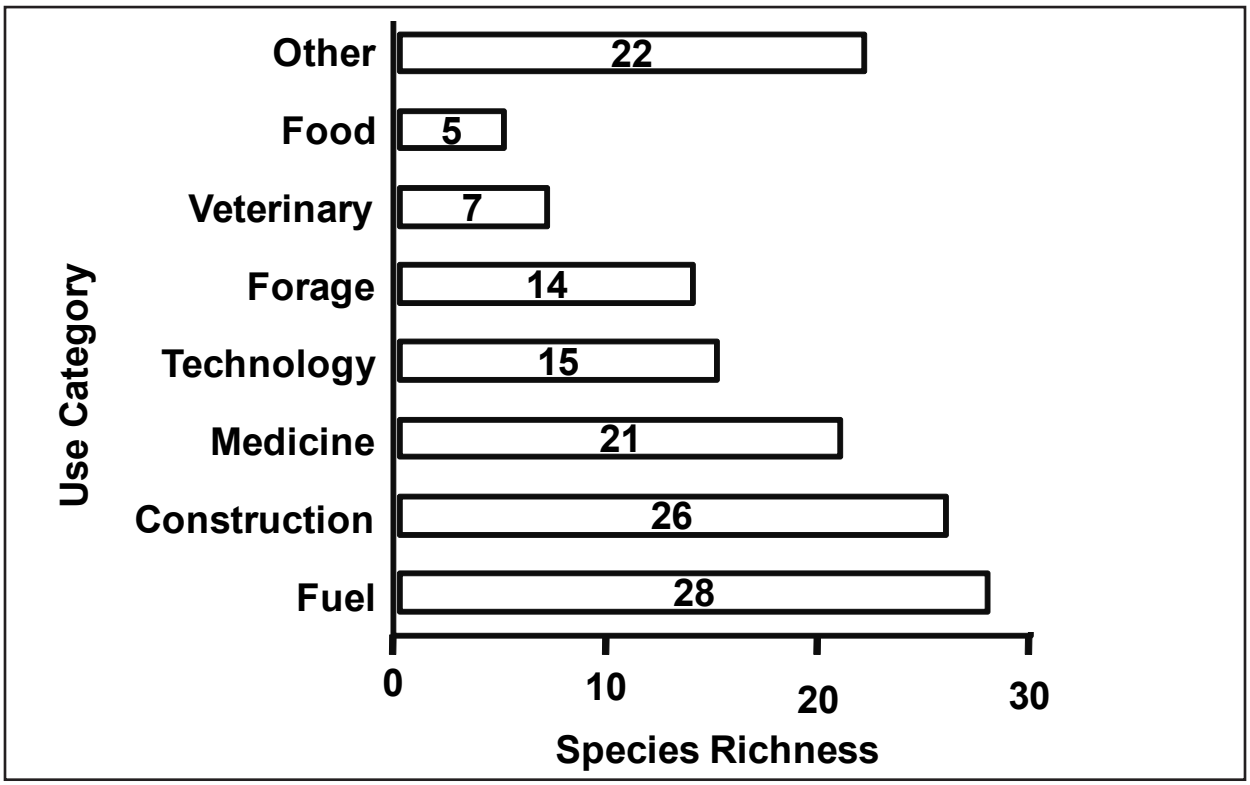

Figure 1. Distribution of species richness in the different use-categories in the "Riachão de Malhada de Pedra" community, municipality of Caruaru (Pernambuco, NE Brazil).

wood uses, and 484 uses (29 species) considered non-wood uses, representing a statistically significant difference ($\chi^2 = 3.93$, $p < 0.05$). The trunk is the plant part most used by the community (68.17%), followed by the bark (20.74 %), and the leaves (4.7%). The products obtained from the tree trunk account for up to 90.2% of all citations, including resin and latex.

Use-citations are reported in Table 2. When comparing use-categories by the number of species and the number of citations, it could be observed that the medicinal, fuel, construction, and technology categories stood out in relation to the rest, either in terms of the number of species or in terms of the number of use-citations.

Table 2. Number of species and use-citations for the use-categories as determined in the "Riachão de Malhada de Pedra" community, municipality of Caruaru (Pernambuco State, NE Brazil).

Use Category	Number of Species	Number of Citations (%)
Fuel	28	416 (29.1)
Construction	26	392 (27.4)
Medicine	21	316 (22.1)
Technology	15	131 (9.2)
Forage	14	27 (1.9)
Veterinary	7	17 (1.2)
Food	5	23 (1.6)
Other	22	106 (7.5)
Quotations total	**36**	**1428 (100)**
		$\chi^2 = 69.29$, $p < 0.001$

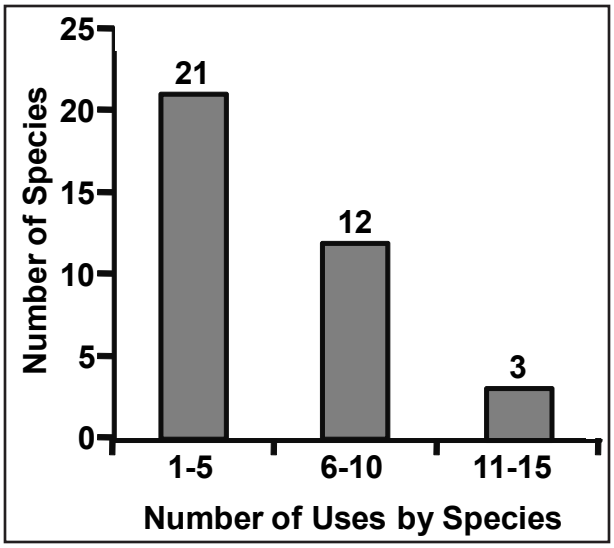

Figure 2. Number of uses attributed to each species in the "Riachão de Malhada de Pedra" community, municipality of Caruaru (Pernambuco State, NE Brazil).

Most species (21) had from 1 to 5 uses, such as *Chorisia glaziovii*, *Clusia* sp., *Manihot* cf. *dichotoma*, and *Lantana camara*. Twelve species had 6 to 10 indicated uses, such as *Eugenia uvalha* and *Ziziphus joazeiro* (Figure 2). The most versatile species, in terms of the number of uses, were *A. colubrina* var. *cebil* and *Schinopsis brasiliensis*, with 13 and 12 cited uses, respectively. In addition, these same species have a wide variety of useful parts (5).

The most cited species were *A. colubrina* (261 citations), *M. urundeuva* (182 citations), *S. brasiliensis* (136 citations), and *C. pyramidalis* (119 citations) (Table 3). However, the most versatile species in terms of the variety of plant parts used was *C. pyramidalis*. The bark, flower, leaf, wood, root, and "the whole plant" of this species are

Table 3. Number of citations and the use-values of useful woody species in the rural community of "Riachão de Malhada de Pedra", municipality of Caruaru (Pernambuco State, NE Brazil).

Family/Species	Citations		Total	Total use-value UV
Species	**Men**	**Women**		
Anacardiaceae				
Myracroduon urundeuva Allemão	83	99	182	1.85
Schinopsis brasiliensis Engl.	80	56	136	1.38
Bombacaceae				
Chorisia glaziovii (O. Kuntze) E. Santos.	6	4	10	0.10
Boraginaceae				
Cordia trichotoma (Vel.) Arráb. ex Steud.	14	16	30	0.30
Cordia globosa (Jacq.) Humb., Bompl. & Kunth.	5	3	8	0.08
Burseraceae				
Commiphora leptophloeos (Mart.) J. B. Gillet.	30	19	49	0.5
Caesalpiniaceae				

Family/Species	Citations		Total	Total use-value UV
Species	Men	Women		
Bauhinia cheilantha (Bong.) Steud.	45	32	77	0.78
Caesalpinia pyramidalis Tul.	65	54	119	1.21
Capparaceae				
Capparis jacobinae Moric.	11	1	12	0.12
Capparis hastata L.	40	27	67	0.68
Clusiaceae				
Clusia sp.	2	0	2	0.02
Euphorbiaceae				
Croton argyroglossum Baill.	8	0	8	0.08
Croton blanchetianus Baill.	46	28	74	0.75
Croton rhamnifolius Kunth.	11	7	18	0.18
Jatropha curcas L.	7	3	10	0.10
Jatropha mollissima (Pohl) Baill.	16	18	34	0.34
Manihot cf. *dichotoma* Ule.	4	4	8	0.08
Sapium lanceolatum (Mull. Arg.) Huber.	21	9	30	0.30
Sebastiana jacobinensis (Mull. Arg.) Mull. Arg.	4	1	5	0.05
Malpighiaceae				
Malpighiaceae 1	11	1	12	0.12
Meliaceae				
Cedrela odorata L.	15	7	22	0.22
Mimosaceae				
Acacia sp.	2	1	3	0.03
Acacia farnesiana (L.) Willd.	12	3	15	0.15
Acacia paniculata Willd.	14	9	23	0.23
Acacia piauhienses Benth.	24	18	42	0.42
Anadenanthera colubrina (Vell.) Brenam.	134	127	261	2.66
Parapiptadenia sp.	6	2	8	0.08
Piptadenia stipulacea (Benth.) Ducke.	22	16	38	0.38
Myrtaceae				
Eugenia sp.	7	1	8	0.08
Eugenia uvalha Camb.	18	1	19	0.19
Myrciaria sp.	21	8	29	0.29
Nyctaginaceae				
Guapira laxa (Netto) Furlan.	10	9	19	0.19
Rhamnaceae				
Ziziphus joazeiro Mart.	39	41	80	0.81
Solanaceae				
Capsicum parvifolium Sendtm.	5	4	9	0.09
Verbenaceae				
Lantana camara L.	8	5	13	0.13
Lippia sp.	3	0	3	0.03

used (total of six parts). These uses are distributed among four categories: forage, construction, medicinal, and "other" uses. The next most versatile species in terms of plant parts used, with 5 parts each, were: *C. blanchetianus* (7 use-categories), *M. urundeuva* (6 use-categories), *S. brasiliensis* (6 use-categories), *Commiphora leptophloeos* (Mart.) J. B. Gillet (5 use-categories), *A. colubrina* (5 use-categories), and *Myrciaria* sp. (5 use-categories). Thus, although *C. pyramidalis* is one of the most versatile species, it is not among the species with the most use-citations. All of these species are listed in more than five use-categories, among which the construction, fuel, and medicinal categories stand out as the most important. This species order is very similar when men's and women's citations are compared, and the correlation analysis demonstrates that the species with the most overall citations were also those most cited by men and women separately ($r = 0.96$, $p < 0.001$).

Six use-value classes were established, with amplitude intervals of 0.5. Class 1 comprises use-values between 0 and 0.5; class 2, from 0.6 to 1; class 3, from 1.1 to 1.5, class 4, from 1.6 to 2; class 5, from 2.1 to 2.5; and class 6, from 2.6 to 3. Seventy-eight percent of the species are included in class 1, and 11% in class 2. Only one species (*M. urundeuva*) had a use-value in the class 4 range, and only one species (*A. colubrina*) had a use-value in the class 6 range. No species demonstrated a use-value in the class 5 range. Species distribution by use-value class is shown in Figure 3 and use-value by species is shown in Table 3. When comparing the average use-values per category, the veterinary category has the highest average (0.96), followed by forage (0.67) medicinal (0.56), construction (0.54), "other" (0.54), technology (0.50), fuel (0.48), and food (0.30) (Tables 4). Nevertheless, the Kruskal-Wallis test did not detect significant differences between these averages.

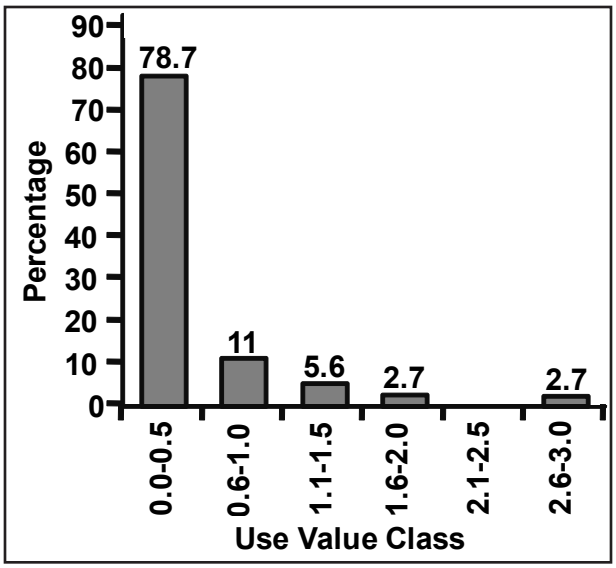

Figure 3. Percentage of species in each of the use-value classes in the "Riachão de Malhada de Pedra" community, municipality of Caruaru (Pernambuco State, NE Brazil).

Discussion

The community examined in this study was aware of the potential use of a majority of the woody species available locally, and demonstrated a strong bias towards wood uses. We had originally expected to find that certain categories were potentially more useful than others (in terms of the use-values assigned to them), but this was not in

Table 4. Use-value by use categories as determined in the "Riachão de Malhada de Pedra" community, municipality of Caruaru (Pernambuco State, NE Brazil).

Use Category*	Use Value Average ± Standard deviation	Number of Species	Important Species
Food	0.30 ± 0.29	5	*Ziziphus joazeiro*
Fuel	0.48 ± 0.62	28	*Myracrodruon urundeuva*, *Schinopsis brasiliensis*, *Caesalpinia pyramidalis*
Construction	0.54 ± 0.62	26	*Anadenanthera colubrina*, *Myracrodruon urundeuva*, *Schinopsis brasiliensis*
Veterinary	0.96 ± 0.95	7	*Anadenanthera colubrina*
Forage	0.67 ± 0.77	14	*Anadenanthera colubrina*, *Myracrodruon urundeuva*, *Schinopsis brasiliensis*
Medicine	0.56 ± 0.69	21	*Anadenanthera colubrina*, *Myracrodruon urundeuva*, *Schinopsis brasiliensis*
Technology	0.50 ± 0.69	15	*Anadenanthera colubrina*, *Schinopsis brasiliensis*
Other	0.54 ± 0.67	22	*Anadenanthera colubrina*, *Myracrodruon urundeuva*, *Caesalpinia pyramidalis*

*Differences between categories were not significant at a 5% probability level using the Kruskal-Wallis test.

fact seen, probably because any given species would contribute its use-value to a number of different categories - for a majority of the plants had multiple uses. The predominance of the use of the wood itself (the trunk of the tree), and the bark and stems, reinforced the importance of these tree resources represent to the community studied (see Albuquerque 2006). Emphasis on these plant parts was also reported by Galeano (2000) in Colombia, Tacher *et al*. (2002) in Mexico, Dalle and Potvin (2004) in Panama, and by Cunha and Albuquerque (2006) in Brazil. The total numbers of species registered in these studies are very similar to those encountered in surveys undertaken in the **caatinga** region (Albuquerque *et al*. 2005, Ferraz *et al*. 2005). Ferraz *et al*. (2005), for example, registered 31 useful native species, with the forage category demonstrating the largest number of species cited (19). In the community examined in the present work, however, forage was not an overly category, with only 14 species being cited.

We encountered a predominant number of useful species in the categories of fuels, construction, and medicine, a tendency observed in other regions (Aguilar & Condit 2001, Cunha & Albuquerque 2006, Louga *et al*. 2000, Lucena *et al*. 2007a, Tacher *et al*. 2000, Voeks 1996). Wood uses fulfill the needs of the local communities in regards to numerous products, and the impact of these uses will need to be carefully measured and analyzed. Traditional methods of collecting data in ethnobotanical studies that are based on carrying out interviews do not generally give a faithful picture of the true use of the plants in a given reagion, or of the impact resulting from that use, as people may cite plants that they do not actually use (Albuquerque & Lucena 2005).

We observed an apparently high number of use-citations attributed to the 36 useful species identified, although the average number of citations offered by the individual interviewees was low (14.6) when compared to the study of Ferraz *et al*. (2005), for example, which reported an average of 28.6 citations per informant. This suggests that although the Riachão community is aware of the potential uses of the species examined, the community members either attributed only a small number of use-citations to them or knowledge concerning their potential uses was not uniformly distributed among those people.

The species *Schinopsis brasiliensis* and *Anadenanthera colubrina* var. *cebil* demonstrated the greatest numbers of different types of uses, indicating the significant versatility of these plants. Another important point revealed in the present analysis was that *S. brasiliensis* is gradually being substituted by commercially available wood products. A similar situation that was not observed with *A. colubrina*, as this species is still widely used in fence construction (Nascimento 2007) and in the production of fuelwood and charcoal (Ramos *et al*. 2008a,b).

An analysis of use-pressure on a given species requires studies that collect information about actual use, the quantities of that resource that are collected, and the frequency of their collection. It is important to point out that the use-value technique employed in the present study can often over-estimate the value of a species, as has been demonstrated by Albuquerque *et al*. (2006). As such, we limited ourselves here to interpreting it as a measure of utilitarian potential.

A majority of the useful species in the study area demonstrated low use-values, indicating that many uses are concentrated among just a few species, a phenomenon that has been observed in many studies with the same type of focus (Albuquerque *et al*. 2005, Cunha & Albuquerque 2006, Ferraz *et al*. 2006, Galeano 2000). The high average use-values attributed to categories comprising only a few species may be explained by the fact that these categories are composed of species with high individual use-values, such as *A. colubrina* and *M. urundeuva*.

The studied species appear to be most used in satisfying local necessities, principally for wood products. Our examination of the use-value indicates that:

1) A small group of species in the study area concentrated a significant fraction of the total observed utilitarian potential. Albuquerque and Oliveira (2007) proposed the utilitarian redundancy model to examine if the presence of various species with the same uses affected their conservation. In general, our data indicates that a small number of species are locally preferred and do receive considerably more attention than others - a situation that can have immediate conservation implications

2) Species with greater use-values are highly versatile in terms of their use-potential, and the harvesting of forest wood products must be evaluated using information concerning real use and actual demand. The certainty of the real use of these products is extremely important for establishing conservation strategies in the region, as Lucena *et al*. (2007a) have pointed out that **caatinga** plants normally have multiple uses (see also Oliveira *et al*. 2007). Additionally, there are real differences in the repertoire of plants known to a community and those that they actually use (Albuquerque 2006). Local populations with access to seasonal dry forests (such as those found in the **caatinga**) appear to favor the use of woody species (especially the stem and branches), as suggested by the seasonal climatic hypothesis (Albuquerque 2006).

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