






## Perception of extractivists about the *Mauritia flexuosa* palm swamp in the Lençóis Maranhenses Region, Brazil

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### Abstract

Researches of environmental perception evidences the extractive context and help policy making. Despite the social and economic benefits, the intensification of extractivism can promote ecological unsustainability and alteration in the perception of forest conservation values. In the region of Lençóis Maranhenses, Northeast Brazil, the sale of products extracted from *Mauritia flexuosa* L.f palm to supply the local and national market is increasing. Thus, we aimed to evaluate the forest values perceived by extractivists in municipalities of the region of Lençóis Maranhenses and how the socioeconomic profile interfere with the environmental perceptions of the interviewees. The research was conducted through semi-structured forms applied to 271 extractivists from the municipality of Barreirinhas, Paulino Neves and Tutóia. The perceived forest values were divided into three categories: economic, ecological and social. It was contacted that there was a prioritization of the values included in the Economic category, in which the source of income is highlighted in the municipalities that most extract the palms. The data revealed that there was a prioritization of the economic category, with emphasis on the forest value source of income. In Barreirinhas, food and climate regulation values were related to socioeconomic characteristics such as gender and monthly income from the sale of handicrafts. There is knowledge about the environmental damages that occur in the forest. However, there is no effective participation of the communities in the management of the Environmental Conservation Units of the region.

**Keywords:** Forest values. Environmental management. Conservation Units. Income.

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## Introduction

In light of growing demands for natural resources, it is challenging to reconcile environmental conservation with economic development, even in environmentally protected areas (LAURANCE, 2012). Residents who live inside or near environmental conservation units, especially economically disadvantaged communities, rely heavily on forest resources for nourishment and income (VEDELD, 2012; THONDHLANA and MUCHAPONDWA, 2014), which can damage the environment (BENNETT e DEARDEN, 2014) or contribute to its conservation (VIEIRA *et al.* , 2016). Natural resource use preferences depend on perceptions (ADAMOWICZ *et al.* , 1997), which can be influenced by socio-economic factors such as age (YANG *et al.* , 2015), gender (ALLENDORF and YANG, 2013) and income (SHARAUNGA *et al.*, 2015).

Environmental perception studies help to create effective management plans. Such research clarifies the reality of extractivism and helps implement political measures in environmentally protected areas (ALLENDORF and YANG, 2013). In this context, we highlight the environmental protection areas located in the Lençóis Maranhenses region. In these areas, there are *Mauritia flexuosa* L.f. (BRASIL, 2002) forests, which are increasingly used to extract fibers to manufacture handicrafts for the local and national tourist market (IPEA, 2016).

The extraction of forest products intended for trade tends to boost local economic development (SAYER *et al.*, 2012) and helps sustain socio-economically vulnerable communities that have access to forest resources (VIRAPONGSE *et al.*, 2014). Despite social and economic benefits, the intensification of extraction can have negative consequences (BELCHER and SCHRECKENBERG, 2007), such as social conflicts, ecological

unsustainability (SCHMINK, 2004) and alteration of the perception of conservationist forest values (VIEIRA and LOIOLA, 2014). In this context, this study was aimed to investigate the environmental perception of communities located in areas used for extraction destined for trade and to evaluate how their socioeconomic profiles interfere in this.

## Procedures and research

### Study Area

The present study was carried out in the municipalities of Barreirinhas, Paulino Neves and Tutóia, which comprise the handicraft production network in the Lençóis Maranhenses region, Maranhão state, northeastern Brazil (IPEA, 2016). In these municipalities, extractive communities that supply Artisan and Extractivist Associations in each municipality evaluated were selected as follows: Residencial Brasil, Cebola, Ladeira and Barreiro, in the municipality of Barreirinhas, Água Riquinha, municipality of Paulino Neves, and Justa in the municipality of Tutóia.

The study area encompasses two state environmental protection areas, the Upaon-Açu/Miritiba/Alto Preguiças and the mouth of the Preguiças River/Small region Lençóis/Lagunar, which are located in the Lençóis Maranhenses region, northeastern Brazil (ICMBIO, 2008).

The vegetation is characterized as Restingas, coastal vegetation usually associated with mangroves, dune fields and freshwater gallery forests (ICMBIO, 2008). The freshwater gallery forests are inhabited by the *Mauritia flexuosa* palm tree L.F., popularly known as buriti in Brazil, forming the Buritizal (BRASIL, 2002).

The state of Maranhão is the largest extractor of buriti palm tree fibers in northeastern Brazil and the Lençóis Maranhenses region collecting

these fibers is one of the main extractive activities, contributing significantly to local income (IPEA, 2016). The municipalities of Barreirinhas (103 tons/year in 2014) and Tutóia (38 tons/year in 2014) stand out as some of the largest extractivists in Brazil (IBGE, 2014). Although it does not appear in IBGE statistics, Paulino Neves does present buriti plant extraction as a source of family income (IPEA, 2016).

### Data collection

The extractivists from Barreirinhas, Paulino Neves and Tutóia were identified through the snowball sampling method and semi-structured interviews were conducted with all the nominees in the communities (ALBUQUERQUE *et al.*, 2014).

Semi-structured interviews were conducted between August 2014 and December 2015. All respondents were asked to sign the free and informed consent form. This study was approved by the Research Ethics Committee at the Federal University of Piauí, with the permission number 886.193.

The forms consisted of three parts. The first part surveyed the socioeconomic variables gender, age, schooling, monthly income obtained solely from the commercialization of products extracted and made from buriti and total monthly income, equal to the sum of all monthly income obtained. The second part was based on the list of the perceived importance of Buritizal (forest values). The third objective was to evaluate residents' knowledge about the conservation unit and environmental problems of the areas. For this, four questions were asked: 1) "Do you know of any environmental conservation units?" If the answer was yes, respondents were asked which ones they knew of and why they are considered environmental conservation units? 2) "Do you help manage any environmental conservation unit?" 3) "What threatens the Buritizais in this area?" 4) "Are the Buritizais areas being reduced? If yes, what are the causes?"

## Data analysis

The values cited by the respondents were grouped into three categories according to the type of value reported (Table 1), following the methodology adopted by Yang *et al.* (2015).

**Table 1.** Categorization of forest values according to the description of respondents from the Lençóis Maranhenses region, Maranhão, Brazil.

Category	Forest Value	Description
Economic	Food	Human and animal food resources.
	Household utensils	Handmade utensils that assist in daily routines such as baskets, woven items, sieves, hunting tools and cages.
	Wood	Wood for cooking and building furniture, doors, fences, houses, bridges, boats.
	Source of income	Extraction of forest resources exclusively for sale and obtaining income, such as the production of tourist handicrafts.
	Natural resources	Other uses of natural resources, such as house cover and fertilizer.
Ecological	Biodiversity maintenance	Maintenance of forest biodiversity for shelter and nesting of animals.
	Water source	Obtaining water for irrigation, general cleaning, bathing, cooking, and human and animal hydration.
	Water purification	Purification of water for consumption, making it flavorless, odorless and suitable for human use.
	Air purification	Air purification and reduction of dust, CO <sup>2</sup> and pollutants.
	Soil protection	Roots prevent soil erosion.
	Maintaining Riverbanks	The forest prevents landslides from the riverbanks.
Social	Climate regulation	Adjusting microclimate, milder temperatures.
	Beauty	Contemplation and appreciation of forest beauty.
	Cultural values	Using the forest to make clothes for typical dances, such as "Bumba meu boi" and making mats for pregnant women to give birth.

Org.: Adapted from Yang *et al.* (2015).

To verify if there were differences between the forest values perceived between the municipalities, the number of times the value cited by the respondents was counted. The differences in the number of forest values per respondent between the municipalities were evaluated using the Kruskal Wallis tests, with subsequent use of the Student-Newman-Keuls test.

Multivariate binary linear regression analyses (R2) were used to analyze whether the independent variables gender, age, years of schooling,

monthly family income (income of all family members per month) and monthly income from *M. flexuosa* commercialization do or do not explain the perception of forest value. In addition, an ANOVA was performed to assess the variability of perception between socioeconomic factors that showed influence. Statistical tests were performed using the BioEstat 5.0 software (AYRES *et al.*, 2007). Significant *F* values and *P* (P-value) values lower than 0.05 were considered significant for analysis.

## Results and discussion

### Perceived forest values

Interviews were conducted with 271 respondents (202 women and 69 men) whose ages ranged from 18 to 89 years. We recorded the perception of 14 forest values, five categorized as economic values, seven ecological values and two social values (Table 2). The economic category is highlighted, in which the forest value: the source of income was most commonly perceived in the three municipalities evaluated, with no significant differences between Tutóia and Barreirinhas ( $P < 0.050$ ) regarding frequency of citation (Table 2). Among the ecological category values, the maintenance of biodiversity was only observed in Barreirinha, while air and water purification were described only in Tutóia (Table 2). No significant differences were observed for the other forest values cited ( $P > 0.050$ ).

We observed that the different categories of perceived values (economic, ecological and social) were similar to those recorded in other conservation units, as in the studies developed by Sodhi *et al.* (2009) in Indonesia, Myanmar, Philippines and Thailand and by Yang *et al.* (2015) in China. Unlike our study, these authors did not verify the prioritization of forest value as a source of income.

**Table 2.** Mean frequency of forest values perceived in Buritizaís in the municipalities of Barreirinhas, Paulino Neves and Tutóia, Maranhão, Brazil.

Forest values	Mean citation of forest values perceived				
	Barreirinhas	Paulino Neves	Tutóia	<i>P</i> -value	
Economic	Food	0.344 ± 0.647 <sup>a</sup>	0.649 ± 0.482 <sup>b</sup>	0.533 ± 0.507 <sup>b</sup>	0.0001
	Household utensils	0.016 ± 0.126 <sup>a</sup>	0.167 ± 0.377 <sup>a</sup>	0.461 ± 0.508 <sup>b</sup>	0.0007
	Wood	0.042 ± 0.202 <sup>a</sup>	0.125 ± 0.334 <sup>a</sup>	0.500 ± 0.511 <sup>b</sup>	0.0007
	Natural resources	0.069 ± 0.254	0.227 ± 0.422	0.000 ± 0.000*	0.1740
	Source of income	0.862 ± 0.375 <sup>a</sup>	0.660 ± 0.479 <sup>b</sup>	0.813 ± 0.397 <sup>a</sup>	0.0070
Ecological	Biodiversity maintenance	0.021 ± 0.144	0.000 ± 0.000*	0.000 ± 0.000*	0.9620
	Water source	0.005 ± 0.073	0.098 ± 0.300	0.188 ± 0.397	0.1960
	Water purification	0.000 ± 0.000*	0.000 ± 0.000*	0.125 ± 0.336	0.5170
	Air purification	0.000 ± 0.000*	0.000 ± 0.000*	0.031 ± 0.177	0.9610
	Soil protection	0.010 ± 0.103	0.020 ± 0.141	0.074 ± 0.267	0.8670
	Maintaining Riverbanks	0.016 ± 0.176	0.039 ± 0.196	0.063 ± 0.246	0.9110
	Climate regulation	0.005 ± 0.073	0.039 ± 0.196	0.156 ± 0.369	0.3900
Social	Beauty	0.016 ± 0.125	0.040 ± 0.198	0.000 ± 0.000*	0.9490
	Cultural values	0.032 ± 0.176	0.000 ± 0.000*	0.000 ± 0.000*	0.9180

Values are expressed as mean response frequency ± SD, analyzed by the Kruskal Wallis test followed by Student Newman-Keuls. Different letters indicate the presence of statistical difference ( $P < 0.050$ ).

\* Forest value not cited.

Org.: Author, 2017.

According to Steel *et al.* (1994) and Sharaunga *et al.* (2015), the work environment and financial dependence on extractivism can lead to a more anthropocentric view of perceived forest values. Thus, for the municipalities evaluated, the extractivism context in which respondents participate could determine a perception of the economic category and prioritization of income source value among them.

## The influence of socioeconomic variables on the perception of forest values

Socioeconomic variables were not related to the perception of forest values in Tutóia and Paulino Neves (Significant  $F < 0.050$ ), whereas in

Barreirinhas gender was related to the perception of food forest value ( $F$ : 0.013;  $R^2$ : 0.075;  $P$ : 0.022) and income from handicrafts was related to the perception of climate regulation ( $F < 0.010$ ;  $R^2$ : 0.140;  $P$ : 0.001).

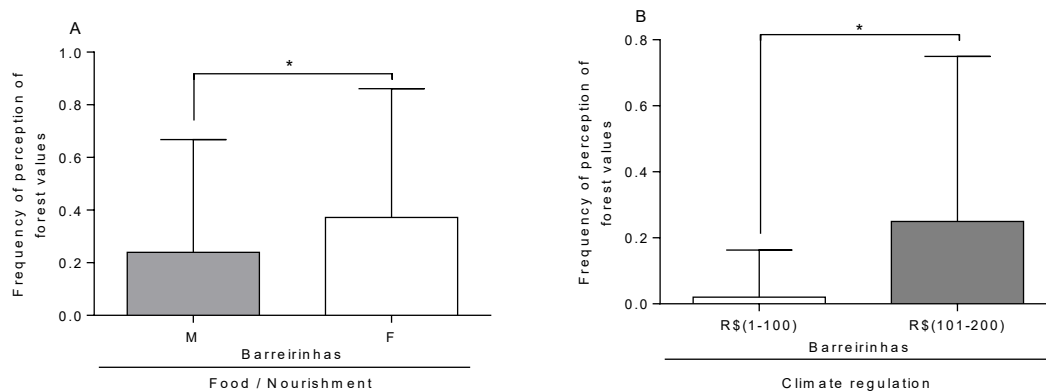
In Barreirinhas, women more frequently mentioned the food forest value than men ( $P < 0.050$ ) (Figure 1A). Conversely, other works, such as studies conducted by Xu *et al.* (2006) and by Allendorf and Yang (2013) in China, stated that men tend to know more about forest values. In addition, these values are more anthropocentric compared to the values perceived by the female gender (MCFARLANE and BOXALL, 2000; SHARAUNGA *et al.*, 2015). In the present study, the higher perception of the food forest value among women may be associated with the fact that they are responsible for preparing food for their families.

We also verified that the monthly income from handicrafts was correlated to the climate regulation value in Barreirinhas ( $p = 0.001$ ) and was higher among those who receive between R\$ 101.00 and R\$ 200.00 reais per month from handicraft sales when compared to those who receive between R\$ 1.00 and R\$ 100.00 reais per month (Figure 1B).

Studies developed by Sodhi *et al.* (2009) and Sharaunga *et al.* (2015) demonstrate the relationship between income from forest derivatives and the perception of the environment. According to Sharaunga *et al.* (2015), the financial benefits obtained from forest derivatives tend to guide perception, mainly for economic category values, while people who obtain higher incomes from non-forest sources have fewer anthropocentric orientations, as they depend less on the forest. These results differ from those observed in the Lençóis Maranhenses region. There was no correlation between income from handicrafts and the perception of economic category values, but there was a correlation with the ecological category.



Figure 1- Evaluation of the influence of socioeconomic factors on perception of forest values in the municipality of Barreirinhas, Maranhão, Brazil.



A: Gender (M: Male and F: female). B: Monthly income from handicrafts. \* and lines indicate significant difference between groups. The data was evaluated by binary variance analysis using ANOVA ( $P < 0.050$ ).

Org.: Author, 2017.

We verified that in Barreirinhas, the income earned from selling products extracted from buriti influenced the perception of the climate regulation value. Respondents who sold the most products reported needing to enter Buritizais frequently to extract resources for their income. In these areas they feel that the climate is milder than in urbanized areas, which could provide the perception of this value among respondents with higher income derived from extractivism.

## Understanding of Protected Areas

The respondents of the three municipalities were asked if Buritizais are Protected Areas (PAs). In the municipality of Barreirinhas, 43.92% (83) of the respondents did not see them as PAs, 25.93% (49) did not know how to answer the question and 30.16% (57) said yes. Among the respondents who stated that the Buritizais are environmental conservation units, 17 did not know why they are PAs, and 29 said that it is due to the presence of

supervisory governmental institutions. The others attributed this status to the presence of the river (8) and the Buritizal (3).

In the municipality of Paulino Neves, 76.00% (38) believed that Buritizais are not PAs; 22.00% (11) did not know how to answer the question and 2% (1) said yes but did not explain why.

In Tutóia, 15.63% (5) affirmed that Buritizais are not PAs, 71.88% (23) did not know how to answer the question and 12.50% (4) said yes. Among those who claimed that Buritizais are PAs, one respondent did not know why they are PAs, one respondent associated their status to the presence of environmental agencies of governmental institutions and two associated it with the protection of the river. None of the respondents in the three municipalities claimed to participate in the management.

It is common for people living in conservation units to know about conservation units (BENNETT and DEARDEN, 2014; YANG *et al.*, 2015). However, our results demonstrated that most respondents did not know that they reside inside one, and those who were aware did not know why it is considered so. This information is similar to that recorded by Xu *et al.* (2006) and Dias *et al.* (2007) regarding the lack of knowledge of residents in these areas. Xu *et al.* (2006) and Vieira and Loiola (2014) associate this deficiency to the lack of communication between inhabitants and managing institutions, which limits the knowledge of the population, as well as their participation in the management of the conservation unit in which they live.

When asked what threatens the Buritizais, 15% (28) of respondents in Barreirinhas reported the extraction of wood; 71% (136) said the extraction of immature leaves from buriti palm trees to manufacture handicrafts that are sold to tourists, 8.46% (16) said the devastation by real estate speculation promoted by hotels, 2.66% (5) said the fires, 1.08% (2) said the drought and 1.80% (2) said the action of birds (buzzards). In Paulino Neves, 38.00% (19) of the respondents attributed threats to burning and devastation (Coivara), 22.00% (11) to the intense extractivism of immature

buriti leaves, 20.00% (10) to natural causes such as water scarcity, lightning, plant aging; 14.00% (7) did not know how to respond, and 6.00% (3) said deforestation for agriculture. In Tutóia, 40.64% (13) attributed this to the practice of Coivara, 28.13% (9) to the extraction of immature buriti leaves, 28.13% (9) to natural causes such as herbivory, water scarcity, plant aging and 3.10% (1) to livestock.

When asked if the Buritizais areas are being reduced 89.43% (169) of the respondents of Barreirinhas affirm that these areas are being reduced, mainly by the death of buritis that are intensely exploited, 8.99% (17) said no and 1.58% (3) did not know how to respond. Some reported that they need to travel to Paulino Neves in order to obtain immature buriti leaves. Similarly, in Paulino Neves 50.00% (25) of respondents affirmed that the Buritizais are being reduced, mainly due to the death of trees promoted by extractivists from Barreirinhas. The other respondents affirmed that Buritizais are being reduced due to the drought occurring at the site (12.00%-6) and 38% (19) reported that there has been no reduction in the Buritizais areas. Such findings show that the traditional management of extractivism aimed at trade is not environmentally sustainably in Barreirinhas and Paulino Neves.

In Tutóia, respondents did not observe a reduction in Buritizais areas. In a study developed by Vieira *et al.* (2016), they verified beliefs about punishment from mystical spirits to those who damage the environment, which contributes to the conservation of Buritizais in this municipality.

## Final considerations

The work environment and financial dependence on extractivism contribute to an anthropocentric view of forest values with the prioritization of the economic category and highlights the forest value as an income

source. Nevertheless, a higher income obtained from selling extracted resources is not a determining factor for the perception of the economic category, in which people who obtain higher incomes from forest resources prioritized ecological perceptions. The influence of the socio-economic profile on the perception is distinct in each group, even though they participate in the same extractivist context.

Residents in environmental conservation units have a poor understanding about the existence of these units and why they are considered so. This contributes to extraction practices that can be environmentally unfeasible, even in environmentally protected areas.

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