

## ***Non-timber Forest Products of *Mauritia flexuosa* L. f.: Loss or Permanence in Quilombola Communities of Southern Amazon?***

While Non-timber forest products are relevant to conservation and development, there are diverse drivers that have a complex impact on their use and traditional ecological knowledge (TEK). The erosion of TEK and its causes were evaluated on buriti (*Mauritia flexuosa* L. f.) in Quilombola communities in Brazil, by using ethnographic and ethnobotanical methods, including snow ball, 23 interviews, and participant observation. Informants reported 15 different uses of buriti divided into five categories (food, animal feed, handicrafts, construction, and ornamental); however, only five uses were actively performed until the end of this study. Differences between knowledge and uses of buriti could be attributed to proximity to urban centers, public policies for livestock production, and decreasing interest in handcraft manufacturing by using local resources. Therefore, it is important to ensure that knowledge and traditional practices in rural communities are combined for the socioeconomic benefits of rural/urban connection. Additionally, public policies need to focus on the local potential associated with biodiversity – including buriti – and with the TEK associated, instead of encouraging exotic cultures that significantly decrease biological and cultural diversity.

**Palavras-chave:** Ethnobotany; Knowledge Erosion; Public policies; TEK; NTFP.

## ***Produtos Florestais Não Madeireiros de *Mauritia flexuosa* L. f.: Perda ou Permanência em Comunidades Quilombolas do Sul da Amazônia?***

Os produtos florestais não madeireiros são relevantes para o desenvolvimento e o desenvolvimento de recursos ecológicos tradicionais (CET). A erosão do CET e suas causas foram avaliadas para o Buriti (*Mauritia flexuosa* L. f.) Nas comunidades quilombolas no Brasil, através da utilização de métodos etnográficos e etnobotânicos, incluindo a bola de neve, 23 entrevistas e observação participante. Os informantes relataram 15 usos diferentes de buriti divididos em cinco categorias (alimentos, ração animal, artesanato, construção e ornamentais); No entanto, as cinco utilizações foram promovidas ao final deste estudo. As diferenças entre o conhecimento e o uso do buriti podem ser atribuídas à proximidade dos centros urbanos, as políticas públicas de produção pecuária e a redução do interesse na fabricação artesanal através da utilização de recursos locais. As proteções são importantes para os benefícios sociobiólicos da conexão rural / urbana. Além disso, como as campanhas públicas devem estar se associando ao TEK e à presença de Buriti nas comunidades da Amazônia, em vez de promover culturas exóticas que reduzem a diversidade biológica e cultural.

**Keywords:** Etnobotânica; Erosão do Conhecimento; Políticas Públicas; CET; PFNM.

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## INTRODUCTION

While Non-timber forest products (NTFP) has been suggested as an important alternative to conciliate conservations and development, at the same time currently there are a notorious disuse of them, erosion of their traditional ecological knowledge (TEK), and abandonment. This is an important fact has not been analyzed in the literature, in spite of their notorious potential consequences on livelihood, local development, and nature conservation. In this context, local studies provide relevant information to a better understanding of this phenomenon. The current paper analyzes the changes in use, loss of TEK and their relationship with diverse drivers related to external factors. We focus on the palm *Mauritia flexuosa*, one of the most important NTFP in the amazon, in terms of number of uses (Martins *et al.* 2012), geographical range (Stiegel *et al.* 2013), current and past users (Santos & Coelho-Ferreira 2012, Barros & Da Silva 2013, Gilmore *et al.* 2013, Arruda *et al.* 2014). Additional studies to local and regional scales can help to understand the phenomena coined by Pulido & Coronel-Ortega (2015) as “use and disuse of non-timber forest products”.

Traditional ecological knowledge is important for maintaining sustainable development and biodiversity (Reyes-García *et al.* 2013, 2014). Studies on TEK have been conducted for several years, but changes in knowledge have not received special attention. These studies have reported information on practices and beliefs accumulated and transmitted through generations and aimed to identify the relationships of humans with the environment (Berkes *et al.* 2000). Knowledge can change, whereas the rate of change depends on the location and interests of human communities (Berks 1999, Benz *et al.* 2000, Reyes-García *et al.* 2013). The loss of TEK mostly affects species that are historically associated with human survival and is mainly caused by changes in land use and management, community integration with the local market, public policies, technology advancement, and climate change (Benz *et al.* 2000, Reyes-García *et al.* 2005, Gray *et al.* 2008, Gómez-Baggethun *et al.* 2010, Reyes-García *et al.* 2014, Litre *et al.* 2014). However, it is not sufficiently documented whether these changes can affect human welfare or cultural characteristics (World Bank 2013, Shackleton & Pandey 2014). Therefore, it is essential to better understand knowledge erosion and the underlying causing factors.

The family Arecaceae includes Amazon-wide hyperdominant palm tree species that support several human communities, providing important ecosystem services (Manzi & Coomes 2009, Santos & Coelho-Ferreira 2011, Steegel *et al.* 2013, Gilmore *et al.* 2013, Arruda *et al.* 2014). A total of 2,700 palm tree species in 240 genera were cataloged worldwide, of which 282 species in 38 different genera are found in Brazil, 122 are considered endemic (Lorenzi *et al.* 2010, Leitman *et al.* 2015). The main palm tree species used by human populations in Brazil are *Euterpe oleraceai*, *Orbignya olerata*, *Astrocaryum aculeatum*, and *Mauritia flexuosa* (Gonzalez-Perez *et al.* 2012, Milanese *et al.* 2013, Barros & Da Silva 2013). However, Arecaceae is affected by deforestation and indiscriminate use in Brazil (Coradin & Lleras 1988, Byg & Balsley 2006, Arruda *et al.* 2014).

Among the 40 different palm tree species found in Mato Grosso, buriti (also known as ‘miriti’ in Brazil, ‘aguaje’ in Peru, ‘canangucha’ and ‘morige’ in Colombia, ‘moretes’ in Ecuador, and ‘palma real’ in Bolivia) is a long-life, arboreal, and dioecious species found in tropical wetlands and swamps in South America. In Brazil,

it appears either isolated or in groups in the savanna, the Amazonian Forest, and to a lesser extent, the Pantanal wetland. Buriti provides several raw materials such as palm hearts and fruits for feeding, rafters for construction, leaves for coverage and forage, fibers for handicrafts, and oil for biotechnology products and cosmetics (Vasthartz & Gentry 1989, Carrera 2000, Delgado *et al.* 2007, Santos & Coelho-Ferreira 2012, Gilmore *et al.* 2013, Arruda 2013, Koolen *et al.* 2013). Buriti is used by several Brazilian and Pan-Amazonian communities, including the Quilombolas and Ribeirinhos (Delgado *et al.* 2007, Manzi & Coomes 2009, Horn *et al.* 2012, Gilmore *et al.* 2013, Barros & Da Silva 2013). Studies on the use and management of palm trees by indigenous people and traditional communities may provide answers about its conservation and permanence in the ecological-cultural system.

The Quilombolas are descendants of African slaves who were shipped to Brazil by the Portuguese in the mid-17<sup>th</sup> century and who have retained a traditional lifestyle. Currently, there are approximately 2,600 quilombos in Brazil, and their culture is significantly affected by changes in the environment and society, leading to the loss of some original characteristics (Salles 1971, Volpato 1996, Thorkildsen 2014, Arruda *et al.* 2014, Fernandes 2015, Fundação Palmares 2016).

In this study, we focused on the Quilombolas in Vila Bela da Santíssima Trindade, Mato Grosso, a zone of ecological tension between the two largest Brazilian biomes, the Amazonian Forest and Cerrado in order to investigate the interactions with buriti uses based on ethnobotanical approach (Radambrasil 1982). Focused on buriti, our objective was study the TEK and their change along the time and their relationship with social, ecological and cultural drivers. Our hypothesis is that the Quilombola people have a deep TEK about this palm because they have had five centuries to generate, transmit and learn about the uses of this species. However, we expect that their TEK and/or uses and management have been eroded in the last decades because of the vertiginous economic changes in Amazonia.

## **METHODS**

### **Study Area and Communities**

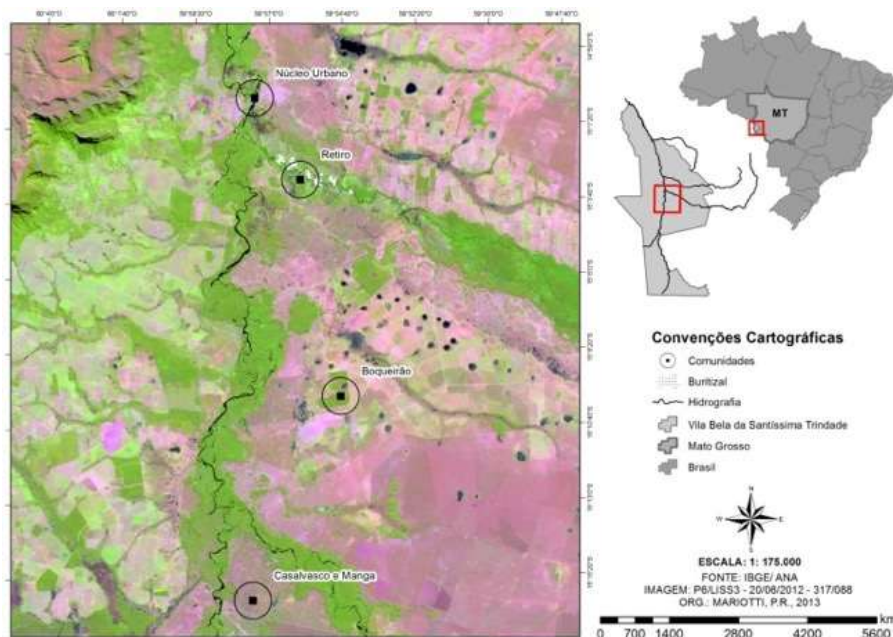
The study was performed in August 2012 and October 2013 in three Quilombola communities in Vila Bela, Trindade County (14°02'South and 16°14'West, 59°24'South and 60°33'West), Mato Grosso State, Brazil. The first author resided in the study area for one week per month for 14 months to better approach and understand the local people. Along the time, their links with local people were deeper and stronger.

The climate in this area is humid tropical or subtropical based on the Koppen climate classification system with an average annual temperature of 23.9–25.6°C and four months of continuous drought. The average annual precipitation is 1,500 mm, but exceeds 3,500 mm in areas with stronger rainfall. The maximum rainfall occurs in December, January, and February. The county is located in the upper Guapore River basin between Savana and the Amazonian Forest, where mountains and lowlands result in a place with high levels of biological diversity.

The study communities were Boqueirão, Retiro, and Casalvasco Manga (Fig. 1) with a total of 20, 25, and 15 people, respectively, distributed in nine, twelve, and five families, respectively. The low number of inhabitants in these communities is related to historical changes, whereas in the past, each of these areas belonged to a single family. When the patriarchs passed away, these lands were distributed among their descendants.

My father owned the entire land. After his death, it was distributed to his children, and now there are grandchildren too (Female, 60 years old).

Boqueirão, Retiro, and Casalvasco Manga belonged to two families. All my siblings, nieces, and nephews live in Casalvasco Manga, and here (Retiro). Most of them here are my nieces and nephews (Female, 76 years old).



**Figure 1.** Localization of the study communities (Boqueirão, Retiro, and Casalvasco and Manga) and the urban center of Vila Bela de Santíssima Trindade.

All three communities were inhabited by from African descendent since the colonial period when Vila Bela was the capital of Mato Grosso State. This black population was enslaved to work in the gold mines, in assembling the then capital and the defense of this border region. Then, it was forsaken by white people, who went to Cuiabá (1920) to build the current capital of Mato Grosso. And this historical moment that formed several free black communities, including those of which descended the three communities studied in this research (Boqueirão, Casalvasco and Manga, Retiro). The people of this community self entitle Quilombo (descendants of Africans). The three communities are have been recognized by the Fundação Palmares (Brazilian entity responsible for reviewing the Quilombola rights) and struggle for land rights through the National Institute of Colonization and Agrarian Reform. The distance between the Boqueirão, Retiro, and Casalvasco Manga communities and the urban center is 17.7 km, 35.4 km, and 43.5 km, respectively (Arruda 2013).

In the 70s and 80s, the study area was connected to southeastern and southern Brazil through paved roads, whereas public policies encouraged southerners to relocate and purchase land at a relatively low cost. The expansion of agriculture towards the Amazon and the incorporation of Brazil to the international food

market led to changes in the patterns of land use. Forest and savanna landscapes were converted to pastures, and livestock farming was enforced. Vila Bela da Santíssima Trindade has the second highest number of cattle in Mato Grosso and the sixth in the country (IBGE 2015). Therefore, Quilombola communities underwent several economic, social, ecological, and cultural changes.

## Interviews

To better understand the local use of buriti and related culture, qualitative and quantitative methods of ethnobotanical data analysis and collection, such as structured and semi-structured interviews and participant observations were performed (Geertz 1989). All the participants read the terms and content of this study and signed a typical consent agreement.

In order to investigate the TEK, use, and cultural importance of buriti, we selected by the snowball method (Bernard 2006) and interviewed 23 informants (18 men and five women) between 27 and 82 years of age that resided in the study area for 5–60 years. They were distributed in the urban region (2), Retiro community (10), Boqueirão community (8), and Casalvasco Manga community (3). The number of informants was delimited by the collector curve, which was stabilized at the 22<sup>nd</sup> interview.

The informant diversity index (IDs) that shows the number of informants that use a specific species was calculated as follows (Byg & Balsley 2001):

$$ID = 1/\sum P_i^2,$$

where  $P_i$  is the contribution of informant  $i$  to the total knowledge of species  $s$ . This is, the number of uses of species  $s$  mentioned by the informant  $i$  divided by the total number of uses reported by the informants as a whole. Therefore, ID ranges between zero and the number of informants that use the species.

## RESULTS AND DISCUSSION

### Quilombolas and Buriti Use

The results showed that 15 products can be developed using different parts of buriti (stipes, leaves, and fruits) divided into five usage categories: handicraft, food, construction, feed, and ornamental (Table 1). These different products were used for their livelihood, as a source of food and utensils that helped in his field, creating some animals and harvest of fruits available in the forest. These also served as a source of exchange with other products not produced or created. A total of four different uses were identified for the fruit, of which the most common was the juice (7). Candy, oil, and animal feed were mentioned only by a single informant. Barros & Da Silva (2013) indicated the importance of the buriti fruit for the Abaetetuba-Pará community, because it is consumed in breakfast due to its high levels in vitamins A and C, carotene, calcium, magnesium, and phosphorus. The Enawene-Nawe community in Mato Grosso also consumes the fruit combined with honey (Santos & Antonini 2008).

The buriti fruit is a source of income for many riverside and indigenous communities and is consumed by approximately 60% of the population (Santos & Coelho-Ferreira 2012, Barros & Da Silva 2013, Gilmore

2013). From 1993 to 1995, 148.8 tons per month were sold in the Iquitos market, Peru, whereas 40 tons per year were traded in the Leticia market, Colombia (Pulido & Cavelier 2001, Gilmore *et al.* 2013). In Iquitos, 124 buriti sacks (approximately one million fruits) are sold per day at a price range of US\$1.09 to US\$12.72 per sack (Delgado *et al.* 2007, Koolen *et al.* 2013). In Roca Fuerte County, Peru, buriti fruit commercialization represented the third biggest average source of household income from January 2012 to December 2012 (Manzi & Coomes 2009).

**Table I.** Frequency of buriti (*Mauritia flexuosa* L. f.) usages and used plant parts by three quilombola communities in Vila Bela de Santíssima Trindade (23 informants).

Usage	Plant Part	Frequency (%)	Harvest Season	Harvest Method	Production Leader
<b>Food</b>					
Juice	Fruit	30	Sept to July	Bunch drop	Woman
Candy	Fruit	4	Sept to July	Bunch drop	Woman
Oil	Fruit	4	Sept to July	Bunch drop and/or Soil gathering	Family
<b>Animal feeding</b>					
Food	Fruit	4	Sept to July	Bunch drop and/or Soil gathering	Man
<b>Handicraft</b>					
Apá	Leaf	78	Year-round	Young leaf pruning	Man
Sieve	Leaf	43	Year-round	Young leaf pruning	Man
Baquité	Leaf	26	Year-round	Young leaf pruning	Man
Wickerwork	Leaf	30	Year-round	Young leaf pruning	Man
Jacá basket	Leaf	4	Year-round	Young leaf pruning	Man
Toy	Leaf	13	Year-round	Young leaf pruning and/or Old stalk removal	Man
Stopper	Stipe	21	Year-round	Old stalk removal	Man
<b>Construction</b>					
Lift	Stipe	26	Year-round	Cut directly from the tree	Man
Roof	Leaf	30	Year-round	Young leaf pruning	Man
Canoe	Stipe	8	Year-round	Cut directly from the tree	Man
<b>Ornamental</b>					
Decoration	Plant	4	Year-round	Seedling Planting	Family

Only one informant mentioned the collection and use of buriti for its juice, whereas all others mentioned the physical difficulties in buriti fruit collection directly from the palm-trees, mainly due to the low number of young people in the communities, since the majority moved to urban areas for studies or career purposes. The shift in the use of NTFP has been also observed in other communities (Benz *et al.* 2000, Reyes-García *et al.* 2005) and can be explained by the proximity to urban centers and changes in lifestyle (Reyes-García *et al.* 2014).

The land is too small. I cannot live here. I cannot share the land with my father (Male, 27 years old).

Buriti stalks and leaves are widely used by many northern, northeastern, and mid-western Brazilian communities for household or commercial use (Santos & Coelho-Ferreira 2012). In Abaetetuba City, Pará State, toys made of buriti stalks are commercialized all year round, but especially during the annual Círio de Nazaré festival. Immature leaves (buriti eye) are used to make linen for bags, rugs, tapes (known as 'mamucabos'), mats, belts, hats, and many other locally and internationally commercialized artifacts (Santos & Coelho-Ferreira 2012). Indigenous and local communities in Mato Grosso State commercialize the linen and some of the products; however, there are no studies recording these commercial activities.

Informants reported seven different stalk and leaf uses divided into two handicraft categories (Table 2); however, the main uses were six, because building was only mentioned by a single informant (Table 1). Despite being aware of buriti stalk and leaf usages, only five informants used buriti stalks and leaves to manufacture sieves, special sieves (known as “apá”), wickerwork, and roofs for pleasure or personal use. The low number of individuals could be explained by the lack of knowledge or the ease of purchasing industrialized products with the same function.

I wanted to learn, but when you get older, everything gets harder. When I was a child, I preferred modernity and easiness (Female, 51 years old).

I like apá made from buriti, because it is better for separating the rice. It is a pity that I did not learn from those who knew how to make it. Nowadays, there are only a few people who still make it. I only know a woman, who does, but she lives far from here, and I am too old to learn (Female, 55 years old).

Now it is easier to go to the city and buy it. It is not necessary to make it anymore. It is very hard work (Female, 45 years old).

**Table II.** Pi Values of each person, highlight the individual of knowledge and Uses of each one in the group.

Informant	Community	Gender	Age	Knowledge Quantity	Pi Value (Knowledge)	Use Quantity	Pi Value (Use)
2	Manga	Male	83	6	0.40	5	0.33
4	Manga	Male	55	5	0.33	1	0.07
6	Retiro	Male	82	5	0.33	0	0.00
13	Boqueirao	Male	47	5	0.33	0	0.00
18	City	Male	76	5	0.33	0	0.00
1	Manga	Male	43	4	0.27	0	0.00
3	Retiro	Male	50	4	0.27	0	0.00
11	Retiro	Male	56	4	0.27	0	0.00
22	Retiro	Male	64	4	0.27	1	0.07
5	Boqueirao	Male	57	3	0.20	0	0.00
12	Retiro	Female	51	3	0.20	1	0.07
19	Retiro	Male	61	3	0.20	0	0.00
20	Boqueirao	Male	50	3	0.20	0	0.00
21	Boqueirao	Male	60	3	0.20	0	0.00
7	Retiro	Male	59	2	0.13	0	0.00
8	Retiro	Female	61	2	0.13	0	0.00
9	Retiro	Female	62	2	0.13	1	0.07
15	Boqueirao	Male	53	2	0.13	0	0.00
17	City	Male	71	2	0.13	0	0.00
23	Boqueirao	Female	58	2	0.13	0	0.00
10	Retiro	Female	50	1	0.07	0	0.00
14	Boqueirao	Male	59	0	0.00	0	0.00
16	Boqueirao	Female	73	0	0.00	0	0.00
<b>Total</b>					<b>4.67</b>		<b>0.60</b>

Buriti stipe is used by some riverine communities in Abaetetuba, Pará for building houses, bridges, and ports (Barros & Da Silva 2013). In this study, informants mentioned five different uses of stipe (handicraft, 70%; building, 14%; food, 12%; animal feed, 2%; and ornamental, 2%); however, they did not use this part anymore.

*Nowadays, we build our houses using bricks and cement. It is easier. We do not use natural resources anymore, because it is too hard (Male, 47 years old).*

In this study, ID was 4.67 (21 informants), relatively low compared with that reported in previous studies on the use of buriti leaves (ID = 35.8; 45 informants; Santos & Coelho-Ferreira 2012), *Attalea speciosa* Mart., and *Attalea eichleri* (Drude) A. J. Hend. (ID = 22.89 and 10.35, respectively - 25 informants, González-

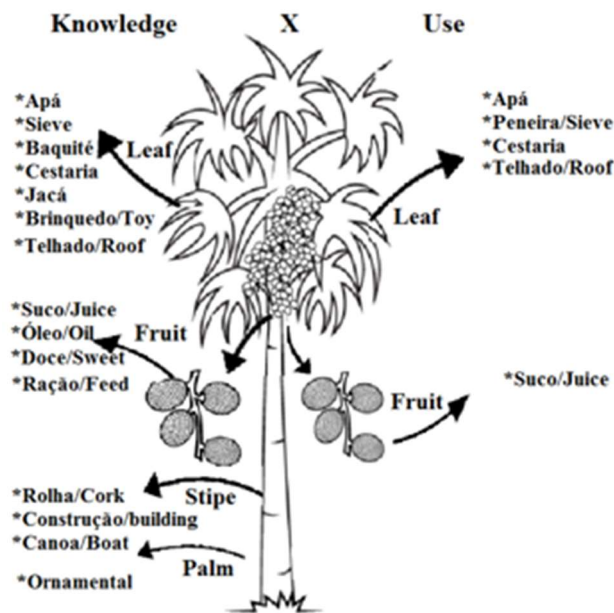
Pérez *et al.* 2012). The low value could be explained by the low number of informants that use buriti (five out of 23 informants) and also the low number of uses (three out of 15 known uses). When we calculated ID including only the informants that actively use buriti, the value was not higher than 0.60 (Table 2). Therefore, it becomes clear that various production techniques may disappear in a short time, if no knowledge preservation action is taken.

The increase in the *per capita* income, mainly due to milk production funded by municipal programs, probably persuaded the informants to accept that modernization was necessary and buriti use obsolete. Informants showed little interest in learning production techniques due to field work and migration to urban environments, looking for better life conditions. Mccarter & Gavin (2014) reported that the loss of TEK can be caused by the society, since the maintenance of knowledge requires joint efforts.

We used to make these products, because we did not have the money to buy them. But when we started making money, we do not need them anymore. Going to the city is easy now. There are buses or rides every day (Male, 51 years old).

We did not learn from our parents. They really knew how to make everything using buriti and other palm trees, but we do not. We are able to buy everything, and it is easier this way (Female, 39 years old).

Knowledge and cultural transmission are influenced by family relations and passes through the generations (Berkes 1999). In Quilombola communities, several difficulties led to the lack of knowledge on buriti uses and production techniques. Figure 2 shows the differences between the knowledge and current uses of buriti.







**Figure 2.** Comparative illustration of the known and active uses of buriti (*Mauritia flexuosa* L. f.) parts by three quilombola communities (Boqueirão, Retiro, and Casalvasco and Manga) in Vila Bela de Santíssima Trindade.

The use of NTFP followed the economic cycle of expansion, stabilization, and decline (Homma 1992). Some important NTFP can include an additional phase, the cultivation. While the buriti is used in many traditional communities in Brazil for subsistence purpose, there are important industrial uses. For example, the oil of the palm is widely used for cosmetic purpose and there are biotechnology purpose, all from natural populations, because it is found abundantly in nature. In this study, the economic role of buriti was almost



zero, whereas the self-subsistence importance was relatively high (Table 3). The results revealed that the loss of TEK also occurs when natural products are substituted by industrial ones. Thus, the sustainable use of NTFP and the maintenance of cultural values are crucial, despite the negative economic impact (Koolen *et al.* 2013).

**Table III.** Illustrative summary of produced handicraft items made of buriti (*Mauritia flexuosa* L. f.) with a short description and usage information.

Handicraft	Description	Usage
<p><b>Peneira/Sieve</b></p> 	<p>Circular utensil, made of buriti leaf petiole fiber, attached to a bamboo arc with small cracks between the lines with an average radius of 41 cm.</p>	<p>Used to separate parts with different thickness—in the studied communities, widely used to separate samp from fine flour.</p>
<p><b>Apá</b></p> 	<p>Utensil similar to the sieve. The fibers are disposed without any space between them.</p>	<p>To select and/or separate groceries (rice, bean, corn, and coffee) by using the ventilation process, since the utensil does not allow the food to pass through it.</p>
<p><b>Baquité</b></p> 	<p>A basket made of buriti leaf lobe, braided according to the craftsman's preference or its goal.</p>	<p>Used to carry animals. When the product is damaged, it is used as chicken nest.</p>
<p><b>Cestaria</b></p> 	<p>Made of buriti leaf lobes.</p>	<p>Used as flower basket, fruit bowl, and laundry basket.</p>

**Jacá**



Made of the fiber that covers buriti leaf petiole. It has a cylindrical shape, with or without handles and varies in size.

Used to carry farm groceries: corn, cassava, bananas, and other products that could be carried on the back of a bull, horse, or people.

**Brinquedo/Toy**



Made of leaf petiole. The craftsman can turn it into different types of toys and objects.

Used to make a wide range of toys, from animals to utensils, and other objects.

**Rolha/Cork**



Utensil made of the buriti leaf petiole, which provides a soft and light material.

The stoppers are used to cover bottles and locally to cover “canjinjim” (a typical regional alcoholic liquor) bottles.

The results supported our hypothesis suggesting that TEK associated with *Mauritia* in Vila Bella is eroded by diverse drivers promoted by globalization. The tendency could be different in more remote places. It is critical to understand the extension where the disuse of NTFP and loss of associated TEK is occurring. It is a very important phenomenon to analyze and revert their tendency because the sustainable harvest of NTFP is one of the main alternatives to avoid deforestation.

**CONCLUSIONS**

This study showed that the use of buriti has been decreased, since the communities reside close to urban centers, and their economy has been influenced by the local market. The relatively low ID values revealed that the increase in the *per capita* income had a negative influence on the use of NTFP and the traditional knowledge. The ecological and cultural importance of buriti in the Quilombola communities is well

known, and consequently, it is important to assure that knowledge and traditional practices will ally with the socioeconomic benefits of rural/urban connection.

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