



# Use and conservation of *Butia* palm groves: the link that goes beyond borders

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## Research

### Abstract

**Background:** *Butia* is a genus palm species from South America. Currently, the species of this genus are threatened with extinction in Brazil. This work aimed to understand the ethnobotanical relationships with *Butia* palm groves, how this process has been built, and how it contributes to the *in situ* conservation of its native genetic resources.

**Methods:** The methodology consisted of conducting semi-structured interviews with an ethnobotanical emphasis. Statistical methods and informant indexes were applied, mixing theoretical discussions with data analysis to assist in understanding the results.

**Results:** 16 uses for **butiá** (the fruit of *Butia* palm) were cited by the interviewed. The most cited was the consumption of fresh fruit. The contact with the *Butia* palm groves varied between daily and seasonal. The activities associated with the *Butia* palm groves ecosystems were tourism and livestock. Proposals for their conservation refer to partnerships between private initiatives and public institutions associated with public policies and legal reserves.

**Discussion:** The *Butia* palm groves are integral to local communities' identities. Choices related to *Butia* palm groves impact communities, just as the *Butia* palm groves also impact local populations.

**Conclusions:** The *Butia* palm groves have great sociocultural and biological importance. The bond shared between people and the *Butia* palm groves goes beyond borders, and its conservation can be related to good practices of extraction, sustainable management and also through public policies and specific legislation aimed at protecting this environment.

**Keywords:** ethnobotany, genetic resources, sociobiodiversity, *Butia* palm groves network, bioeconomy

## Background

*Butia* (Arecaceae) is a genus of subtropical palms with distribution in southern South America. The genus *Butia* comprises 22 species (Deble *et al.*, 2017; Soares, 2015; Sant'Anna 2021), distributed in Argentina, Paraguay, Uruguay (Geymonat & Rocha, 2009; Noblick, 2010; Soares, 2015; Keller & Paz-Deble 2020) and Brazil, which is the country that has the most significant number of species. In addition, 20 species are distributed in different Brazilian regions: Northeast (Bahia), Midwest (Federal District, Goiás, Mato Grosso do Sul), Southeast (Minas Gerais, São Paulo), and South (Paraná, Santa Catarina, Rio Grande do Sul) (Eslabão *et al.* 2016, Ellert Pereira *et al.* 2017, Sant'Anna 2021).

In a social and economic sense, the *Butia* genus offers raw material for several types of food and drinks, as well as handicrafts (Marchi *et al.*, 2018). However, due to several large-scale anthropic actions in the *Butia* palm groves, which oppose the traditional uses of the ecosystem, the genus currently composes lists of extinction and vulnerability (IUCN 2016). As a strategy to raise society's awareness of the importance of conserving the species and the *Butia* palm groves ecosystems, the project *Butia* Palm Groves Network (Rota dos Butiazais, in Portuguese, and Red Palmar, in Spanish) was proposed. This project is a network for integration between people, places, and countries (Brazil, Uruguay, and Argentina), aiming to promote the conservation and sustainable use of biodiversity associated with *Butia* palm groves, ecosystems where *Butia* palms are predominant (Barbieri *et al.* 2015). Furthermore, the *Butia* Palm Groves Network considers the cultural link with *Butia*, and the products derived from it essential to increase their valuing, leading to the preservation of *Butia* and the environment (Barbieri *et al.*, 2017). The most common product of the *Butia* palm groves is the fruit, known as **butiá**. The *Butia* Palm Groves Network emerged in 2015 in partnership with the Brazilian Agricultural Research Corporation, Embrapa, and several public and private institutions. The people who idealized the network are the main disseminating agents of the project.

Among the activities conducted by large-scale human activities that threaten the *Butia* palm groves, there is pressure for converting the ecosystem areas into intensive crops and the growth of urban and road areas (Sosinski Júnior *et al.* 2019). Moreover, real estate speculation is also responsible for much of the reduction in the native populations of *Butia* in Brazil (Kumagai & Hanakazi 2013). As a result, besides traditions, historical and cultural knowledge associated with the *Butia* genus are being lost amid the capitalization of the environment.

Understanding socio-ecological systems is one of the main focuses of ethnobiological studies (Albuquerque *et al.* 2019). Therefore, the concern with the conservation and maintenance of biodiversity is of great importance due to the management of the dynamic balance of ecosystems, and the applicability of resources in socio-economic systems. (Watson *et al.*, 2018).

In the case of *Butia*, Rivas and Barilani (2004) and Rivas and Barbieri (2014) suggest the creation of plans for the development and promotion of products derived from *Butia* palm, arguing that the use of *Butia* palm by residents should be part of the conservation strategies of the biodiversity. One of these actions is the *Butia* Palm Groves Network project, which aims to integrate the different areas of knowledge and network people who work or have some connection with the species (Barbieri *et al.*, 2017).

In this sense, ethnobotany studies the interactions between people and plants, contributing to the revitalization of associated knowledge (Albuquerque *et al.* 2005 and 2019). The analysis of data in ethnobotany, using the method of individual interviews, provides an idea of how responses can be combined to create the social and cultural profile of the study population. Such methodology aims to perceive the symbolic value of using a particular plant and its cultural and environmental importance, determining a consensus factor among the informants when recognizing it as a possible identity marker (Silva *et al.* 2010).

Considering the exposed scenario, this work aimed to understand the ethnobotanical relations with the *Butia* palm groves, how this process has been built, and how it has contributed to the *in situ* conservation of genetic resources.

## Materials and methods

At the II International Meeting of the Rota dos Butiazais, held in Pelotas (Rio Grande do Sul, Brazil) in August 2018, 14 people of different genders, age groups, occupations, countries, and historical-cultural contexts were interviewed (Table 1). Each respondent answered eight semi-structured questions (Appendix 1).

Due to institutional regulations on work performed with human beings, the study was submitted to the Research Ethics Committee of the Federal University of Pelotas, obtaining a favorable opinion No. 2,565,059. The semi-structured questionnaire was applied to each agent in order to raise knowledge about the sociocultural

environment in which they are inserted. The social profiles revealed by the interviews directly involve the practices and uses associated with *Butia* palm groves and *Butia* fruits and leaves. During the interviews, the informants answered the questions and shared other personal narratives in the conversation.

Table 1. List of survey respondents, informing gender, occupation, and institution/location.

Interviewed	Gender	Occupation	Location
A. M.	man	environmentalist	Ubajay, Argentina
E.F.	woman	craftswoman	Ubajay, Argentina
M.P.	woman	businesswoman	Rocha, Uruguay
J.S.M.	woman	confectioner	Tapes, RS, Brazil
M.B.I.	woman	craftswoman	Santa Vitória do Palmar, Brazil
C.H.B.	woman	farmer	Tapes, RS, Brazil
A.A.M.S.	man	farmer	Pescaria Brava, Brasil
M.G.	man	artist	Caxias do Sul, Brazil
M.P.	woman	environmentalist	Ubajay, Argentina
M.E.P.	woman	farmer and businesswoman	Ubajay, Argentina
F.T.	woman	businesswoman	Tapes, RS, Brazil
M.C.V.	woman	environmentalist and tour guide	Guichón, Uruguay
G.M.	woman	student	Imbituba, Brazil
R.J.	man	politician	Giruá, Brazil

The study was centered on an approach that integrated qualitative and quantitative instruments to gather social data from the interviewees about activities associated with the use of *Butia* palm groves, their potentialities, and possible limitations of the plant, among other topics. In this sense, the study aims to understand the ethnobotanical relations with the *Butia* palm groves. The intentional sampling technique was used (Bailey 1982, Bernard 1994) to identify the interviewees.

### Data analysis

The qualitative data of the interviews were studied from content analysis (Minayo, 1993; Franco, 2005), based mainly on the interviews conducted and relating them to the theoretical framework researched.

For quantitative data, indices were used to determine the nature of the informant's consensus and the nature of the distribution of knowledge. The calculated indices were: Informant Diversity Value (IDV), Use Diversity Value (UDV), Contact Diversity Value (CDV), Associated Activities Diversity Value (AADV), and Conservation Proposals Diversity Value (CPDV) (Byg & Baslev 2001, Minayo 2010).

The IDV consists primarily of the sum of individual quotes from an interviewee. The total of this sum is divided by the total number of uses, contact, associated activities and conservation proposals, respectively. And to obtain the final IDV values, shown in the tables, the resulting individual indices are added and divided by the total uses in the specification of each category (gender: male or female; Country: Argentina, Brazil and Uruguay; connection: owner or extractive).

The UDV, Contact, AA and CP were calculated considering the total citations of a specific use, or contact, or associated activity or conservation proposal, divided by the total number of citations of uses, contact, associated activities or conservation proposals, respectively in each topic.

The informants were categorized according to gender (woman, man), country where they live (Argentina, Brazil, Uruguay), and their connection with the *Butia* palm groves (extractivist or owner). Then, the results were subjected to statistical analysis using the Kruskal Wallis test (above two categories) and Mann-Whitney (up to two categories) with the aid of the Minitab 19 statistical program.

## Results and Discussion

### The prospect of using the *Butia* genus

The diversity of plants known and used by humans results from ancient interactions between populations and plants. Primarily, plants supplied food, medicinal and ritualistic purposes and recently, industrial needs (Albuquerque 2002). In this way, ethnobotany is a tool found halfway between nature and culture and can explain

how the relationship between plants and humans work. Through the interviews, we observed the importance of *Butia* palm groves for the people who earn their livelihood with them, making clear the concern of all interviewees with the conservation of this environment.

The interactions between nature and culture are fluid and inseparable paths (Ingold 2000, Latour 2014). Such interpretation can be seen in the interviewees' speech, such as E.F., a craftswoman. When asked about her relation to the *Butia* palm groves, she says: "... for me, the palm trees choose the places, there is a whole pathway, a corridor, which takes Corrientes (in Argentina), Brazil, Paraguay..." "...I have lived for many years near the El Palmar National Park, with many palm trees, as the Indigenous called it sour fruits, and worked with products like vinegar, liquor, pulp ...". Keller & Paz-Deble (2020), in an ethnobotanical study with palm trees in Misiones, Argentina, highlight that *Butia* is currently used for ornamentation of gardens. Part of the *Butia* palms leaves was once used to make sandals, which are also widely used by the Guarani people to make mats and mattresses and fresh consumption and used to make a wide variety of drinks.

When asked about the possible age of the *Butia* palm groves in his region, A.A.M.S. exposes the economic importance of *Butia* palms over time, as well as the old ways of using this plant: "... I think they are *restinga* areas, hundreds of years old ... Because you don't see the *Butia* palm groves in other areas, they are particular to some points, and we have known them for many years. In the 40s and 50s (of the 20th century), *Butia* palms were used, the fibers of the leaves became mattress fillers, in São Paulo and Rio (de Janeiro), and some of it (fruits) was consumed as alcoholic beverages, used in the production of cachaça flavored with **butiá**".

The habit of using **butiá** fruits for the flavoring of cachaça was reported by Marcato (2004) in Paraná. Such activity was frequent among many of the residents of the locations visited by the researcher. Thus, choices made by extractivists combined forms and methods in the sense of how such communities dealt with *Butia* palms. On the other hand, Dabezies & Rivas (2020) found several reports when presenting the uses of *Butia odorata* in southeastern Uruguay. The most cited were liqueur production with the fruit, coconut coffee made from seeds, the filling of cushions with leaf fibers, and jelly made from the fruit.

During the interviews, sixteen uses were associated and highlighted by the interviewees to one of the products of the *Butia* palm groves: the fruits. The uses mentioned include production of jellies, juices, cakes, bread, cucas, liquor, salty snacks, vinegar, flavoring of cachaça, cookies, therapeutic, use of coquinho, fresh fruit selling, crafts, art (with leaves and fruits) and consumption of fresh fruit (Table 2). However, among the uses explained by the interviews, the one that stood out was the consumption of fresh fruit, appreciated by all respondents (UDV = 0.23). Statistical differences in the uses given to the *Butia* palm's fruits, leaves, among others, were observed with respect to connection (Owner or extractivist), when observed the IDV ( $p=0.02$ ). This difference is associated with the fact that extractivists' income depends on their contact/marketing of the products obtained from the leaves, fruits, and pulp of the *Butia* palm. However, we had access to only two owners, and such results could be different if there was a larger sample number of respondents of this nature.

When questioned about its relationship with the Tapes *Butia* palm groves, the informant J.M.S. said: "... they (products from *Butia* palm) are present at my house on a daily basis, it has become a routine because of my work. At harvest time, and in other times of the year. But when I don't have that daily contact with the environment (*Butia* palm groves), I can use the frozen fruit... Currently, I am working on diversifying. I am working with a variety of **butiá** products. I make juice, liqueur, we have our line of snacks. We do work with **butiá** in the snacks too. There is a line of sweets, chocolates, bread, cakes, cookies. Today, I work with it in practically everything..."

As noted by the statement above, the knowledge of preparation of food related to **butiá** is constant as well as their form of consumption. Such knowledge can be perpetuated in a generational and community way, helping conserve what is necessary for food production (DaMatta, 1987). When analyzing the context of *Butia*, it can be seen that one of its primary uses is focused on cooking (Buttow et al., 2009). Anthropology considers the preparation and consumption of food as identity markers of communities, religions, ethnic groups, and even nations. It is not difficult to associate culinary types with populations (DaMatta 1987, Laplantine 2007, Mintz 2001, Oliveira 1996), such as, for example, Japanese sushi, gaucho barbecue, Mexican taco, Jewish Matzo or Amalá from Afro-Brazilian religions.

Table 2. Number of citations for the different uses of **butiá** (\* Production of jellies (PJ), juices (J), cakes (C), bread (B),ucas (C), liquor (L), salty snacks (SL), vinegar (V), cachaça (CA), cookies (CK), therapeutic (TP), use of coquinho (UC), fresh fruit selling (FFS), crafts (CR), art (A) and fresh fruit (FF), with a demonstration of the Informant's Diversity Values (IDV) and Use Diversity Values (UDV) for the different categories, gender of the interviewees, country of origin of the interviewees and working relationship with the *Butia* palm groves or *Butia* palm. Equal letters in the columns indicate no significant difference between the groups, according to the Kruskal Wallis (Country) and Man-Whitney (Gender and Connection) at a 5% error probability.

Category		Use citations																
		PJ*	J*	C*	B*	C*	L*	SL*	V*	CA*	CK*	TP*	UC*	FFS*	CR*	A*	FF*	IDV*
Gender	Man (n=4)	1	2	0	0	0	1	0	0	1	0	1	2	2	1	1	4	0.100A
	Woman (n=10)	4	4	2	2	2	6	1	1	2	1	1	3	3	1	1	10	0.171A
Country	Argentina (n=4)	1	1	0	0	0	2	0	1	0	0	0	0	0	0	0	4	0.112A
	Brazil (n=8)	4	3	2	2	2	3	1	0	3	1	2	4	4	2	2	8	0.175A
	Uruguay (n=2)	0	2	0	0	0	2	0	0	0	0	0	1	0	0	0	2	0.109A
Connection	Owner (n=2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0.100B
	extractivist (n=12)	5	6	2	2	2	7	1	0	3	1	1	5	4	2	2	12	0.229A
Total of citations		5	6	2	2	2	7	1	1	3	1	2	5	4	2	2	14	
UDV		0.08	0.10	0.03	0.03	0.03	0.11	0.01	0.01	0.05	0.01	0.03	0.08	0.06	0.03	0.03	0.23	

\* Production of jellies (PJ), juices (J), cakes (C), breads (B),ucas (C), liquor (L), salty snacks (SL), vinegar (V), cachaça (CA), cookies (CK), therapeutic (TP), use of coquinho (UC), fresh fruit selling (FFS), crafts (CR), art (A) and fresh fruit (FF)

Use Diversity Value (UDV)= number of citations for each use category divided by the total number of citations for all categories

\*\*Informant Diversity Value (IDV)= Summation of the number of citations of each interviewee divided by the total number of citations in the category (gender=man or woman; country= Argentina, Brazil, Uruguay; connection= owner or extractivist).

When asked about the importance of *Butia*, interviewee M.B.I. said: "For us, it is extremely important (the *Butia*), because our city is Santa Vitória do Palmar, so people have a reference to Santa Vitória, to have a large number of palm trees. *Butia* palm groves Network is rescuing the history of *Butia* palms because this is our city's history; there is a cultural rescue. Therefore, the handicrafts produced here (in Santa Vitória do Palmar) represent our city... I work with handicrafts derived from the *Butia* palm; I work with the leaf, the coconut, the fiber, and also with the fruit in the culinary part..." This statement is an example of an identity marker that connects this informant to a sense of belonging when talking about the *Butia* palms that represent her city.

This way, helping the proper management of the species, as can be seen in the speech of G.M.: "The creative economy activity that I am a part of is linked to *Butia* palm leaves. Also, to the **butiá** fruit and the area of the *Butia* palm groves. My activity is related to the articulation and preservation of the species, which is linked to the *Butia* palm groves ecosystem". Sosinski et al. (2019) argue that a strategy to promote the conservation of *Butia* palms is to encourage people to use the products made from *Butia*. The use of the plant generates social significance. It, consequently, moves a productive system associated with financial activities, which requires the maintenance of the resource so that continuous gain occurs following legal requirements, especially when it comes to a native plant threatened with extinction (Brazil Decree Law 25 of 1937 and Brazil, 6,938). However, this approach must respect limits that ensure sustainable exploitation. Sosinski et al. (2019) also highlight that to improve the commercialization chain of native species for conservation, the Rio Grande do Sul Environment Secretariat (SEMA) developed a simplified and tax-free process for environmental regularization for extractivism and cultivation of native plants and products for marketing (including *Butia*). Known as environmental certification of extractivism and agroforestry production (SEMA, 2017), it is a process that meets legal requirements. Also, it aims to improve the understanding of the exploitation chain of these endangered species, such as *Butia*.

This environmental certification allows for the regularization of extractive activities, such as roadside collectors and vendors, farmers who economically exploit these fruits, leaves, and seeds, including seedlings for restoration (Sosinski et al. 2019). In addition, it allows the establishment of a productive structure that contributes to the valorization of the *Butia* species, and at the same time allows the environmental agency to acquire accurate information about the species, populations, different uses, market demands, and conservation opportunities (Sosinski et al. 2019, 2020b).

### **The contact with *Butia* palm groves**

To assess the contact with *Butia* palm groves, results among the five periods obtained from the conversations were observed: daily, weekly, monthly, fruiting and sporadic, the most cited was the daily (n=5), with the highest rate of women (n=3), in Argentina (n=3) and Brazil (n=2), and most frequently by extractivists (n=4). Regarding the distribution of contact with *Butia* palm groves among the interviewees' categories, due to the wide variation in the means of the informants' diversity values (IDV), it was not possible to observe significant differences. This information can be best viewed in Table 3.

Through qualitative research, it was possible to observe an effort to perpetuate the economic and cultural relationship associated with the maintenance of the *Butia* palm groves. There is a continuous effort to maintain the *Butia* palm groves. The communities have a special connection that originates in childhood since affective bonds and associated memories with the plant and ecosystem happen at a young age. The emotional bond with *Butia* palm groves was established for nine interviewees while the interviewees were children. This relationship is an ally in combating environmental threats and promoting the well-being and equality of communities (Vygotsky, 2007). "... I was born here surrounded by the palms. And in my family, a traditional getaway was to get these coconuts..." points out M.C.V.

The results show that sporadic activities conducted in *Butia* palm groves are associated with obtaining income (citation n=2). Furthermore, the frequency of visiting the environment is associated with the seasonality of the fruits. However, the daily actions in the *Butia* palm groves focused on conservation (citation n=6). Therefore, it was found that the most frequent visits are associated with people who work in conservation units of the species, network management, or sustainable associations. As described in the speech by A.M., an employee of the El Palmar National Park: "...yes, I go daily...", "...the palm groves are a component of the ecosystem of this place, and therefore a strategy for biodiversity conservation...".

Table 3. Number of citations of the frequency of contact with *Butia* palm groves, with a statement of the Informant's Diversity Values (IDV) and Contact Frequency Diversity Values (CDV) for the different categories, gender of the interviewees, respondents' country of origin and working relationship with *Butia* palm groves. Equal letters in the columns indicate no significant difference between the groups, according to the Kruskal Wallis (Country) and Man-Whitney (Gender and Connection) test at a 5% error probability.

		Contact with the <i>Butia</i> palm groves					
Category		Daily	Weekly	Monthly	Fruiting	Sporadic	IDV*
Gender	Man (n=4)	2	1	0	2	0	0.333 A
	Woman (n=10)	3	2	1	2	2	0.444 A
Country	Argentina (n=4)	3	0	0	0	1	0.444 A
	Brazil (n=8)	2	2	1	3	1	0.360 A
	Uruguay (n=2)	0	1	0	1	0	0.200 A
Connection	Owner (n=2)	1	1	0	0	0	0.200 A
	extractivist (n=12)	4	2	1	4	2	0.520 A
Total of citations		5	3	1	4	2	
CDV		0.33	0.20	0.07	0.26	0.13	

\*\*Informant Diversity Value (IDV)= Summation of the number of citations of each interviewee divided by the total number of citations in the category (gender=man or woman; country= Argentina, Brazil, Uruguay; connection= owner or extractivist). CDV= Number of citations for each contact category divided by the total number of citations for all categories.

In this context, the extractivists of the **butiá**, those who use the raw material for the elaboration of their activities, do not assume a predatory stance in relation to the environment of their livelihood, since, after the harvesting of a certain amount of material, it is not necessary to return to the collection site. J.M.S., when asked about the frequency of visits to the *Butia* palm groves, says: "... No, I don't go too much, I have (**butiá** fruits) in my work..." "... I have more contact with the fruits at harvest time...". Conscious extractivism focuses on a sustainable lifestyle, respecting nature's time and space, fighting against the conception of domain (Díaz *et al.* 2019, Latour 2014).

#### Associated Activities with *Butia* palm groves

The interviewees described nine activities associated with the *Butia* palm groves. They are cattle breeding, agriculture, tourism, river stone extraction, eucalyptus plantation, extractivism organization, archaeological excavations, ecological associations with other plant or animal species, and the establishment of a cooperative company.

The activity most mentioned in the conversations was tourism, with a higher rate for women (n=4), extractivists (non-owners) (n=4), residing in Argentina(n=3). Another activity that occurred the most was cattle raising in the *Butia* palm groves. However, due to the large variation in the means, no significant differences were observed for the IDV. The problems involving such activity concerning the environment were mentioned in all reports (Table 4).

The activities associated with the *Butia* palm groves were diverse. In the participants' speeches, it was possible to observe the impact of other economic activities on the *Butia* palm groves, for example in M.C.Vs' dialogue, "... at this moment the problem we have is flowering and monoculture, each day we have less space for *Butia* palm groves. Studies are showing that Uruguay has less and less place for this landscape. What we have to do is look for how to protect the *Butia* palm groves (of *Butia yatay*) in some way. One of the main problems is the forestation with eucalyptus..." This narrative corroborates with Carrasco (2012), where he observes that monoculture has become the predominant system in the world. Between 1988 and 2002, smaller farms with up to 200 ha discontinued their activities, giving space to extensive crops, which implied an excessive use of pesticides. Thus, the ecological threat of monoculture is evident. There is also a great loss of biodiversity, both in terms of landscapes and species. Such disturbances, in some cases, are reversible, depending on their magnitude.

Other problems indicated by the informants' narratives involved activities associated with cattle raising in areas where the *Butia* palm groves occur. F.T., another interlocutor, presented to be positive in relation to livestock that

interacts with the *Butia* palm groves, in the same way, the interviewed states that this must be done strategically "...Without cattle ranching, the *Butia* palm groves cannot be maintained, everything must be done intelligently, and this process should help to conserve the environment...". Still, she demonstrates how this could be done: by "having rotations at different times of the year, which will make the pasture better, have a certain number of animals to leave too, dividing them into paddocks." The interviewee M.P.I. pointed out that the existence of the *Butia* palm groves is also important for the livestock, as they benefit from the space "...When I pass by the *Butia* palm grove, in midsummer, the shade of the *Butia* palms protects the livestock from the sun rays. Also, the livestock feed on the fruits...". The interviewee M.E.P. is also optimistic about the presence of livestock in the *Butia* palm groves "...we have healthy and very fat cattle...". One of the interviewees pointed out that in her place of work, *Butia* palm groves, there is management in relation to livestock in the winter period, to enable the development of new plants, M.P. said: "...there is an area called conservative management, where they take the livestock in winter, precisely so that the *Butia* palms can emerge and not be damaged...".

Table 4. Number of citations of associated activities close to or in the same space where the *Butia* palm groves are (\*livestock (LS), agriculture (Agro), tourism and trail(T), river stone extraction (RSE), planting eucalyptus (PE), extractive organization (EO), archaeological excavations (Arch), scientific research (SR), the establishment of a cooperative company (ECOO), Landscaping (Land) with a demonstration of the Informants Diversity Value (IDV) and Associated Activity Diversity Values (AADV) for the different categories, gender of respondents, country of origin of respondents and working relationship with *Butia* palm groves. Equal letters in the columns indicate no significant difference between groups, according to the Kruskal Wallis (Country) and Man-Whitney (Gender and Connection) test at a 5% error probability.

		Associated activity										
Category		LS*	Agro*	T*	RSE*	PE*	EO*	Arch*	SR*	ECOO*	Land*	IDV*
<b>Gender</b>	Men (n=4)	0	1	1	1	1	2	0	0	0	1	0.116 A
	Women (n=10)	4	2	4	0	1	0	1	2	1	2	0.212 A
<b>Country</b>	Argentina (n=4)	2	1	3	1	1	0	0	0	0	1	0.133 A
	Brazil (n=8)	1	2	1	0	0	2	0	2	1	2	0.171 A
	Uruguay (n=2)	1	0	1	0	1	0	1	0	0	0	0.100 A
<b>Connectio n</b>	Owner (n=2)	1	0	1	0	0	0	0	1	0	1	0.111 A
	extractivist (n=12)	3	3	4	1	2	2	1	1	1	2	0.211 A
<b>Total of citations</b>		4	3	5	1	2	2	1	2	1	3	
<b>AADV</b>		0.16	0.12	0.20	0.04	0.08	0.08	0.04	0.08	0.04	0.12	

\*livestock (LS), agriculture (Agro), tourism and trail(T), river stone extraction (RSE), planting eucalyptus (PE), extractive organization (EO), archaeological excavations (Arch), scientific research (SR), the establishment of a cooperative company (ECOO), Landscaping (Land).

\*\*Informant Diversity Value (IDV)= Summation of the number of citations of each interviewee divided by the total number of citations in the category (gender=man or woman; country= Argentina, Brazil, Uruguay; connection= owner or extractivist). AADV= Number of citations for each associated activity category divided by the total number of citations for all categories.

Activities related to livestock affects the management of *Butia* since one of the great difficulties in the establishment of new plants of the species is in the long period that the seed takes to germinate, which can reach more than 24 months, in addition to the long period until the fruiting (Carpenter 1988, Broschat 1998). During the emission of the first pinnate leaves, *Butia* is also more exposed to weather and herbivore attacks, especially in periods of scarcity of more palatable forages (Báez & Jaurena, 2000). In contrast, the presence of cattle is essential in the management of ecosystems in the *Butia* palm groves (Rivas *et al.*, 2017; Sosinski *et al.*, 2020b). Grazing helps to avoid competition for light with other species of plants with faster development and facilitates the regeneration of new *Butia* palms. Research has recommended techniques such as the conservative management of livestock in native fields, where the presence of cattle is restricted during some days of autumn and winter. These are periods of greater scarcity of pasture and greater possibility of damage to *Butia* seedlings (Sosinski Junior *et al.* 2015, 2019, 2020b; Hagemann 2016, Rivas & Barbieri 2014).

In this sense, conservative management is vital for conserving the *Butia* palm groves ecosystem and maintaining the local economy through consortium activities, such as tourism.

Knowing how to conserve also applies to the perspective of tourism. In this context, ecotourism is seen as "a segment of tourist activity that uses, in a sustainable way, natural and cultural heritage, encourages its conservation and seeks the formation of an environmental awareness through the interpretation of the environment, promoting the well-being of the populations" (Brasil 2010, 17). If well planned and to provide tourists with an interpretive educational experience, ecotourism can be an important tool for developing and conserving endangered species. Such activity is cited by the interviewees, who evidenced its use for the conservation of *Butia*. For instance. M.E.P.: "... yes, when they are aware of it, but often the population does not know the importance of these places (*Butia* palm groves), because it can generate jobs for the community. We generate 20 jobs. There is a National Park that needs people to work. Thus, 50% of the families in this community alone have a direct or indirect link with the *Butia* palm groves; there is a need for many people around these palm trees that receive tourists..." "...The environmental benefit of the palm that houses animals, the fauna, there is a nearby forest, wild animals. We have more than 120 birds, other animals, plant species, all of which are protected, which is a benefit. Because the palm is protected, it also protects animals. The *Butia* palm groves are important for nature, for wild animals, to maintain ecosystems and forest ecosystems, also field ecosystems..."

Therefore, the concern with the rational use of space is perceived in the discourse, seeking a balance between the ecological, economic, and sociocultural aspects of the area where the *Butia* palm groves are found. The concern with the generation of minimal negative impact on the natural and sociocultural environment can also be observed, from a long-term perspective (Albuquerque *et al.* 2015), mainly with the involvement of the local community in the process of planning and developing activities such as ecotourism.

#### **Proposals for the conservation of *Butia* palm groves**

Several ideas were indicated as tools to increase the value and interest that people attribute to the *Butia* palm groves, as well as actions that contribute to the conservation of *Butia*. With the analysis of the interviews and according to the Conservation Proposals Diversity Value index, the most cited strategy was the development of environmental awareness (n=11). This was the most cited strategy individually, according to the IDV, by the categories of women (0.300), Brazilians (0.285) and extractivists (0.320), and no significant difference was observed. The participants also cited public policies and academic/scientific partnerships as measures to encourage environmental awareness and, consequently, the conservation of the *Butia* palm groves (Table 5).

In general, the respondents showed concern with the conservation of the *Butia* palm groves. However, in their speeches, the lack of knowledge of effectively conserving the *Butia* palm groves was evident. Proposals for the conservation of genetic resources are essential, especially when it comes to native and threatened plants (Oliveira & Bursztyn 2001), such as the case of *Butia*. The participants in this study, without exception, agree that the development of environmental awareness is crucial for the conservation of species. Thus, the respondents demonstrated the will to improve the educational practices and the generation of knowledge associated with *Butia* palm groves.

All the actions mentioned by the participants involved proposals for public or private partnerships, tourist activities, environmental education, ecomuseums, and the creation of buffer zones, as previously mentioned. However, the proposals most mentioned and highlighted were related to academic/scientific partnerships (n=5) and the creation of public policies (n=4), as can be seen in M.P.I.'s narrative, an Argentine businesswoman: "... lately, they have been giving a lot of importance. We, who belong to the place, need support from the government so that we can continue with everything that we may have from activities, tours, tourism, making good crafts, everything we can work with the fruits of *Butia* palm..."

*Butia* palm groves comprise a valuable diversity of associated native flora and fauna, where trophic chains and energy flows characteristic of communities occur (Barbieri *et al.* 2015, Sosinski Junior *et al.* 2020a). They are the source of various ecosystem services, information/culture, forage and livestock production, habitat maintenance, biodiversity conservation, as well as mitigation of greenhouse gases and regulation of the water cycle (Sosinski Junior *et al.* 2015, 2019 and 2020a).

Table 5: Number of citations of conservation proposals for *Butia* palm groves (\*public policies (PP), environmental awareness (EA), private partnerships (PRIPART), academic/scientific partnerships (ASPART), public partnerships (PUPART), tourist activities (TACT), environmental education (EED), buffer zones (BZ), ecomuseum (Ecomus), Informant diversity value (IDV)), with the statement of Informant Diversity Values (IDV) and Conservation Proposals Diversity Values (CPDV) for the different categories, gender of respondents, country of origin of respondents and employment relationship with *Butia* palm groves. Equal letters in the columns indicate no significant difference between the groups, according to the Kruskal Wallis test and Man-Whitney at a 5% error probability.

Category		Conservation Proposals									
		PP*	EA*	PRIPART*	ASPART*	PUPART*	TACT*	EED*	BZ*	Ecomus*	IDV*
<b>Gender</b>	Men (n=4)	1	2	2	1	2	0	0	0	0	0.177A
	Women (n=10)	3	9	1	4	0	1	2	1	1	0.300 A
<b>Country</b>	Argentina (n=4)	0	3	1	2	0	0	2	1	0	0.177 A
	Brazil (n=8)	3	7	2	2	2	0	1	0	1	0.285 A
	Uruguay (n=2)	1	1	0	1	0	1	0	0	0	0.111 A
<b>Connection</b>	Owner (n=2)	0	2	0	2	0	0	0	0	0	0.222 A
	extractivist (n=12)	4	9	3	3	2	1	2	1	1	0.320 A
<b>Total of citations</b>		4	11	3	5	2	1	2	1	1	
<b>CPDV</b>		0.1	0.3					0.0			
		3	6	0.10	0.16	0.06	0.03	0.06	3	0.03	

\*public policies (PP), environmental awareness (EA), private partnerships (PRIPART), academic/scientific partnerships (ASPART), public partnerships (PUPART), tourist activities (TACT), environmental education (EED), buffer zones (BZ), ecomuseum (Ecomus).

\*\*Informant Diversity Value (IDV)= Summation of the number of citations of each interviewee divided by the total number of citations in the category (gender=man or woman; country= Argentina, Brazil, Uruguay; connection = owner or extractivist).

CPDV= Number of citations for each conservation proposals category divided by the total number of citations for all categories.

*In situ* conservation provides the maintenance and recovery of species populations in their original environments. The strategies carried out in residences, production units, or *Butia* palm groves ecosystems, have contributed to the conservation of diversity at all levels, in addition to enabling the producer / extractivist the accession and use of genetic resources to improve their livelihood.

In Tapes and Barra do Ribeiro, Rio Grande do Sul state, where the largest remnants of *Butia* palm groves in Brazil are found, the genetic resources are conserved *in situ*, that is, in the farms (Costa et al., 2017; Mistura, 2013). Furthermore, the *Butia* Palm groves were defined as Legal Reserves areas on each farm. In general, Brazilian environmental legislation provides legal protection for native flora in three ways: protection for those species in official extinction lists at federal and state levels (Brasil, 2014; Rio Grande do Sul, 2014); preventing the plant from being cut, which is allowed only in exceptional cases; and restrictions on the suppression or exploitation of vegetation according to its ecological complexity (Sosinski et al. 2019).

In Uruguay, most *Butia* palm groves of *Butia odorata* are also located in private properties where agricultural activities are practiced (primarily rice cultivation and livestock) (Rivas, 2013). The *Butia* palm groves (of *Butia odorata*) are part of the "Bañados del Este" Biosphere Reserve (UNESCO, 1976). By National Law 9872 (1939), (Law nº 9.872, 1939, altered by Law nº 15.939 1987), the damage and the cutting of palm groves was prohibited (Rivas 2005; Dabezies & Rivas 2020). Some strategies for encouraging *in situ* conservation seek the valorization of **butiá** fruits and the *Butia* palm groves as a part of Uruguay's identity. Furthermore, when properly conducted, cattle management contributes to the conservation of *butia* palm groves. In Uruguay, there are also initiatives by organizations and institutions that work together to protect *Butia* palm groves (Betancurt and Crosa, 2014).

Since 2009 the *Butia* palm groves have been considered native vegetation by the Argentine legislation through Decree No.91/2009. And in 2017, the Law n° 26.331 for the protection of native vegetation was approved. It is also important to highlight that, since 1966, Argentina has maintained the El Palmar National Park, created to protect *Butia yatay* (Entre Ríos province) (Batista *et al.* 2014; Policelli *et al.*, 2018). There is also regional legislation to protect natural environments (El Palmar, 2015). Also, it is worth noting that Argentina has four other areas with *Butia* palm groves protected in addition to the Parque Nacional El Palmar. In the Refugio de Vida Silvestre La Aurora del Palmar, in the Sitio Ramsar Palmar *Yatay* and in the Parque Nacional Mburucuyá, we find *Butia yatay*, while in National Park Iberá we find *Butia paraguayensis*, *B. yatay* and *B. poñi* (Maranta 2020). Maranta (2020) also emphasizes that Argentina is concerned about conserving its biodiversity through areas of protection and conservation, mainly through the creation of protected areas, which has many advantages but also limitations. Yet, he highlights that the use of native plants is relatively little promoted in Argentina, unlike in Brazil and Uruguay, where conservation is more associated with intended use than with their preservation.

The recognition of legal reserves for the *Butia* palms groves is essential for their conservation. Nevertheless, it can not be the only strategy to promote the conservation of the *Butia* palm groves. Considering the Brazilian example, even if there are legal reserves in the country, the *Butia* palm groves are not adequately recognized in the official vegetation classification systems (Brazilian Institute of Geography and Statistics (IBGE), 2012; Veloso *et al.* 1991, Sosinski *et al.* 2019); however, there is an exception when palm groves are associated with other types of vegetation such as Pampa (Brazilian Institute of Geography and Statistics (IBGE), 2012; Oliveira-Filho, 2009). There is a lack of ecological recognition and legal protection of palm groves as natural and ecologically integral ecosystems in Brazil (Sosinski *et al.*, 2019). Thus, other strategies that aimed at the conservation of *Butia* palm groves are adopted by those who are concerned about this ecosystem.

The perception of the *Butia* palm groves contexts shown by the interviewees presents some concern about the conservation of the native plants, as can be seen in the speech of M.G. when asked about the importance of the *Butia* palm grove "... The system we use is agroforestry, syntropic agriculture. The palm tree is a source of connection in the ecosystem. It fulfills its function as a fruit rich in vitamin C. For the local fauna, it brings great diversity to the place... It brings many animals there, and they come back... The whole ecosystem then has more importance ... " and also states that " ... currently people are more aware of preserving nature ... ".

A.A.M.S.'s statement points out the environmental interactions with *Butia* palms space and income generation. When asked about the possibility of extractivism and preservation, A.A.M.S. said: "... Every time I drink juice or have some jelly, I drink liquor (from **butiá**), I am helping, I am exercising to improve the generation of income for those on the field, who are extractivists...". A.A.M.S. also adds: "... through the ECOVIDA network, and participating in Agroecology, and the Slow Food movement, we managed to preserve, conserve, and show the importance of **butiá** for everyone. The issue of fauna, flora, the issue of income generation and the options for sustainably making money...".

The sustainable management of native fruit species is a tool for preserving existing agrobiodiversity in the places where these plants coexist. For the management of ecosystems of *Butia* palm groves in places where there are agricultural activities, the exclusion of grazing during the winter and the continuous grazing of cattle during the rest of the year is a sustainable alternative, which helps in the conservation of the native field. *Butia* seedlings that develop under proper management escape the action of trampling and grazing animals, and already established plants have more significant potential for sprouting (Sosinski *et al.*, 2015). Sustainable extractivism, associated with management, can be planned through a harvesting circuit covering many collection sites and providing for rotation between them. Thus, avoiding excessive harvesting in a single area, some fruits must remain on each palm due to the regeneration of the environment. In addition, it favors the production of seedlings and the feeding of wild animals (Rivas and Barbieri, 2014, Sosinski *et al.*, 2015, 2020b).

The generation of income from the sustainable management of natural resources has contributed to the conservation scenario (Negi *et al.*, 2017). Movements such as Slow Food, which aims to provide food produced consciously, respecting both the environment and the people responsible for the production (Petrini 2009), motivate critical thinking about non-agroforestry systems. Slow Food operates both locally and globally, with international institutions such as FAO - Food and Agriculture Organization of the United Nations. Moreover, it establishes bonds of friendship with governments worldwide (Petrini 2009).

Two statements point to the importance of the existence of the *Butia* Palm Groves Network for this sustainable relationship. First, according to R. J., when asked about the role of the *Butia* Palm Groves Network, "... since the beginning, *Butia* Palm Groves Network has been important. These partnerships that the event has today, with Technical Assistance and Rural Extension Company (Emater) and Embrapa, entities that are also concerned, seeking alternatives with the community. This integration of other regions, for example, strengthens the journey to continue and expand, with knowledge, the exchange of experience, in short... Even though it is an old plant, its use continues, and this shared knowledge guarantees a little plant conservation. People working with **butiá**, having economic goals too, will be more concerned with spreading, expanding, replanting, and conserving the *Butia* palm groves that already exist..." The *Butia* Palm Groves Network has been an ally, providing integrative experiences, which, as an alternative to the traditional economic system, collaborate directly or indirectly to conserve *Butia* palm groves (Rivas *et al.* 2020). This can be observed through C.H.B.'s speech: "...You observe that this consortium with the *Butia* Palm Groves Network has been beneficial, to a certain extent, because as there was no regeneration, we sought out Embrapa. Since then, research has been done, but the property is always managed considering the *Butia* palm groves".

Albuquerque and Andrade corroborate the speeches about the *Butia* Palm Groves Network's interaction networks (2002). The authors reinforce the idea that knowledge accumulated by local populations and integration of different communities in favor of a common goal constitute a powerful tool. Developmentalists and conservationists can use this tool to manage and maintain these areas.

## Conclusions

This study sought to compile the view of different participants in the *Butia* Palm Groves Network event that took place in 2018. People from different social spheres, sites, states, and countries share their interest in conserving the *Butia* species and the *Butia* palm groves. However, although the interviews attest to its importance, almost none of the interlocutors knew how to effectively implement a practical way to conserve the *Butia* palm groves beyond conscious extractivism. In order to efficiently conserve such environments, a Statal contribution is necessary through specific legislation, recognition, effective surveillance, and scientific research involving the *Butia* palm groves. Unfortunately, the goodwill of the people who work with the *Butia* palm groves is not enough to defend its ecosystems. Nonetheless, initiatives such as the *Butia* Palm Groves Network, the Solidarity Chain of Native Fruits, the Slow Food, among other organizations, promote the production and sale of products from the sustainable use of the ecosystem, which adds value to the conservation interest of these places. Moreover, the understanding of livestock management methods and other associated activities such as tourism also contributes to *Butia* palm groves' conservation.

The *Butia* palm groves cross countries' borders and harbors a unique sociocultural and biological importance. Given the historical and cultural importance of **butiá** and *Butia* palm groves and their valuation as a heritage, both natural and social, their conservation is necessarily related to good practices of extraction and sustainable management.

## Declarations

**List of abbreviations:** Informant Diversity Value (IDV), Use Diversity Value (UDV), Contact Diversity Value (CDV), Activities Diversity Value (AADV), Proposals for conservation Diversity Value (PCDV) Production of jellies (PJ), Juices (J), Cakes (C), Breads (B), Cucas (C), Liquor (L), Salty snacks (SS), Vinegar (V), Cachaça (CA), Cookies (CK), , therapeutic (TP), use of coquinho (UC), fresh fruit selling (FFS), crafts (CR), Art (A), Fresh Fruit (FF), Livestock (LS), Agriculture (Agro), Tourism (T), River Stone Extraction (RSE), planting eucalyptus (PE), extractive organization (EO), archaeological excavations (Arch), scientific research (SR), the establishment of a cooperative company (ECO), Landscaping (Land), public policies (PP), environmental awareness (EA), private partnerships (PRIPART), academic/scientific partnerships (ASPART), public partnerships (PUPART), tourist activities (TACT), environmental education (EED), buffer zones (BZ), ecomuseum (Ecomus).

**Ethical approval and consent to participate:** The study was submitted to the Federal University of Pelotas Research Ethics Committee, obtaining a favorable opinion No. 2,565,059.

**Consent to publication:** Not applicable in this section

**Availability of data and materials:** Not applicable in this section

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**Authors' contributions:** TS followed the interviews, carried out the statistical analysis of the data, and wrote the work. PSG contacted respondents and conducted the interviews. MKP performed the transcription of the audios of

the interviews. JMGD contributed by indicating anthropological references. JGC proofreading. JGW proofreading and statistical support. RLB supervised and guided the development of the work.

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## Appendix 1

Questions		Answers	Observations
1.	How long has <i>Butia</i> palm grove existed? How did it come about?		
2.	How long have you known <i>Butia</i> palm groves?		
3.	Do you use <i>Butia</i> palm groves? How often?		
4.	Does <i>Butia</i> palm groves influence your direct daily activities?		
5.	Do you consider <i>Butia</i> palm groves important for the local community and for nature? Because?		
6.	What are the main activities in the <i>Butia</i> palm groves area?		
7.	Do <i>Butia</i> palm groves favor these activities? Because?		
8.	What would be important for activities with <i>Butia</i> palm groves to be maintained? Because?		