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Ethnobotany of rural people from the boundaries of Carlos Botelho State Park, São Paulo State, Brazil

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RESUMO – (Etnobotânica de uma população rural próxima do Parque Estadual Carlos Botelho, SP, Brasil). Neste estudo, nós descrevemos e analisamos o uso de recursos vegetais em uma região próxima a uma área de conservação. Os dados foram coletados através de entrevistas semi-estruturadas, incluindo listagens livres dos recursos vegetais conhecidos. As espécies foram identificadas através de coletas botânicas e de observações de campo. Foram entrevistados 58 habitantes; cultivo de banana, trabalho em fazendas de gado e extração de palmito são suas atividades econômicas principais. Foram mencionadas 248 etnoespécies, correspondendo a mais de 200 espécies botânicas. As plantas foram agrupadas em quatro habitats (A = floresta bem preservada; B = floresta perturbada, em estágios successionais avançados; C = ambientes recentemente perturbados; D = áreas cultivadas e quintais). Uma maior diversidade foi encontrada para o habitat A, seguido por C+D, e finalmente por áreas B; entretanto, é esperada uma riqueza maior de espécies para a área B quando comparada a C+D. Há poucas espécies comuns, e proporções comparáveis de espécies intermediárias e raras, para todos os habitats. As espécies comuns ocorrem em todos os tipos de habitats. O conhecimento local das plantas dos habitats bem preservados é mais diverso do que para plantas de outras áreas, sugerindo que a relação entre habitantes e a área de conservação é ainda intensa.

Palavras-chave: Floresta Atlântica, diversidade, etnobotânica, conhecimento ecológico tradicional, áreas perturbadas

ABSTRACT – (Ethnobotany of rural people from the boundaries of Carlos Botelho State Park, São Paulo State, Brazil). In this article we describe and analyze the use of plant resources in a region nearby a conservation area. Data were collected through semi-structured interviews, in which we asked the interviewees to free list the plants known. Species cited were identified through collection of botanical samples, and field observations. Fifty-eight inhabitants were interviewed; banana farming, cattle ranching, and extracting palm hearts are their main economic activities. A total of 248 ethnospecies were mentioned, including over 200 botanical species. Plants were grouped into four habitats (A = well-preserved forest; B = disturbed forest in old successional stages; C = recently disturbed environments; D = cultivated areas and home gardens). Highest diversity is known for plants from A habitats, followed by C+D, and finally by B areas; however, a higher number of species is expected in B areas when compared to C+D. There is a small number of common species, and comparable proportions of intermediate and rare species, for all habitats. Common species occur in all types of habitats. Local knowledge of plants from well-preserved habitats is more diverse than for plants from other areas, suggesting that the relationship between inhabitants and the conservation area is still intense.

Key words: Atlantic forest, diversity, ethnobotany, traditional ecological knowledge, disturbed areas

Introduction

The Atlantic Forest is the second largest tropical rain forest of Brazil, following the Amazon. Reduced in its area, with less than 10% of its original range remaining, this biome tops the list of Brazilian conservation priorities, due to its high endemism, diversity, and threats of habitat destruction (Myers *et al.* 2000). The scenario of habitat destruction has historical roots in Brazilian colonization (Dean 1996) and was intensified in the last century with the presence of the largest Brazilian urban centers, such as São Paulo and Rio de Janeiro, and pressures related to agricultural growth, real estate speculation and the expansion of tourism.

Despite these major pressures, there are also native and rural inhabitants living near the forested areas and, in many instances, depending directly on the forest for some of their livelihood. Focusing on this relationship between people and plants (Schultes & Reis 1995;

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Minnis 2000), ethnobotanical studies in Brazilian Atlantic Forest have grown in the last decade. Instead of essentially descriptive studies, quantitative approaches have been developed and applied, such as in the case of ethnobotany of native inhabitants of the Atlantic coast - the caiçaras (Begossi *et al.* 1993; 2002; Figueiredo *et al.* 1993; 1997; Rossato *et al.* 1999; Hanazaki *et al.* 2000; Peroni & Hanazaki 2002). The paramount importance of these studies is associated with the presence of human settlements near areas topped for conservation priorities, especially when some local practices, knowledge, and skills are valued for conservation purposes. It is not by a chance that some native populations remain near the last fragments of Brazilian Atlantic Forest, often overlapping conservation areas. The conservationist debate over areas free from people versus areas where conservation and use could be coupled is not a new one (Zube & Busch 1990; Schimink *et al.* 1992; Kemf 1993; Schwartzman *et al.* 2000; Peres & Zimmerman 2001). Ethnobotany studies can contribute to this debate, analyzing how local people identify and use the forest resources, and which areas and which species are used most intensively (La Torre-Cuadros & Islebe 2003; Dalle & Potvin 2004). This view is embedded with the *in situ* conservation perspective, which includes the aims of maintain the forest together with some of the cultural relationships between people and plants (Tuxill & Nabhan 2001).

In spite of these studies focused on ethnobotany of settlements of the Brazilian Atlantic Forest coast, inhabited by farmer-fishermen, very few studies analyze the knowledge and use of plant resources by other rural communities (Voeks 1996; 2004; Di Stasi *et al.* 2002; Medeiros *et al.* 2004; Voeks & Leony 2004; Silva & Andrade 2005). Rural communities in Brazil include a wide range of cultural influences (Ribeiro 1995) and, in some cases, when they share characteristics such as self-determination, production for subsistence, local institutions, and reinforced cultural traits; they are considered to be traditional people (Diegues & Arruda 2001). In other instances, these characteristics are almost absent, and rural people encompass inhabitants from different regions of the country as well as people native to urban and periurban areas.

The main aspect investigated in Atlantic Forest ethnobotany is the use of medicinal plants, influenced by the development of ethnopharmacological studies and by numerous investigations on medicinal plants (see Schultes & Reis 1995; Balick & Cox 1996). Other plant species with non-medicinal uses are heavily exploited in Brazilian Atlantic Forest, such as palm hearts ("palmito juçara", *Euterpe edulis* Mart.) extraction, generating chronic socio-environmental conflicts due to the illegal status of such activities. Besides the knowledge of medicinal resources and the controversial extraction of palm hearts, the local inhabitants are expected to have some knowledge of the local flora. The aim of this paper is to describe and analyze the use of plant resources (medicinal and non-medicinal) in a region near a conservation area, the Carlos Botelho State Park, focusing on tree species. Specifically, we are interested in investigating which kind of plant resources are identified and used by people living near a relatively well-preserved conservation area.

Methods

Study site – Brazilian Atlantic rainforest is characterized by a complex of vegetation types, including the forests in mountain slopes, the coastal plains with swamp forests, dry semideciduous forests and open thicket vegetation on marine sand deposits (Scarano 2002). The forest area in the studied region is characterized as an ombrophilous dense forest (Veloso & Góes Filho 1982), with a high diversity of tree species. Custódio Filho *et al.* (1992) registered 176 tree species, estimating a total richness of about 250 tree species for the Carlos Botelho State Park area. According to O.C. Negreiros (unpublished data), the trees with higher importance value include *Bathysa* sp., *Euterpe edulis* Mart., *Sloanea* sp., *Tetrastylidum* sp., several Myrtaceae, *Cryptocarya* sp., *Nectandra* sp., *Chrysophyllum* sp., *Hieronima* sp., *Cupania* sp., *Cabralea* sp., *Inga* sp. and *Torrubia* sp.

The study area encompasses the rural communities on the southern boundary of Carlos Botelho State Park, in the southern part of São Paulo State, Brazil. With an area of 37,644 ha, this conservation area was constituted in 1982 by the fusion of four reserves created in the 1940s. An ancient trail used to transport cattle and goods was enlarged, before the creation of the reserves, and transformed into a road that runs 33km across the Park, connecting the towns of São Miguel Arcanjo and Sete Barras. The Park has no local inhabitants living inside its boundaries, yet the presence of the road is a constant threat to conservation.

This study focuses on the rural communities located in the municipality of Sete Barras, at the southern boundary of Carlos Botelho State Park. The area belongs to a region widely known as Ribeira Valley, a region that has been relatively isolated from the Brazilian economic mainstream due to historical factors and to the lack of infrastructure to overcome its biophysical limitations. As a result, this region presents the lowest indices of literacy and income in São Paulo State, and the largest concentration of continuous Atlantic Forest remnants in Brazil (Hogan *et al.* 1999).

The municipality of Sete Barras has about 13,900 inhabitants, with 66% of this population living in the rural area (IBGE 2002). Banana plantations are responsible for most of the agricultural production in this region. Other economic activities in the rural area are small-scale cattle ranching, fruit crops, and palm-heart planting and extraction. According to the official census (IBGE 2002), the latter activity is responsible for less than half percent of the local economy. However, it is an outstanding and conflicting activity, which involves illegal extraction of a forest resource (Orlande *et al.* 1996; Reis *et al.* 2000), and these figures can be underestimated.

The rural inhabitants of the region are composed mainly of laborers on banana plantations and small farmers. Some of them probably have some proportion of Amerindian blood, however they are not Indians. They are primarily from European-colonizer and African-slave stock, constituting the typical Brazilian rural people (Cândido 1977; Ribeiro 1995). These native inhabitants are not considered strictly to be traditional people, because they are not self-determined as such (Cunha & Almeida 2000), yet they have lived in this region for generations and share broad characteristics of the rural Brazilian inhabitants. There is high mobility among the local families, as temporary laborers on banana farms. A preliminary survey indicates that about 10 percent of the houses along the SP-139 road were abandoned, and about a quarter were closed.

Data collection – Fieldwork was done from 2002 to 2004. We selected the communities closest to the southern boundary of the Carlos Botelho State Park, along the road. We explained the purpose of the research after preliminary contact with the interviewees. Data were then collected through semi-structured interviews, with adult residents who agreed to take part in the research. The sampling effort corresponded to 50% of the houses, interviewing inhabitants in one out of two houses. We interviewed both male and female inhabitants, separately, who had lived in the region for at least two years. Refusal to participate in the interview occurred in 7% of the contacted residents. After a socio-economic characterization, we asked each interviewee to free list the plant resources he or she knew. Directed questions were used to investigate particular aspects of local knowledge, regarding plants for medicine ("plants used for remedies"), food ("edible plants" or "plants with edible fruits"), handicrafts ("plants used by artisans and for construction"), wood and timber, and firewood. For each cited taxon we asked about its uses and where the plant could be found (e.g. home gardens, near the road, anthropic environments, secondary succession, forest, swamps).

Cited plants were collected with the help of each interviewee. Plants widely known, such as orange, banana and other well-known plants were identified *in situ*. Plant vouchers were deposited in the ESA herbarium (University of São Paulo, Brazil).

Data analysis – The plant ethnotaxonomy was briefly analyzed and compared with the classic hierarchical ranks proposed by Berlin *et al.* (1973) and Berlin (1992), considering the information present in all interviews as a group.

The species mentioned were grouped according to habitat in four main types. These types were previously defined (Peroni & Hanazaki 2002; Hanazaki *et al.* 2005) and they match general perceptions of the local inhabitants of Brazilian Atlantic forest in four emic categories. In this specific case, the assumption of similar semantic meaning in classifications of local people and conservation professionals is realistic, since the local users are not strictly traditional people (see Casagrande 2004 for further discussion). Type A habitats correspond to well-preserved forest (or, according to the interviewees, "mata"). The major area of this kind of forest is the Carlos Botelho State Park. However, a few other fragments were found throughout the region. Type B habitats correspond to the forest once altered by deforestation, yet at successional stages up to 50 years from the last deforestation (or "capoeirão"). Type C habitats correspond to environments directly and recently disturbed by human activities (or "capoeira"). This type also includes anthropic environments such as the edges of roads and trails, semi-abandoned yards and non-cultivated areas around houses. Type D habitats include cultivated areas, both productive plots (or "roças") and managed home gardens (for further discussion on management intensity and environments, see Hanazaki *et al.* 2005). Since this paper stresses the ethnobotanical knowledge in forest areas, types C and D were grouped together for further diversity analysis.

The salience of a plant listed by respondents refers to its psychological prominence (Quinlan *et al.* 2002), and can be calculated through free-listing interviews (Bernard 1995) that combine the frequency of plant citation with the order of citation (Robbins & Nolan 1997). Salience relies on the fact that: a) the respondents tend to mention the most culturally important items first in a list, and b) the best-known plants are usually listed more frequently (Trotter & Logan 1986; Quinlan *et al.* 2002).

Hill's diversity numbers were used to compare proportions of rare, intermediate and common species (Magurran 1988; Williams *et al.* 2005). Hill's numbers provide a method to describe the relationship between diversity indices (Magurran 1988) and, according to Williams *et al.* (2005), the values of N1 (Shannon-Wiener, base *e*), N2 (reciprocal of Simpson's index, 1/D) and $N\infty$(reciprocal of the proportional abundance of the commonest species, or reciprocal of Berger-Parker index), corresponding to measures of abundant, very abundant, and most abundant species in a sample, respectively. The value of $N\infty$can be interpreted as a measure of the common species, $N1-N\infty$can be interpreted as a measure of the number of intermediate species, and N0-N1 corresponds to a measure of rare ones. Other diversity comparisons followed Begossi (1996) and Hanazaki *et al*. (2000) and included the estimated richness for a rarefacted sample and Shannon-Wiener comparisons using a modified *t* test (Magurran 1988; Hanazaki 2004).

Results and discussion

The interviewees – Fifty-eight local inhabitants were interviewed, with ages ranging from 18 to 93 years (mean = 49 yrs, s.d. = 18.9 yrs), corresponding to 30 women and 28 men. The households have an average of four members. About 38% of the interviewees were born outside the Ribeira Valley Region. These outsiders averaged 50 years old (s.d. = 17.2 yrs) and have lived in the region for 23 years on average (s.d. = 12.5 yrs). More than a quarter of the interviewees are illiterate and more than half only attended primary school (up to four years). Only three percent of the interviewees reached higher levels.

The main economic activities of the inhabitants of this region are related to banana farms, cattle ranching and extraction of palm hearts. Less than a half of the interviewees own their land. Most of the inhabitants live in rented houses or in rent-free houses lent by their owners. Four small-property owners were planting seedlings of *Euterpe edulis* Mart. and other palms such as *Archontophoenix alexandrae* (F. Muell.) H. Wendl. & Drude and *Euterpe oleracea* Mart. in order to produce palm hearts in secondary forests on their property. Two of these owners mentioned that they intend to replace banana crops with restored forest, to produce palms in the understory. However, the illegal extraction of *E. edulis* is still practiced in the region and represents one of the major threats to biological diversity in this area (Orlande *et al.* 1996; Matos & Bovi 2002).

The average per capita income is R$ 101.97, with a high standard average of R$ 96.29, pointing to social stratification in the sampled area (in June 2002, R$ 1.00 = US$ 0.37). Highest per capita income was from families that own their land and have banana farms, employing local labor. Families with the lowest incomes were those who live in areas owned by their employers and who work for monthly wages or are paid on a daily basis (a day of work in the banana fields earns about R$ 10.00). Also included in this group are the small banana farmers and "posseiros" (people who have land tenure through use over time).

Plant knowledge – Plant ethnotaxonomy compared to the classical hierarchical ranks proposed by Berlin *et al.* (1973) and Berlin (1992) is exemplified in Fig. 1. The local perception of the plant world has some slight differences from the standard urban Brazilian perception. According to the interviewees, there is no name for the unique beginner rank, and no name for the plant world. The taxon "planta" is restricted to the cultivated plants, such as "laranja" (orange), "banana", and "mandioca" (cassava). The local knowledge related to the native trees can be detailed in the taxon "árvore" and under the dichotomy "árvore de cerne" and not-"árvore de cerne". The latter refers to the native trees used for firewood and other purposes, and the former differentiates the native trees used preponderantly as timber (also known as "madeira de lei"). Other details were related to trees with edible fruits, and trees used for medicinal purposes.

The entire group of interviewees (n = 58) mentioned a total of 731 citations, corresponding to 248 ethnospecies (Hanazaki *et al.* 2000, or generic plant folk taxa, following Berlin 1992, see also Fig. 1). Among the 248 ethnospecies, 25 names were synonyms, according to the interviewees. Binomial names account for 14.9% of the generic plant taxa. One-to-one correspondence was observed with 223

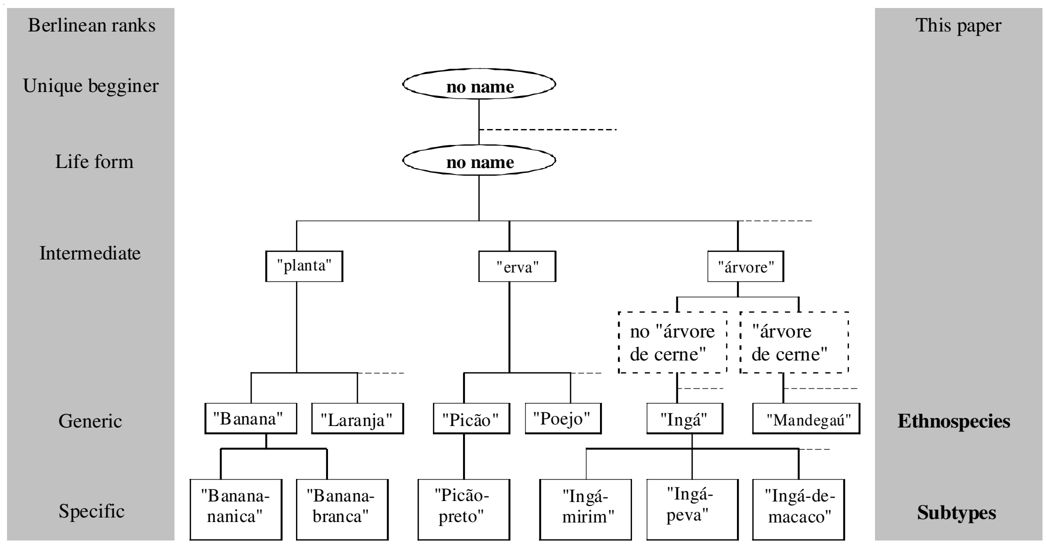

Figure 1. A model for the ethnotaxonomy of plant resources cited by the interviewees at the southern boundary of Carlos Botelho State Park, Brazil.

plant species. The synonyms included names with slightly different sounds, such as the inversions of /Z/ with /J/, in the case of "jacatirão" and "nhacatirão". Synonyms also included different names attributed to the same reference plant, such as "caquera" and "quaresmeira" (*Senna multijuga* (Rich) Irwin et Barn.).

Local varieties (or specific plant folk taxa, following Berlin 1992) were considered to be subtypes of a given generic plant taxon, even if it corresponds to different botanical species, such as in the case of *Ingas* (ethnospecies, or generic taxon *Inga*; subtypes "ingá-mirim", "ingá-peva", "ingá-de-macaco", "ingá-ferro").

Plant uses and environments – A similar proportion of plant citations was observed for habitat types A (well-preserved forest, 36%) and D (cultivated areas and home gardens directly managed, 31%), followed by type B (old successional stages, 22%), and finally type C habitats (recently disturbed areas, 11%). Nevertheless, if we consider habitats C + D together, a highest proportion of plants (42%) corresponds to this group. According to Chazdon & Coe (1999), second-growth forests have high utilitarian value as well as conservation value, and will likely become important sources of forest products. The importance of secondary forest as a source of ethnobotanical information was also stressed by other authors (Toledo *et al.* 1995). Especially for medicinal plants with herbaceous and/or weedy habits, cultivated areas and home gardens directly managed are important environments for its collection. Voeks (2004) discussed the dependence on successional mosaics for plant medicinal resources in Atlantic forest areas. The association between directly managed habitats and plant medicinal resources configures a pattern well documented in ethnobotanical literature (Bennett & Prance 2000; Stepp & Moerman 2001; Stepp 2004; Albuquerque *et al*. 2005; Estomba *et al.* 2006). However, we agree with Casagrande (2004) when he considered that there are problems in generalizing these results, because the importance of well-preserved forest varies between types of products (e.g. medicinal, construction materials), and because the economic and ecological relationships are unique in each case (e.g. market pressures towards different forest resources). For example, regarding wild edible plants, Ladio & Lozada (2004) found that the greatest total richness and highest diversity of plants come from distant forest environments, and not from areas nearby homes.

Five general use categories were observed (Tab. 1). The majority of ethnospecies cited have only one general use (63%). Plants with two general uses made up 31% of the cited taxa, and only 6% of the plants were used for three general purposes. The highest number of species was used for medicinal purposes, followed by plants for timber and for food. However, the majority of medicinal plants are obtained from habitats C and D, when compared to A or B ($\chi^2 = 37.80$, $p<0.01$, 2 df). The same was observed for edible plants ($\chi^2 = 14.14$, $p<0.01$. 2 df). On the

Table 1. Main uses of cited plants, according to the interviewees. Values in parentheses indicate the percent of each use in relation to the total uses, for 282 citations of uses attributed to the 223 plants.

Use	Description
Medicine (30%)	Leaves used for infusion, cataplasm, baths. Bark used in alcoholic beverages. Resins, roots and fruits are rarely used. Used to treat common symptoms of colds, flu, headaches, toothaches, stomachaches, kidney malfunctions, high blood pressure, intestinal worms, to heal wounds, rheumatism, bladder, dysentery, indigestion, eczema, menstrual pains, measles, among others.
Wood (24%)	For construction of houses and some furniture; manufacturing of handles; manufacturing of canoes, fence posts, and wooden wagons.
Food (23%)	Edible fruits eaten raw or as juice; edible tubers and palm hearts eaten cooked; leaves used as a seasoning.
Firewood (9%)	Low-quality wood for timber, either dry or, in some cases, recently cut.
Handicrafts (7%)	Mainly lianas and climbers to provide fibers for handicrafts such as baskets, brooms, mats, fish traps, hats.
Other (7%)	Commercial uses (palm heart and some ornamentals), ornamental uses, fruits used to attract small mammals and birds, fruits used as bait, magic uses (to protect against "evil-eye").

other hand, the majority of plants used to provide wood are obtained from A habitats (χ^2 = 37.48, p<0.01, 2 df), and plants used for firewood are collected from B habitats (χ^2 = 22.67, p<0.01, 2 df). Plants used for handicrafts and other uses have a similar distribution among the habitats (χ^2 = 0.88, p>0.01, 2 df), that is, one type of environment does not predominate over the others.

The group of species used for medicinal purposes are mainly herbaceous plants, from type D habitats, which agrees with the findings of Albuquerque *et al.* (2005), Stepp (2004) and Stepp & Moerman (2001), among others. Medicinal plants commonly used correspond to the main species used elsewhere in Atlantic Forest communities (Begossi *et al.* 2002; Di Stasi *et al.* 2002) and in other Brazilian regions, such as *Mentha piperita* L., *Cymbopogon citratus* (DC.) Stapf., *Psidium guajava* Raddi, *M. pulegium* L., and *Plectranthus barbatus* Andrews.

Assessing woody species for timber, medicine and other uses, Chazdon & Coe (1999) found that in the Atlantic Forest of Costa Rica, species richness was highest for medicinal species. Amongst the woody species found in our study, very few are used for medicinal purposes. Trees are collected in habitat types A and B, and are used for timber and wood, and in a few cases to attract game animals and birds. Firewood is obtained in disturbed areas, near homes, and on the edge of old-successional fragments. The understory of old-successional fragments is used by some land owners to cultivate palms, and occasionally to extract other forest products such as edible fruits and wood for fences and tool handles.

Ethnobotanical knowledge differs between men and women. For habitats A and B, men mentioned over twice as many species as women. In contrast, for types C and D, women mentioned more species than men. These gender differences were observed elsewhere (Rossato *et al.* 1999; Voeks & Leony 2004; Lawrence *et al.* 2005) and reflect the lower mobility of women when compared to men. Women are more restricted to the domestic environment, and have a profound knowledge of the local pharmacopoeias based on herbs and cultivated plants near residences. The knowledge of species from habitats types A and B reflects the particularities of the knowledge about native species, especially trees. On the other hand, men have a higher mobility due to their economic activities (Rossato *et al.* 1999). In the study area, this mobility was often associated with palm-heart extraction and past timber extraction. The extraction of timber and wood resources is a typical male job, except for the extraction of some firewood from type B habitats which is also practiced by women. Additionally, the tree species mentioned by more than 15% of the interviewees indicated a higher salience among men than among women (Fig. 2). Considering these species, the two with highest saliences for women were *jacatirão* (*Miconia cinnamomifolia* (DC.) Naudin) and *goiaba* (*Psidium guajava* L.). The first is a source of firewood collected in type B habitats near homes and also has a high visual salience (lilac flowers). The latter produces a prized fruit frequently present in home gardens and, although it is widely used as medicinal in other places, no mention of medicinal use was recorded in this study.

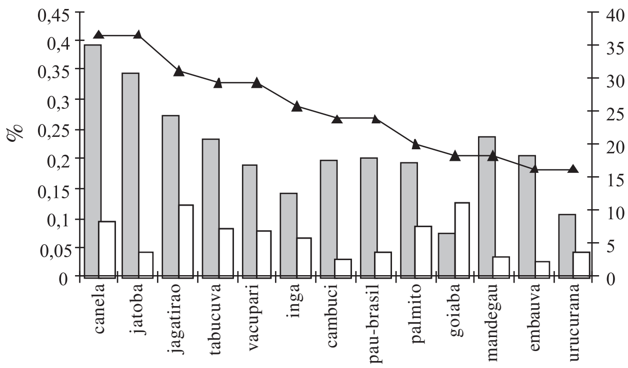

Figure 2. Frequency of citations (right scale) of the most cited trees and salience index (left scale) according to men and women. (■ = Men; □ = Women; –▲– = Citations).

Table 2. Diversity measures for plants cited in each environment (A = well preserved forest; B = disturbed environment in old successional stages; C and D = recently disturbed or cultivated areas).

	A	B	C and D
Richness (S, or N0)	100	58	82
Shannon-Wiener (base e) (H', or N1)	4.139	3.605	3.912
Reciprocal of Simpson (1/D, or N2)	43.098	26.426	34.482
Reciprocal of Berger-Parker (1/d, or N")	17.400	12.804	14.864
H_{max}	4.605	4.060	4.407
Citations	348	256	327

Diversity – A highest plant diversity was cited for plants from type A habitats (well-preserved forest), when compared to type B (old successional forest) and types C + D (recently disturbed areas). Using rarefaction curves (Magurran 1988; Begossi 1996; Williams *et al.* 2005), we observe that for the same number of interviews, there is a higher number of expected species from well preserved forest, followed by recently disturbed environments and old successional vegetation (Fig. 3).

Shannon-Wiener (base e) indexes for these three groups also show this pattern, with highest values for type A habitats, followed by C+D and B habitats (Tab. 2). The difference between Shannon-Wiener indexes was statistically significant for types A and B, types A and C+D, and types B and C+D ($t_{A,B}$=6.984, 564.327 df; $t_{A,C+D}$=3.079, 671.401 df; $t_{B,C+D}$=3.939, 562.441 df). These figures indicate that we observe the highest diversity in well-preserved areas, followed by disturbed areas, and finally by old successional areas; however, a higher number of species is expected

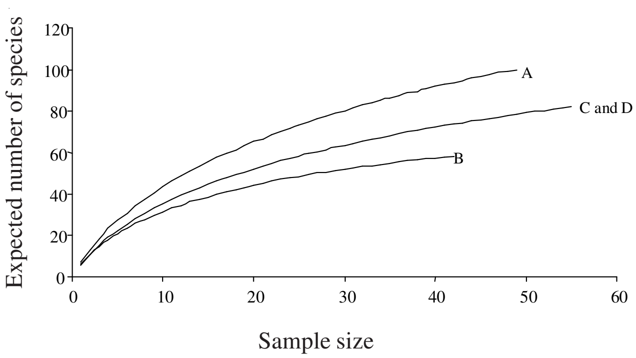

Figure 3. Rarefaction curves for plants cited in each environment (A = well-preserved forest; B = disturbed forest in old successional stages; C and D = recently disturbed and cultivated areas).

in old successional areas when compared to recently disturbed areas (Fig. 3). It is important to stress that, since diversity indexes applied to ethnobotanical information are based on citations from interviews; they do not directly reflect the species diversity in each environment. If the ecological apparency affects the use of a given species, we should expect this relation to be true. However, Albuquerque and Lucena (2005) have shown that there is no consistent evidence yet to affirm that these relationships are constant.

The comparison of rare, intermediate, and common species among the habitats resulted in a small number of common species, and comparable proportions of intermediate and rare species, for all the environments (Fig. 4). Following Williams *et al.* (2005), in the markets of Johannesburg, the number of species represented by N2 and N∞ (common species) are indicators of the number of ethnospecies that are candidates for more immediate conservation action, reflecting the commonness or dominance of the species in the sample. In the region of Carlos Botelho State Park, we identified 42 common species from habitat A, the same number from habitat B, and 55 common species from habitats C+D. Among the 34 common species identified according to Hill's numbers and cited per 10% or more interviewees, only nine can be considered non-native to Atlantic Forest region (Tab. 3). These nine species correspond to edible fruit trees cultivated in home gardens (e.g. *Persea americana* Mill., *Citrus sinensis* (L.) Osbeck, *Artocarpus integrifolia* L.) or even farms (*Musa*) or medicinal herbs (*Cymbopogon citratus* Stapf, *Mentha* × *piperita* L., *M. pulegium* L., *Melissa offincinalis* L.). The common native trees according to the interviewees include species which produce edible fruits as well, such as *Campomanesia*

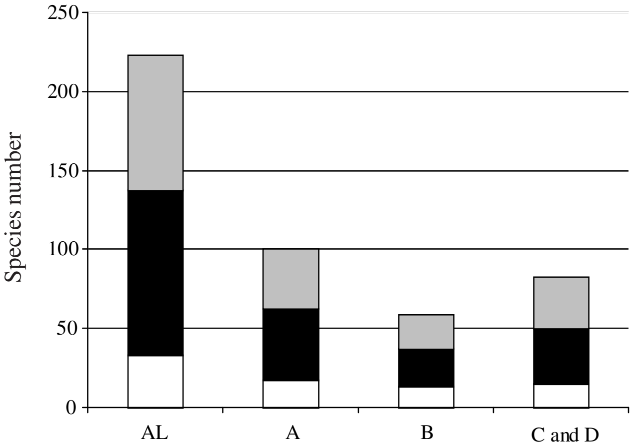

Figure 4. Number of plants in each category of Hill's numbers (see text for further explanation), for all plants and for plants in each environment (A = well-preserved forest; B =disturbed forest in old successional stages; C and D = recently disturbed and cultivated areas). (■ = Rare; ■ = Intemediate;□ = Commom).

phaea (O. Berg) Landrum, *Garcinia gardneriana* (Planch & Triana) Zappi, and *Psidium cattleyanum* Sabine. The first species has already been identified as a potentially economic fruit (Kawaski and Landrum 1997); the others were mentioned in other parts of Brazilian Atlantic forest as important edible fruits (Hanazaki *et al.* 2000). The use of these species is potentially interesting since a standing tree bearing fruits is more valuable for conservation than a timber tree.

According to these criteria, it is possible to set priorities for a group of species for conservation purposes, including *C. phaea* (O. Berg) Landrum, *Cryptocarya moschata* Nees & Mart., *Inga* spp., *Hymenaea courbaril* L., *Tetrastylidium grandifolium* (Baill.) Sleumer., *G. gardneriana* (Planch & Triana) Zappi, and *Eugenia multicostata* Legr. (Tab. 3). These species share characteristics of being commonly

Table 3. Common species (according to Hill's numbers and with more than 10% of citations) in each environment. Introduced species are marked with an asterisk (A: well-preserved forest, n=42; B: disturbed forest in old successional stages, n=42; CD: recently disturbed or cultivated areas, n=55). Data in percentage.

Ethnospecies	Botanical species	Family	A	B	CD
Abacate	*Persea americana* Mill.*	Lauraceae	0	0	15
Araçá	*Psidium cattleianum* Sabine	Myrtaceae	14	0	11
Banana	*Musa × acuminata* Colla*	Musaceae	0	0	11
Boldo	*Plectranthus barbatus* Andrews*	Lamiaceae	0	0	38
Bucuúva	*Virola bicuhyba* (Schott) Warb.	Myristicaceae	14	0	0
Cambuci	*Campomanesia phaea* (O. Berg) Landrum	Myrtaceae	31	31	24
Canela	*Cryptocarya moschata* Nees & Mart.	Lauraceae	48	48	0
Capim-santo[1]	*Cymbopogon citratus* Stapf*	Poaceae	0	0	24
Caquera[2]	*Senna multijuga* (Rich) Irwin & Barn.	Caesalpiniaceae	0	19	0
Carqueja	*Baccharis trimera* (Less) DC	Asteraceae	0	0	16
Embaúba	*Cecropia glaziovii* Snethl.	Cecropiaceae	0	21	0
Erva-cidreira	*Melissa officinalis* L.*	Lamiaceae	0	0	18
Figueira	*Ficus* sp.	Moraceae	19	0	0
Goiaba	*Psidium guajava* L.	Myrtaceae	24	0	18
Hortelã	*Mentha × piperita* L.*	Lamiaceae	0	0	40
Ingá	*Inga* spp.	Mimosaceae	33	33	25
Jabuticaba	*Myrciaria floribunda* (West ex Willd.) Berg	Myrtaceae	19	0	15
Jaca	*Artocarpus integrifolia* L.*	Moraceae	0	0	11
Jacataúva	*Citharexylum myrianthum* Cham.	Verbenaceae	0	14	0
Jacatirão[3]	*Miconia cinnamomifolia* (DC.) Naudin	Melastomataceae	0	40	0
Jambro	*Eugenia oblongata* (CF)	Myrtaceae	0	0	11
Jatobá	*Hymenaea courbaril* L.	Caesalpiniaceae	48	48	0
Juçara[4]	*Euterpe edulis* Mart.	Arecaceae	26	0	20
Limão	*Citrus sinensis* (L.) Osbeck*	Rutaceae	0	0	11
Mandegaú	*Tetrastylidium grandifolium* (Baill.) Sleumer.	Olacaceae	24	24	0
Pau-brasil	*Eugenia multicostata* Legr.	Myrtaceae	31	0	0
Pau-de-óleo[5]	*Copaifera langsdorfii* Desf.	Caesalpiniaceae	14	0	0
Peroba[6]	*Cariniana estrellensis* (Raddi) O. Kuntze.	Lecythidaceae	19	19	0
Poejo	*Mentha pulegium* L.*	Lamiaceae	0	0	35
Quina	*Strychnos brasiliensis* (Spreng) Mart.	Loganiaceae	19	0	0
Tabucúva	*Capsicodendron dinisii* (Schwacke) Occhioni	Canellaceae	0	38	0
Timbopeva	*Paullinia* spp.; *Serjania* spp.	Sapindaceae	19	19	0
Urucurana	*Hyeronima alchorneoides* Allem.	Euphorbiaceae	21	21	0
Vacupari	*Garcinia gardneriana* (Planch & Triana) Zappi	Clusiaceae	38	0	29

[1]or capim-cidró, erva-cidreira, capim-cidrão, capim-cidreira; [2]or quaresmeira; [3]or nhacatirão; [4]or palmito; [5]or copaíba; [6]or guatambu.

known by the local inhabitants, as well as having an area of occurrence that includes type A habitats, or well preserved forests.

Some tree species can be considered as priority for conservation purposes, according to commonness amongst the interviewees, following the criteria of Williams *et al*. (2005). However, as stressed by Casagrande (2004), we should avoid the danger to conservation strategies of treating knowledge as synonymous with use and cultural importance. The same advice applies when considering that the relationship between knowledge and use are not linear. In the case of the boundaries of Carlos Botelho State Park, the use of forest trees other than *E. edulis* is usually secondary to this major activity. The challenge presented in this scenario is how we can conserve the forest with such illegal activity. One of the possible answers to this challenge is to focus our conservation efforts on other tree species as well, particularly those which are used as sources of edible fruits and not wood, currently or potentially.

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