



## How is local knowledge about plants distributed among residents near a protected area?

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### Abstract

The interactions between people and plants may result in knowledge of plant resources. This knowledge can vary according to factors such as age, gender, occupation, resource availability, urbanization and restrictions on the use of native resources. This study aimed to understand the interaction between people and plants in two rural communities surrounding the National Forest (FLONA) of Ibirama, Santa Catarina, Brazil. Specifically, the study aimed to investigate the distribution of local knowledge of plants according to gender, age and occupation of residents in these communities. Semi-structured interviews were conducted followed by free listing and guided tours. A total of 104 interviews were conducted with adult men and women, who cited 475 plants found in the region that are used for numerous purposes. Of these plants, 184 are cultivated, 183 are extracted and 8 are cultivated and extracted. In general plant knowledge is shared between communities, in relation to gender, age and occupation. However, there are differences in the knowledge of timber resources, which is found to be higher among men and people with 41 years or more in age. These differences can be attributed to the influence of urban centers and the presence of the National Forest. However, respondents also view the FLONA positively, once they recognize the advances related to the conservation of nature, since there is greater control of deforestation and an increase in local avifauna. It is necessary to develop strategies to involve communities in the management of protected areas in order to ensure effective conservation of natural resources and the maintenance of local plant

**Keywords:** Use of plant resources - intracultural variation - ethnobotany

## **Introduction**

The potential use of plant resources by human populations varies according to customs, behaviors and cultural characteristics of the group. The interaction between people and plants results in diverse knowledge. This knowledge is also influenced by factors such as age, gender and occupation, as well as environmental factors such as availability of resources, and may result in variations of people's interaction with plants (Arias-Toledo et al. 2007; Reyes-Garcia et al. 2007; Camou-Guerrero et al. 2008).

Migration of human populations also results in changes in plant resource knowledge. Through the migration process, immigrants carry with them their own traditions, lifestyles, worldviews, and plant knowledge. These factors help to strengthen their cultural identity while in a foreign country. However, immigrants face cultural barriers, as well as language barriers, prompting them to seek new strategies in order to adapt to a new environment. This adaptation is a result of cultural negotiations, which may alter the use of plant resources. Nevertheless, strengthening a distinct cultural identity can be an opposite force to adaptation. Therefore, immigrants need to move between these two points, in order to adapt to a new environment without losing their traditional cultural identity (Pieroni and Vandebroek 2007).

Immigration may also occur between a rural and urban environment. Since there are no fixed boundaries, people share information through various channels, exchanging knowledge and practices in plant use (Ososki et al. 2007). Nonetheless, growing urbanization processes influence people-plant interactions by modifying the procurement of plant resources and, consequently, plant knowledge. For example, Reyes-Garcia et al. (2005), when comparing plant knowledge of two Tsimane villages in the Bolivian Amazon, concluded that the community furthest from the urban center had more diversified knowledge than people of a community closer to the urban center.

The ease in buying industrialized goods and the legal restrictions surrounding natural resource extraction decreases the use of native plant resources, directing the people-plant interaction to cultivated resources (Amorozo and Gély 1988; Begossi 2006). Consequently, the diversity of used plants may decrease. With the passage of time, younger people's plant knowledge tends to be less diversified than the knowledge of the elderly, who had more opportunities to use natural resources (Figueiredo et al. 1993; Hanazaki et al. 2000; Ruddle 2000).

In many cases, legal restrictions on the use of local plant resources are generally associated with the presence of more restrictive protected areas (Arruda 1999; Teixeira 2005; Silva et al. 2009). In the case of protected areas with sustainable use, it is expected that legal restrictions act to regulate the uses of some locally extracted plant resources. On the other hand, conservation areas would allow the preservation of local plant use, therefore, establishing a two-way interaction between conservation and use.

In this context, the development of urban centers and the reduction in plant resource use, may jointly contribute to the transformation or hybridization of a local communities plant knowledge, which may be caused by lifestyle changes or restrictions in plant use related to environmental legislation (Alexiades 1999; Ruddle 2000).

Intracultural variations are exemplified in studies that show the difference in knowledge of men and women regarding medicinal and timber resources. Women generally have superior medicinal plant knowledge, because they are responsible for the collection and manipulation of these plants, the preparation of medicines, as well as the

transmission of this knowledge (Hanazaki et al. 2000; Begossi et al. 2002). On the other hand, men usually partake in knowledge regarding timber resources, and demonstrate greater knowledge regarding native tree species and its construction purpose (Hanazaki et al. 2000). Which results in different roles in access, use and management of natural and cultivated environments based on gender (Martin 1995; Ruddle 2000; Hanazaki 2004).

Understanding these variations and identifying the most important plant species may enhance the understanding of biodiversity and promote appreciation for the local population's knowledge, which may include knowledge on conservation strategies. The objective of this study was to understand the interaction between plants and people in two rural communities located in near a protected area with sustainable use. More specifically, the objective was to investigate the distribution of plant knowledge and its variations according to gender, age and occupation. Four hypotheses were explored in this study: a) knowledge on medicinal plants is more diverse among women, since it is expected that women are important elements in the local medical system of preparing, managing and collecting medicinal plants; b) men have greater knowledge of plants used in construction than women, so, it is expected that men know a greater number of native trees used for construction and improvements; c) plant knowledge differs between the youth and elderly, since it is expected that younger people have less diversified knowledge and do not demonstrate the same plant knowledge as older people, which is a consequence of increasing urbanization and easy access to industrial resources; d) the proximity to urban centers, as well as the reduction of activities related to subsistence agriculture and the implementation of a protected area contributes to the loss or transformation of the local communities plant resource knowledge.

## Material and Methods

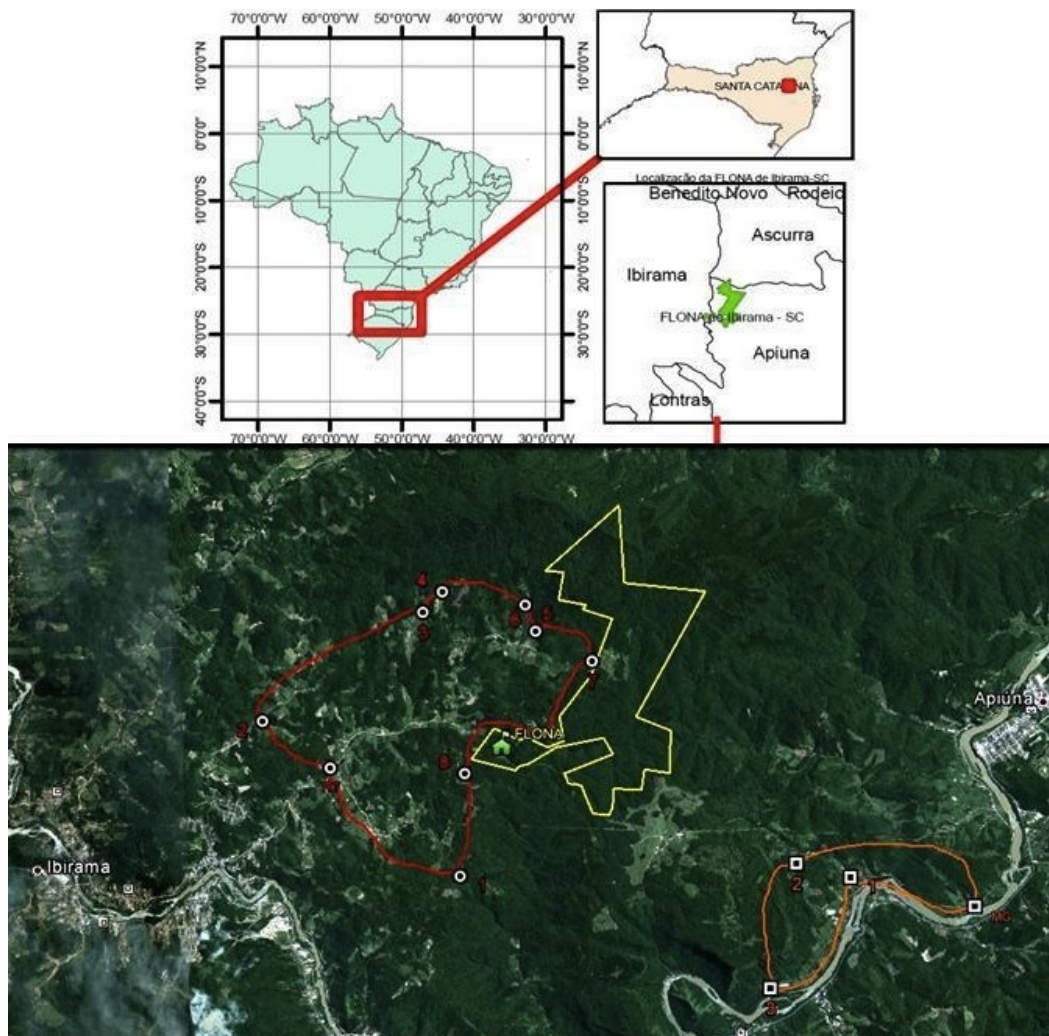
### *Study area*

Rural communities, coming from the process of foreign colonization, form the surroundings of the Ibirama National Forest, a protected area with sustainable use in southern Brazil. The Germans and Italians were the first to arrive from Europe and were selected by a Brazilian immigration policy as people who were better able to contribute to the development of the Itajaí valley (Vanzuiten 2011). The Itajaí region was considered uninhabited. Subsequently, it was necessary to explore the region, clearing forest areas for the construction of houses, opening areas for agriculture, creating openings for roads and contributing to the diversification of products and services (Vanzuiten 2011). In order to explore the valley, people, named *colonos* (settlers), were selected based on skills in farming practices, among other professions such as construction workers, bakers, artisans and seamstresses (Secchi 2004).

Ibirama was settled by German immigrants, circa 1899 (Secchi 2004) and Apiúna was founded in 1878 with the arrival of Italian immigrants (Garrote et al. 2008). The German and Italian immigrants sought to maintain their culture of origin but underwent the process of "nationalization". This process demanded that the European immigrants adapt to the Brazilian culture, and were prohibited from exercising activities related to their culture of origin and speak their native language in public (Vanzuiten 2011).

German immigrants had a greater resistance to the nationalization process, especially after the beginning of the 2<sup>nd</sup> World War (Vanzuiten 2011).

This study was conducted in the communities of Ribeirão Taquaras in the municipality of Ibirama, and Morro Grande in the municipality of Apiúna, which make up part of the areas surrounding Ibirama National Forest (Figure 1). Access to the headquarters of the National Forest is through the community of Ribeirão Taquaras, whose residents are of German heritage and maintain the cultural characteristics of their ethnic origin, as well as the German language. The residents identify themselves as a “German” community. The residents of Morro Grande are of Italian descent but consider themselves “Brazilians”. There is no strong ethnic self-determination in this group, as there is for Ribeirão Taquaras. The communities are made up of farms that practice subsistence agriculture, as well as reforestation with pine trees (*Pinus* sp.) and eucalyptus trees (*Eucalyptus* sp.). The native vegetation is characterized by IBGE (2004) as tropical dense rainforest.



**Figure 1.** Study area. The boundaries of National Forest of Ibirama, Santa Catarina are in yellow. In red are the approximate limits of the community of Ribeirão Taquaras, Ibirama, and in orange are the approximate limits of the community Morro Grande – Apiúna, SC, Brazil.

## Data collection

This study was submitted to the Ethics Committee for Human Research (CEPSH) at the Federal University of Santa Catarina (process: 1018 FR: 371401) and the Brazilian Institute of the Environment and Natural Resources (IBAMA), through the System Authorization and Information on Biodiversity (SISBIO), registration no. 25612-1 / registration at IBAMA: 486745.

Prior to beginning data collection a meeting was held with residents of both communities, where a Prior Informed Consent Term was presented and discussed. Afterwards the objectives and methods of research were explained, and lastly, permission was asked to carry out the study.

A map with the family units of Ribeirão Taquaras was made available by a healthcare worker in the local service center. The map was used to delimit the area of the community, accounting for 100 family units, and is consistent with local leaders like the President of the Farmers Association, and the President and the Treasurer of the local Church. In the community of Morro Grande, a map of the family units was prepared with the help of three local residents, totaling 18 family units.

From October 2010 to May 2011 interviews were conducted with adult men and women of all households that agreed to participate. Households where no inhabitants were found after three visits were excluded from the sample. Interviews were based on semi-structured scripts, and free listings and guided tours were also conducted. During the semi-structured interview, the researcher has the liberty to further discuss certain elements, even though there are some fixed topics (Viertler 2002). The first section of the interview consisted of socio-economic questions, and open questions regarding the existence and meaning of the National Forest, and possible changes in the use of local plant resources after its implementation. The response categories were drawn up *a posteriori*, so, a respondent may fulfill more than one category. In the second section, men and women were separated for the free listing. Respondents listed the plants, which were used and found in the community, grown or extracted. These plants were grouped into categories of use, as shown in Table 1. The categories “food”, “medicinal” and “manufacturing” were defined *a priori*, in order to clarify the type of information that was being requested. Other categories were defined from respondent citations.

Respondents were coded according to the community (RT: Ribeirão Taquaras / MG: Morro Grande), followed by the number of interview, gender (♂: for male / ♀: for female) and age (e.g. 43yr: 43 years). The interviews were numbered by family unit, when we interviewed more than one person of the same family unit, the number of the interview was followed by the letter “b” or “c” for a second or third person.

Plants were cited by popular name. Thus citations like *jacatirão*, *jacatiron* and *choquequeron*, for example, were grouped as a single plant, choosing the most common citation, in this case *jacatirão*. Two or more different names were not obtained for a single botanical species.

When separating plants by categories of use, those who had more than one category were counted in both categories, respecting the order of citation regarding the cited category.

Guided tours were conducted from January to October 2011 with available informants who had the highest number of free listing citations. This methodology was used to confirm, photograph and collect botanical material for identification of plants

mentioned during the free list. Some species were identified in the field. The collected specimens were identified by A. Dunaiski Junior from the Herbarium of Faculdades Integradas Espírita (HFIE) in Curitiba, Paraná, Brazil. The identified plant material was deposited in the FLOR Herbarium of the Federal University of Santa Catarina and HFIE Herbarium. The non-fertile material will be incorporated into the Laboratory of Human Ecology and Ethnobotany collection at the Federal University of Santa Catarina.

**Table 1.** Description of plant resources use categories (adapted from FAO 1992).

<b>Category of use</b>	<b>Description</b>
Food (edible plants)	Plants utilized as food consumption, including drinks;
Medicinal	Plants utilized for therapeutic purposes;
Timber	Plants utilized in constructions and fabrication of tools;
Firewood	Plants utilized as fuel for fire;
Manufacturing	Plants utilized as raw material for the production of handicrafts or decorations;
Fodder	Plants utilized in domestic animal foraging, including edible plants and plants used in treatments of diseases;
Repellent	Plants utilized as repellent from mosquitos and fleas;
Ornamental	Plants utilized for decoration in gardens, cited by the respondents as “plants for beautiful”;
Other uses	This category consists of plants cited for various uses that do not fit the above categories, such as: cosmetics, use as fishing bait, tanning leather, to provide shadow, to sell, incense, to extract oil, to make soap, to bless, scare away the “evil eye”, smoke meats, herbicide, fertilizer, place underneath hats to alleviate the effects of solar rays during farm work, and plants utilized to stimulate hen’s egg laying.

### *Data analysis*

The program *Free List* from the software *Visual Anthropac* (Borgatti 1994) was used to analyze the free listings. The frequency of plant citations was checked, where the plants that are most important to the communities were identified. This analysis assumes people cite plants that they remember at the time of the free list, thus, the plants cited are considered the most important, either because of its frequent use or its cultural value.

The groups of respondents were pre-defined according to gender (male or female), age (people less than or equal to 40 years and people 41 years or older), and occupation (rural environment: people with income exclusively from agriculture, including people who have retired from this activity, and urban environment: people who work in industries, businesses and public agencies). Comparison within a community permitted the separation of German, Italian and other influences.

## Results

### *Residents from the National Forest's surroundings*

Ribeirão Taquaras is one of the oldest communities in the Ibirama region. It was through this region that the colonizing contractor of the state of Santa Catarina received and distributed German immigrants, who became the first settlers of Ibirama (Secchi 2004). The homes and properties were passed down from generation to generation and remained the same, in other words, they remained rural properties that perform subsistence farming and animal husbandry.

The current residents of Ribeirão Taquaras, descendants of German immigrants, seek to maintain customs and practices, as well as the spoken language of their ethnic origin. Among these customs, differences were found in the behavior between men and women, especially among the elderly, where women do not go around unaccompanied. For example, in a community meeting, two groups were formed: one male and one female.

Morro Grande is characterized as rural properties of farmers who have been in the region for nearly 50 years. The people in this community came from neighboring municipalities seeking to live peacefully and safely. Of the residents interviewed, only four live on properties that belonged to their parents or grandparents. However, even these residents had previously lived in other cities and returned to Morro Grande as adults.

The two communities are predominantly small rural properties with agricultural activities. In the communities 22% of residents are retired, 20% consider themselves as farmers and the rest work in industries, businesses, or public agencies, but all practice subsistence agriculture. The presence of pine and/or eucalyptus reforestation is common on the properties. In Ribeirão Taquaras the predominant crops are tobacco (*Nicotiana tabacum* L.) and rice (*Oryza sativa* L.), and in Morro Grande some residents plant various horticultures to provide food for the public schools in Apiúna.

In total 104 interviews were conducted, 91 in Ribeirão Taquaras (65 family units), and 13 in Morro Grande (12 family units), with a total of 56 women and 48 men, aged between 17 and 81. In regards to occupation, 39 work in industries and commerce, 60 depend solely on agriculture and five people were only working part-time in agriculture (Table 2).

**Table 2.** Number of respondents in the communities of Ribeirão Taquaras (Ibirama) and Morro Grande (Apiúna) regarding gender, age, occupation and community.

	Morro Grande (n=13)		Ribeirão Taquaras (n=91)	
	MALE	FEMALE	MALE	FEMALE
Number of Respondents	6 (46%)	7 (54%)	41 (45%)	50 (55%)
Urban occupation	1 (8%)	3 (23%)	18* (20%)	22 (24%)
Rural occupation	5 (38%)	4 (31%)	28* (31%)	28 (31%)
Age less than or equal to 40	0	3 (23%)	11 (12%)	17 (19%)
Age greater than or equal to 41	6 (46%)	4 (31%)	30 (33%)	33 (36%)

\* Ribeirão Taquaras - 5 people work in urban and rural environments.

### The known plant resources in the surroundings of the National Forest

From the free list 475 plants found in the region were cited, 184 of the plants are cultivated, 183 are extracted (species extracted directly from the native vegetation without management) and eight are cultivated and extracted. The mode of procurement of the remaining plants was not possible to characterize. Of the cited plants, 184 were identified to the species level, 39 at the genus level and 29 at the family level. The remaining plants could not be identified. The plants mentioned by only one person (idiosyncratic) totaled 184 species. Table 3 displays the number plant citations by category, plants cited with more or less than 20% citation frequency, as well as the number of citations each use category received. In the community of Morro Grande 239 plants were cited from 13 interviews and in Ribeirão Taquaras, 421 plants were cited from 91 interviews.

**Table 3.** Number of plants cited by category of use and number of citations each category of use received (n = 104 interviews conducted in Morro Grande (n = 13) and Ribeirão Taquaras (n = 91).

Category of use	Cited plants	Citations	Plants with more than 20% citation frequency	Plants with less than 20% citation frequency
Food	178 (37%)	2504	40	138
Firewood	42 (9%)	104	3	39
Fodder	69 (15%)	319	4	65
Medicinal	167 (35%)	754	9	158
Timber	123 (26%)	707	8	115
Manufacturing	51 (11%)	185	4	47
Other uses	40 (8%)	58	1	39
Ornamental	65 (14%)	159	3	62
Repellent	11 (2%)	18	2	9

#### Plants for food

The food category had the highest number of plant citations, as well as category citations (Table 3). This category includes primarily cultivated plants, where cassava (*Manihot esculenta* Crantz) is the most important plant with a high percentage of citation frequency (Table 4). After cassava, the most important plants were orange (*Citrus sinensis* (L.) Osbeck), tangerine (*Citrus reticulata* Blanco), jaboticaba (*Myrciaria jaboticaba* (Vell.) O. Berg) and palmito (*Euterpe edulis* Mart.), with native tree species with citation percentages exceeding 60% (Table 4).

The palmito (*Euterpe edulis* Mart.) is a native species to the dense rainforest and is endangered of extinction. It has limited use due to the CONAMA Resolution No. 294 of December 12<sup>th</sup>, 2001 and may be used only by farmers who sustainably cultivate or manage the extraction of the species. Respondents cited the palm cautiously, due to conflicts related to the use of this plant. Most people reported its use because they plant



the species, while others have linked its use to the past, when they could extract it following their own management rules. Its use is related to family or community events and is cited as “very tasty”. In addition to the use of the palm’s fruit and meristem as food, it was also cited in the timber category, since its stem was used in roofing and manufacturing, and its leaves were used to make chairs and roofs. This species also has value for its beauty, being cultivated in gardens as an ornamental plant and “bird attraction”. Residents claim to have lots of palm on their properties, planted or not, however these palms are subject to theft. People from neighboring regions perform illegal harvesting of palm heart on private properties, in turn the property owners are held responsible. Thus respondents, theft victims, discuss the loss of the palm for consumption, as well as their payment of a fine imposed by environmental agencies for the removal of the palms.

When comparing the two communities with citation frequencies of more than 50% for edible plants, the community of Ribeirão Taquaras cited nine plants, whereas the community of Morro Grande cited these same plants plus ten other species: lettuce (*Lactuca sativa* L.), beans (*Phaseolus vulgaris* L.), beets (*Beta vulgaris* L.), papaya (*Carica papaya* L.), nona (*Annona* sp.), chives (*Allium fistulosum* L.), plums (*Eriobotrya japonica* (Thunb.)Lindl.), potato (*Solanum tuberosum* L.), corn (*Zea mays* L.) and avocado (*Persea americana* Mill.). This demonstrates a shared knowledge between communities. However, Morro Grande had a larger number of plants with a high citation frequency, which may be related to how some people in the community Morro Grande obtain their main income from the commercialization of food plants.

**Table 4.** Plants with more than 20% frequency of citation used for food (n = 104 with n = 13 in Morro Grande and n = 91 in Ribeirão Taquaras).

Family	Scientific name	Frequency (%)
Euphorbiaceae	<i>Manihot esculenta</i> Crantz.	88.5
Rutaceae	<i>Citrus sinensis</i> (L.) Osbeck	82.7
Rutaceae	<i>Citrus reticulata</i> Blanco	76.9
Myrtaceae	<i>Myrciaria jaboticaba</i> (Vell.) O. Berg	64.4
Arecaceae	<i>Euterpe edulis</i> Mart.	63.5
Musaceae	<i>Musa seção Musa</i>	55.8
Myrtaceae	<i>Psidium guajava</i> L.	54.8
Brassicaceae	<i>Brassica oleracea</i> var. <i>capitata</i> L.	53.8
Cucurbitaceae	<i>Cucumis sativus</i> L.	53.8
Asteraceae	<i>Lactuca sativa</i> L.	47.1
Rosaceae	<i>Eriobotrya japonica</i> (Thunb.) Lindl.	46.2
Convolvulaceae	<i>Ipomoea batatas</i> (L.) Lam.	45.2
Rosaceae	<i>Prunus persica</i> (L.) Batsch	45.2
Poaceae	<i>Zea mays</i> L.	44.2
Fabaceae	<i>Phaseolus vulgaris</i> L.	43.3
Amaranthaceae	<i>Beta vulgaris</i> L.	41.3
Vitaceae	<i>Vitis vinifera</i> L.	40.4
Brassicaceae	<i>Brassica oleracea</i> var. <i>botrytis</i> L.	40.4
Solanaceae	<i>Solanum tuberosum</i> L.	39.4

Continuation Table 4

Bromeliaceae	<i>Ananas</i> sp.	37.5
Caricaceae	<i>Carica papaya</i> L.	36.5
Solanaceae	<i>Solanum lycopersicum</i> L.	36.5
Apiaceae	<i>Daucus carota</i> L.	36.5
Rutaceae	<i>Citrus × limonia</i> (L.) Osbeck	35.6
Cucurbitaceae	<i>Sechium edule</i> (Jacq.) Sw.	33.7
Clusiaceae	<i>Garcinia macrophylla</i> Mart.	32.7
Alliaceae	<i>Allium fistulosum</i> L.	31.7
Malpighiaceae	<i>Malpighia glabra</i> L.	31.7
Lauraceae	<i>Persea americana</i> Mill.	30.8
Annonaceae	<i>Annona</i> sp.	30.8
Araceae	<i>Colocasia esculenta</i> (L.) Schott	29.8
Passifloraceae	<i>Passiflora</i> sp.	27.9
Ebenaceae	<i>Diospyros kaki</i> Thunb.	26.0
Moraceae	<i>Ficus carica</i> L.	26.0
Myrtaceae	<i>Eugenia uniflora</i> L.	22.1
Brassicaceae	<i>Brassica oleracea</i> var. <i>acephala</i> DC	22.1
Alliaceae	<i>Allium cepa</i> L.	22.1
Oxalidaceae	<i>Averrhoa carambola</i> L.	21.2
Rosaceae	<i>Fragaria × ananassa</i> (Weston) Duchesne	21.2

### Medicinal plants

In this category, the plants most often cited (Table 5) were mint (*Mentha spicata* L.), boldo (*Plectranthus* sp.), erva-doce (*Ocimum gratissimum* L./ *Melissa officinalis* L.) and aloe (*Aloe vera* (L.) Burm. f. / *Aloe arborescens* Mill.). Plants cited in this category were collected in areas of easy access, close to houses, backyards, and are communally shared among the residents. Respondents stated that their medicinal plant knowledge was obtained from their mothers and grandmothers. However, a deeper study of medicinal plants is necessary in these communities in order to confirm the effective use of cited plants, since during the interviews it was common to hear, “they say this plant is to treat (...)” (MG7♂59yr), or “I hear my mother say that this plant is good for (...) but I've never used it” (RT13♂42yr).

The means of communication also had an influence on plant knowledge. For example, the figatil (*Vernonia condensata* Baker), received only 10% citation frequency, however when people cited this plant, they talked about its name being incorrect: “we always call it figatil, but I saw on TV that the name is ‘true boldo’” (RT13c♀36yr; RT21♂59yr; MG05♀72yr), asserting that the information from the television was correct.

During the medicinal plant free listing, respondents from Morro Grande cited plants while also discussing details on its use, such as the methods of preparation, purposes, and how to choose plants. The majority of respondents in Ribeirão Taquaras merely cited plant names indicating past use or plants that have medicinal potential but were not used. This may indicate a greater familiarity of the Morro Grande community with medicinal plants, and therefore justify the increased amount of medicinal plants

mentioned with more than 20% frequency in Morro Grande (14) compared with Ribeirão Taquaras (9).

**Table 5.** Plants with more than 20% frequency of citation for medicinal use (n = 104 with n = 13 in Morro Grande and n = 91 in Ribeirão Taquaras).

Family	Scientific name	Frequency (%)
Lamiaceae	<i>Mentha spicata</i> L.	68.8
Lamiaceae	<i>Plectranthus</i> sp.	42.7
Lamiaceae	<i>Ocimum gratissimum</i> L. / <i>Melissa officinalis</i> L.	38.5
Asphodelaceae	<i>Aloe vera</i> (L.) Burm. f. / <i>Aloe arborescens</i> Mill.	31.3
Myrtaceae	<i>Psidium guajava</i> L.	29.2
Poaceae	<i>Cymbopogon nardus</i> (L.) Rendle	26.0
Asteraceae	<i>Bidens pilosa</i> L.	22.9
Lamiaceae	<i>Melissa officinalis</i> L.	21.9
Rutaceae	<i>Citrus sinensis</i> (L.) Osbeck	19.8

### Timber and Firewood

The timber category obtained a large number of plant citations, as well as category citations, being inferior only to the categories “medicinal” and “food” (Table 3). Plants cited for use as timber or firewood, are mostly native to the dense rainforest. The cited plants containing more than 40% frequency as wood (Table 6) were *canela* (*Ocotea* sp./ *Nectandra* sp.), eucalyptus (*Eucalyptus* sp.), *peroba* (not identified), pine (*Pinus* sp.), cedar (*Cedrela fissilis* Vell.), and *jacatirão* (*Miconia cinnamomifolia* (DC.) Naudin). Citations above 20% frequency for firewood (Table 7), included eucalyptus, *capororoca* (*Myrsine coriacea* (Sw.) R. Br. ex, Roem & Schult), and pine. Pine and eucalyptus trees were cited as currently used besides trees that fall naturally.

The men learned from their parents and grandparents how to identify and use the species for timber and firewood. Many male residents over 50 years of age have worked with wood extraction as part of their income, or as employees in logging companies. The current presence of forest remnants in advanced successional stages, called by the respondents as “native forest”, is primarily because of its past as a location for timber resources. Respondents considered the forest as a “savings” where there were resources available for their children to build their homes in the future. The respondents had their own rules for the extraction of timber. They selected trees of quality, good shape (trunk as straight as possible) and older in age, while guiding the extraction to minimize larger environmental impacts. However, with the legislation for the protection of the Atlantic Forest (Article 225 of the Federal Constitution and Decree no. 99.547/90) logging became forbidden, and those who maintained native forests on their properties, complained about these limitations of resource use:

*“Who cleared the forest in the past, today has a place to plant, and has a way to make money. Who kept the forests intact, cannot do anything anymore”;*  
 MG08♂72yr

“If we want firewood (native) from the property we must pay. It ends up costing more money than buying pine or eucalyptus wood at the timber store”; RT37♂52yr.

“Why can’t we take the wood from the forest on our property, but if you pay you can?” RT59c♂75 yr.

Logging exploitation led to the regulation of forest resources, primarily to avoid shortages. In 1952 the former Forest Garden of Ibirama (now the National Forest), began producing pine, eucalyptus and *araucaria* (*Araucaria angustifolia* (Bertol.) Kuntze) seedlings (Secchi 2004). Respondents stated that during the Garden’s existence, they received seedlings for free. Farmers were afraid to plant the seedlings, especially eucalyptus, because of its high water demand in order to grow, and consequently, “the earth dried” (MG08♂72a; RT12b♂71yr). However, tobacco (*Nicotiana tabacum* L.) crops were very common, which the farmers sold dried. Companies that bought tobacco encouraged farmers to plant pine and eucalyptus, alleging that the farmers could no longer use native firewood during the tobacco drying process.

The ban on native tree logging and the external stimulus for planting pine and eucalyptus may explain the high frequency of these species’ citations (Tables 6 and 7). These species are cultivated in areas called “reforestation”. Reforestation is an agricultural activity present in 68% of the respondent’s households and replaces a considerable area for crops. Since most farmers are retired, and their children work outside of agriculture, reforestation reduces the hand labor needed on the property. This substitution is frequently increasing, since reforestation work demands less time than crop cultivation.

While the community of Morro Grande had more familiarity with medicinal plants, the community of Ribeirão Taquaras had more familiarity with trees used as a timber resource. The inhabitants of this latter community provided detailed accounts of the plants, including its intended use and cutting management.

**Table 6.** Plants with more than 20% frequency of citation for use in logging (n = 104 with n = 13 in Morro Grande and n = 91 in Ribeirão Taquaras).

Family	Scientific name	Frequency (%)
Lauraceae	<i>Ocotea</i> sp. / <i>Nectandra</i> sp.	62.7
Myrtaceae	<i>Eucalyptus</i> sp.	60.2
Apocynaceae	<i>Aspidosperma</i> sp.	54.2
Pinaceae	<i>Pinus</i> sp.	48.2
Meliaceae	<i>Cedrela fissilis</i> Vell.	47.0
Melastomataceae	<i>Miconia cinnamomifolia</i> (DC.) Naudin	45.8
Lauraceae	<i>Ocotea odorifera</i> Rohwer	22.9
Fabaceae	<i>Copaifera langsdorffii</i> Desf.	21.7

**Table 7.** Plants with more than 20% frequency of citation used as firewood (n = 104 with n = 13 in Morro Grande and n = 91 in Ribeirão Taquaras).

Family	Scientific name	Frequency (%)
Myrtaceae	<i>Eucalyptus</i> sp.	53.1
Myrsinaceae	<i>Myrsine coriacea</i> (Sw.) R. Br. ex Roem. & Schult.	21.9
Pinaceae	<i>Pinus</i> sp.	21.9

### Plants for foraging

Raising livestock (cattle, pigs, sheep or poultry) for personal consumption is present in 52% of the households. Only 4% of respondents derived their principal income from these activities. Besides pasture, the animals are fed with fodder, and the farmers plant some crops in order to supplement the animal's diet. Among the main plants cited for this purpose are corn (*Zea mays* L.), sugarcane (*Saccharum officinarum* L.), *capim-gramon* (Poaceae, not identified), and *capim-elefante* (*Pennisetum purpureum* Schumach.) (Table 8). "Get the fodder" is a daily activity in the lives of respondents who own livestock. The choice of crop varies with the season and resource availability, changing between a summer fodder (as *capim-gramon*, *capim-elefante*) and a winter fodder (e.g. oats *Avena sativa* L., and *grandiúva* *Trema micrantha* (L.) Blume). The extracted plants used as animal feed were collected during guided tours in the forest, and included, for example, the *caeté* (*Heliconia velloziana* Emygdio) and the *embaúba* (*Cecropia pachystachya* Trécul.) fruit, which help diversify animal feed.

Certain animal diseases are treated with plants, for example, banana leaves (*Musa* section *Musa*) and garlic (*Allium sativum* L.), are used to treat parasites, and *mamica-de-cadela* (*Zanthoxylum rhoifolium* Lam) is used to treat snake bites.

**Table 8.** Plants with more than 20% frequency of citation used in animal foraging (n = 104, with n = 13 in Morro Grande and n = 91 in Ribeirão Taquaras).

Family	Scientific name	Frequency (%)
Poaceae	<i>Zea mays</i> L.	55.4
Poaceae	<i>Saccharum officinarum</i> L.	33.8
Poaceae	not identified	29.7
Poaceae	<i>Pennisetum purpureum</i> Schumach.	21.6

### Manufacturing plants

This category consists of plants that have been cited for making *balaios* (baskets), brooms, chairs, toys, among others. During the interviews or guided tours, it was observed that these tools are still in use, however their manufacture is related to the past. The plants most frequently mentioned were the *cipó* (53%), bamboo (Bambusaceae) (29%), *cipó-são-joão* (29%), and *taquara* (Bambusaceae) (24%) (plants that could not be identified). All plants are found in areas of native forest. The ease in buying these tools in urban centers, the decrease in access to forest areas, supports the

citation of these activities as something from the past. The use of these species may have changed due to residents altering routines because of retirement or work in urban environments, or because of restrictions by environmental legislation.

In Ribeirão Taquaras, only the *cipó* (not identified) obtained a frequency of use greater than 50%. In Morro Grande the *taquara* is emphasized (86%) and was cited as the main plant used to manufacture a “cove” (Figure 2), a fish trap currently manufactured by the residents of this community. The *taquara* is followed by bamboo (71%) and *cipó-liaça* (*Philodendron* sp.) (57%), which may also be used to manufacture a “cove”.



**Figure 2.** The “cove”, a fishing trap made of *taquara* (Bambusaceae) by the residents of Morro Grande, Apiúna, Santa Catarina (Photo: Juliana Saldanha).

### *Ornamental plants*

The houses’ gardens are rich and diverse in ornamental plants. In Ribeirão Taquaras respondents expressed concern over their garden, since maintaining a well-kept garden is a trademark of German descendants. In Morro Grande, only women demonstrated this concern with the garden. Ornamental plants are named by respondents as “plant for beautiful” and many of these species are collected within the native forests, shared among neighbors, and/or purchased at floricultures. Most plants do not receive a specific name, generally being called “roses”, “bromeliads” and “orchids,” which elucidates the high frequency of citation for rose (*Rosa* sp.) (53%), orchid (30%) (not identified), followed by fern (not identified) (25%).

### *Repellent plants*

Some plants were cited for having insect repellent substances. This included plants that repel mosquitoes, such as *citronella* (*Cymbopogon* sp.). Plants used to repel fleas from animals and environments, such as tobacco (*Nicotiana tabacum* L), were also included obtaining a 29% citation frequency. Respondents from Ribeirão Taquaras cited eight plants for this purpose, and respondents in Morro Grande only cited four plants.

### *The distribution of local plant knowledge within groups: Gender*

During the guided tours conducted with men, the use of timber resources in the past was prevalent. Those who did not extract their own timber for income worked cutting down native trees for logging companies. The men's timber knowledge is extensive, where they are able to recognize species by visual and olfactory traits, the color of the core, cutting method, by the description of how the timber should be sawn, and its usefulness due to its "hardness". In addition, men cited the medicinal properties of some species like *tajuba* (not identified), where the "milk" is used for toothaches, *ipê-roxo* (*Handroanthus heptaphyllus* (Vell.) Mattos) for diabetes, *copaiba* or *pau-óleo* (*Copaifera langsdorffii* Desf.) as an anti-inflammatory, *taiuiá* (*Cayaponia floribunda* Cogn.) to help in digestion, *mamica-de-cadela* (*Zanthoxylum rhoifolium* Lam) to combat snake bites and *embaúba* (*Cecropia pachystachya* Trécul) for bronchitis. The men cited 14 species used as timber, 20% above the citation frequency, while women, cited only six species, mostly native. Women referred to timber resources as plants they heard about from their father or grandparents, showing no familiarity with the use of these plants. The plants most commonly cited by women as timber resources were eucalyptus (77% frequency) and pine (64% frequency), which are exotic species grown in reforestation areas.

However, when the respondents were asked from whom they learned about plant resources, medicinal plants were learned from mothers or grandmothers, while woody plants were learned from fathers or grandfathers. This demonstrates a gender separation in the transmission of knowledge.

### *The distribution of local plant knowledge within groups: Age*

In relation to the citation frequency, differences were seen in the timber category, since people over 40 years of age mentioned a greater number of plants than people younger than or equal to 40. The latter may be due to the use of timber resources in the past, since most are native tree species, whose use is limited and restricted by legislation. Parents do not extract native timber anymore, therefore they do not teach their children to use and identify these species. In this category the youth cited plants that are currently used (pine and eucalyptus) and high quality tree species, such as *canela*, *peroba* (*Aspidosperma* sp.) and cedar (*Cedrela fissilis* Vell.). The other use categories did not differ regarding age, including the manufacturing category.

### *The distribution of local plant knowledge within groups: rural or urban occupation*

Of the people interviewed 60 live exclusively from agriculture or are retired farmers, and 39 people work in industries, textile, government agencies or businesses. No differences were found regarding the frequency of plant citation between these occupation groups. This may be explained by a mixture of practices, people working in urban environments also exercise subsistence agriculture such as maintenance of small crops and gardens, selection of plants for animal foraging, selection of firewood, as well as maintenance of gardens with ornamental plants.

### *Perception of respondents regarding the protected area*

Although 94.4% of the National Forest located is located in Apiúna, 42% of the residents of Morro Grande do not know about the National Forest. The protected area's boundaries in this region are not as close to this community, a large unoccupied farm makes up the portion nearest to the National Forest. In Ribeirão Taquaras, 97% of respondents are familiar with the National Forest. This difference between the communities can be attributed to the presence of the National Forest's headquarters in Ribeirão Taquaras. Thus, the protected area is present in the resident's daily life, since there are street signs in Ribeirão Taquaras indicating the National Forest, as well as visitor and staff traffic. The community is also the place of living for some of these employees.

The respondents positively view the National Forest because of its capacity for nature conservation (perception of 46% of respondents in Ribeirão Taquaras and 42% of respondents Morro Grande), its beauty, and its recreational possibilities (24% Ribeirão Taquaras/ 17% Morro Grande). At the same time, restrictions regarding the use of native vegetation and changes in agricultural practices signifies that respondents from Ribeirão Taquaras see the protected area negatively. Sixteen percent of respondents claim that the presence of the National Forest brings them harm and hinders the implementation of activities related to agriculture and procurement of native species.

Respondents name the National Forest as "Florestal", which was also the name for the Ibirama Garden. Therefore, 21% of residents of Ribeirão Taquaras today view the National Forest area as "abandoned", where formerly work opportunities existed. Today there are no more work activities since employment is related to the management of the area, wherein the Ibirama Garden provided working production and planting of seedlings for reforestation, among other activities. There is need for further clarification on the role of protected areas and the activities conducted to achieve the objectives of the protected area.

Respondents in Morro Grande only had positive perceptions regarding the National Forest or did not discuss the significance of the protected area to them (8%). However, they stated that changes have occurred in resource acquirement due to the presence of the protected area, which is the same for respondents in Ribeirão Taquaras. The changes are related to restrictions in the use of local resources (21% RT/ 8% MG), the necessity to modify some agricultural practices (21% RT and 33% MG), and loss of employment in the Ibirama Garden or loss of supply of reforestation seedlings (RT 4%/0% MG). For 21% of respondents in Ribeirão Taquaras and 8% in Morro Grande, no changes occurred in acquiring resources after the installation of the



National Forest. Nevertheless, despite the difficulty in understanding the function of the protected area, the respondents perceived changes in the environment, specifically in the increase of local avifauna, as well as the control of deforestation. Twenty-five percent of respondents in Ribeirão Taquaras and 33% in Morro Grande, state that things changed for the better, since there was no environmental conservation.

## Discussion

The respondents demonstrated knowledge regarding plants for various purposes, reflecting the diversity of cultivated and extracted plant resources in the region. Among the purposes that received the largest number of plant citations were the food, medicinal and timber categories. Of these, the category that received the most citations was food, since it is a daily need. These results demonstrate that knowledge regarding resources is related to use. Similarly, Miranda et al. (2011) found that the effective use of plant resources in *Caiçara* communities are mostly associated with cited food plants (for 97% of plants known and used), resulting in a greater emphasis of this category. In the case of Morro Grande, residents not only use plants as a food source, but also as a source of income. Marketing vegetables is the main source of income for some respondents. Morro Grande had the greatest number of plants cited as food and medicinal, this result is justified not only in relation to the use of resources, but also the flux of information, as many residents of this community have lived in other regions of the state. According to Ososki et al. (2007) the constant flux of information and knowledge exchange contributes to the increase in plant knowledge diversity. Medeiros et al. (2012) added that migrants tend to both adapt to the new flora of the host country and to continue to use and acquire the original flora from their home country. Thus, situations such as those of Morro Grande and, especially, Ribeirão Taquaras, can contribute to an increased ethnobotanical repertoire, due to the recent migration.

The most important food plant was cassava, which is also highly important in other communities, such as the *caiçara* communities of Cardoso Island (Miranda et al. 2011) and Ponta do Almada (Hanazaki et al. 1996), both in the southeastern region of the Brazilian Atlantic Forest. Cassava is a widely used species, cultivated in communities of the Amazon Forest and Atlantic Forest (Emperaire and Peroni, 2007). By the mid 1950's cassava fields were planted through slash and burn system or shifting cultivation. This type of cultivation is still present (with adjustments depending on the region) in regions of the Amazon Rainforest in northern Brazil, and the Atlantic Forest in southern and southeastern Brazil (Emperaire and Peroni 2007). The growing importance of *Manihot esculenta* Crantz involves cultural, economic and ecological aspects. Small cassava crops are locations that favor genetic agrobiodiversity, evolutionary dynamics of the species, and represent the cultural dimension (Faraldo et al. 2000; Emperaire and Peroni 2007). This practice is no longer found in the studied communities, a consequence and change brought by the presence of the National Forest, due to the prohibition of deforesting native vegetation, as regulated by a Federal Decree from 1990 (Decree no. 99.547/1990). Later, the Atlantic Forest Law (Law no. 11.428/2006), allowed the use of native vegetation under exceptional character, yet the bureaucracy and high costs for obtaining this authorization makes the use of native vegetation unviable for small farmers. With this, farmers complain that without the forest clearing

they need to apply fertilizer to the cassava planting area, resulting in disadvantages to cultivate this species.

Furthermore, as stated by Martins (2005), when these populations are forced to discontinue the practice of slash and burn agriculture, “there is not only a loss of variability but also a termination of the evolutionary process that generates the variability”.

After cassava, the most important species were trees. In particular two species native to the region demonstrated an elevated interaction between people and the natural environment. The decrease in use of native resources is common as the food industry and agriculture develop (Ladio and Lozada 2001). However, this result illustrates the great importance that these native resources have on communities. Nutritional value is generally attributed to these species, since the use of native plants for food not only helps to improve the family income, but also fosters food security (Ladio and Lozada 2001; Ekué et al. 2010).

The *palmito* stands out among these native plants. The community values it as an edible and ornamental plant, and for building and manufacturing. Parallel to this study, another research was developed in Ribeirão Taquaras which aimed to evaluate the influences of landscape use on the population characteristics of the species (Milanesi 2012). This study found a high use value and salience index for this species. This species is an important resource for the community, possessing historical and current ties. Along time, the *palmito* has gained some new uses, such as the extraction of the pulp of the inflorescences and its cultivation in homegardens, which favors the conservation of this species.

The distrustful form that *palmito* was cited may reflect the conflict with the use of this resource. The commercialization of its meristem is strong in both internal and external markets. However, this extraction causes plant death (Reis et al. 2000) and currently the species has a threatened species' status. Due to its prohibition, the *palmito* became illegally extracted, both in public and private areas (Reis et al. 2000, Barroso et al. 2010). The conflicts around this species are present in several regions of the Atlantic Forest (Galetti and Fernandez 1998; Barroso et al. 2010) and could be minimized by regulating the sustainable management of this resource. According to Reis et al. (2000), the *palmito* has a high potential for sustainable management and can contribute to the conservation of forest remnants and restoration of degraded areas, since the *palmito* has a high market value, short harvest cycles (compared to timber resources, for example), and a high density.

Medicinal plants are grown in places of easy access, like homegardens. This was also shown in other studies done in the Atlantic rainforest, for example, Ponta do Almada (Hanazaki et al. 1996), the surroundings of the Carlos Botelho State Park (Hanazaki et al. 2006), Sertão do Ribeirão in Florianópolis (Giraldi and Hanazaki 2010), *caçara* communities on Cardoso Island (Miranda et al. 2011), and the community of Barra do Jucu in the municipality of Vila Velha. More specifically, in the community of Barra do Jucu, Albertasse et al. (2010) related the medicinal plant availability and easy access to the learning of these medicinal plants. Medicinal plant use provides maintenance of traditional practices and long-lasting interactions between people and the local flora (Giraldi and Hanazaki 2010). However, plant knowledge may undergo changes due to various internal factors such as, changes in practices and transmission of knowledge, external factors, such as access to manufactured drugs, as well as the

flux of information exchange. In this study the citation of *figatil* represents an influence of media on plant knowledge. In this case, respondents reported as erroneous the local terminology for this species (*figatil*), and considered the correct terminology what was reported by a television program (“true *boldo*”). Such influences are part of a globalized world where the combination of technological, social, political and environmental factors transform the significance of local knowledge (Alexiades 2003).

Respondents in Morro Grande had a greater familiarity with medicinal plants than respondents in Ribeirão Taquaras, who were more familiar with timber resources. More information is required on the plant’s effective use. The difference between communities with respect to medicinal use may be related to the current use, where Morro Grande has the largest variety of medicinal uses, and knowledge is directly related to use (Camou-Guerrero et al. 2008). In regards to timber resources, its use was cited in the past within the two communities. However, Ribeirão Taquaras has a historical relationship with the extraction of timber dating back to the colonization period (Secchi 2004). Subsequently, many respondents worked for logging companies, providing a more significant relationship to this resource, while enhancing the people’s knowledge and value of timber.

Most of the species cited by the two communities as timber and firewood resources are native to the dense Atlantic rainforest. However, legal restrictions on the use of these resources and incentives for planting pine and eucalyptus resulted in the replacement of plants used for timber and firewood. Furthermore, this resulted in the loss of diversity in knowledge, and the replacement of native forests by homogeneous plantations of exotic species. Siminski and Fantini (2010) discuss the process of reduction of forest remnants in the state of Santa Catarina, in an analysis of the applications for forest removal submitted to the state’s environmental agency. This analysis revealed that the main motivation for forest removal is economic use of the land, since the native vegetation is believed to be of low economic value. These areas were considered more profitable if used for reforestation with pine and eucalyptus, and were identified as the main land uses after the removal of native forest. In the studied area, this problem can be mitigated by actions from the protected area, which has among its objectives the sustainable use of native forest resources (MMA 2007). These actions could take into account local knowledge of these resources in the development of sustainable strategies. Using local knowledge will allow the interaction with the natural environment to remain, which may increase the value of local knowledge and reduce the dominance of exotic species within the local vegetation.

Moreover, authors such as Bernardo et al. (2009), Siminski and Fantini (2010), and Siminski et al. (2011), argued that restrictions on the use of native resources as a strategy for biodiversity conservation are not effective for Santa Catarina. These restrictions of use along with the lack of environmentally acceptable alternatives for managing these resources result in disinterest of small farmers in maintaining forest remnants on their properties.

The interactions of people with resources found in the natural environment favors plant knowledge diversity. This includes the category of plants used for manufacturing. The plants cited for this purpose are native, and the practices surrounding the use of these plants is threatened by easy access to industrial tools, as well as reduced access to places where these resources can be obtained. The frequency with which people visit the area where these resources can be obtained is directly linked to knowledge of the

area. This was also found by Albuquerque and Lucena (2005), in their discussion of the accessibility and availability of resources in communities in northeast Brazil. Native plants with used for manufacturing were also found by Miranda et al. (2011) and Hanazaki et al. (2000) in *Caçara* communities, demonstrating the relationship of this knowledge to forest areas. The high citation frequency of plants used to manufacture “the cove” (fishing trap) can be attributed to its current practice, given the proximity of the communities to the river, since its current use contributes to knowledge regarding the resource (Camou-Guerrero et al. 2008).

Native plants are also used to diversify livestock feed. The relationship of the plants in animal husbandry goes beyond food; plants are also applied to veterinary medicine. Due to high costs in maintaining animals, it is estimated that the use of medicinal plants as a primary source of prevention and control of diseases is frequent and widely used in many countries for several centuries (Khan et al. 2011). As a prevention method, the use of plants as parasite repellent was corroborated, which acts both to protect domestic animals (e.g. tobacco used to repel fleas), as well as humans (e.g. citronella used to repel mosquitoes).

Ornamental plants can be acquired either by extraction from the environment, exchanges between neighbors, as well as purchases at floricultures. A well-kept garden is seen as a sign of care by the residents, and is highly valued. The concern with maintaining a beautiful garden is common among women from Morro Grande and common between men and women of Ribeirão Taquaras. The care for gardens may be linked to the German culture, which was also seen by Caporal (2007) in a study of German descendants in São Bonifácio, Santa Catarina.

In the category of timber resources, men have a more diverse knowledge, including native and exotic species, whereas women, predominantly cite exotic plants (eucalyptus and pine). Men’s superior knowledge of timber resources in comparison to women was also found by Hanazaki et al. (2000) in a *caçara* community and Guedes-Bruni et al. (2011) in the Poço das Antas Biological Reserve, both within the Atlantic rainforest. These authors found similarities between men’s knowledge and their work history, since they were dismissed from the timber industry or had contact with someone in the family who did logging related work. Activities directly related to timber resources broaden the knowledge of these plants. These are high-energy activities, and are considered primarily male activities (Ahmen and Laarman 2000), thus explaining women’s decreased familiarity with these resources.

As for the other use categories there were no differences incitation frequencies between men and women, even in the medicinal use category, where women often have an increased knowledge of plants (Hanazaki et al. 2000; Begossi et al. 2002). Hanazaki et al. (1996) also found this shared knowledge of medicinal plants among men and women in Ponta do Almada (SP) and Giraldi & Hanazki (2010) in the Sertão do Ribeirão. However, respondents affirmed that medicinal plant knowledge transmission is done by women (mothers and grandmothers) and woody plants by men (fathers and grandfathers).

Differences in age categories are related mainly to timber resources, a consequence of longer interactions with the environment by older generations. Studies such as Hanazaki et al. (1996, 2000), Begossi et al. (2002) and Miranda et al. (2011) justify increased plant knowledge by older people to the accumulation of life experience. They imply that older generations have had more opportunities to experience natural

resources and use a greater diversity of plants, and were less affected by external factors. However, Luziatelli et al. (2010) also argued that much of the variation between informants is due to personal interests and social relations, adding complexity to this general tendency of acquiring medicinal knowledge through age. For woody plants, in some studies no difference was found in contrasting ages (Kristensen and Lykke, 2003; Stave et al. 2007). In other situations, such as with firewood in Northeastern Brazil, older people knew more about plants used for firewood and charcoal, but no age differences were observed for the species currently used (Ramos et al., 2008).

The use of plant resources is closely related to knowledge (Reyes-Garcia et al. 2007; Camou-Guerrero et al. 2008), since it is necessary to know the plant before using it, during the course of time this knowledge changes once a plant is no longer used. Nevertheless, in other categories no differences were found, even in the manufacturing category. The opposite was true in the work by Miranda et al. (2011) in *Caiçara* communities of Cardoso Island (SP), who found the manufacturing category among the most cited by individuals over 40 years of age. Different scenarios can be expected for intracultural variation of knowledge, depending on the context of the study. For example, Ayantunde et al. (2008) showed that for herbaceous and woody plants known by agropastoral communities in Niger, there is a curvilinear trend between age of the respondents and number of identified plant species, up to a certain advanced age when the number of species known tends to decline.

Even though those working in the urban environment also perform the activities related to subsistence, the time available for these people to interact with the natural environment is decreased, which is reflected in the resources managed in environments far from the family property, such as forest areas. Decreasing the interaction with the environment also decreases the use of local plant resources, which in turn affects the knowledge regarding useful plants.

Respondents positively view the National Forest, inasmuch that it contributes to the conservation of nature, which is perceived by respondents to increase local avifauna and native vegetation. However, the presence of the protected area has brought changes in resource procurement. Respondents view this negatively, since there are restrictions on natural resource use and changes in agricultural activities. Respondents associated the National Forest to the Ibirama Garden, often making no distinction between the two entities. The Ibirama Garden was seen as a source of income, a result also obtained by Secchi (2004). Some respondents were employees of the Ibirama Garden, and received seedlings for reforestation. Thus, the change in management from the Pine National Institute to IBAMA made the Ibirama Garden a protected area with sustainable use, which also resulted in a decreased income for residents.

The results from this study are similar to the results obtained by Secchi (2004) when discussing the perception the Ribeirão Taquaras community regarding the National Forest. The author adds that the community's involvement with the protected area is distant. These results are also common in Morro Grande, where most of the residents have no knowledge of National Forest's existence. Consequently, greater efforts are needed to explain the functions of the National Forest. Furthermore, the activities necessary to achieve the protected area's goals need to effectively include the surrounding communities, as stated in the guidelines of the Brazilian System of Protected Areas (Brazilian Law 9985/2000), in order to ensure the effective participation of local communities in the management of the protected area.

## Conclusions

There are a wide range of useful plants known by the communities of Morro Grande and Ribeirão Taquaras, however many citations were related to the past, since currently, there are restrictions on the use of natural resources by legislations. Therefore, significant changes in farming practices, as well as the extraction of natural resources, influenced plant knowledge.

Overall plant knowledge is shared within the community, in relation to gender, age and type of occupation. A greater knowledge of medicinal plants by women was not observed, whereas knowledge of woody plants was found to be higher among men and people of 41 years or more. Differences in frequency of citations between the communities were also found, which may be related to the current or more frequent use of the resource.

These differences are reflections of the urban center's influence, where most people work and have access to industrial products, consequently decreasing the frequency of interaction with the natural environment. The substituted activities may have been influenced by the presence of the protected area, as well as practices related to agriculture. Therefore, it becomes necessary to acquire resources through different means. Nonetheless, respondents also view the presence of the National Forest positively, recognizing the advances related to the conservation of nature, such as a greater control of deforestation and increased local avifauna, which to them means a change for the better. Strategies to involve communities in the management of protected areas are necessary, in order to reduce the distance between local communities and the National Forest, and ensure the effective conservation of natural resources.

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