

The Knowledge and Harvesting of *Myracrodruon urundeuva* Allemão by Two Rural Communities in NE Brazil

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ABSTRACT

The aroeira (*Myracrodruon urundeuva* Allemão) is a species of high regional value, with medicinal proprieties and wood-like characteristics that make it very useful. With this in mind, the aim of this work was to evaluate the state of knowledge and the uses of *M. urundeuva* in two communities located close to a fragment of caatinga in the municipality of Caruaru-PE. The studies were completed in about 20 ha of caatinga where 50 semi-permanent parcels were established for analyzing local availability and measuring both the structural parameters (DSL and height) and harvesting of these plant populations. Harvesting was measured by classifying the percent of extracted bark. In parallel, ethnobotanical data collection techniques were used in the communities adjacent to caatinga (Riachão and Ameixas). The two communities had multiple uses for *M. urundeuva*, including medicinal uses (53.2% of the citations in Riachão, 64.9% in Ameixas) and construction (31.5% in Riachão, 29.7% in Ameixas). The 27 sampled plants had an average height of 6.70 m and an average diameter of 11.80 cm. Forty-nine aroeira were found whole, from which 65.3% had no signs of harvesting. Of the other 34.7%, the great majority (58.8%) had up to 10% of the bark extracted. Thus, it can be concluded that *M. urundeuva* is a species with a variety of uses that does not suffer much impact from bark harvesting in the region.

Keywords: caatinga, conservation, ethnobotany, bark harvesting, local knowledge

INTRODUCTION

The “aroeira” (*Myracrodruon urundeuva* Allemão – Anacardiaceae) is widely distributed throughout the Brazilian northeast and is well studied because of the medicinal properties of its bark (Leite 2002; Monteiro *et al.* 2005). Anti-inflammatory, analgesic, antiulcerogenic and anti-diarrheic activities of the bark have already been pharmacologically evaluated and confirmed (Menezes and Rao 1988; Chaves *et al.* 1998; Leite 2002; Viana *et al.* 2003). Beyond these proprieties, the species also has uses as a wood. Its brownish-red wood has high mechanical resistance and does not rot. It is considered a hardwood, making it a preferred species for civil and naval construction, joinery, carpentry, cattle corrals, and stakes for fences and bridges (Morais *et al.* 1998; Leite 2002; Queiroz *et al.* 2002).

In caatinga, species with therapeutic value have been facing pressure due to an intense demand in formal and informal markets (Monteiro *et al.* 2006; Oliveira *et al.* 2007; Lucena *et al.* 2007a). *M. urundeuva* is considered “vulnerable” on the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis-IBAMA list of endangered species (IBAMA 2005). Therefore, studies of medicinal plant populations, such as studies of the impact of harvesting and how the plants are used, deserve attention because they are important tools for management and conservation strategies. In this short communication, we evaluate *M. urundeuva* and its uses in two rural communities located in a caatinga area in the state of Pernambuco, examining bark extraction, population structure, and the local availability of the populations.

MATERIALS AND METHODS

Study area

The study was carried out in the municipality of Caruaru, located between the 8° 14' 18.2" S and 35° 54' 57.1" W parallels, in a plateau 530 m above sea level. It has a warm semi-arid climate and is located 150 km away from Recife, the state capital, in the physiographic sub-zone of Agreste in Pernambuco, a micro-region of the Vale do Ipojuca (Alcoforado Filho *et al.* 2003). According to IBGE estimates (2003), 217,084 people reside in urban areas and 36,228 in rural areas. There is a predominance of eutrophic yellow podzolic soil, abrupt to moderate (Acrotort, loamy sand) with a wavy to strongly wavy relief. The area has a stationary climate with 710 mm annual precipitation and an average temperature of 22.7°C and drought between August and February (Alcoforado Filho *et al.* 2003).

For this study, a section of caatinga, classified as hypoxerophytic, was selected with an area of about 20 ha. This section belongs to the Instituto Agrônomo de Pernambuco (IPA), and has had native vegetal covering for at least 30 years (Alcoforado Filho *et al.* 2003). Two rural communities close to the studied forest section were selected: the community of Riachão de Malhada de Pedra and the community of Alto das Ameixas. Both communities are characterized mainly by cattle breeding and subsistence agriculture. Their populations are predominantly adult with low education, and agriculture is the main occupation (Lucena *et al.* 2007b, 2008). These areas were chosen with the aim of understanding the knowledge about, uses of, and management of *Myracrodruon urundeuva* Allemão. More information about the physical, biological and social environment of the region, as well as the local practices and appropriation of natural resources, can be found in Lucena *et al.* (2007a, 2007b), Albuquerque and Oliveira (2007), Florentino *et al.* (2007) Oliveira *et al.* (2007), Monteiro *et al.* (2005, 2006a, 2006b) and Ramos *et al.* (2008a, 2008b).

Ethnobotanical inventory

Interviews with heads of household were conducted in the two communities. All the inhabited houses whose owners consented to participate were visited. Thus, from the 123 registered homes in Riachão de Malhada de Pedras, 98 people were interviewed (55 men and 43 women), while in Alto das Ameixas, from the 65 registered houses, 58 were interviewed (25 men and 33 women).

The first part of the work consisted of registering socioeconomic data (e.g. age, marital status, place of birth, length of residence) and general knowledge about the useful plants in the region from each interviewee. Knowledge was compared between men and women and between the two communities. Statistical significance of the data was determined with the non-parametric Kruskal-Wallis test, using the software BIOESTAT 4.0 (Ayres *et al.* 2005). This general set of information also served as a basis for other ethnobotanical studies developed in the region (Monteiro *et al.* 2006a, 2006b; Albuquerque and Oliveira 2007; Lucena *et al.* 2007b; Oliveira *et al.* 2007; Ramos *et al.* 2008a, 2008b). Through analysis of these interviews, we selected the “main informants”, identified for their wider knowledge about plant resources in the region. They were responsible for enriching the research with more detailed information about the use of *M. urundeuva*. Eleven main informants were selected in Riachão and six in Ameixas. At this stage, specific questions about the use of the species were made, including when the bark is harvested, where it is collected, how often, which trees have the best bark, and the amount of bark extracted from the trunk. Though the small number of informants seems to limit any inference that may be made from the data, it is necessary to emphasize that, besides being specialists recognized by the other members of the community, these informants are frequently asked to prepare medicine from *M. urundeuva* bark (Monteiro *et al.* 2006a). Therefore, because they are the main bark collectors, they became the sources of information for answering the questions raised in this research.

Local availability of *Myracrodruon urundeuva* Allemão

For the study of the local availability of the species the structural parameters of the populations were measured. *M. urundeuva* individuals from the area of study were identified in the field with the help of local informants. Fifty permanent plots of 10 × 10 m were established in previous studies (Araújo 1998), totaling an area of 0.5 ha. The plots were distributed in a contiguous way in the interior of the area (approximately 10 m away from the border). The height, circumference at soil level (CSL) and circumference at breast level (CBL) of the individuals with $CSL \geq 9$ cm were measured. Afterwards, the circumference data were converted into diameter at soil level ($DSL = CSL/\pi$) and diameter at breast level ($DBL = CBL/\pi$). The heights and diameters were classified with intervals of 2 m and 4 m, respectively. The specimens were collected, identified and herborized. Voucher material is now recorded by the Professor Vasconcelos Sobrinho herbarium (PEUFR), Departamento de Biologia, Área de Botânica of Universidade Federal Rural de Pernambuco.

Stem bark harvesting from *Myracrodruon urundeuva* Allemão

To evaluate harvesting, in addition to the species marked in the parcels, we walked throughout the area in order to increase the number of individuals in the analysis. From this point, a classification system was employed based on the percent of bark extracted from each observed individual in a band 2 m from the soil following an 8 point scale, based on the proposal of Cunningham (1993) with slight modifications (Fig. 1). The Spearman correlation coefficient (Sokal and Rohlf 1995) was calculated between the level of damage and the value of the DSL, as well as the DBL, in order to verify whether there is a possible selection criterion concerning the size of the exploited individuals.

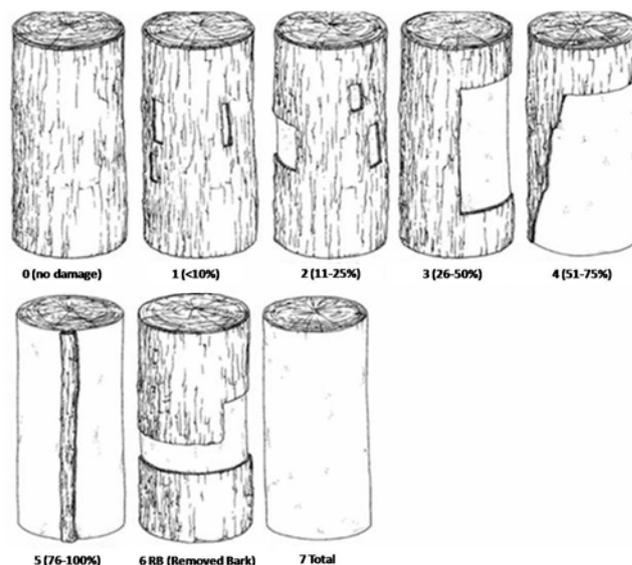


Fig. 1 Ordinal classification of the harvesting damage levels for the stem bark. Modified from Cunningham (1993).

RESULTS

Local use of the species

In the general interviews, made with all the members that agreed to participate in the work, most of the informants of Riachão de Malhada de Pedra (81.63%) cited the species *M. urundeuva* when asked about the useful species in the region, while in Alto das Ameixas only 50% of those interviewed identified the species. The informers also reported a large variety of uses for this plant, grouped into five categories as presented in Table 1. The prominent uses in Riachão were: medicinal (53.2% of the citations), construction (37.9%) (39 citations for fences, seven for house poles and one for vine stakes) and fuel (11.3%). In the community of Alto das Ameixas the uses were: medicinal (67.5%), cons-

Table 1 Number of citations of use of *Myracrodruon urundeuva* Allemão in Riachão de Malhada de Pedra and Alto das Almeixas communities, Caruaru, Pernambuco, Brazil.

Community (number of informants)	Use category	Number of citations
Riachão (98)	Medicinal	66
	Construction	47
	Fuel	14
	Fodder	2
	Others	3
Ameixas (58)	Medicinal	27
	Construction	11
	Fuel	2

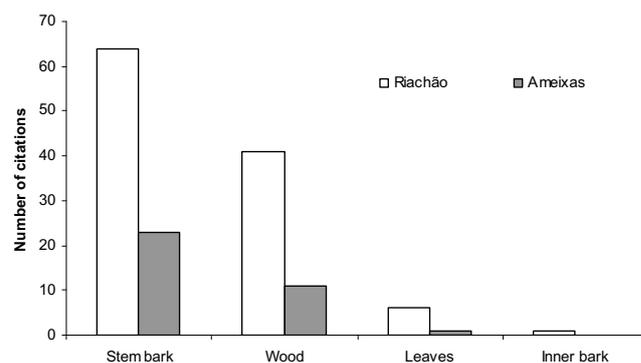


Fig. 2 Number of citations for the used parts of *Myracrodruon urundeuva* Allemão, in Riachão de Malhada de Pedra and Alto das Ameixas, Caruaru, Pernambuco, Brazil.

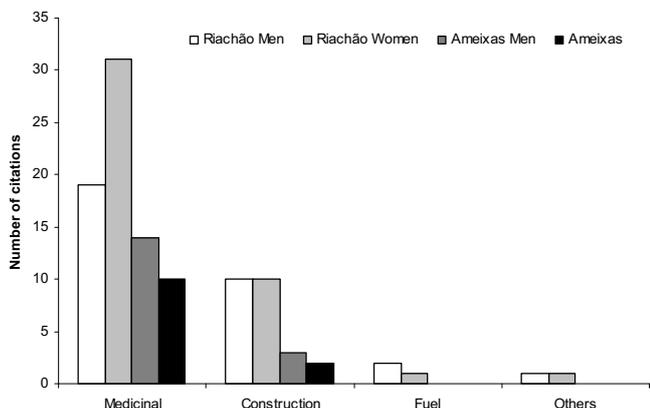


Fig. 3 Number of citations per use category for *Myracrodruon urundeuva* Allemão, separated by gender in Riachão de Malhada de Pedra and Alto das Ameixas, Caruaru, Pernambuco, Brasil.

truction (27.5%) (ten citations for fence and one for “fascine” fence, a fence found mainly in yards composed of vertically juxtaposed sticks) and fuel (5%) (Table 1).

The parts of the plant that are most used are: stem bark, with 57.2% of the informants citing it in Riachão, followed by wood (36.6%), leaves (5.4%) and inner bark (0.9%) (Fig. 2); in the community of Ameixas a similar distribution occurred, with bark continuing first (65.7% of the citations), followed by the use of wood (31.4%) and of leaves (2.9%) (Fig. 2).

Among medicinal uses, the informers from Riachão de Malhada de Pedra cited mainly anti-inflammatory uses (73.2%), followed by the treatment of pain and coughs, 7.1% and 5.4% respectively. In Alto das Ameixas the use of *M. urundeuva* against inflammation was also the most cited (30.8%), however, the use for pain presented greater prominence, being mentioned by 26.9% of the people interviewed, followed by the use for feminine aches, in reference to menstrual cramps (11.5%).

Comparing the number of citations between the interviewed men and women on the diversity of uses attributed to the species, we can see that in the community of Riachão, women proved to have a greater knowledge of the medicinal attributions of the plant than men, and they are responsible for 62% of the citations about use diversity (Fig. 3), but this difference is not statistically significant ($p > 0.05$; $H = 2.261$). In Ameixas, the men had a higher knowledge of the medicinal attributes of the plant (58.3% of the citations) (Fig. 3), however, this difference was not significant either ($p > 0.05$; $H = 0.094$). By analyzing the knowledge differences between the genders of the two communities, we see that both women and men of Riachão proved to have significantly greater knowledge of the diversity of uses of *M. urundeuva* than the men ($p < 0.05$) and women ($p < 0.05$) of Ameixas.

Key informants

When asked if there was any time of the year preferred for the collection of *M. urundeuva* bark, all were unanimous in affirming that there was not, and they reported that collection is connected to use, not the period of the year. The area studied was cited by the informants as the main source for collection of the plant (66.7% of the informants from Ameixa and 81.8% from Riachão) while the others collect mainly from the trees surrounding their residences. It is also worthwhile to emphasize that all those interviewed affirmed that the bark is not bought or collected in other regions.

A great number of those interviewed (63.6% – Riachão de Malhada de Pedras; 50% – Alto das Ameixas) reported that they only collect the bark when they need it. Only one interviewee, from the community of Riachão de Malhada de Pedra, showed concern over the uncontrolled extraction of the bark, emphasizing that its removal can compromise the

plant.

About 45.5% of the main informants from Riachão ($n = 5$) and 83.3% from Ameixas ($n = 5$) confirmed the existence of a relation between the size of the tree and bark extraction, saying that the biggest trees are favored. The others from Riachão and Ameixas answered that there were no difference concerning the individual tree’s size. This shows that the majority of those in Riachão do not use this criterion when exploiting the resource; while in Ameixas there is a tendency towards more selectivity.

The experts from Riachão extracted bark at an interval that varied from 10 cm to 2 m in length, but the main band of extraction was reported to be between 30 and 90 cm (54.5% of the informants), followed by lengths of 10 cm and 2 m (each comprising 9.1% of the citations). It is worthwhile to note that some of the Riachão informants (27.3%) could not specify how much bark they remove during each collection event. The band of bark removed by the Ameixas experts had more variation, ranging from 30 cm to 4 m in length, detaching a band from 30 to 45 cm (60% of the informants), followed by lengths of 2 m and from 3.5 to 4 m (each comprising 20% of the citations). None of those interviewed commercialized the bark of the plant.

Local availability and harvesting of *Myracrodruon urundeuva* Allemão stem bark

Twenty-seven whole *M. urundeuva* individuals were sampled, with heights varying from 2.5 m to a little over 14 m with an average of 6.70 m (± 3.14). Most of the individuals (about 62%) were found in the first height class, between 4.1 and 6.0 meters (Fig. 4). The diameter at soil level varied from 3.2 cm to 43.6 cm, with an average of 11.80 cm (± 10.80). The majority of individuals were in the first diametric class, between 3.0 and 7.0 cm (Fig. 5).

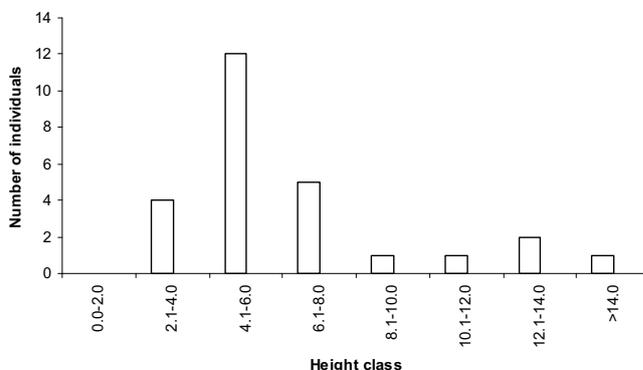


Fig. 4 Distribution of populations of *Myracrodruon urundeuva* Allemão in height classes in a caatinga fragment area, Caruaru, Pernambuco (Northeast of Brazil).

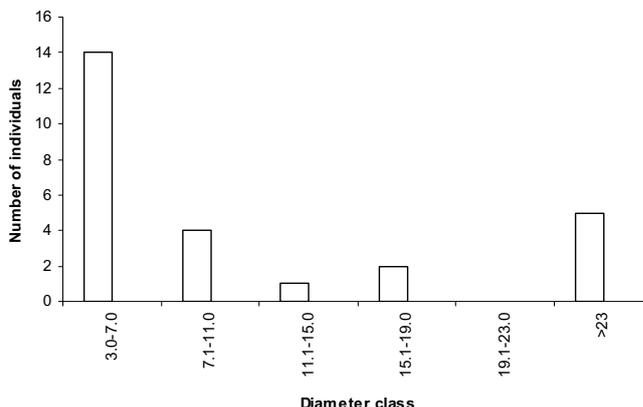


Fig. 5 Distribution of *Myracrodruon urundeuva* Allemão populations in diametric classes in a caatinga fragment area, Caruaru, Pernambuco (Northeast of Brazil).

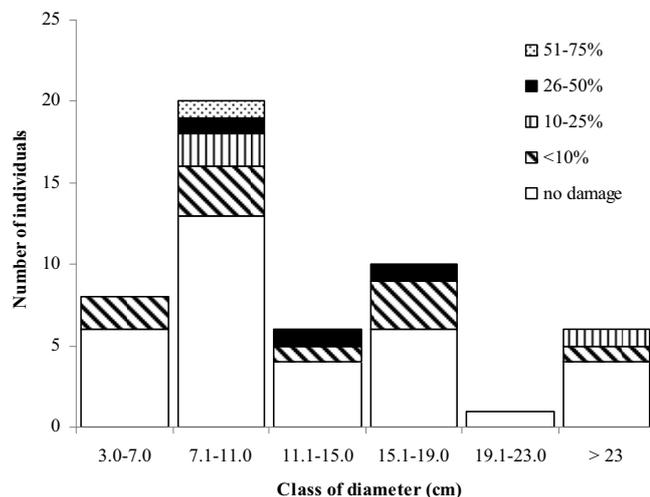


Fig. 6 Distribution of damages in diametric classes of *Myracrodruon urundeuva* Allemão in a caatinga fragment area, Caruaru, Pernambuco (Northeast of Brazil).

By walking, 49 trees were found in the area of study, with 65.3% showing no signs of harvesting (Fig. 6). Of those with signs of harvesting, the total distribution of damage showed that most (58.8%) had up to 10% extracted bark. Only one individual was classified in level 4 (51-75% of barks extracted), the highest category of damage found in this work.

The interval from 7.1 to 11 cm contained the highest number of individuals with signs of harvesting (eight), but it is worth noting that this class also contains the most individuals (42.8%) (Fig. 6). The diametric class with intervals from 15.1 to 19 cm also had a considerable number of individuals (ten), of which four had signs of harvesting (three up to 10% and one up to 25% of the bark extracted). For the individuals in the higher diametric class in the area (six), only two showed signs of harvesting (Fig. 6).

There was no significant correlation between harvesting damages and the diameter of the aroeira individuals at breast level ($r_s=0.25$; $p>0.05$), or at soil level ($r_s=0.11$; $p>0.05$). Therefore, it can be observed that bark collection is not related to the size of the individuals.

DISCUSSION

Local use

The medicinal use attributed to *M. urundeuva* is widely present in both Riachão de Malhada and Alto das Ameixas, although there is a significant difference between them regarding the number of citations and diversity of use. One possible explanation, based on field observations, might be the presence of a health office in Ameixas, which suggests that this community is more exposed to accidental medical practices. This simple factor could be acting to substitute traditional medical practices, resulting in a gradual reduction of knowledge about the species at issue. Riachão is more dependent upon medicinal resources from the adjacent forest. This is probably due to a lower influence of other therapeutic alternatives, either because of the lack of a health office, or because of the cultural importance of this practice. However, these are just conjectures, since the data presented here are not sufficient to make these inferences. Further work to elucidate these observations and address such questions is necessary.

Some studies have reinforced the idea that increased urbanization suffered by one community causes a decrease in knowledge of medicinal plants, causing an erosion of the local therapeutic practices and promoting the use of allopathics (Amoroso 2002; Vanderbroek *et al.* 2004; Reyes-García *et al.* 2005). On the other hand, the high cost of indus-

trialized medicine could also be preventing the acceptance of these drugs in Riachão (see Begossi *et al.* 2002). Nevertheless, for this study, verification of the real use of *M. urundeuva* by the communities is necessary, since a plant isn't necessarily heavily used just because it has received a high number of citations (Albuquerque 2006). In light of this, the inferences above are limited since some data are based only upon field observations and the effectiveness of use was not tested in this study.

Myracrodruon urundeuva is well known in the communities studied, which makes us believe that this species may be exploited in the region for its locally perceived therapeutic characteristics and for its wood (Monteiro *et al.* 2006b; Lucena *et al.* 2008; Oliveira *et al.* 2007; Ramos *et al.* 2008a, 2008b). Although the informants have knowledge of a vast range of medicinal species composed mainly of exotic plants, there is a preference for using species native to the region (see Albuquerque and Oliveira 2007).

The women and the men in the same community revealed similar knowledge of the diversity of medicinal uses for *M. urundeuva*. This result is different from the one found by Begossi *et al.* (2002) in Caicara communities, in which women are the holders of knowledge about the locally used medicinal species. Monteiro *et al.* (2006b) found a situation similar to the one in Begossi *et al.* (2002), drawing attention to the fact that the men generally have more knowledge about the use of plants for wood, and make more incursions in the forest, while the women retain more knowledge about domestic activities, like the maintenance of agroforestry yards and the medical use of plants (Luoga *et al.* 2000; Lacuna-Richman 2003; Florentino *et al.* 2007). However, there are also studies, including the present body of work, that have not observed this pattern, finding no significant difference in the knowledge of plant use between genders (Matavele and Habib 2000).

Local availability and harvesting of *Myracrodruon urundeuva* Allemão stem bark

The populations of *M. urundeuva* found in the region are composed mainly of juvenile individuals with diametric classes distributed in a shape close to an inverted J, suggesting a capacity for auto-regeneration and possibly maintenance of density levels (Silva and Barbosa 2000), since diameter is an indication of age (Antonini and Nunes Freitas 2004). This data can also suggest the occurrence of a selective cut, eliminating individuals with a bigger diameter. Although medicinal use of the plant by the communities of Riachão and Ameixas does not seem to affect the populations of these plants in the local vegetation, the structural data described above reveals a fragility of *M. urundeuva* individuals if their use, mainly as wood, becomes intensive. According to Leite (2002), *M. urundeuva* is one of the neotropics most endangered species because of its frequent use as a wood, mainly in the construction of fences and vine stakes. Multiple uses for the same species are common practices in the region of caatinga (Lucena *et al.* 2007a). Monteiro *et al.* (2006b), when studying the uses and availability of *Anadenanthera colubrina* (Vell.) Brenan (angico) near the same rural communities of the municipality of Caruaru-PE, realized the species was heavily used for wood, indicating that the resource might be structurally affected, not by local medicinal practices, but mainly by other uses associated with the species, such as its use for wood. When it comes to evaluate the harvesting impact on populations of useful species, the whole cultural context of the use practices must be considered for each given species.

M. urundeuva individuals are under a bark collection regime either in the forest or in agroforestry yards. Little is known about the possible biological alterations suffered by medicinal plants submitted to different management regimes. The majority of studies on this topic are directed at edible plants, mainly concerning incipient domestication, like the studies of the Mesoamerica region (Casas *et al.* 1997; Albuquerque 2005b). This approach, like the percep-

tion of the vegetation dynamic at the time of exploitation, are valuable for developing strategies directed at the conservation of biodiversity.

There was no evidence for any criteria directing bark removal from *M. urundeuva*, which can affect the smallest individual because of the randomness of extraction. Borges Filho and Felfili (2003) observed a similar situation in the case of the "barbatimão" (*Stryphnodendron adstringens* (Mart.) Coville), in which disordered bark collection can put this species at risk for local extinction. There is a tendency for *M. urundeuva* bark collection from individuals belonging to the lowest diametric classes. However, in Ameixas, data on bark extraction were not significantly correlated with diameter. This is not congruent with the information from residents and the sizes of trees with harvested bark. Nevertheless, the data are still insufficient to make major inferences. More studies are needed to address these questions. In general, however, collection is disordered, and when conducted in this manner, it significantly affects thin stemmed trees, because according to Borges-Filho and Felfili (2003), such a practice can make the plants more physically fragile. These same authors also warn that the removal of bark affects the longevity of plants, since the cut in the stem can affect the phloem, damaging secondary growth and development (see Borges Filho and Felfili 2003). However, the results of this study suggest that the medicinal use of this species does not seem to put it at risk, since a large portion of the individuals examined did not have signs of damage. There is no local commercialization of the bark, so it is restricted to domestic use. This last consideration reinforces the idea that this species does not suffer great bark harvesting pressure, since medicinal plant commerce is one of the main causes of overexploitation of vegetation resources, often provoking irreversible damages to the populations (Cunningham 1993; Purohit *et al.* 2001; Maikhuri *et al.* 2003).

Prunus africana (Hook. f.) Kalkman, a species with multiple uses and high local and international economic value, is documented by Cunningham and Mbenkum (1993) and Ndibi and Kay (1997) to be subject to bark collection at a massive rate due to a strong commercial demand. This compromises populations of this species in many regions of Africa. Botha *et al.* (2004), studying the commercial impact of the collection of *Warburgia salutaris* (Bertol.) Chiov., also drew attention to the fact that strong commercial interest in medicinal species, mainly when harvesting is conducted in a disordered way, results in a decrease of the local population, which can drive the plant into scarcity.

FINAL CONSIDERATIONS

M. urundeuva is a species whose use is wide spread in the studied communities, who use it most often for medicinal purposes. The majority of the informants collect its barks according to necessity, and they did not show any worry in the interviews about any damage that this harvesting activity might cause.

It is important to note that even considering that the medicinal use of the plant does not affect the structure of the population in the region, the structural data show an apparent fragility in the species if it is intensely used, mainly as wood.

Finally, it is important to note that the data presented in this work can serve as a protocol for basic investigation to identify the possible impacts that the harvesting activity may cause. However, we emphasize that more in-depth studies might attempt to associate information about the use and collection of the species by members of the whole community, since the data acquired through key-informants might be limited if they do not reflect the general opinion of the community.

In order to have more reliable data it would be of interest to follow collection activities and also to access data about real use of the plant, since inferring this through general interviews can be an important source of error.

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