

Does the June Tradition Impact the Use of Woody Resources from an Area of Atlantic Forest in Northeastern Brazil?

Alyson Luiz Santos de Almeida • Patrícia Muniz de Medeiros • Taline Cristina da Silva • Marcelo Alves Ramos • Shana Sampaio Sieber • Ulysses Paulino de Albuquerque*

Laboratório de Etnobotânica Aplicada, Departamento de Biologia, Área de Botânica, Universidade Federal Rural de Pernambuco, Av. Dom Manoel de Medeiros s/n, Dois Irmãos, CEP: 52171-900 Recife, Pernambuco, Brazil

Corresponding author: * upa@db.ufrpe.br

ABSTRACT

In this work, we will approach a woody usage that is a cultural symbol: bonfires in honor of Catholic Saints (John the Baptist, Anthony and Peter). We aimed to investigate the contribution of the bonfire tradition to woody resource use in an area of the Atlantic Forest in the Três Ladeiras community, NE Brazil. We sought to verify the extent to which this tradition can impact forest resources, as well as to register the local population's impressions about such traditions. This study was carried out in June celebrations (*festas juninas*) of 2007 and 2008 (except for the Saint Anthony celebration in 2007), when we performed semi-structured interviews, photographic recordings and measurements of all the community bonfires. We registered a total volume of 146.26 m³ of piled wood in the bonfires. Resource acquisition for bonfires in recent years was classified as being difficult by 90% of the respondents, mainly due to the local context of prohibition against forest resource use. These findings indicate that extraction of wood products for bonfires in the community is not concentrated in forest areas, hence one has to be cautious when inferring about the impacts resulting from this tradition.

Keywords: ethnobotany, firewood, traditional festivities, tropical forest resources

INTRODUCTION

Throughout history, people have utilized forest resources in order to supply the necessities that are vital to their survival (Plotkin 1995; Albuquerque 2005a, 2005b). For a long time, the use of these products was conducted with few restrictions, or even in a free and unrestricted way. Currently, with the accelerated process of ecosystem degradation caused by economic growth, some people and institutions seek to promote environmental sustainability in order to minimize the consequences of world irresponsibility toward natural resources conservation. In this context, wood exploitation is one of the most frequent and ancient ways of plant resource use. It is classified as one of the primary negative impacts on the forest (Shakar *et al.* 1998; Awasthi *et al.* 2003; Walters *et al.* 2005) because it results in the annual cutting of thousands of hectares of native vegetation around the world.

In the household sector, wood use is mainly restricted to the poorest populations, especially from the rural areas of developing countries (Top *et al.* 2004; Naughton-Treves *et al.* 2007; Ramos and Albuquerque 2007). These countries own 55% of the world's forests (Youngquist and Hamilton 2000), and many of these are highly diverse areas. This context of high biological diversity and great demand for woody forest resources requires the development of ethnobotanical studies focused on the conservation of these resources. Nevertheless, there is a lack of ethnobotanical research investigating wood product utilization and its biological consequences; these studies tend to concentrate on the use of wood for fuel (firewood and charcoal) (Kersten *et al.* 1998; Abbot and Lowore 1999; Samant *et al.* 2000; Nagothu 2001; Tabuti *et al.* 2003; Aumeeruddy-Thomas *et al.* 2004; Bhatt and Sachan 2004a, 2004b; Brouwer and Falcão 2004; Ramos and Albuquerque 2007; Ramos *et al.* 2008a, 2008b).

In this work, we will discuss what can be considered a fuelwood use, yet not related to daily warming and cooking activities, but rather as cultural symbol: bonfires in honor of

the Catholic Saints (John the Baptist, Anthony and Peter) in Pernambuco State, Northeastern Brazil. We aim to describe traditional bonfires for celebrations dedicated to these Saints by investigating the potential impacts of the bonfire tradition to woody resource use in an area of Atlantic Forest. We verify the extent to which this tradition can cause impacts on forest resources, as well as register the local population's impressions regarding the tradition of making bonfires. In addition, we also intend to complement and enrich our interpretation of the data by means of a visual ethnographic essay.

JUNE CELEBRATIONS AND THE BONFIRE TRADITION

It is believed that June celebrations have existed since antiquity among Romans and Aryans (Campos 2007). In the literature, the origin of this tradition is not well described, but some suggest that it arises from Roman mythology as a way of honoring the God Juno in rituals marked by fire-adoration (Prefeitura do Recife 2004). Other reports affirm that because the celebration has an agrarian nature, its occurrence was not restricted to Europe, but was embraced in Asia and Africa as well, as part of rituals celebrating the arrival of summer in the Northern Hemisphere (the period for grain harvest) (Benjamin 1992; Fernández 1996; Campos 2007). Rural populations in these regions celebrated these festivities as a way of repelling bad spirits that caused drought, land sterility and pest infestations of grain crops.

June festivities were then incorporated into popular Catholic traditions in order to honor some of its Saints. Bonfires are one of the primary elements of this tradition and were added to Catholic rites of June celebrations to announce John the Baptist's birth. The bonfires were originally destined to honor Saint John, but are now also prepared for Saint Peter and Saint Anthony's celebrations in Brazil (Prefeitura do Recife 2004).

Although there are few studies in the literature about the



Fig. 1 Partial views of the Três Ladeiras community (Pernambuco State, Northeastern Brazil).

impact of making bonfires (see Martins *et al.* 2004), the local media brings news and communication against the continuation of this practice (O Norte 2008; Sertão News 2008; Tribuna do Norte 2008), aiming to conserve biodiversity.

METHODS

Study area

The study was conducted in the Três Ladeiras community (**Fig. 1**), located in the Três Ladeiras District (**Fig. 2**), municipality of Igarassu, Pernambuco State. The municipality is part of Greater Recife and it is 32.3 km away from the state capital (CONDEPE/FIDEM 2007). It was colonized in 1560, after the expulsion of indigenous tribes from the coast of Pernambuco (CONDEPE/FIDEM 2007).

Igarassu has a warm and moist climate, with autumn-winter rains (according to Köppen), annual mean temperature of 25.2°C and annual mean rainfall of about 2000 mm³ (CONDEPE/FIDEM 2007). The municipal seat has an altitude of 19 m. Monthly per capita income in the municipality is about 75.00 USD and the main agricultural activity is sugarcane planting, which was responsible for 7,776 ha of harvested area in 2005 (IBGE 2006).

Três Ladeiras is one of the three municipality Districts (together with Nova Cruz and Igarassu). It has a population of 1,764 people (IBGE, 2000); most of these are concentrated in the Três Ladeiras village (or community), bearing the same name as the district. The study was developed only in the village proper, where there are 1,471 habitants (749 men and 722 women) according to the local health station. The health station also divides the community into five areas or sectors, and these sectors differ from each other in social, economic, demographic and religious aspects.

Regarding local religion, there is a clear division between Catholicism and Protestant religions, and it reflects a general tendency for the increasing of protestant religions over predominant Catholicism (Lopes Júnior 1998). There is a catholic church in the center of the community and there are also Protestant churches in both central and distant areas. The source of employment for most people in the village is sugarcane cutting, but this kind of occupation is restricted to men, so unemployment among local women seems to be prevalent, so they are dedicated to household services. Men or women who work in other sectors usually have jobs in more urbanized regions, such as in the center of Igarassu or in a neighboring municipality called Abreu e Lima.

In the village region, there is an important sugar and alcohol factory the São José Factory Inc. It has an area of 24,700 ha (Farias *et al.* 2007). Inside the factory's limits there are 156 Atlantic Forest fragments, which occupy 6,660 ha (Trindade *et al.* 2007), that is, 27% of the factory property area; this percentage is under the limits established by Brazilian law for the Legal Reserve (Brasil 1989). These fragments form the São José Ecological Reserve (Usina São José 2008). The fragments owned by the factory have distinct sizes, 40.4% of them being smaller than 10 ha and comprising 2.1% of the total forest area; and 15.4% being larger than 100 ha and comprising 81.3% of the forest area (Trindade *et al.* 2007). Because of the protected status of these fragments the proper São José Factory holds employees responsible for forest inspection, and the local residents are allowed to collect only dry wood for firewood use. Nevertheless, to legally gain access to the forest, residents have to acquire an "order", which is a document

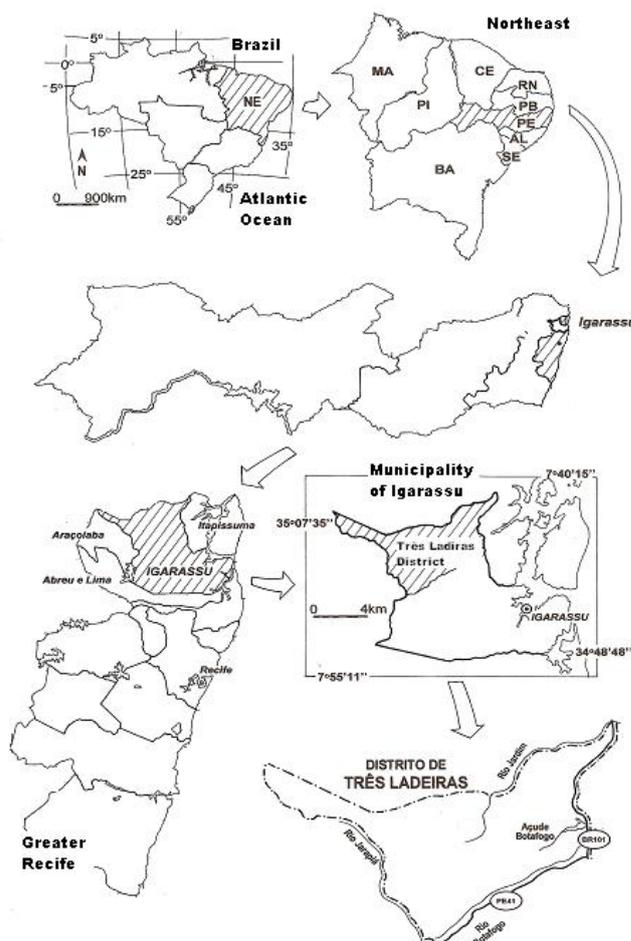


Fig. 2 Localization of the municipality of Igarassu and Três Ladeiras community (Pernambuco State, Northeastern Brazil).

allowing dry firewood harvest. Such orders must be obtained in the factory, and they are only given to people who work there. This permit is valid for one month; after that point, the dweller has to return to the factory in order to acquire a new document.

Ethnobotanical information

The study was conducted during the June festivities of 2007 and 2008 (except the St. Anthony celebration in 2007). Interviews and bonfire observations were developed on June 12, 23, and 28 of each year, corresponding to the eves of the days dedicated to the Saints (when the bonfires were lit). *In situ* inventories (Gaugris and van Rooyen 2006) were conducted in households that had bonfires mounted or were in the process of mounting. For each bonfire found, one family member that took part in wood collection or construction was asked to answer a semi-structured questionnaire (Albuquerque *et al.* 2008a), and a total of 79 people were interviewed. Questions included: plants present in bonfires, resource collection areas, and plant state when collected (dried or green). Furthermore, given that the community uses firewood for domestic purposes, and in order to have a comparative basis, res-

pondents that used firewood were asked to indicate how long would be necessary to consume the amount of wood present in the bonfire if this material was used, according to domestic patterns, for firewood consumption. Furthermore, respondents were asked about their perception as to the custom of making bonfires; they were also asked about how they would respond to cases of wood scarcity or total use prohibition, and how they would act to reconcile traditional practices with the guarantee of future availability for these resources.

Wood volume calculation and plant material

For all bonfires found in 2007 and 2008 (148), even for those for which it was impossible to perform interviews and obtain species composition (34 bonfires), we obtained measurements for the calculation of the pile volume (m³) (Batista and Couto 2002). Pile volume, as indicated by Sá e Silva *et al.* (2008), is calculated as follows:

$$V = L \times \int \times \bar{h}$$

where V = pile volume; L = length of the pile; \int = log length, and \bar{h} = average of five different height measurements of the wood pile.

Species were classified according to their occurrence in: (1) common local forest areas and (1) common degraded and/or anthropogenic areas.

Plant material cited in the interviews was collected, identified and deposited in Prof. Vasconcelos Sobrinho Herbarium, at Universidade Federal Rural de Pernambuco.

Discourse of the Collective Subject analysis

To evaluate respondents' answers about their attitudes towards reconciling traditional practices and guaranteeing future resource availability, the discourse of the collective subject was employed (Lefevre 2005). We opted for this analysis since it demonstrates the collective thought, in this case, the impressions of people who have the custom of making bonfires in the community. The analysis consisted of: a) extracting the key-expression that characterized the answers of each respondent; b) classifying and grouping these expressions into pre-established central ideas, through codification in the data base; c) building the discourse based on central ideas. Seventy-nine people were asked: if you were responsible for elaborating a plan (strategy) to guarantee that wood was always available for making bonfires, what would you do?

Visual ethnography essay

It has been pointed out that the increasing importance given to photographic registers in ethnobotanical studies, which are evidence and permanent supporting material to help elucidate findings, also guide future works by other researchers (McClatchey *et al.* 2005; Vogl-Lukasser and Vogl 2005). Therefore, in possession of all the data generated with this study, we realized the opportunity of compiling photographic registers of the bonfire elaboration process in the June celebrations. These efforts can aid in the collection and interpretation of data by increasing empathy for the informants and understanding people's daily lives (Mokkamul 2006), their traditions and the contexts of plant resource use (Vogl-Lukasser and Vogl 2005).

Images were taken during field work, with previous permission from the informants. These informants received, at later times, their photographs as a gesture of gratitude for their collaboration with the research. Mokkamul (2006) affirmed that this practice was highly opportune, since it garnered favor with the locals and facilitated research development. All photographs were taken by the authors at 2007 and 2008 celebrations, using the following equipment: Sony DSC P-93 compact digital camera, with a 3x Zoom Lens (7.9-23.7 mm); Canon PS A 540 compact digital camera, with a 4x Zoom Lens (5.8-23.2 mm); Kodak EasyShare C513, with a 3x Zoom Len (36 mm).

Data analysis

The frequency of each species was calculated based on the number of bonfires where a given species could be found, divided by the total number of bonfires that had their composition indicated by the informants (114 bonfires). To verify whether bonfires were built with similar wood volumes in each celebration (for St. John and St. Anthony) and between years (2007 and 2008), the Student's *t*-test was used with square root transformed data (Zar 1996). For this analysis, information obtained in the St. Anthony celebration was not considered since this data was collected only in one year.

The Jaccard similarity coefficient (Araújo and Ferraz 2008) was used to verify the similarity of species composition in 2007 and 2008. To verify grouping tendencies in the species composition of bonfires, a Principal Coordinates Analysis (PCO) was performed with Gower's General Similarity Coefficient using data regarding bonfire constitution. PCO was performed with the software MVSP 3.1 (Kovach 1999).

From the information acquired through interviews and the wood volume registered in bonfires, annual firewood consumption for domestic ends was indirectly estimated. This number is thought to be an estimate given that only bonfire-makers were considered for firewood consumption values. This analysis was performed according to the following equation:

$$AFC = \sum [(vol/t) \times 52]$$

where:

AFC = annual firewood consumption in the community

vol = bonfire volume

t = time (in weeks) that the bonfire wood was supposed to last if it was used for domestic ends

52 = number of weeks per year.

RESULTS AND DISCUSSION

Bonfire composition and richness

Bonfires were built with 51 ethnospecies, among whom 44 species were identified as belonging to 30 genus groups and 25 families, with Anacardiaceae (7 spp.), Myrtaceae (4 spp.) and Annonaceae (3 spp.) being the most frequent families (Table 1). Species present in a higher number of bonfires were: *Mangifera indica* L. (40.4% of bonfires), *Artocarpus integrifolia* L. (39.5%), *Cecropia palmata* (Willd.) (25.4%), *Anacardium occidentale* L. (22.8%) and *Byrsosima sericea* DC (16.7%). Of these, *M. indica* and *A. integrifolia* are exotic species common to anthropogenic areas (homegardens, sidewalks, streets, for example), while *C. palmata* is a native and typically pioneer species, very numerous in perturbed and regenerating areas. *B. sericea* is a native species valued locally because of its fuel attributes (Silva and Andrade 2005; Albuquerque *et al.* 2008b). It was verified that 41 ethnospecies were present in less than 10% of bonfires, demonstrating that there is a small group of apparently "preferred" species.

Of all ethnospecies found in bonfires, 55% are common to perturbed or anthropogenic areas. However, when considering only plants that were cited as preferred (13 ethnospecies), 61.5% are common to forest areas, and *B. sericea* is the species preferred by the highest number of respondents (11). Differences between real use and preference are related to the prohibition of forest resource use. Although people recognize that forest species have greater fuel quality, they use a higher number of species coming from anthropogenic areas. This pattern is not true for daily firewood use in the region, since people use forest species for firewood in a much more substantial way than they utilize non-forest species (Silva e Andrade 2005; Albuquerque *et al.* 2008b). Two reasons can explain the difference of consumption patterns between firewood and bonfires in the community: (1) Unlike firewood use, making bonfires is a symbolic act; therefore, species with lower fuel qualities than those that are commonly used as firewood can be used; (2) Bonfires are

Table 1 Floristic composition and frequency of species employed in bonfires in June celebrations of the Três Ladeiras community (Pernambuco State, Northeastern Brazil).

Species	Local name	Frequency (%) (n=114)	
Anacardiaceae	<i>Anacardium occidentale</i> L.	Cajú, Cajú-roxo	22.81
	<i>Mangifera indica</i> L.	Manga	40.35
	<i>Schinus terebenthifolius</i> Raddi.	Aroeira	1.75
	<i>Spondias mombin</i> L.	Cajá	4.39
	<i>Spondias purpurea</i> L.	Seriguela	2.63
	<i>Tapirira guianensis</i> Aubl.	Cupiuba (Pau-pombo)	14.91
	<i>Thyrsodium schomburgkianum</i> Benth.	Cabatã-de-leite	1.75
Annonaceae	<i>Annona marcgravii</i> Mart.	Aticum	0.88
	<i>Annona muricata</i> L.	Graviola	0.88
	<i>Xylopia frutescens</i> Aubl.	Imbira-vermelha	0.88
Arecaceae	<i>Cocos nucifera</i> L.	Côco	2.63
Caesalpiniaceae	<i>Caesalpinia echinata</i> Lam.	Pau-brasil	1.75
Caricaceae	<i>Carica papaya</i> L.	Mamão	0.88
Cecropiaceae	<i>Cecropia palmata</i> Willd.	Embaúba	25.44
Clusiaceae	<i>Clusia nemorosa</i> G. Mey.	Orelha-de-burro	1.75
	<i>Vismia guianensis</i> (Aubl.) Pers.	Lacre	0.88
Combretaceae	<i>Terminalia catappa</i> L.	Coração-de-nego	6.14
Euphorbiaceae	<i>Euphorbia tirucalli</i> L.	Avelóz	0.88
	<i>Pogonophora schomburgkiana</i> Miers	Cocão	7.02
Fabaceae	<i>Apuleia leiocarpa</i> (Vog.) Macbr	Jitai	2.63
	<i>Bowdichia virgilioides</i> Humb., Bonplan & Kunth.	Sicupira-preta	2.63
Lauraceae	<i>Ocotea glomerata</i> (Nees) Mez	Louro	0.88
	<i>Persea americana</i> Mill.	Abacate	9.65
Lecythidaceae	<i>Eschweilera ovata</i> (Cambess.) Miers	Imbiriba	14.91
Malpighiaceae	<i>Byrsonima sericea</i> DC.	Murici	16.67
	<i>Malpighia glabra</i> L.	Acerola	4.39
Malvaceae	<i>Hibiscus rosa-sinensis</i> L.	Papoula, pampola	1.75
Mimosaceae	<i>Mimosa caesalpiniiifolia</i> Benth.	Sabiá, sabiazeira	4.39
Moraceae	<i>Artocarpus integrifolia</i> L.	Jaca	39.47
	<i>Artocarpus</i> sp.	Fruta-pão	0.88
Myrtaceae	<i>Eugenia uniflora</i> L.	Pitanga	1.75
	<i>Psidium guajava</i> L.	Goiaba	1.75
	<i>Syzygium jambolanum</i> (Lam.) DC.	Azeitona	15.79
	<i>Syzygium malaccense</i> (L.) Merr. & L.M. Perry	Jambo	1.75
Oxalidaceae	<i>Averrhoa carambola</i> L.	Carambola	0.88
Poaceae	<i>Bambusa</i> sp.	Bambú	8.77
	<i>Cupania</i> sp.	Cabatã	4.39
	<i>Talisia esculenta</i> (A. St.-Hil.) Radlk.	Pitomba	14.04
Sapotaceae	<i>Achras sapota</i> L.	Sapoti	1.75
	<i>Pouteria</i> sp.	Leiteiro	0.88
Simaroubaceae	<i>Simarouba amara</i> Aubl.	Praiba	0.88
Solanaceae	<i>Solanum paniculatum</i> L.	Jurubeba-amarela	0.88
Sterculiaceae	<i>Guazuma ulmifolia</i> L.	Mutamba	0.88
Verbenaceae	<i>Aegiphila sellowiana</i> Cham.	Orelha-de-cabra	3.51
Not identified	Not identified 1	Cinzeiro	0.88
	Not identified 2	Imbira-branca	1.75
	Not identified 3	Mulandi	0.88
	Not identified 4	Sambaquim	3.51
	Not identified 5	Sete-cascos	1.75
	Not identified 6	Sicupira (branca)	2.63
	Not identified 7	Favinha	0.88

traditionally built in front of the household, and this place is very susceptible to inspections and detections of illegally harvested material, while firewood can be deposited deep within the household, generally next to the kitchen, with less exposure to inspection.

When considering ethnospesies composition in bonfires across the two years, similarity was 60.68%: there was not great variation in species lists from one year to another. *Euphorbia tirucali* L., *Averrhoa carambola* L., *Psidium guajava* L., *Annona muricata* L., *Pouteria* sp., *Ocotea glomerata* (Nees) Mez, *Carica papaya* L. and *Eugenia uniflora* L. were only registered in 2007, while *Annona marcgravii* Mart., *Xylopia frutescens* Aubl., *Artocarpus* sp., *Syzygium malaccense* L. Merr. and L.M. Perry, *Guazuma ulmifolia* L., *Hibiscus rosa-sinensis* L., *Caesalpinia echinata* Lam., *Simarouba amara* Aubl., *Bowdichia virgilioides* Humb., Bonplan and Kunth, as well as three non-identified species known locally as “cinzeiro,” favinha and “mulandi,” were only

found in 2008 bonfires.

Principal Coordinates Analysis did not show a grouping tendency among bonfires from the same celebration (**Fig. 3**). Although bonfires are dispersed in the graph, the four different quadrants exhibit distinct characteristics (**Fig. 3**): (I) mixed bonfires (forest and non-forest plants) or bonfires exclusively composed of non-forest species, with *Artocarpus integrifolia* present in all bonfires; (II) mixed or non-forest species bonfires with a predominance of *Artocarpus integrifolia* and *Mangifera indica*; (III) mixed or non-forest species bonfires with predominance of *M. indica*, and (IV) mostly mixed bonfires with a high presence of forest species (especially *Byrsonima sericea*), *Cecropia palmata* and *Anacardium occidentale*. Some of the bonfires made for the same household tended to have similar compositions, independent of the celebration (**Fig. 4**).

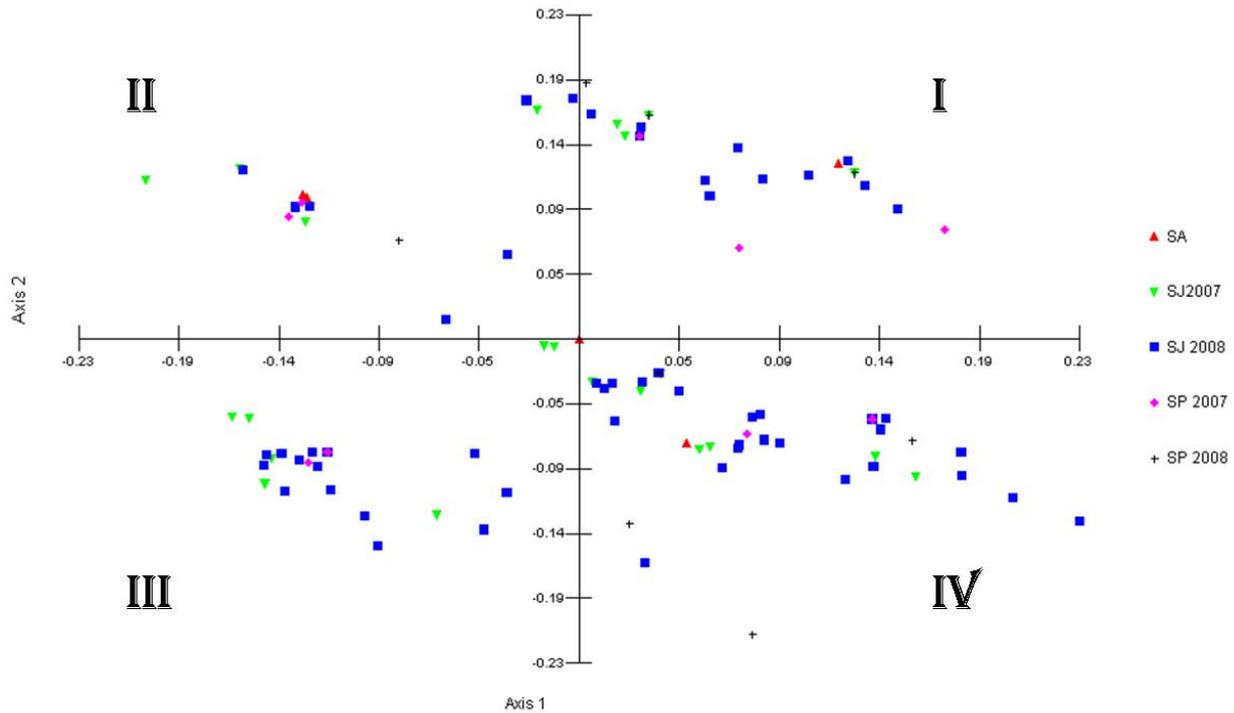


Fig. 3 Principal Coordinates Analysis (Gower's General Similarity Coefficient) considering composition of bonfires built in St. Anthony/2008 (SA), St. John/2007-2008 (SJ 2007 and SJ 2008) and St. Peter/2007-2008 (SP 2007 and SP 2008) celebrations in the Três Ladeiras community (Pernambuco State, Northeastern Brazil). Roman numerals refer to the quadrants.

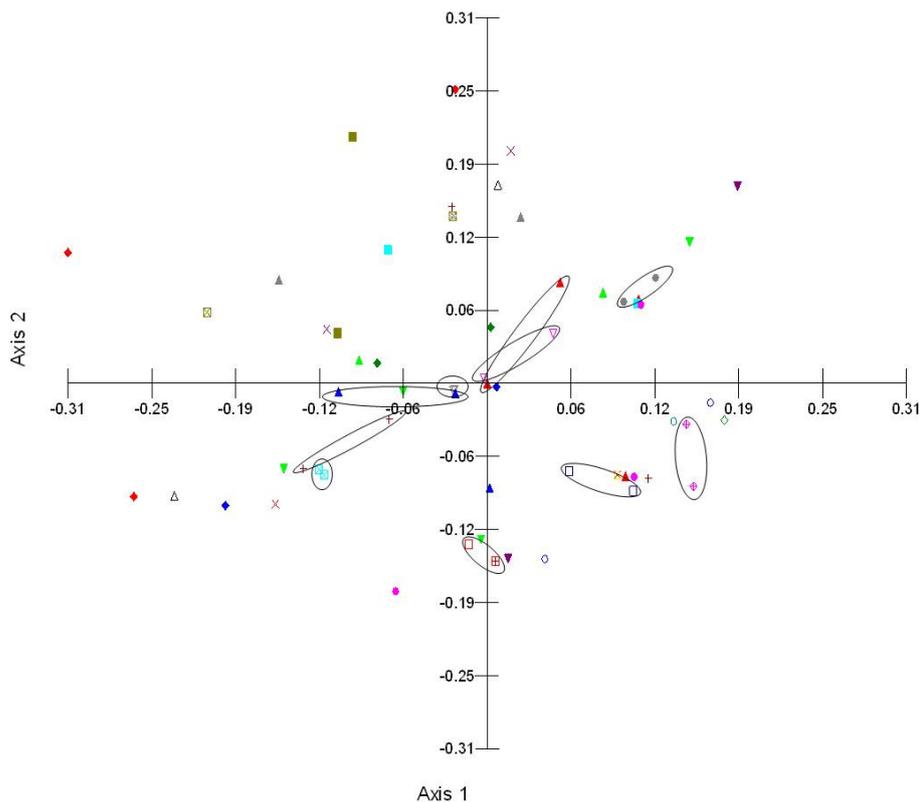


Fig. 4 Principal Coordinates Analysis (Gower's General Similarity Coefficient) considering composition of bonfires built in St. Anthony/2008 (SA), St. John/2007-2008 (SJ 2007 and SJ 2008) and St. Peter/2007-2008 (SP 2007 and SP 2008) celebrations in the Três Ladeiras community (Pernambuco State, Northeastern Brazil). Only bonfires of households that created them for more than one celebration are included. Similar colored symbols (ex: blue filled squares) indicate bonfires built in the same household for different festivities (ex: St. John 2007 and St. Peter 2008). The ellipses elicit those bonfires from the same household which had similar species compositions.

Wood consumption for bonfires

In the community, a total of 146.26 m³ of pile wood was registered, considering the sum of all bonfires built in all festivities (from 2007 and 2008). These bonfires were constructed with an average of 1.52 m³ of wood and most bon-

fires were built with less than a cubic meter of pile wood (Fig. 5).

Festivities that had higher wood volumes were St. John/2008 (74.15 m³), St. John/2007 (39.27), St. Peter/2008 (14.79), St. Peter/2007 (14.12) and St. Anthony/2008 (3.98). Although 2008 had a higher total volume (88.94 not consi-

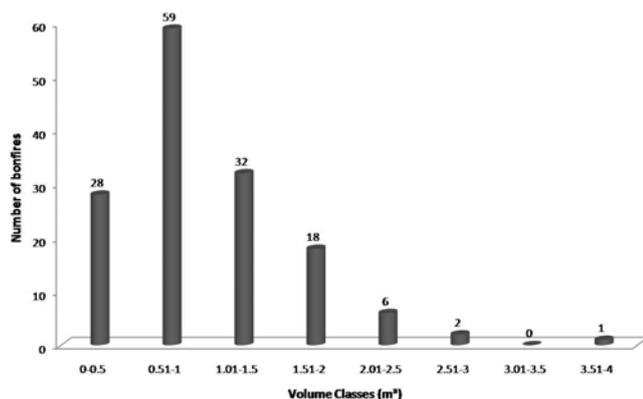


Fig. 5 Volume distribution (m³) of pile wood in bonfires registered in the Três Ladeiras community (Pernambuco State, Northeastern Brazil).

dering St. Antony, as compared to 53.39 in 2007), bonfires were constructed with similar amounts of wood in the two years ($t=0.14$; $p<0.05$). These results indicate that differences in bonfire volumes between 2007 and 2008 were not due to changes in bonfire size, but rather to the number of mounted bonfires. In fact, considering 2007 St. John and St. Peter celebrations, there were 55 bonfires in the community, while in 2008 there were 86 bonfires when summing the two celebrations. St. Anthony's celebration in 2008 had only six bonfires.

Volumes of bonfires reported by the 53 informants that are also firewood users varied from 0.05 to 2.52 m³. When asked about how long the bonfire material would last if it was used daily for firewood, they answered that it could last from two days to eight weeks. Therefore, total wood volume used for bonfires is equivalent to 3.44% of the total firewood consumption for domestic ends (cooking) among respondents.

Wood consumption and collection patterns

More than half of the material used for bonfires was collected in community non-forest areas (67.31%), followed by forest areas (20.6%), prior forest areas that were turned into farm fields (11.26%), and other construction wood

Table 2 Collection and consumption patterns of woody compounds used for bonfires in the Três Ladeiras community (Pernambuco State, Northeastern Brazil).

	Sum of citation number	%
Collection place	(n=364)	
Non-forest areas	245	67.31
Forest areas	75	20.60
Forest areas converted to farm fields	41	11.26
Rest of construction areas	3	0.82
Collector	(n=366)	
Men	332	90.71
Women	31	8.47
Men and women	3	0.82
Collection situation	(n=366)	
Dry	207	56.56
Green	143	39.07
"Zarolha" (intermediate stage between green and dry, when the plant is already cut but is still in the dying and drying process)	16	4.37
Used part	(n=344)	
Branches	140	40.70
Trunks	55	15.99
Branches and trunks	149	43.31
Reason for species presence in bonfires	(n=362)	
Availability	310	85.64
Preference	44	12.15
Availability and preference	8	2.21

(houses and fences, less than 1%) (Table 2). Regardless of where plants were collected, this is an activity almost exclusively executed by men, since 90.71% of the materials were collected by men, 8.47% by women and 0.82% by both.

When considering collected materials, it was verified that 43.31% of used materials were trunks and branches, 40.7% were only branches and 15.99% were only trunks. It was also verified that, according to the informants, 56.56% of plants were collected when dried, sick, and/or dead during informants' search of the wood, while 39.07% were collected alive. Moreover, a total of 4.37% of plants were collected at an intermediate stage between green and dry, when the plant is already cut but is still in the dying and drying process. This stage is locally known as "zarolho".

The large majority of materials were collected because of their availability (85.84%). Species preference was also an important factor that led to collection of 11.15% of materials. Furthermore, 2.21% of materials were collected for both reasons, since they were both available and preferred.

Local impressions about the tradition of making bonfires and discourse of the collective subject

With regard to the reasons that led informants to make bonfires for June celebrations, 11% of the respondents cited religious reasons as the main factor, that is, construction and lighting of bonfires as related to religious rites for the saints during June festivities: St. Anthony, St. John and St. Peter, as shown in the following comment of an interviewee: "Making bonfires is a way of remembering the saints". The majority of people (67%) cited this custom as a way of preserving tradition among the family and the community (ex: "It is a tradition from ancient times and I keep doing it"). Assimilation processes, encouraged by modernization and the availability of public services, have led many communities to the loss of their traditions. Nonetheless, some religious and cultural practices can survive even in non-traditional communities, as in the present community and communities studied by Cocks *et al.* (2006) in southeastern South Africa. In this study, the authors observed that many people maintain the practice of building wood artifacts that are used in gender-specific religious rites.

Some informants also said that they make bonfires mainly because of utilitarian factors (38%), and that they usually associate bonfires with roasting maize (*Zea mays* L.), given that this plant is also part of the June celebrations' cultural context and that its harvest coincides with the celebrations (ex: "I don't make bonfires for tradition, but rather for roasting maize"). Since antiquity, the June time of year is associated with grain harvests (Benjamin 1992; Fernández 1996; Campos 2007); maize could have been incorporated as a way of maintaining this association.

St. John's celebration is the most widely-celebrated in the community, since all respondents mentioned making bonfires in this festivity, and the community (98% of respondents) perceives this date as the one with the highest number of mounted bonfires. There are also those that make bonfires for St. Peter (35%) and St. Anthony (19%). Only 6% usually make bonfires for all three celebrations.

The custom of making bonfires for St. John may have a historic explanation, given that the Catholic Church associated their construction with the announcement of John the Baptist's birth (Prefeitura do Recife 2004). With regard to St. Anthony and St. Peter festivities, it is not well known how bonfires were incorporated. It is only known that, traditionally, men that are called Anthony or Peter have to light a bonfire in front of their houses as a way of honoring these Saints. This name-specific tradition was also found in Três Ladeiras, but it is probably not the only factor that governs this custom for St. Anthony and St. Peter celebrations.

Resource acquisition for bonfires in recent years was classified by 90% of informants as being difficult, since they say that resources are not readily available in the region. We have to be cautious when interpreting this data

given that, unlike other areas around the world that face or faced energy crisis (Mercer and Soussan 1992; Arnold *et al.* 2006; Ouedraogo 2006), Três Ladeiras exhibits no a lack of fuelwood, but rather, inhabitant difficulty in accessing these resources due to severe harvesting restrictions in forest fragments of the region, which are owned by the São José Factory. Only 10% of the people mentioned not facing difficulties for collecting forest wood to build bonfires because they turn to forest resources even with a formal prohibition. About 67% of respondents identified some kind of problem when lighting bonfires: most of them (81%) pointed out respiratory problems; some indicated global warming (4%) and others indicated general accidents (15%), such as risks related to electrical supply system exposure to fire or heat, or even risks to the plants close to bonfires. There were also those who did not identify any problem concerning bonfires (30%) and those who did not answer this question (3%).

When informants were asked about their perception of possible nature-related problems caused by bonfire confection, 50% mentioned some kind of problem. Among them, it was possible to identify the following groups: air pollution (56%), deforestation (26%) and risks to plant species due to contact or proximity with fire (18%). Forty-two percent of all respondents did not identify any problem, and 8% did not answer.

When questioned about what they would do if there was not wood available for bonfires in the community, 72% reported that they would stop making bonfires, e.g.: “If there wasn’t wood no one would make bonfires, it would end. Celebration wouldn’t be as fun as before.” However, 19% mentioned that they would find another way, e.g.: “I would light a candle to the saint, it makes the same effect,” or “I would burn garbage in front of my house to represent the bonfire.” Finally, 9% said that they would acquire wood from other regions, e.g.: “I would make it with material from elsewhere; I would search for wood far from here.” Notably, 72% of interviewees were not disposed to search for alternative ways of maintaining the tradition. Those who reported keeping this custom would make bonfires even if they needed to exchange wood for other materials like dried leaves, garbage and candles, demonstrating the strong symbolism of this ritual (Fernández 1996).

Regarding people’s attitudes if they faced a prohibition of wood harvest for bonfire confection, 92% said that they would obey the law and would not make bonfires, e.g.: “I wouldn’t make it. If it’s forbidden one has to obey. No one can overlook the law.” Four percent of respondents would contest the law, e.g.: “I am against prohibition” and 4% would make bonfires even with a prohibition, e.g.: “I would do it anyway.” It is important to clarify that this information may not be reflecting reality, since these people may have felt ashamed of telling their real attitudes should they confront the hypothetical situation that was presented to them.

For the construction of the Discourse of the Collective Subject regarding the question: If you were responsible for developing a plan (strategy) to guarantee that wood was always available for making bonfires, what would you do? Seventy nine answers were analyzed in the two years of research (Table 3), so that it was possible to build the following discourses:

“I don’t know the plan I would have; I have no idea of how to do it... We should try because trees are good, but I don’t have an idea for the trees not to end up because it is from nature. I would not even make bonfires.”

“Maybe pruning sick branches and planting new trees, or collecting only dry wood... People could search for fallen branches. I wouldn’t allow alive trees to be fallen, but the dried ones wouldn’t be harmful. People could also plant in road boards and not allow collection in forest areas, only if they collected branches and they made a collective effort to plant new trees. I wouldn’t let anybody cut green wood, and I would also leave an area for wood production, and then people could collect it, but some part of the area would always be growing wood...”

“People could buy wood in other regions and people

Table 3 Central ideas and key expressions recognized in the Discourse of the Collective Subject about “strategies to assure endless wood availability to make bonfires” for 79 respondents from the Três Ladeiras community (Pernambuco State, Northeastern Brazil).

Order number	Key expressions	Central ideas
1	<i>“I don’t know the plan I would have; I have no idea of how to do it... We should try because trees are good, but I don’t have an idea for the trees not to end up because it is from nature. I would not even make bonfires.”</i>	(1) “I don’t know the plan I would have”.
2	<i>“Maybe pruning sick branches and planting new trees, or collecting only dry wood... People could search for fallen branches. I wouldn’t allow alive trees to be fallen, but the dried ones wouldn’t be harmful. People could also plant in road boards and not allow collection in forest areas, only if they collected branches and they made a collective effort to plant new trees. I wouldn’t let anybody cut green wood, and I would also leave an area for wood production, and then people could collect it, but some part of the area would always be growing wood...”</i>	(2) “Maybe pruning sick branches and planting new trees.”
3	<i>“People could buy wood in other regions and people could do smaller bonfires instead of the big ones. I would come together with people to discuss what we could do...”</i>	(3) “I would come together with people to discuss what we could do.”

could do smaller bonfires instead of the big ones. I would come together with people to discuss what we could do...”

Thirty percent of people reported that they did not know which strategy to apply, so they opted for not giving any information. Ten percent of respondents answered this question with arguments that did not fit with the subject. A large part of the interviewees (43%) contributed interesting ideas, and their speeches involved ideas of reforestation and/or plant management, like using dead plant parts. It is clear that each person perceives, reacts and responds distinctly before acting upon the environment. Answers or manifestations are, therefore, results of the perceptions, cognitive processes, judgments and expectations of each person (Faggionato 2001).

Most informants are disposed to develop attitudes towards the conservation of resources for bonfires. This finding can be favorable to the development of future strategies for sustainable management in the area. The ideas could be utilized for general conservation strategies and applied to the acquisition of wood for use as firewood and in the context of construction. Some studies point out the importance of developing joint management plans, with the integration of the community functioning as a useful tool for the success of this activity (Halffter 1981; Bell 2000; Brown *et al.* 2004), but these types of studies are poorly disseminated in Brazil.

Visual ethnography essay

In Três Ladeiras, the material used for making bonfires is acquired in nearby areas comprised of both remaining forest areas and, non-forest areas like home gardens and common regions (Figs. 6, 7). Collection is predominantly executed by men and the younger are generally enthusiastic regarding participation in the process (Fig. 8). However, as many bonfire compounds are large and heavy, the activity is executed by adults. Mounting the bonfire does not take long, since wood pieces are disposed placed next to where stakes that support the bonfire are fixed (Fig. 9).

Many types of bonfires were registered, and they changed according to the type of material that is being used. Everyone who makes bonfires follows a similar-shaped pattern consisting of: piled branches and trunks of similar



Fig. 6 Wood collection areas for bonfire construction in the Três Ladeiras community (Pernambuco State, Northeastern Brazil). (A, B): general view of Atlantic Forest fragments. Forest areas that suffered vegetation clear-cutting to allow space for small-scale farming or sugarcane planting (C, D).



Fig. 7 Wood collection areas for bonfire construction in the Três Ladeiras community (Pernambuco State, Northeastern Brazil). Community areas next to or inside household territories (A). Material can also be acquired by cutting plants in household neighborhoods (B), by pruning individual large-sized fruit trees such as *Artocarpus integrifolia* L. (C) or by pruning the unhealthy branches of orchards (D).



Fig. 8 Children fixing stakes in the soil for bonfire mounting in the Três Ladeiras community (Pernambuco State, Northeastern Brazil). This is one of the first mounting steps; it can be executed by children because it does not require great physical strength.

lengths, with the thicker parts toward the bottom and away from the ground in such a way that the wind helps ignition.

These constructions can differ in the number of species utilized, from the monotypic (only one plant species) to the polytypic (with more than one species). Bonfires can also vary in terms of material origin and fuel value (according to local perception) (Fig. 10). Furthermore, in the case of people who live in the main street, when they mount their bonfires they are careful with respect to the paving in the main street. They sometimes use simple artifices, like fixing stakes (that delimit bonfires) in fresh pseudostems of *Musa paradisiaca* L. Another way of confining bonfires is by fixing thinner stakes, but stakes still strong enough to tolerate the bonfire's complete burning (Fig. 11).

Some materials are used to ignite the bonfire, such as wood slices that can be put under the bonfire or, more commonly, on top of the woodpile, as well as fuel or vegetable oil and plastic materials that, when burned, are very efficient in burning wood (Fig. 12). Although it seems to be safe, this activity requires careful attention, and is therefore generally executed by adults (Fig. 12).

Women do not effectively take part in this process, but they are still tied to the tradition. During the day, they are in the kitchens preparing typical foods that are eaten and shared with neighbors at night, when lighting the bonfires. Thus, tradition is a way of fraternizing and is also a way of



Fig. 9 Bonfire mounting process in the Três Ladeiras community (Pernambuco State, Northeastern Brazil). Holes are dug in the soil to hold the stakes that will serve as frameworks and will support bonfire compounds (A and B). Stakes can also be fixed in banana tree trunks in such a way as to keep a space between the wood and the ground, allowing the wind to facilitate the burning of material (C and D). Wood is piled until all material is settled. After this, the bonfire is considered finished (E and F).



Fig. 10 Different types of bonfires in the Três Ladeiras community (Pernambuco State, Northeastern Brazil). Monotypic bonfires, with only one or two species, generally derived from non-forest areas (A, B, C, D and G); and polytypic bonfires, with various species derived from both forest and non-forest areas (E, H and I).

celebrating the maize (*Zea mays* L.) harvested three months earlier, during the Saint Joseph celebration (in March).

FINAL CONSIDERATIONS

Any predetermined ideas regarding the impact of wood resource harvesting for bonfires must take into consideration that collection patterns can vary according to local contexts. In the Três Ladeiras community, wood harvest to this end was not concentrated in the Atlantic Forest, since most of the products were acquired in non-forest areas. This factor could have been influenced by prohibitions against using material from forest fragments in the region. In spite of the prohibitive milieu, a small group of native species is used for bonfire construction, notably *Byrsonima sericea* DC. and *Tapirira guianensis* Aubl. Members of the community pointed out possible solutions to reconcile the use of plant products with forest maintenance, demonstrating that these people seem to have a predisposition to make conservation efforts, and it can be an important factor when evaluating other types of use that demand high pressure on native re-

sources.

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Fig. 11 Bonfire construction in the Três Ladeiras community (Pernambuco State, Northeastern Brazil). Strategies used for avoiding damage on the main street pavement, such as: use of *Musa paradisiaca* L. trunks (stakes that serve as supports are fixed) (A, B and C), and the fixing of thinner stakes in thicker bonfire trunks (C, D and E).

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Fig. 12 Bonfire construction in the Três Ladeiras community (Pernambuco State, Northeastern Brazil). Use of materials to ignite bonfires, such as wood slices and dried branches, which can be disposed of under or on the bonfire (A and B); edible oil and plastic material (C, D and E); and assessment of the superior parts of bonfires (F, G, H and I).

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