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Traditional knowledge about forest species: different times, different views

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ABSTRACT

The utility of traditional knowledge in drawing up restoration and conservation plans for the Brazilian Atlantic Forest still receives little attention. In the present study we sought identify the threats of loss of the traditional knowledge about forest species as well exemplify how it could be use as complement to the formal knowledge in the Atlantic Forest restoration. The traditional knowledge about flora was assessed to determine whether it differ according to age of people and landscape conservation status. The list of species from the traditional knowledge differed from those from formal botanical surveys and mention some species known to occur in the Atlantic Forest that did not appear in the list of botanical formal surveys. This result suggests the natural rarity of these species and/or drastic reduction of occurrence due to overexploitation in the past. The results point to the importance of actions for maintaining traditional knowledge with actions that motivate young people to acquire knowledge about vegetation today under the domain of elderly. The relevance of traditional knowledge in addition to formal knowledge for the choice of species for forest restoration was also highlighted.

Keywords: Atlantic Forest, Ethnobotany, Ethnoecology, Local Community, Reference Ecosystem.

INTRODUCTION

The Atlantic Forest in eastern Brazil in addition to environmental services provides resources to society, including natural food and fibers, wood for different purposes, among others (PARRON; GARCIA, 2015). The use of resources, as well the agricultural expansion, triggered the process of deforestation, which has led to habitat fragmentation and threats to biodiversity (FOLEY *et al.*, 2011; HANSEN *et al.*, 2013; SANTOS-SILVA *et al.*, 2016). There are no alternatives other than protecting and conserving remaining areas and the execution of restoration projects to maintain ecosystem services and mitigate the effects of climate change. However, despite the theoretical and empirical basis already available for forest restoration, as highlighted by Benyei *et al.* (2019), concrete advances are still needed that involve the participation of local communities.

The recognition of primitive natural ecosystems as references, which are sometimes used as indicators of the success of restoration projects, has often been indicated as fundamental for the implementation of such plans (ARONSON *et al.*, 1995; BREWE; MENZEL, 2009; HOBBS, 2007). The reference ecosystem is used as a basic parameter of comparison, that is, to evaluate the progress of the project, since, generally, the restoration goal seeks to reach as close as possible to the reference ecosystem (LONDE *et al.*, 2020). In this sense, it is essential to observe a series of environmental characteristics of an area before taking it as primitive and as a reference. For that it is, necessary to take in account different types of reference information, as well as mapping the multiple sources of information to understand patterns of change (SUGANUMA *et al.*, 2013). In addition to the concern of having reference information, the fact that human society interacts with natural resources in focal areas of restoration must also be considered and thus it is important to consider the contributions of human actions and culture (BIRÓ *et al.*, 2019).

Considering that the local population is the largest holder of knowledge about management practices that led to the current condition, the traditional knowledge can provide historical information about the state of the ecosystem and its past use (BALAGUER *et al.*; 2014; REYES-GARCIA *et al.*, 2019). The development of strategies for restorantion and sustainable use of forests and formulation of policies using of traditional knowledge also can contribute to the conservation of the threatened species (PÍO-LEÓN *et al.*, 2017). However, in many areas that need restoration, formal knowledge does can not be used used to provide ecological information to support restoration strategies. Because the formal survey of ecological data often requires time for research and publication of results, the search for traditional knowledge becomes a support tool to forest restoration plans (MELI *et al.*, 2014; GRAHAM *et al.*, 2016). Thus, the understanding the relationship between traditional knowledge of the use of natural resources can favors the execution and success of conservation projects and

consequent forest restoration (MCDONALD, 1977; ALBUQUERQUE; ANDRADE, 2002). From this perspective, traditional knowledge information combined with formal knowledge offered by inventories of flora and ecological data, would lead to better management strategies or instruments for biological and cultural conservation. The complementary use of both traditional and formal knowledge is a way to balance interests and values between scientists, politicians and the local population, and conserve biological and cultural diversity (MONROY-ORTIZ *et al.*, 2018).

Although ethnoecological studies have the adult and elderly public in common, it is possible that traditional knowledge is heading towards extinction, as this group of elderly people inevitably walk towards the end of their life cycle carrying traditional knowledge with them (PONTE; DIAS, 2016). A lack of interaction and exchange of traditional knowledge among people and communities can lead to the loss of this type of information (PEIXOTO; SILVA, 2011). The ease of access to new information by new generations distances the valuation of traditional knowledge that could contribute to the conservation and management of natural resources (AMOROZO, 2002; VEIGA-JÚNIOR, 2008; LISBOA *et al.*, 2017).

With the expectation of emphasizing how traditional knowledge about forest species can been lost over time and how this knowledge can be include in forest restoration plans for the Atlantic Forest, the present study sought to answer the following questions: (1) The past and present life style of the people determine their knowledge in relation to native plant species? (2) Does the state of conservation of the landscape in which the interviewees live determine their knowledge about the flora of the Atlantic Forest? (3) Does the most cited botanical species by the community are also included in the published floristic surveys of local forest fragments? The answers of these questions can contribute to lighting about the compatibility of the use of traditional and formal knowledge to select species for forest restoration programs.

MÉTODOS

Study area

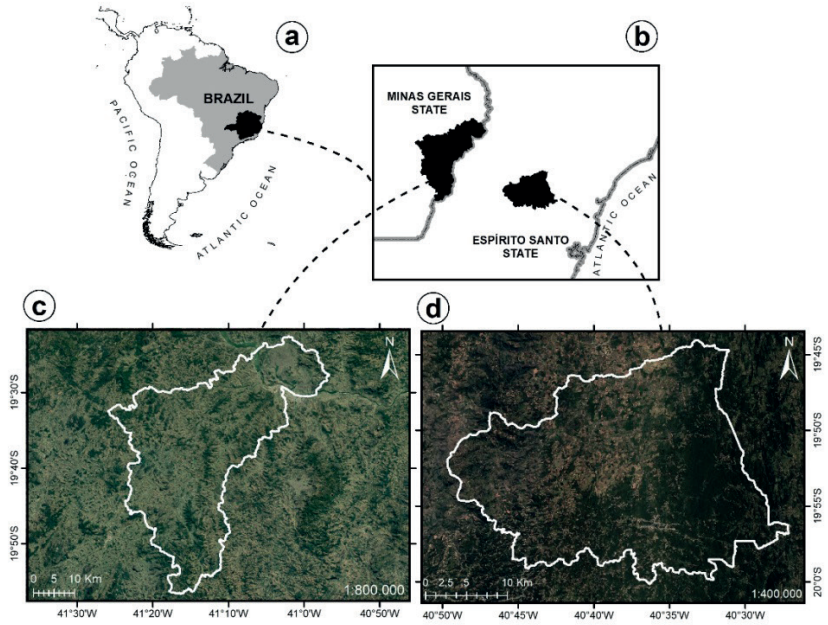
The present work involved informants from two municipalities in the Southeast Region of Brazil with different realities regarding the conservation of the Atlantic Forest: Aimorés in the state of Minas Gerais and Santa Teresa in the state of Espírito Santo (Figure 1). The municipality of Aimorés (19°29‘45‘‘S, 41°03 ‘50‘‘W), encompasses 134,877 ha and 25,193 inhabitants, referred to as “aimorenses”, 80% of which live in an urban area (IBGE, 2018). Aimorés is inserted in the region of Vale do Rio Doce under the Atlantic Forest domain, with the predominant formation being Seasonal Semideciduous Forest, according to the

phytogeographic divisions of IBGE (1992). The forest was progressively replaced by areas of pasture and coffee plantations throughout the course of colonization. In addition, the disordered use of wood and the construction of the Vitória-Minas railway and the Aimorés hydroelectric plant also contributed to the process of forest destruction due to the demand for firewood, fires caused by sparks launched by locomotives and the flooding of stretches of forest for the hydroelectric plant. Currently, Aimorés has 73% of its total area for agriculture and livestock (pasture), and 21% of secondary vegetation in the Atlantic Forest. With a history of degradation, the municipality has areas designated as Área de Proteção Ambiental (APA; area of environmental preservation) and Reserva Particular do Patrimônio Natural (RPPN; private reserve of natural heritage), such as the Instituto Terra to combat deforestation, in which approximately 710 hectares are in the process of forest restoration, (INSTITUTO TERRA, 2019; IBGE, 2020). The per capita income in reais of Aimorés, according to IBGE 2017, was 16,877.78. Among the sectors of the economy, agriculture and livestock are the least relevant, followed by the secondary sector, in the area of food industries and mineral extraction and by the tertiary sector (commercial activity and civil construction) (IBGE, 2018).

Santa Teresa is located in the central mesoregion of Espírito Santo (19°56‘12‘‘S, 40°35‘28‘‘W), with an area of 68,320 ha and a population of 21,815 inhabitants, referred to as “teresenses” (IBGE, 2018). The municipality is under the Atlantic domain with vegetal formations of Dense Ombrophilous Forest and is one of the municipalities that make up the Corredor Central da Mata Atlântica (CENTRAL CORRIDOR OF THE ATLANTIC FOREST; MINISTÉRIO DO MEIO AMBIENTE, 2006). The municipality has 28% of its total territory for agriculture and livestock and 52% of secondary vegetation (IBGE, 2020), of which 16% are protected by Unidades de Conservação (CONSERVATION UNITS; MINISTÉRIO DO MEIO AMBIENTE 2006; SILVA *et al.*, 2010). Santa Teresa is a world record region for biodiversity (MENDES; PADOVAN, 2000). A total of 476 tree species of 178 genera and 66 botanical families were found in one hectare (THOMAZ; MONTEIRO, 1997), surpassing known values for tropical forests throughout the world, even the Amazon (VIANA, 2000; INCAPER, 2013). The municipality contains areas of integral protection, such as Estação Biológica de Santa Lúcia and Reserva Biológica Augusto Ruschi, which have high species biodiversity indexes and connect forest fragments rich in endemic, rare and endangered species (IPEMA, 2004). In addition to conserved areas, the rugged relief combined with the region’s climate of mild temperatures, high humidity due to intense rains throughout the year and soils with low nutritional status, make the region of Santa Teresa unsuitable for traditional agriculture such as coffee, thereby also contributing to local conservation (FEITOZA *et al.*, 1999; SILVA *et al.*, 2010). The per capita income in reais of Santa Teresa, according to IBGE (2017), was

19,353.67. Among the sectors of the economy, agriculture is the most relevant followed by industry (IBGE, 2017).

Figure 1. Location of the study areas emphasizing the current degree of degradation and conservation of the areas. (A) Location of states in Brazil; (B) Location of municipalities in the states; (C) Aimorés -MG; (D) Santa Teresa- ES.



Source: authors.

Data collection

Data were collected in the months of January, February and March 2019. The interviewees were divided into two groups: young people aged between 15 and 29 years, and elderly people aged 60 and over. A total of 100 people was interviewed, with 25 young and 25 elderly from each municipality. The interviewees were located at random by informal meetings with people being approached on the street or at fairs, squares or even, in some cases, at their homes. Data were collected using the participatory research model through interviews with semi-structured questionnaires and open-ended questions based on the traditional knowledge of the local social subject (MARCONI; LAKATOS, 1999). Two models of scripts suitable for each public (young and elderly) were adopted, which comprised questions about floristic composition, use and importance of the local flora in the past and present, and the awakening of young people's interest or lack of interest in nature. Respondents were able to freely discuss the issues addressed as the questions presented great flexibility thus allowing interviewees to delve into elements that emerged during the conversation (ALBUQUERQUE; LUCENA, 2004). Every conversation was recorded, with prior authorization from the interviewees, and later transcribed.

Profile of the informants

More than 60% of the interviewees were female, with 70% from Aimorés and 52% from Santa Teresa. The mean ages for young and elderly respondents in Santa Teresa were 20 and 77 years, respectively, while in Aimorés they were 18 and 68 years. All the elderly people interviewed in Santa Teresa were retired; 36% of them had been farmers, while the rest were divided among former domestic workers (12%), drivers (12%), and entrepreneurs (8%), among others. Of the young from Santa Teresa, 76% were students, 24% of which were in higher education, and 24% only worked. More than 80% of the elderly of Aimorés were retired; their former professions included domestic workers (48%) and farmers (20%), among others. Of the young, 72% were students, 4% of which were in higher education, and 28% only worked, exclusively in commerce. It should be noted that the respondents from Santa Teresa were older and and had 20% more in higher education than the respondents from Aimorés.

Data analysis

After the interviews, floristic lists were generated for each municipality according to the use class of the species. Associations between degree of knowledge (according to the number of species mentioned, i.e., richness) and age group, location, gender, profession and uses of species were analyzed by Chi-square (χ^2) test at 5% probability using R (CORE TEAM, 2014). The information was organized into five classes to assess the ways in which species were used: food, domestic construction (houses, windows, furniture, musical instruments), rural construction (fences, plows, tool handles), fuel (firewood and coal) and medicinal.

Confirmation of scientific names and the origin of the species mentioned by the entreviews in each municipality were based on the Lista de Espécies da Flora do Brasil (2018). Family identification followed the classification system of Angiosperm Phylogeny Group IV (APG IV, 2016). The lists obtained from traditional knowledge were compared with the lists of formal knowledge published by Thomaz and Monteiro (1997) and Saiter and Thomaz (2014) for Santa Teresa and Oliveira-Filho *et al.*, (2005) for Aimorés, seeking to identify in the list of floristic surveys the species mentioned by the interviewees in the two municipalities. This research is part of the activity of access to Associated Traditional Knowledge and was registered with SisGen (Sistema Nacional de Gestão do Patrimônio Genético e do conhecimento tradicional associado), in compliance with the provisions of Law No. 13,123/ 2015 and its regulations under number AD07AA8.

RESULTS

A total of 116 botanical species were obtained from the 100 interviews, with 111 species being recorded for the municipality of Santa Teresa and 75 for Aimorés. The sum of the totals for the municipalities exceeds the total number of species because there were species in common to both areas and thus cited more than once. The municipality of Santa Teresa has a large area of native forest compared to the municipality of Aimorés and, therefore, even indirectly, young people from Santa Teresa are more accustomed to botanical species. This was confirmed by the statistically significant difference (χ^2= 6.64, p=0.03) between the number of native species mentioned by the young people of the two municipalities. The young people of Santa Teresa mentioned 42 species, 60% of them native to the Atlantic Forest, while those of Aimorés, mentioned only 29 species, 48% native.

Of the young people interviewed, 72% in each location were students. For Santa Teresa, 48% were students of basic education (first and second level), 24% were in university education (architecture, law, mechanical engineering, veterinary medicine and pedagogy) and 28% worked (freelancers and teachers), while for Aimorés 68 % of students attended basic education, 4% university education (accounting science course) and 28% worked specifically in commerce. The average number of species cited among primary school students in Santa Teresa was 5 species and in Aimorés 4 species, among those attending university education in Santa Teresa there were 4 species and in Aimorés, one species. While young people who only worked, the average of species mentioned in both places was 4 species. Regardless of the level of education of young people, the number of species mentioned is relatively low compared to the elderly.

In relation to the elderly, the number of native species was predominant with no statistical differences between the municipalities. For the total cited species by the elderly, 86% and 73% were native in Santa Teresa and Aimorés, respectively. These results indicate that the state of municipal conservation indirectly influences the young people's botanical knowledge, while for the elderly, who for the most part were exposed to experiences in the field in their youth, the status of municipal conservation did not directly influence traditional knowledge.

The Chi-square test indicated a significant difference (χ^2= 8.52, p=0.001) in the number of species cited by elderly and young people in Santa Teresa, with the elderly citing 62% of the recorded species. However, no statistical difference in the number of species cited by young and elderly respondents was observed for the municipality of Aimorés. There was a significant difference in degree of knowledge according to gender only for elderly people of Santa Teresa (χ^2= 10.41, p=0.004), with the number of species cited by men exceeding that cited by women (Figure 2A). There was no significant difference between genders of young people.

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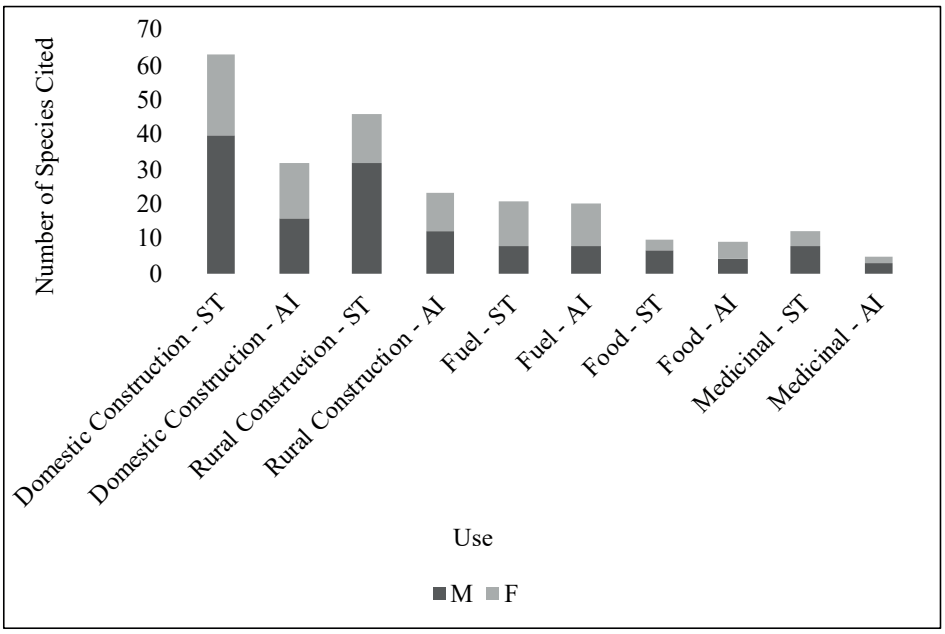
Professions that provided direct contact with nature, such as logging and farming, influenced the number of species mentioned, especially for elderly men in Santa Teresa with farmers citing 53 species and loggers citing 32 species. The species most cited by the elderly, regardless of municipality, were those for domestic construction (houses, furniture etc.), followed by rural construction (fences, tool handles, etc.) and fuel (burning, coal) (Figure 2A). Fruit species, common in backyards and supermarkets, were the most recalled among young people, followed by those for domestic construction. The percentage of medicinal species known to young people was below 1%. Young people in the municipality of Santa Teresa were more heterogeneous in their knowledge of species than were young people of Aimorés (Figure 2B).

Figure 2. (A) Distribution of the number of species cited by the elderly (60 years and older) from the municipalities of Santa Teresa, Espírito Santo (ST), and Aimorés, Minas Gerais (AI), according to use and to gender, male (M) and female (F). (B) Distribution of the number of species cited by young people (between 15 and 29 years) of the municipalities of Santa Teresa, Espírito Santo (ST), and Aimorés, Minas Gerais (AI), according to use and to gender, male (M) and female (F). *Some young respondendts mentioned a species but were unaware of its use.



Among the species most cited among young people, the exotic species *Mangifera indica* L. stood out in both municipalities, with 23% and 48% citation in Santa Teresa and Aimorés, respectively. Among the elderly, the natives *Goniorrhachis* sp. and *Aspidosperma polyneuron* Müll.Arg. were the most cited species, with more than 30% of the elderly in the municipality of Santa Teresa citing them, while in Aimorés 37% of the elderly cited *Aspidosperma* sp. and 20% cited *Goniorrhachis* sp. (Table 1). Of the species most cited by young of Aimorés, 10% were native, while 50% of those cited by young of Santa Teresa were native. All the species most cited by the elderly were native.

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Table 1. Species most cited by young and elderly respondents in the municipalities of Santa Teresa, Espírito Santo, and Aimorés, Minas Gerais.

Santa Teresa - ES					
Young			**Elderly**		
Species	No. of citations	Origin	Species	No. of citations	Origin
Tabebuia/Handroanthus sp.	11	Native	*Goniorrhachis* sp.	25	Native
Mangifera indica L.	10	Exotic	*Aspidosperma polyneuron* Müll.Arg.	21	Native
Artocarpus heterophyllus Lam.	8	Exotic	*Cariniana legalis* (Mart.) Kuntze	16	Native
Aspidosperma polyneuron Müll.Arg	9	Native	*Tabebui/Handroanthu a* sp.	15	Native
Aimorés - MG					
Young			Elderly		
Species	No. of citations	Origin	Species	No. of citations	Origin
Mangifera indicai L.	14	Exotic	*Aspidosperma polyneuron* Müll.Arg.	17	Native
Cocos nucifera L.	10	Exotic	*Goniorrhachis* sp.	9	Native
Malpighia glabra L.	9	Exotic	*Tabebuia/Handroanthu* sp.	6	Native
Paubrasilia echinata (Lam.) Gagnon, H. C. Lima & G. P. Lewis	7	Native	*Anadenanthera* sp. e *Cedrela fissilis* Vell.	5	Native

Comparison of the species most mentioned by the interviewees with tree species of a floristic survey conducted in the municipality of Aimorés by Oliveira-Filho *et al.*, (2005), and in Santa Teresa by Thomaz and Monteiro (1997) and Saiter and Thomaz (2014), revealed a few species in common. The list fron the traditional knowledge for Aimorés had two species in common with the published list — *Cedrela fissilis* Vell. and *Tabebuia* sp. — while that for Santa Teresa had only *Tabebuia* sp. in common with the published lists. The species with the highest density in Santa Teresa, according to Thomaz and Monteiro (1997) and Saiter and Thomaz (2014), were E*uterpe edulis* Mart., *Ocotea aciphylla* (Nees & Mart.) Mez, *Unonopsis riedeliana* R.E.Fr., and *Eriotheca macrophylla* (K. Schum.) A. Robyns, which were not mentioned during the interviews. Among the native species mentioned by the interviewees, 10% are not included in the published floristic lists. In addition, there are species that are not among the most mentioned, but are on the lists of traditional knowledge and are also on the published lists, they point out *Euterpe edulis* Mart., *Hymenaea* sp., *Inga* sp. And *Melanoxylon brauna* Schott.

When asked about the interest about the knowledge and use of natural resources, the young and elderly in the municipalities analyzed were unanimous in answering that the direct dependence on nature influenced the knowledge about species (Figure 3A and B). However, when inquiring about the lack of interest of young people in knowledge related to forest species, 69% of young people from Santa Teresa stated that technology and convenience, associated with the ease of access to the products in supermarkets, are precursors of the current lack of interest among young people. Meanwhile, 65% of young people form

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Aimorés related the lack of interest in this knowledge to technology and the absence of natural qualities attractive to people (Figure 4A). For elderly people in Santa Teresa (53%), the lack of interest of young people in nature is related to the need to study, due to the lack of guidance and encouragement on the part of parents. Sixty percent of elderly people in Aimorés justify this current lack of interest due to technology, lack of time and other types of entertainment (Figure 4B).

Figure 3. (A) Responses of young people from the municipalities of Santa Teresa and Aimorés to questions about the interest of the elderly in the knowledge of forest species and their use. (B) Responses of elderly from the municipalities of Santa Teresa and Aimorés to questions about their interest in the knowledge of forest species and their use.

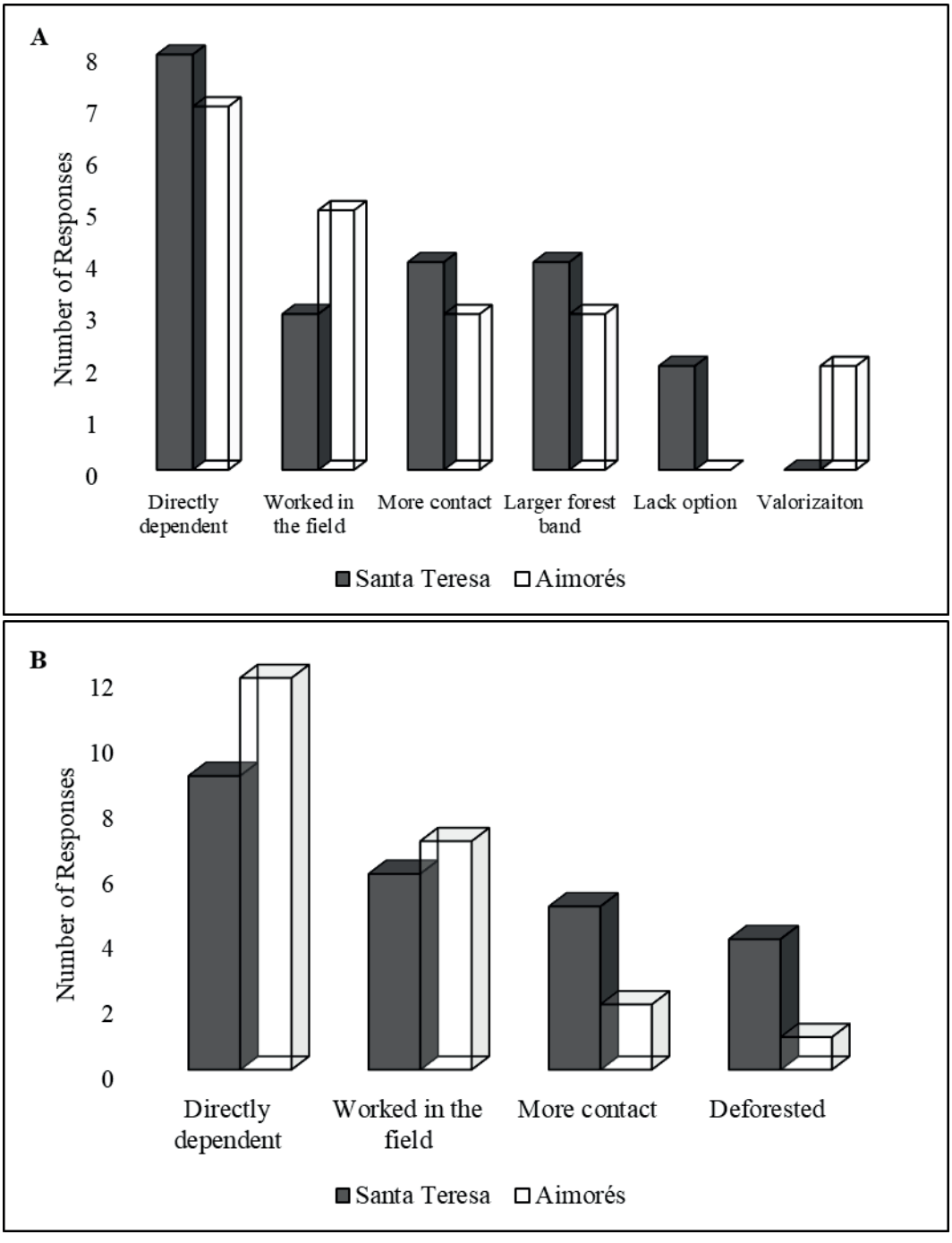

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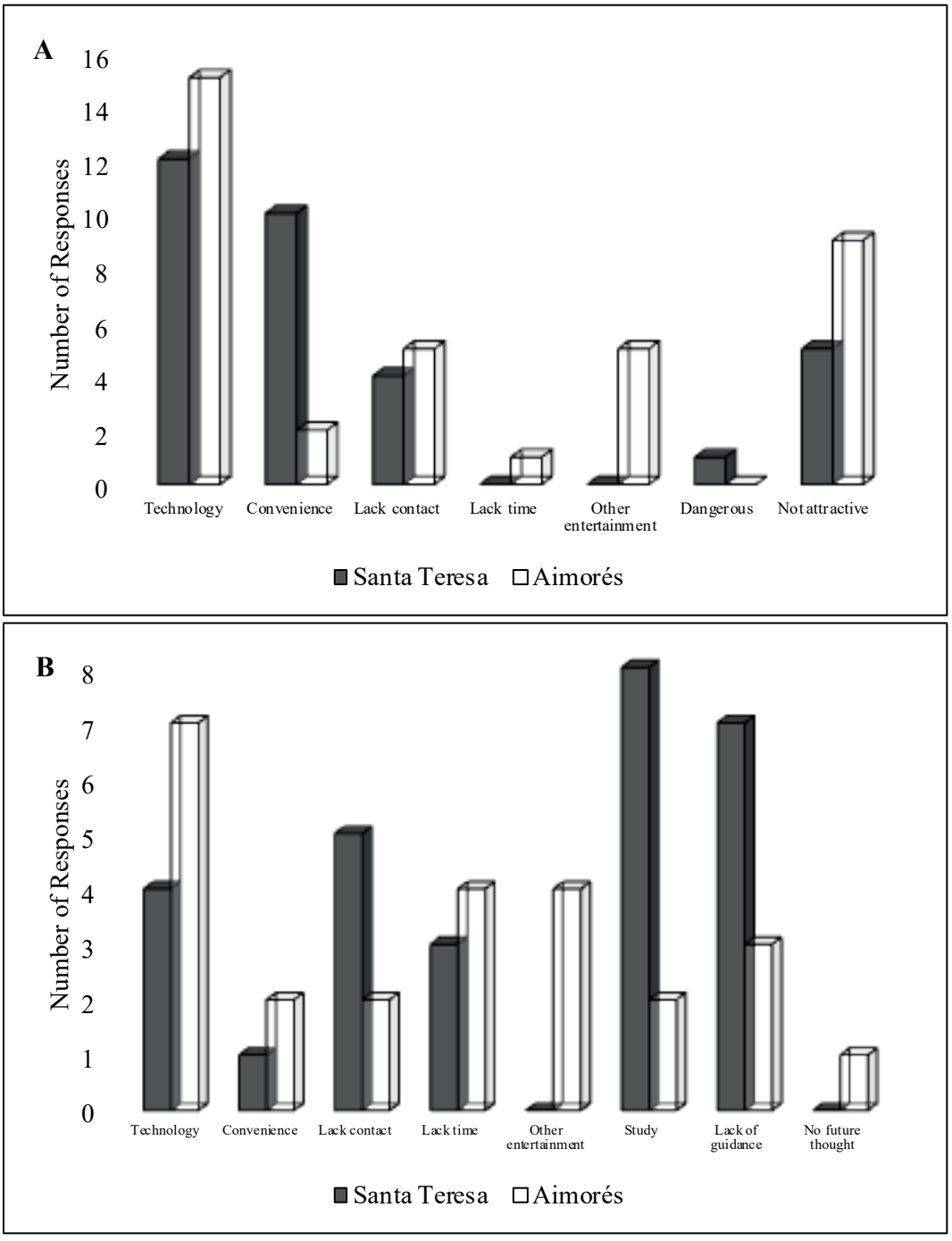
Figure 4. (A) Responses of young people from Santa Teresa and Aimorés to the question of the lack of interest of young people in forest species. (B) Responses of elderly people from Santa Teresa and Aimorés to the question about the lack of interest of young people in forest species.



For leisure, more than 30% of young people in Santa Teresa and 47% in Aimorés routinely access the internet or television. Forty-one percent of young people from Santa Teresa reported having contact with green areas at country homes, farms, beaches or at Instituto Nacional da Mata Atlântica. In Aimorés, only 10% of the young people reported having frequent contact with green or natural areas. The elderly reported that, in their youth, contact with forest areas was intense even during leisure time. Forty percent of elderly people in Santa Teresa and 60% of Aimorés confessed that due to the need to work daily, leisure time was

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limited to attending masses or religious festivities. However, they also highlighted fishing, football, wheel games, river bathing, among others, as leisure.

DISCUSSION

A greater traditional knowledge has been frequentlfy reported in regions of high biological diversity where populations often maintain direct contact with the natural environment (PRIMACK; RODRIGUES, 2006). Consistent with these reports, a positive effect in the number of species cited by young people of the municipality with better state of conservation of the natural landscape was registred. This was observed despite of the restricted knowledge about species among young when compared with ederly people. Our results suggest that more than the current state of forest conservation, the memory about the utility of species in the past determined the higher number of native species of the Atlantic forest mentioned by the elderly. The traditional knowledge that was consolidated and remembered, mainly by the elderly, is related to intense contact with natural areas and the result of cumulative processes over time (GOMES, 2014).

The the limited knowledge about native forest species by young individuals, even those in the municipality where there is significant preserved Atlantic Forest, indicates the rapid erosion of local knowledge and the need for initiatives for its preservation (BENYEI *et al.*, 2019). The region that encompasses the studied municipalities was historically occupied by indigenous groups of the macro-jê linguistic-cultural stem (BAETA; MATTOS, 2007), Botocudos peoples who began to suffer genocide at the end of the 18th century (KRENAK, 2009). This indicates that knowledge about the floristic resources of the Atlantic Forest has long been experiencing a process of erosion that continues today.

In addition to age, gender and profession of the interviewees also influenced their degree of knowledge of botanical species. Professions with greater contact with the environment, such as loggers and farmers, which are generally male, contributed significantly to the number of species mentioned. There is a tendency in ethnobotanical studies for men to show a greater degree of knowledge of forest species for the use of wood, while women commonly recognize species related to the medicinal field. This tendency is because knowledge is accumulated according to experiences and work divisions among genders. Therefore, even in the face of the current scenario of women's independence and freedom, experiences are still lacking in several aspects to consolidate this type of knowledge (LUCENA *et al.*, 2007; VOEKS, 2007; VIU *et al.*, 2010). Young people, who currently have little contact with forest areas, hardly know or remember the species. This litlle knowledge among the young, regardless of gender, is related to the lack of interest in the knowledge and experiences of older people. "Listening to stories" was among the leisure activities recorded for the elderly,

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which may also contribute to their greater accumulated knowledge about forest resources. Traditional knowledge is passed on for generations through informal conversations in daily life in the domestic environment, where, at the same time, theoretical and practical knowledge is acquired through observations, explanations and codifications; however, young people today are impatient or unmotivated to listen to older people (PASA; ÁVILA, 2010; VIU *et al.*, 2010).

The view of the elderly towards young people's lack of interest in traditional knowledge may be linked to a lack of parental guidance and the need to study. For the elderly, studying means migrating to urban areas and abandoning rural areas or interior cities. Authors such as Caldart (2003) and Rocha *et al.* (2018) have discussed and problematized the theme in economic, social and educational aspects, stating that current rural education projects have gained strength and there is no longer a need to leave the countryside. However, according to the elderly interviewed in the present research, rural exodus is still an alternative for professional success. Changes in habits and lifestyle over generations can affect the dynamics of traditional knowledge due to economic, political, social, cultural, and environmental changes (PANIAGUA-ZAMBRANA *et al.*, 2014). The knowledge of the elderly regarding the use and importance of forest species, in the eyes of young people, is summed up as strict dependence on nature. This view becomes worrying because young people do not associate populational well-being with basic services promoted by the environment, such as provisioning food and water. There is a range of studies aimed at integrating man and nature that associate technological advancement and the migration of rural populations to urban areas due to the disinterest of young people in traditional knowledge about botanical species and their use, including in the medical field, due to the lack of contact, practicality and easy access to goods on shelves and the internet (AMOROZO ,2002; VEIGA-JÚNIOR, 2008; LISBOA *et al.*, 2017). The lack of contact with green areas can be a precursor for the lack of interest in traditional knowledge on behalf of young people.

Our results indicate that most young people have access to the internet or television as leisure, which can explain the little interest in knowledge related to forest species due to the lack of contact with these environments. It is noted that young people's memory of botanical species is summarized in fruit species commonly found in squares, backyards, on streets and even in supermarkets. Their justification for this reduced contact is based on the lack of time due to studies or work, lack of interest, or even less because they believe they no longer need the natural environment or knowledge about forest species. However, it is necessary to emphasize the need to exercise caution when interpreting relationships between age and ethnoecological knowledge. The experience of the elderly with culture and traditional knowledge over time has been identified as a way of safeguarding the traditional knowledge they

built by themselves, while young people still need this exposure for knowledge formation and maturity (WESTMAN; YONGVANIT, 1995; VOEKS; LEONY, 2004; VIU *et al.*, 2010).

Sociocultural factors interfere with traditional knowledge among age groups (SOP *et al.*, 2012). Like what was found in the present study, Fentahun and Hager (2009) noted that an individual's routine acts directly on their degree of ethnobotanical knowledge. Times have changed and, in the present study, when comparing the present and the past, the reports of the elderly reveal that even in their youth their leisure time was spent in contact with forest areas. According to the interviewees, the simple routine of attending church on Sundays was related to the natural environment because it was necessary to cross forest fragments on foot, horseback or by bicycle. In addition, frequent visitations to rivers for bathing or fishing and listening to stories told by elders were as seen as intertainment. Currently, however, young people are interested in keeping social networks up to date and frequenting bars, restaurants, and clubs, emphasizing once again that traditional ethnobotanical knowledge can go a long way towards extinction.

In the present study, the more extensive presence of forest conservation areas implied high number of native forest species mentioned by young people. The municipality of Santa Teresa has a large native forest area compared to the municipality of Aimorés, and so, even indirectly, young people from Santa Teresa are more accustomed to botanical species. The young from Aimorés remembered exotic fruit species in addition to the brazilwood, *Paubrasilia echinata* (Lam.) Gagnon, H. C. Lima and G. P. Lewis, which are species present in the daily lives of these young people. *P. echinata* is one of the most talked about species in schools in the historical context of its exploitation (SCHWARTZ, 1998) and the very origin of the name of the country, which may have promoted the association of the species with its occurrence in the conserved forests of Aimorés. It is common for the species most cited by interviewees to be related to their use in the daily lives of everyone, as well as the nature of their relationship and contact (CAMOU-GUERRERO *et al.*, 2008; SOP *et al.*, 2012).

Among the species mentioned by the young people from Santa Teresa, *Tabebuia* sp., *Handroanthus* sp., *Mangifera indica* L., *Artocarpus heterophyllus* Lam. and *Aspidosperma polyneuron* Müll.Arg stand out. *Tabebuia* sp./ *Handroanthus* sp., known for their beauty and flowers with exuberant colors, are widely used in urban afforestation (CARVALHO, 2003), while *M. indica* and, *A. heterophyllus* are common in domestic backyards in Brazilian cities composing orchards that feed residents (ALGRANTI, 1997). In its turn, *A. polyneuron* has excellent wood for carpentry and joinery (CAMPOS-FILHO; SARTORELLI, 2015). The food and economic value of these species make them common in the daily lives of young people, facilitating the recall and knowledge of these species. The most common species cited by the elderly of both municipalities were destined for domestic and rural construction and fuel,

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such as: *Goniorrhachis* sp., *Aspidosperma polyneuron* Müll.Arg., *Cariniana legalis* (Mart.) Kuntze and, *Tabebuia* sp./ *Handroanthus* sp.. Based on the interviews, it was found that these species were the most extracted from the Atlantic Forest in the 1950s and 1960s for the construction of houses, furniture, fences, and firewood.

When comparing traditional and formal knowledge, it is noted that the species with the highest density in forests in the municipality of Santa Teresa in the 1990s were not those mentioned by most respondents. When determining the floristic composition of Estação Biológica de Santa Lúcia in the municipality of Santa Teresa, Thomaz and Monteiro (1997) found the species with the highest densities to be: *Euterpe edulis* Mart., *Ocotea aciphylla* (Nees & Mart.) Mez, *Unonopsis riedeliana* R.E.Fr., and *Eriotheca macrophylla* (K.Schum.) A. Robyns. Since the species with the highest densities in the conserved area differ from those mentioned by interviewees, it is possible to wonder whether the species extracted in earlier times were not the most frequent in the area, or even, were the most extracted species exhausted before the execution of the scientific research. However, when analyzing the floristic lists of Thomaz and Monteiro (1997), Oliveira-Filho *et al.* (2005) and Saiter and Thomaz (2014), it is observed that although they occur in smaller number, there are still species in Aimorés such as *Cedrela fissilis* Mart. and *Tabebuia* sp, while in Santa Teresa only *Tabebuia* sp.

The native species mentioned by the people interviewed have in common a wide range of occurrence between Ombrophilous and Seasonal Semideciduous Forests throughout the states of Espírito Santo and Minas Gerais (LISTA DA FLORA DO BRASIL, 2018). It was expected that for the municipality with the greatest representation of preserved areas of Atlantic Forest (Santa Teresa) the tree species mentioned in the interviews would still be present, even if on a small scale, in the forest remnants. However, contrary to what was expected, it was in the municipality with the lowest degree of preserved forest coverage (Aimorés), which has an impactful history of degradation, that a greater number of species mentioned were listed in the floristic surveys. However, it should be noted that active restoration projects are developed in Aimorés in which native species make up their base (INSTITUTO TERRA, 2019), which may be a cause of the result obtained here.

In a study about culturally important species for dry forest, Suárez *et al.* (2012) observed that the species used in restoration projects, produced in nurseries, were not always those that fall into the category of overexploitation or moreuseful to the people. Still, according to the authors, neglecting the demands of the population considerably minimizes their interest in such projects. So, as pointed by Monroy-Ortiz *et al.* (2018), a way to balance interests and values between scientists, politicians and the population is to complement formal knowledge with information from traditional knowledge, that is, to consider species whose presence is in the memory of the inhabitants of the localities, but they are not represented in studies of

the flora of the forest remnants. The development of a perspective focused on searching for comprehensive knowledge about the ecosystem and and the community illustrates the importance of taking care to use only the formal knowledge as base to define the reference ecosystem as a restoration goal. The discrepancy between the list obtained from the interviews in this study and the reference lists suggests that the definition of reference ecosystems based on the scientific species lists can be improved by adding traditional knowledge of the population surrounding the areas to be restored, notably that accumulated by the elderly.

CONCLUSION

The state and extent of forest preservation areas seens do affect the knowledge about flora by young people wile a memory of the past use of plants determine the higher knowledge by ederly people. A way of life more disconnected from the natural environment and/or the lack of effective educational programs for valuing nature's resources, seems to be the cause of low traditional knowledge about the native flora by young people. Our results showed that attention is needed to establish criteria for forest restoration, since species present in the published floristic inventories differs from those of the traditional knowledge acquired over the years by people who have experienced the deforestation process. The integration of traditional knowledge of the local elderly population with the formal knowledge would support better choise of species to restore degraded areas.

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