

Socioeconomic Factors and Cultural Changes Explain the Knowledge and Use of Ouricuri Palm (*Syagrus coronata*) by the Fulni-ô Indigenous People of Northeast Brazil

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Socioeconomic Factors and Cultural Changes Explain the Knowledge and Use of Ouricuri Palm (*Syagrus coronata*) by the Fulni-ô Indigenous People of Northeast Brazil. The contact of indigenous people with non-indigenous societies has provoked socioeconomic and cultural change. One of the main consequences of these changes is the deviation of cultural traits, which may be related to a decrease in traditional knowledge of natural resources. We collected data on the knowledge and usage of the Ouricuri palm (*Syagrus coronata*), cultural change variables, and socioeconomic profiles of artisans of the Fulni-ô indigenous community of Pernambuco, northeastern Brazil. We found that diversity of resources for craft production and higher levels of education were related to a higher knowledge of Ouricuri palms. The practice of collecting Ouricuri leaves is maintained by younger artisans, those who diversify the resources for craft production, and those who diversify their income-generating activities. However, Fulni-ô who used leaves from such species had lower levels of education compared with those who did not use them, demonstrating that higher educational levels contribute to the maintenance of Ouricuri knowledge, but not to the Ouricuri leaf usage.

Mudanças culturais e fatores socioeconômicos explicam o conhecimento e uso do Ouricuri (*Syagrus coronata*) pelo povo indígena Fulni-ô no Nordeste do Brasil. O contato de povos indígenas com sociedades não indígenas tem provocado mudanças socioeconômicas e culturais. Uma das principais consequências dessas mudanças é a perda dos traços culturais, o que pode estar relacionado com a diminuição do conhecimento tradicional a respeito de recursos naturais. Foram coletadas informações relacionadas ao conhecimento e uso da palmeira Ouricuri (*Syagrus coronata*), variáveis relacionadas a mudanças culturais, além de identificar o perfil socioeconômico de artesãos da comunidade indígena Fulni-ô de Pernambuco, Nordeste do Brasil. Verificamos que a diversidade de recursos para a produção de artesanato e um maior grau de escolaridade estavam relacionados ao maior conhecimento a respeito da palmeira Ouricuri. A prática de coletar folhas de Ouricuri é mantida por artesãos mais jovens, por aqueles que diversificam os recursos para a produção de artesanato e aqueles que diversificam suas atividades geradoras de renda. No entanto, os Fulni-ô que utilizavam folhas dessa espécie apresentaram menores níveis de escolaridade quando comparados àqueles que não as utilizavam, demonstrando que maiores níveis de escolaridade contribuíram para a manutenção do conhecimento sobre o Ouricuri, mas não para a manutenção do uso das folhas dessa espécie.

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Introduction

Traditional ecological knowledge and the use of natural resources by indigenous people have been the target of investigations that aim to record and understand which factors contribute to their transformation (Albuquerque et al. 2011a; Benz et al. 2000; Caniogo and Siebert 1998; Godoy et al. 1998; Reyes-García et al. 2005; Soldati and Albuquerque 2012). This system of knowledge, practices, and beliefs is constantly changing and may involve adaptive processes (Berkes et al. 2000).

Due to growing contact between indigenous and non-indigenous societies, scientists have focused not only on documenting traditional ecological knowledge systems of native peoples, but also on understanding how such systems have been influenced by cultural mixing; that is, what consequently leads to cultural changes (Aguilar-Santelises and del Castillo 2015; Gross et al. 1979; Guèze et al. 2015; Pérez-Llorente et al. 2013; Reyes-García et al. 2014; Saynes-Vásquez et al. 2013). Cultural changes refer to processes that occur when individuals from different cultures interact, unleashing transformations in their world views and/or unique ethnological patterns (Berry 2008; Lopez-Class et al. 2011). Several measures have been used as indicators of cultural modification, such as level of education (Aguilar-Santelises and del Castillo 2015; Reyes-García et al. 2010; Saynes-Vásquez et al. 2013; Sternberg et al. 2001), integration with the market economy (Godoy et al. 2005; Reyes-García et al. 2005, 2007), and decreased access to natural resources due to conservation policies (Ruiz-Mallén and Corbera 2013). The loss of the native language (Aguilar-Santelises and del Castillo 2015; Saynes-Vásquez et al. 2013) and the degree of divergence from original values and beliefs (Reyes-García et al. 2014) have also been used. The main findings of these works highlight a negative association between cultural changes and the persistence of traditional ecological knowledge.

In addition to cultural shifts, socioeconomic factors such as age, family size, occupation, and monthly income have also been pointed out as important modulators of traditional ecological knowledge (Andrade et al. 2015; Araújo and Lopes 2012; Byg and Balslev 2001, 2004; Campos et al. 2015; Gavin

and Anderson 2007; Paniagua-Zambrana et al. 2014). Generally, the elders have greater knowledge about natural resources (Araújo and Lopes 2012; Byg and Balslev 2004; Paniagua-Zambrana et al. 2014; Voeks and Leony 2004). The same is true for those whose occupation requires direct contact with nature, like farmers, fishermen (Araújo and Lopes 2012; Byg and Balslev 2001), and extractivists of natural resources. Knowledge is also positively and directly influenced by both family size (Gavin and Anderson 2007; Medeiros et al. 2013; Paniagua-Zambrana et al. 2014) and monthly household income (Byg and Balslev 2001, 2004; Campos et al. 2015).

To investigate the influence of cultural changes and socioeconomic factors on traditional ecological knowledge, various natural resources have been used as study models. Palms (Arecaceae) are great models due to their broad distribution and high economic and cultural values (Byg and Balslev 2004; Campos et al. 2015; Martínez-Ballesté et al. 2006; Paniagua-Zambrana et al. 2014). For instance, the palm *Syagrus coronata* (Mart.) Becc. (Ouricuri), the leaves of which are used in the production of handmade objects, stands out as part of the identity of the Fulni-ô people of northeastern Brazil (Quirino 2006; Silveira et al. 2012). The Ouricuri shows a high index of cultural significance (Silva et al. 2006) and is considered a “cultural complex” by Pinto (1956), as this palm is involved in many activities of the Fulni-ô routine, like income generation by handicraft production and religious practices. Resources that relate to the cultural identity of a group of people, developing key functions such as food, medicine, construction, and/or spiritual practices, are presented in the literature as cultural keystone species (Garibaldi and Turner 2004). The outstanding cultural significance of this species led us to suggest that it could be related to cultural resistance on the part of the Fulni-ô in face of the strong contact with the non-indigenous society.

The Fulni-ô are 1 of 11 native groups found in the state of Pernambuco. They are regarded as people who preserve many of their traditions, being the only indigenous group of Pernambuco state that maintains their native language (*Yaatbe*) in addition to speaking Portuguese (ISA 2013). The history of the Fulni-ô is characterized

by numerous conflicts with colonists, missionaries, and farmers in the municipality of Águas Belas. Since the beginning of the 17th century, these groups imposed religious rules and forbade Fulni-ô to speak their native language and celebrate their sacred rituals (Sá 2014). The struggle for the appreciation of the culture remains to the present. Currently, besides communication in *Yaathe* by some members of the village, the Fulni-ô still maintain their sacred and secret rituals, in which they perform religious practices (Quirino 2006; Silveira et al. 2012). Ouricuri, the religious retreat, takes place in the village of the same name. During the period of the ritual, anyone who does not belong to the Fulni-ô group is not allowed in the village (Quirino 2006), even those who are married to people of this ethnicity (Silveira et al. 2012). An exception is observed for the Kariri-Xocó people of Alagoas, with whom they have a close relationship (Quirino 2006).

Until 1980, the main village had one state school, which had been created in 1920 along with the Indian Protection Service (SPI). It offered only the initial years of education and aimed to integrate the Fulni-ô with the non-indigenous society (Silveira et al. 2012). Created in mid-1980, the second state school, which was bilingual, had set a goal of rescuing the Fulni-ô culture. However, the education curriculum included the same subjects taught at non-indigenous schools, with the exception of the *Yaathe* language lessons (Silveira et al. 2012).

The economy of the Fulni-ô revolves primarily around the production and sale of handicrafts. They also perform musical presentations in other municipalities, usually in April, when “Indian Day” is celebrated in Brazil. During the course of our research, we noticed that many members of the Fulni-ô community also live from the leasing of their lands and receive financial aid from the federal government, such as retirements, and/or the “Bolsa Família” (a social program of the Brazilian government that provides financial aid to families living in poverty). Moreover, occupations such as teachers, masons, motorcycle taxi drivers (mototaxi), housekeepers, and vendors are very common among the Fulni-ô. In the handicraft production process, there are both artisans (men and women) that exclusively use the leaves of the Ouricuri palm (Fig. 1) and artisans (mostly men) who use other raw materials, such as timbers and seeds, of other species. All these materials are collected in areas nearby the indigenous village. According to

Campos (2011), the broom made of leaves from the Ouricuri palm was the main object produced by the Fulni-ô, and several families made a living from selling them. However, there was a reduction in the commercialization of these brooms, stimulating the production of other kinds of items, which are related to the native Brazilian stereotype held by the non-indigenous society (Campos 2011; Silva 2016) like feather headdresses and earrings and archery items.

The relationship of the Fulni-ô people with the Ouricuri palm, which bears the same name as the sacred ritual and the village used for religious purposes, has been discussed by Campos (2006). Pinto (1956) highlighted the intense production of handicrafts with the leaves of this species, in addition to being used in house construction and as food and clothing that are used in the sacred Ouricuri ritual. When investigating the cultural significance index of plant species used by Fulni-ô people, Silva et al. (2006) observed that *S. coronata* received the most elevated value. It leads us to acknowledge that the Ouricuri is a species of great cultural significance for this indigenous group and that it could be associated with a lesser degree of cultural changes, like fluency on the native language and a higher degree of kinship with Fulni-ô ethnicity. Moreover, the name of the sacred ritual, which formerly took place close to a *S. coronata* tree, is derived from the importance of this palm to this native group (Pinto 1956).

Thus, the aim of this project was to test the following hypotheses: (1) local knowledge and collection of the leaves of *S. coronata* are influenced by socioeconomic factors such as age, family size, diversity of income sources, diversity of resources used for production of handicrafts, amount of financial aid received from the government, fluency of the native language, kinship, and level of education, and (2) the use of *S. coronata* by the Fulni-ô is positively associated with greater fluency in the native language, a higher degree of kinship with Fulni-ô ethnicity, and a lower level of education.

Methods

CHARACTERIZATION OF THE STUDY AREA

This study was conducted in the Fulni-ô indigenous village, which is located in the municipality of Águas Belas (9° 07' 03" S, 37° 07'



Fig. 1. Handicrafts produced by Fulni-ô artisans using *Syagrus coronata* (Mart.) Becc. leaves in Águas Belas, Pernambuco, northeastern Brazil. **a** Baskets. **b** Brooms. **c**, **d** Mats.

06" W), 311.2 kilometers (km) from the capital of the state of Pernambuco in the northeast of Brazil. Águas Belas is situated in the southern semi-arid region known as “*agreste*” and is part of the Ipanema River basin. The region has a semi-arid climate (BShw) (Köppen 1948) with mean annual temperature of 25 °C and the mean annual rainfall of 600 mm (CONDEPE/FIDEM 2006).

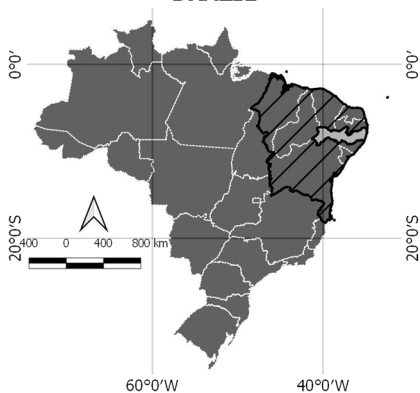
Located in a typical area of Caatinga vegetation (CONDEPE/FIDEM 2006) and contiguous with the city of Águas Belas, the Fulni-ô land (Fig. 2) has approximately 11,500 ha (CONDEPE 1981). The Fulni-ô population is distributed in two villages, which are 4 km from each other. No demographic census is available for these villages. However, according to information obtained at the health center of the indigenous land, the main village (or village headquarters) has approximately 3430 inhabitants and the Xixiakhlá village, a more rural area, consists of 100 inhabitants (Fig. 2). The Ouricuri village, which is also part of the Fulni-ô indigenous land, is only occupied during the period of their annual religious ritual, from September to December.

COMMUNITY RECOGNITION AND LEGAL ASPECTS

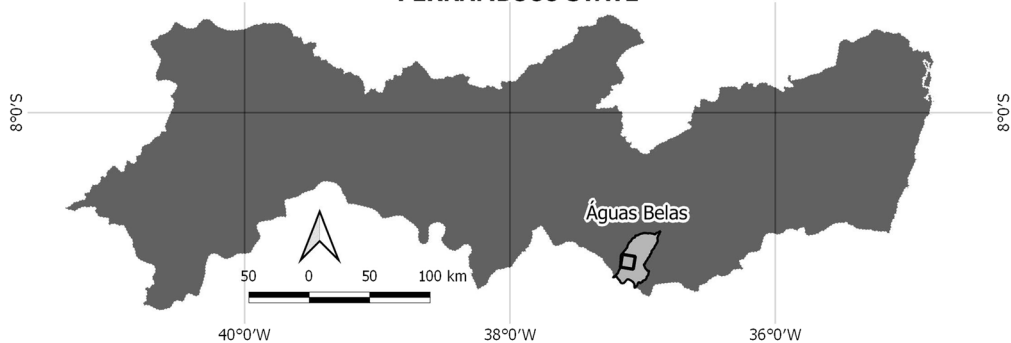
A first visit to the Fulni-ô community was done in the company of researchers from our laboratory who had previously conducted studies in the region (Albuquerque et al. 2008, 2011a, b, c; Soldati and Albuquerque 2012). At this first contact, a meeting with the leaders of the Fulni-ô village was held to explain the objectives of the research, requesting authorization from them, and dissemination among the entire community. After receiving authorization from the leadership, the project was submitted to the committees responsible for approving research with traditional communities and indigenous peoples: National Commission of Ethics in Research (CAAE 24211014.0.0000.5207), National Indian Foundation (authorization no. 04/AAEP/PRES/2015), National Historical and Artistic Heritage Institute (case no. 2000.000203/2014–35), and

Fig. 2. Location of the Fulni-ô community composed of three villages: the main village, the Xixiakhlá village, and the Ouricuri village (village where the ritual takes place). The main village is located 500 m from the city of Águas Belas, Pernambuco, northeastern Brazil.

BRAZIL



PERNAMBUCO STATE



FULNI-Ô INDIGENOUS VILLAGES

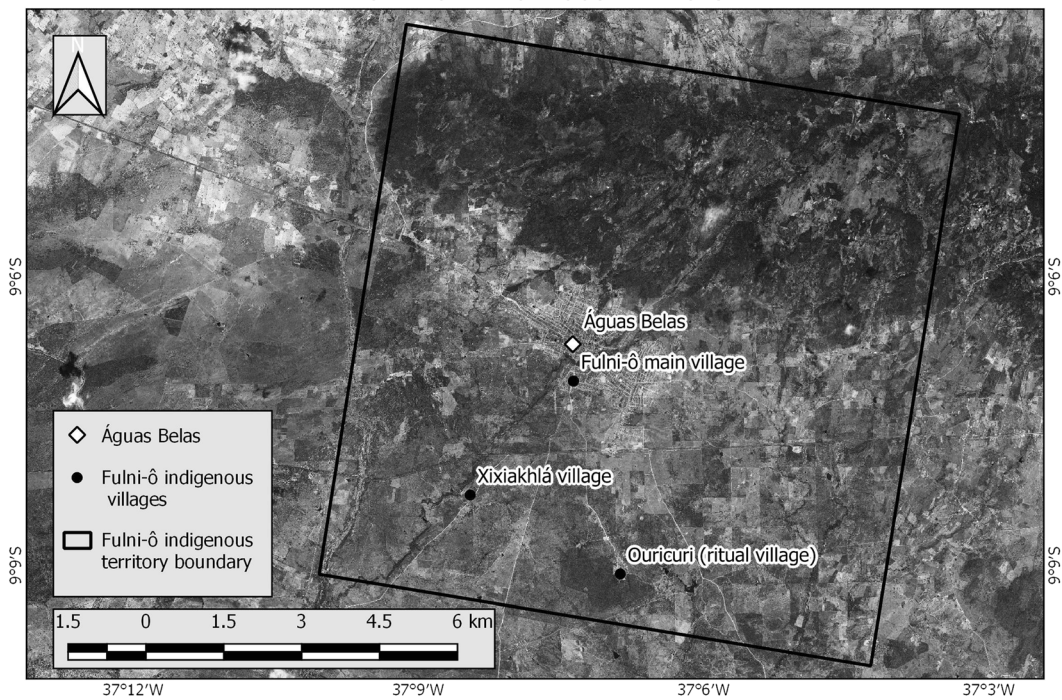


TABLE 1. QUESTIONS USED IN THE SEMI-STRUCTURED INTERVIEWS WITH THE FULNI-Ô OF ÁGUAS BELAS, PERNAMBUCO, NORTHEASTERN BRAZIL.

Do you speak and understand the <i>Yaathe</i> language?	What is your degree of kinship with the Fulni-ô ethnicity?	What is your level of education?
(1) I understand some things and I speak some things (2) Yes, fluently	(1) Only the father or the mother is Fulni-ô (2) Both father and mother are Fulni-ô	(1) Illiterate (2) Incomplete elementary school (3) Elementary school diploma (4) Incomplete high School (5) High school diploma (6) Incomplete higher education (7) Higher education diploma

The numbers refer to the scores assigned to the possible responses

System of Authorization and Information in Biodiversity (authorization no. 41944-1).

SOCIOECONOMIC FACTORS, CULTURAL CHANGES, AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Home visits to all artisans who produce crafts from *S. coronata* leaves were conducted from January 2014 to January 2015. To identify these artisans, we used the “snowball” technique (see Albuquerque et al. 2014; Noy 2008), which consisted of intentionally selecting informants by identifying and interviewing a craftsman, who gave us referral to another craftsman, until all the artisans in the community were reached. Thus, the technique was adapted to the context of the study area with the objective of selecting, among the people in the community, only those who produce handicrafts with Ouricuri leaves. After locating all the relevant artisans, we spoke to the local leadership to verify the existence of other specialists who may not have been identified through the “snowball” method, thereby locating three other experts. In total, 66 artisans were interviewed, 26 of whom were leaf collectors and 40 were not (that is, they bought or received the leaves from someone who harvested them).

Semi-structured interviews (Albuquerque et al. 2014; Bernard 2006) were conducted with the artisans to collect data on their knowledge about *S. coronata* palms and socioeconomic characteristics. The following information was collected: age, family size, practice of other income-generating activities besides handicrafts, value of financial aid received from the government, use of other raw

materials for handicrafts besides the Ouricuri leaves, manner of obtaining leaves (whether collecting or not), and known uses of the palm.

Three factors were used to measure cultural changes: level of education, fluency in the *Yaathe* language, and degree of kinship with the Fulni-ô ethnicity (both parents are Fulni-ô or only one of them is Fulni-ô). Fluency in the *Yaathe* language and the degree of kinship with the Fulni-ô were indicated by the village leaders as indicators of cultural changes (i.e., the less fluency in *Yaathe*, the greater degree of cultural change; if both parents were Fulni-ô, the lesser degree of cultural change). The level of formal education was used as an indicator of cultural change following Reyes-García et al. (2010, 2014), Saynes-Vásquez et al. (2013), and Sternberg et al. (2001) such that the higher the level of education, the greater the degree of cultural change. This information was collected during the semi-structured interviews and each response was classified using a score as shown in Table 1.

The interview about language fluency, kinship, and schooling was conducted with the help of a member of the Fulni-ô indigenous group. Regarding the language questions, we asked the interviewees if they were fluent in the *Yaathe* language or if they understood some things and spoke some things. The interviewee was the person who answered this question.

CULTURAL CHANGES AND USE OF OURICURI LEAVES

We selected four groups of informants: (1) artisans who used only *S. coronata* leaves as raw material for production of handicrafts; (2) artisans who used

TABLE 2. EFFECTS OF SOCIOECONOMIC VARIABLES AND CULTURAL CHANGE VARIABLES ON THE NUMBER OF KNOWN USES OF *SYAGRUS CORONATA* (MART.) BECC. BY FULNI-Ô NATIVE PEOPLE OF ÁGUAS BELAS, PERNAMBUCO, NORTH-EASTERN BRAZIL.

Variation sources	Estimate	STD error	Z value	P
Intercept	2.07114	0.24809	8.349	< 0.00001***
Diversity of resources	0.27523	0.08789	3.131	0.00174**
Fluency in <i>Yaathe</i> language	0.15587	0.09070	1.719	0.08570
Kinship	- 0.21795	0.13437	- 1.622	0.10481
Level of education	0.07280	0.03452	2.109	0.03498*

***Indicates significant p values for alpha < 0.0001; **Indicates significant p values for alpha < 0.001; *Indicates significant p values for alpha < 0.05

both *S. coronata* and other raw materials (wood, seeds, feathers, etc.) for production of handicrafts; (3) artisans who did not use *S. coronata* leaves as raw material for production of handicrafts; and (4) non-artisans. Groups (1) and (2) were selected based on the answers that informants gave to the following question: “Do you use other raw materials besides Ouricuri leaves for craft production?” These questions were asked during the semi-structured interviews. Group (3) was selected from the database compiled by Silva (2016). Group (4) was selected from a database compiled by Torres Avilez (2017), which was constructed from 389 interviews carried out in the same study site, to investigate the role of gender in knowledge on medicinal plants. The participants of the four groups were questioned according to the questions in Table 1: Participants in the groups (1) and (2) answered the questions at the time of the semi-structured interviews, and the other participants, i.e., those in groups (3) and (4), were interviewed in their residences at a different time.

DATA ANALYSIS

We used a generalized linear model (GLM) with a Poisson error structure followed by stepwise regression to test the effects of socioeconomic factors and cultural change variables on the number of known uses of *S. coronata* (response variable). There was no multicollinearity between our variables. Thus, age, family size, value of financial aid received from the government, income-generating activities (“income diversity”), work using other kinds of craft (“diversity of resources”), fluency in the *Yaathe* language, kinship, and level of education were all included as explanatory variables. The variables “income diversity” and “diversity of resources” were coded as [1] if the answer was

affirmative and [0] if the answer was negative. We also used a GLM with a binomial error structure followed by stepwise regression to identify the influence of the aforementioned explanatory variables on the probability of *S. coronata* leaf gathering (response variable, binomial family), which was classified as [1] if the answer was affirmative and [0] if the answer was negative.

To test whether fluency in the *Yaathe* language, kinship, and level of education (our measures of cultural change) explain the use of Ouricuri leaves, we performed a GLM with these variables as explanatory and the probability of using Ouricuri leaves as the response variable (binomial family), which was classified as [1] (uses Ouricuri leaves) and [0] (does not use Ouricuri leaves).

All statistical tests were performed using R 3.2 (R Development Core Team 2015) and the Bioestat 5.3 program (Ayres et al. 2007).

Results

DID SOCIOECONOMIC FACTORS AND CULTURAL CHANGES EXPLAIN THE KNOWLEDGE AND PRACTICE OF GATHERING *S. CORONATA* LEAVES?

Forty-one artisans were assigned to group (1) and 25 of them were assigned to group (2). Based on the responses obtained using the “free-listing” database of Silva (2016), 26 artisans who did not use the *S. coronata* leaves for producing handicrafts were identified (group 3). We identified 312 participants whose occupation did not involve handicraft production from all respondents in the research of Torres-Avilez (2017). Next, to set up the fourth group, we performed a random sampling without replacement of the total of 312 non-artisans, resulting in 82 non-artisan people that comprised group (4).

TABLE 3. EFFECTS OF SOCIOECONOMIC VARIABLES AND CULTURAL CHANGE VARIABLES ON THE PRACTICE OF *SYAGRUS CORONATA* (MART.) BECC. LEAF COLLECTION BY THE FULNI-Ô NATIVE PEOPLE OF ÁGUAS BELAS, PERNAMBUCO, NORTHEASTERN BRAZIL.

Variation sources	Estimate	STD error	Z value	P
Intercept	- 0.0605350	1.4749138	- 0.041	0.9673
Age	- 0.0696041	0.0351869	- 1.978	0.0479*
Amount of financial aid received from the government	- 0.0013781	0.0008957	- 1.539	0.1239
Diversity of income	1.8745987	0.8914440	2.103	0.0355*
Diversity of resources	1.8310852	0.7593393	2.411	0.0159*
Fluency in <i>Yaathe</i> language	1.8167277	1.0190471	1.783	0.0746

*Indicates significant p values for $\alpha < 0.05$

Indigenous artisans who diversified resources for handicraft production ($\beta = 0.27523 \pm 0.08789$; $z = 3.131$; $p = 0.00174$) and with higher levels of education ($\beta = 0.07280 \pm 0.03452$; $z = 2.109$; $p = 0.03498$) had greater knowledge about the species than those who did not (Table 2). Similarly, younger artisans ($\beta = - 0.0696041 \pm 0.0351869$; $z = - 1.978$; $p = 0.0479$), those who diversified their income ($\beta = 1.8745987 \pm 0.8914440$; $z = 2.103$; $p = 0.0355$), and those who used different resources for handicraft production ($\beta = 1.8310852 \pm 0.7593393$; $z = 2.411$; $p = 0.0159$) were more likely to collect leaves than the opposite (Table 3).

WAS THE USE OF *S. CORONATA* LEAVES EXPLAINED BY FLUENCY IN THE *YAATHE* LANGUAGE, KINSHIP, AND LEVEL OF FORMAL EDUCATION?

The Fulni-ô people with lower levels of education were more likely to use Ouricuri leaves for production of handicrafts ($\beta = - 0.7609 \pm 0.1401$; $z = - 5.430$; $p < 0.0001$) (Table 4). The fluency in the *Yaathe* language and kinship with Fulni-ô ethnicity did not show significant influence on the Ouricuri leaf usage.

Discussion

DID SOCIOECONOMIC FACTORS AND CULTURAL CHANGES EXPLAIN THE KNOWLEDGE AND PRACTICE OF GATHERING *S. CORONATA* LEAVES?

Artisans who diversified the resources to produce crafts demonstrated greater knowledge about *S. coronata* palms, suggesting that the production of other kinds of handicrafts may be influencing the process of sharing knowledge about this species. How this happens is unclear. However, it is possible that the transmission of such information occurs while the artisans collect the resources used in handicraft production. Our findings show that artisans who diversified the resources used not only knew more about the Ouricuri, but they also tended to gather the palm leaves. When searching for the leaves, artisans collected other resources, which can often be found in the same locations where the Ouricuri palms occur. Thus, in this case, investing in a greater diversity of resources reduces neither knowledge nor the practice of collecting culturally important species. The collection practice is important for learning about natural resources, since the environment promotes direct contact of the collector with such resources (Byg and Balslev 2001).

TABLE 4.. EFFECTS OF FLUENCY ON THE NATIVE LANGUAGE, KINSHIP, AND LEVEL OF EDUCATION ON THE USE OF *SYAGRUS CORONATA* MART. BECC LEAVES BY THE FULNI-Ô NATIVE PEOPLE OF ÁGUAS BELAS, PERNAMBUCO, NORTHEASTERN BRAZIL.

Variation sources	Estimate	STD error	Z value	P
Intercept	3.3889	1.3461	2.518	0.0118*
Fluency in <i>Yaathe</i> language	- 0.2674	0.3908	- 0.684	0.4937
Kinship	- 0.7431	0.6430	- 1.156	0.2478
Level of education	- 0.7609	0.1401	- 5.430	< 0.0001***

***Indicates significant p values for $\alpha < 0.0001$

More specifically, the sensory contact provided by collection favors learning about resources and motivates conservation, as emotional responses are often evoked during this process (Soulé 1988).

Having a job working in non-indigenous communities, like teaching, mototaxi driving, and housekeeping, as well as having a higher level of education, may lead to diminished contact between indigenous people and the natural environment (Reyes-García et al. 2010; Saynes-Vázquez et al. 2013). This can lead to less knowledge about natural resources (Araújo and Lopes 2012). For the Fulni-ô, we expected that a higher level of education and the involvement in other occupations may offer better financial opportunities but, in so doing, contribute to a reduction in the practice of collecting Ouricuri leaves. However, our results showed a different scenario, as those artisans who had a higher level of education exhibited higher knowledge about Ouricuri palms, and those who diversified their income were those who contributed to the maintenance of the habit of collecting Ouricuri leaves. This result reinforces the cultural significance of the species, as it indicates that investing in education and in the diversity of income does not compromise the traditional knowledge and the harvesting practice. However, age differences can influence the level of involvement in *S. coronata* leaf collection. Consistent with our results, Virapongse et al. (2014) showed that *Mauritia flexuosa* L.f. leaf collectors were predominantly young, as they are more able to climb the palms to carry out collection of resources. In our study, the fact that collectors are young may be related to the greater ease of this group to go to collection sites, since populations of *S. coronata* are found in steep areas with difficult access.

WAS THE USE OF *S. CORONATA* LEAVES EXPLAINED BY FLUENCY IN THE *YAATHE* LANGUAGE, KINSHIP, AND LEVEL OF FORMAL EDUCATION?

In our work, less cultural change was represented by the maintenance of the fluency in native language, a low level of formal education, and the presence of both parents belonging to the Fulni-ô group. But the only factor among these that was associated with the use of Ouricuri leaves by Fulni-ô indigenous people was the lower level of education.

A higher level of education, when it occurs in indigenous people, can trigger incorporation of

knowledge from non-indigenous society, providing less contact with natural resources and leading to a decrease in traditional ecological knowledge (Reyes-García et al. 2010). Moreover, a higher level of education promotes admission in the external labor market, which probably influenced the Fulni-ô to search for different occupations that provide better financial opportunities. Saynes-Vázquez et al. (2013) contribute to the analysis of the effect of education on decreased traditional knowledge, suggesting that the time spent at school could have been used for learning activities related to the use of the flora by an indigenous group of Mexico. The same seems to have occurred to the Fulni-ô: it is probable that indigenous people who had little or no access to school spent more time learning activities related to their traditional culture and ecological knowledge, maintaining the handicraft activities with the Ouricuri. Thus, different occupations were being incorporated due to the contact of the Fulni-ô with the non-indigenous society around them, changing their way of viewing the world, beliefs, and customs, thus leading to cultural changes (Lopez-Class et al. 2011; Sam and Berry 2010). Due to these changes, the Fulni-ô people with greater levels of education have strayed from handicrafts with Ouricuri leaves, as our results have shown.

Another consequence of cultural changes that are occurring with indigenous people is the decrease or loss of their native language (Aguilar-Santelises and del Castillo 2015; Saynes-Vázquez et al. 2013). This fact may be associated with the loss of traditional ecological knowledge, as verified by Benz et al. (2000), when demonstrating that the maintenance of the native language contributes to the process of sharing knowledge about plants. Saynes-Vázquez et al. (2013) affirm that the association between the fluency loss of the native language and decreased traditional ecological knowledge is due to interruption of the knowledge transmission process. However, it seems that this is not the case in our findings. The Fulni-ô who were sampled in our work were either bilingual or spoke and understood at least a little *Yaathe*, and no artisan spoke exclusively their indigenous language. This suggests that fluency in the native language does not seem to be a determining factor in knowledge transmission related to the Ouricuri.

Aguilar-Santelises and del Castillo (2015), by comparison of traditional knowledge about plants between societies with different degrees of contact with other cultures, verified that those groups that

had experienced a higher level of cultural mixing presented less knowledge, a result attributed to the reduced contact of these peoples with their own culture and with natural resources. On the other side, van den Boog et al. (2017) found that indigenous children who have been exposed by acculturation and urbanization for several decades in Suriname possess similar knowledge about non-timber forest products in comparison with indigenous children of a group that had experienced a more recent contact with the non-indigenous society. In our work, we believed that those individuals whose fathers and mothers belong to the Fulni-ô had higher contact with beliefs, practices, and customs of their people, thereby presenting a higher tendency to maintain activities linked to their culture, such as the handicrafts using fronds of the Ouricuri. Similarly, we anticipated that the presence of either a father or mother belonging to a non-indigenous society may have influenced the process of cultural transformation of their children, contributing to the deviation from cultural activities, like Ouricuri handicrafts, and higher appreciation of non-indigenous practices. But this was not the case.

When analyzing the importance of Ouricuri by the Index of the Identified Cultural Influence (ICI) of cultural keystone species proposed by Garibaldi and Turner (2004), we identified that the species presents a high index (33 out of 35), demonstrating the species' elevated importance to the identity of the Fulni-ô. Thus, we can affirm that the palm *S. coronata* may also contribute to the affirmation of the ethnic identity of this native people. In this process, known as "ethnogenesis," human groups seek to generate and continue their own culture and identity, an action that reflects on the social dynamics and politics of these groups (Bartolomé 2006; Sider 1976). Grünewald (2002) exemplifies it with the jurema (*Mimosa* sp.), a plant that is used by indigenous people of northeastern Brazil in rituals that are related to the affirmation of their culture, identity, and ethnicity. This is a means of self-definition of an indigenous community as distinct from other inhabitants of the region. It is possible that the Ouricuri palm is fulfilling a similar role. According to Pinto (1956, 102), "The Ouricuri is a true cultural complex and, around this element, many activities of the native people of Águas Belas are developed." "The Ouricuri, due to its importance, lent its name to the religious activities of the Fulni-ô" (Pinto 1956, 104). In this sense, the scope of cultural and ecological sustainability is extremely important in a scenario of cultural changes.

Conclusion

The process of cultural changes by which the Fulni-ô people have been subjected due to contact with the non-indigenous society has generated new socioeconomic and job conditions that seem to explain the removal of some of its members from the handicraft activity with Ouricuri leaves. However, even in the face of such changes, we highlight the existence of individuals who use those leaves and still maintain this activity, which was associated with a lower level of education. On the other hand, the higher level of education and the diversification of resources for production of handicrafts were important in maintaining the knowledge of *S. coronata*, which underscores the cultural importance of the species. The practice of collecting Ouricuri leaves is maintained by younger artisans, those who diversify the resources for craft production, and those who diversify their income-generating activities.

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Compliance with Ethical Standards

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