

**KNOWLEDGE, USE AND MANAGEMENT *IN SITU* OF LICURI (*SYAGRUS CORONATA*
(MART.) BECC.)**

Ernani Machado de Freitas **LINS NETO**^{1*}; Érica dos Reis **ARAÚJO**¹; Priscyla Maria Silva **RODRIGUES**¹; Jhonathan de Oliveira **SILVA**¹

¹ Universidade Federal do Vale do São Francisco (UNIVASF).

*Autor para correspondência: E-mail: ernani.linsneto@univasf.edu.br

Recebido: 22/02/2023 Aceito: 28/06/2023

Abstract: The aim of this study was to verify the relationships between the forms of use and management adopted by extractivists of the palm *Syagrus coronata* (Mart.) Becc., as well as their knowledge about it, and to relate ethnobotanical parameters to phenotypic traits in a caatinga area located at the Jiboia settlement in Senhor do Bonfim, Bahia. Licuri is considered a resource of high commercial importance for residents of the Jiboia Settlement. Thirty-five interviews were conducted with the extractivists from April to November 2018. Five categories of use were reported, with emphasis on human food, trade and animal feed. There was a significant relationship between the informants' age, oldest people, and the extractivism of *S. coronata*. Women's knowledge was also significant. To evaluate the relationship between the residents of the settlement and the Licuri, semi-structured interviews were applied. Phenotypic characterization was performed with selected *S. coronata* palms in the managed and unmanaged areas. From ethnobotanical and phenotypic data, it was possible to understand the population dynamics and the cultural universe surrounding the use and management of *S. coronata*, a native species from the northeastern semi-arid region of Brazil and currently under searched regarding this last aspect.

Key words: Caatinga, Ethnobotany, Extractivism, Palm trees.

**CONHECIMENTO, USO E MANEJO *IN SITU* DO LICURI (*SYAGRUS CORONATA*
(MART.) BECC.)**

Resumo: Objetivou-se verificar as relações entre conhecimento, uso e manejo do extrativismo da palmeira *Syagrus coronata* (Mart.) Becc. e relacionar parâmetros etnobotânicos a características fenotípicas em uma área de caatinga localizada na região do Assentamento Jiboia em Senhor do Bonfim, semiárido baiano. Foram realizadas 35 entrevistas com os extrativistas do assentamento, ocorrendo entre os meses de abril a novembro de 2018. Foram relatadas cinco categorias de uso, recebendo destaque as categorias alimentação humana, comércio e alimentação animal. Houve relação significativa entre a idade dos informantes, pessoas mais velhas, com a prática do extrativismo do *S. coronata*, bem como o conhecimento das mulheres foi significativamente

maior no tocante ao extrativismo da espécie. O licuri é considerado um recurso de elevada importância comercial para os moradores do Assentamento Jiboia. Para avaliar a relação das pessoas do assentamento Jiboia com o Licuri foram aplicadas entrevistas semiestruturadas. A caracterização fenotípica foi realizada com indivíduos de *S. coronata* selecionados na área manejada e área não manejada. De posse dos dados etnobotânicos e fenotípicos foi possível compreender melhor as dinâmicas populacionais, e o universo cultural entorno do uso e manejo de *S. coronata*, espécie nativa do semiárido nordestino e pouco estudada, quanto este último aspecto.

Palavras-Chave: Caatinga, Etnobotânica, Extrativismo, Palmeira.

CONOCIMIENTO, USO Y MANEJO IN SITU DEL LICURI (*SYAGRUS CORONATA* (MART.) BECC.)

Resumen: El objetivo fue verificar las relaciones entre conocimiento, uso y manejo del extractivismo de la palmera *Syagrus coronata* (Mart.) Becc. y relacionar parámetros etnobotánicos con características fenotípicas en un sitio de caatinga ubicada en la región de asentamiento Ilhamado Jiboia en Senhor do Bonfim, región semiárida de Bahia. Se realizaron 35 entrevistas a extractivistas del asentamiento, ocurridas entre los meses de abril y noviembre de 2018. Se reportaron cinco categorías de uso, con énfasis en alimentación humana, comercio y alimentación animal. Hubo una relación significativa entre la edad de los informantes, personas mayores, con la práctica de extracción de *S. coronata*, así como el conocimiento de las mujeres fue significativamente mayor respecto al extractivismo de la especie. El licuri es considerado un recurso de gran importancia comercial para los habitantes del asentamiento Jiboia. Para evaluar la relación entre las personas del asentamiento y Licuri, se aplicaron entrevistas semiestruturadas. La caracterización fenotípica se realizó con individuos de *S. coronata* seleccionados en las áreas manejada y no manejada. Con los datos etnobotánicos y fenotípicos, fue posible comprender mejor la dinámica poblacional y el universo cultural en torno al uso y manejo de *S. coronata*, especie originaria del semiárido baiano y todavía poco estudiada en cuanto a esta última aspecto.

Palabras clave: Caatinga, Etnobotânica, Extractivismo, Palma.

INTRODUCTION

The effects of human intervention on the environment occupy a prominent place in global debates about the conservation of biodiversity. In this sense, it is necessary to constantly advance in the understanding of the processes related to the ecosystem transformations caused by anthropic actions. Some aspects of the reverberations of this impact can be contemplated in studies aimed at clarifying the dynamics, over a space-time

continuum, of knowledge, use and management of natural resources (Casas et al., 1997; Casas et al., 2006, Lins Neto et al., 2014). In this perspective, Mesoamerica stands out as one of the main regions focused on scientific investigations about the effects of human management, especially in situ, on plant populations and communities (Casas et al., 2006). In order to avoid confusion with the term management, will be employed here the concept used by Casas et al. (2014), for which management is a human activity aimed at transforming or maintaining elements or functions of socioecological systems, starting from a high degree of intentionality. For more information about the Mesoamerican model, see Casas et al. (2006).

Seeking to test Mesoamerican models in other socioecological contexts, studies were conducted in Brazil, especially in the northeast region (Lins Neto et al., 2014). These were aimed at characterizing knowledge, use and management, as well as assessing possible effects of human action and activity on phenotypic and genotypic aspects of perennial plant populations, such as umbuzeiro (*Spondias tuberosa* Arr.), pequi (*Caryocar coriaceum* Wittm.) and babassu (*Attalea speciosa* Mart. ex Spreng) (Lins Neto et al., 2010; Lins Neto et al., 2012; Sousa Júnior et al., 2013; Lins Neto et al., 2013; Campos et al., 2015; Sousa Júnior et al., 2018).

In this sense, another species that fits the model previously described, is the Licuri, *Syagrus coronata* (Martius) Beccari – (Arecaceae). This palm is well distributed, both in dry and wet forest (Sousa et al., 2018); as well as potential for food, ornamental, forage use, highlighting the use of leaves in the production of bags, hats, brooms, dusters (see Campos et al., 2019), in addition to other applications (wax in the manufacture of carbon paper, grease for shoes, furniture and car paint, oil for the production of soaps) (Santos and Santos 2002; Aroucha and Aroucha 2013). The versatility of licuri uses is expressed in the extractive culture of this palm, especially in the state of Bahia (Aroucha and Aroucha, 2013). The economic importance of licuri is evident, especially the use of the leaves of this palm in handicrafts, which has been studied in some human groups, such as the Fulni-ô ethnic group (Rufino et al., 2006, Silva et al., 2006; Campos et al. 2019). However, studying the relationship of people with licuri fruits, characterizing forms of management of the species oriented according to the extraction of this reproductive structure, is still a little contemplated approach. In addition, in view of the environmental changes resulting from the destruction of 'licurizais' by management practices such as deforestation, burning, overgrazing, among others, as Aroucha & Aroucha (2013) warn, understanding the dynamics of these processes

will enable more and more decision-making about the use and management of perennial species of economic importance.

Therefore, the objective of this study was to assess the knowledge and use of *Syagrus coronata* (licuri), as well as to relate them management practices of the species. In addition, we sought to characterize phenotypically licuri individuals, under extractivism, as well as the morphology of their fruits, in order to identify the patterns of this part of plant that is available to the community.

METHODOLOGY

Study area

The study was conducted in the Jiboia settlement, located in the municipality of Senhor do Bonfim, Bahia. The settlement was created in 2009 and has an area of 1,045.44 ha, where 52 families reside, distributed in two agrovillages: the agrovillage 1 (10°32'54.7"S-40°11'12.9"W) with 36 families and the agrovillage 2 (10°32'0.8"S-40°12'47.2"W) with 16 families, distance of approximately 4 km from each other. The legal reserve near the settlement is approximately 209 ha (Alves et al., 2014). The area of vegetation is of the type Caatinga sensu stricto. It is a typical rural community based on agricultural activities. It should be noted that the vegetation is composed of an abundance of *S. coronata*, a species considered cultural, artisanal and food heritage according to the municipal law nº 1.383/16 (Senhor do Bonfim, Bahia, 2016). In order to supplement the income, residents work in the extraction and marketing of licuri fruits. Products from agricultural and extractive activities are traded in open markets, mainly in the city of Senhor do Bonfim-BA (Fig. 1).

Ethnobiological data collection

After informal conversations and visits to all the settlement's homes, thirty-five people aged 19 to 63 years (one representative from each household out of 132 residents of the two rural agrovillages) agreed to participate. It is noteworthy that only five people from the second agrovila participated in the research, and for this reason, we decided, for the purpose of analysis, to group them into agrovila 1. Information on the knowledge, use and management of this palm tree was obtained based on semi-structured interviews with the residents of the Jiboia settlement. Specific questions were asked about their knowledge on

the palm and the use they make of it, for example: What uses are attributed to licuri? What are the ways of use? How did you learn and pass this knowledge? Questions were also asked about the practices of selection, collection and commercialization of the licuri. Among those residing in the house, who are the ones involved in collecting? Is there a distinction between licuri individuals? If so, which factor (s) is it related to? Do these differences affect the selection of individuals for collection? Are there local preferences for collection? If so, which parameter (s) are these preferences associated with (distance to collection areas, attractive morphological characteristics, organoleptic aspects, among others)? The fruits are traded (through positive answers, questions about the licuri trade were deepened, for example, values involved in the trade, amount of the resource extracted per collection event, etc.)? The ethnobiological research was performed from April to November 2018 and the study was approved by the Ethics Committee on Research with Human Beings of the Federal University of Vale do São Francisco (UNIVASF) (CAAE: 80624417.0. 0000.5196). In order to assess the forms of management used locally, we considered the models of in situ management of studies developed in the Mesoamerican region based on Casas et al. (1997) and Casas et al. (2007).

Phenotypic characterization of *Syagrus coronata* (Mart.) Becc.

To characterize the phenotypic variability of fruits of *S. coronata*, 1200 mature fruits of licuri were collected from 30 individuals in each area (managed and natural). According to Silva et al. (2019) the areas managed near the agrovillages are open spaces for the development of agricultural activities, while the natural areas are environments with an apparent absence or low anthropic interference. The characteristics of each individual were measured, as follows: total height, diameter at breast height (DBH) and diameter at soil height (DSH). For biometric analysis of fruits, the variables measured were: length (longitudinal direction), width, thickness (transverse direction) and weight. The length, width and thickness of the fruits were measured with a pachymeter with a precision of 0.01 mm (Pantec® brand), and the weight of the fruits was obtained using a precision analytical balance (model AUW220D).

Data analysis

Comparative analysis of informants' knowledge was performed from five quantitative measures (Byg and Baslev, 2001): informant diversity value (IDV), informant equitability

value (IEV), usage diversity value (UDV), Consensus Value for Collection Location (CVCL), and Consensus Value for Usage Types (CVUT) (Table 1). For this analysis we considered age classes (adults ≥ 40 and <40 years old) and gender (Byg and Baslev, 2001; Monteiro et al., 2006). In order to verify the significance of the differences between the indices, the normality of the data was tested (Shapiro-Wilk test). Given the normality of the data, we used ANOVA for unbalanced data in further tests. Once the normal distribution of data was not observed, a non-parametric test (Kruskal-Wallis at 5% probability) was used. All analyzes were performed using the R version 4.2.2 software (R Core Team 2022).

In order to evaluate the factors that influence the extractivism of licuri, generalized linear models (GLM) were built using Poisson distribution, having as explanatory variables (independent) age (two class: 46 until 60 years and below 30 years) and number of uses, and as response variable (dependent) the management intensity (determined by citing the amount of fruit collected per collection event). Proceeded with the simplification of the variables that were not considered significant for the model ($p > 0.05$), as well as verification of the residuals. The analyses were performed using the software R version 4.2.2 (R Core Team 2022).

Principal Component Analysis (PCA) was performed from seven (7) phenotypic measurements of *S. coronata* from the managed and natural area. This ordination used Euclidian distances to generate a biplot with two first axes of trait variation, allowing the detection of trade-offs or co-variation of traits between habitats. The scores from the first axis (axis with major explanation) were used to perform an analysis of variance (ANOVA). In this analysis the managed and natural area were used as explanatory variable. The analyses were developed using the software R 4.2.2 (R Core Team 2022).

RESULTS

Knowledge and use of licuri

Among the 132 residents in the settlement, 35 participated in the survey, of which 25 women (71%) and 10 men (29%). From the interviews, it became evident that the licuri extractivism is a practice mainly performed by women. The licuri is a palm tree widely known in the Jiboia settlement. All interviewees know and use the species. Eleven types of use were recorded (Table 3), distributed into 5 categories (Table 3). Of these uses, licuri milk

and fruit trading were cited by all informants. Licuri fruit has a huge variety of uses in the Jiboia settlement, among which the consumption as human food of different forms, such as sweets, licuri oil and licuri milk.

Licuri leaves are mainly used for construction (3% of informants cited this use), as part of the coverage of some homes, bathrooms, hen houses and fencing (Fig. 2). Women showed greater knowledge of the diversity of use compared to men (Table 2). Comparing the total usage diversity values (UDV) between women (0.306) and men (0.208), significant differences were found (Kruskal-Wallis $\chi^2 = 17.3$; $p < 0.003$). The difference remains when we consider the UDVs of women older than 40 years (0.315) compared to men of the same age (0.208) (Kruskal-Wallis $\chi^2 = 33.9$; $p < 0.000$).

The human food category obtained the highest number of citations (Table 3) with a UDV equal to 0.443, followed by commercial use (0.430), animal feed (0.063) and construction (0.038). For this last category of use, the leaves are used for the construction of ranches (Fig. 2).

Licuri milk was an important type of use since it was the most reported (CVUT = 3.318) (Table 3). This is associated with the wide application of this type of use in the preparation of traditional recipes, such as licuri rice, especially during the Holy Week, a Catholic celebration that takes place in April.

The licuri fruit is traded by most of the informants from Jiboia settlement. The value obtained from the sale of licuri fruits can reach US\$ 7.50/week during the period of greatest availability of the resource.

Fruit management and extractivism of licuri

The managed areas showed the highest consensus value for the collection location (CVCL) (Table 3). This preference is associated with the daily development of other activities in these locations (mainly agriculture and livestock). Access to collection areas that are closer to homes was mentioned in 91.43% of the reports as the determining factor in resource collection in managed areas, followed by fruit availability per plant (65.71%) and fruit size (20% of reports). Regarding the management time in the studied areas, most informants stated that *S. coronata* has existed in the region for a long time. Prior to the emergence of the settlement, many informants were already exploring the resource in these areas. Regarding the forms of management, local extractive practices are well adjusted to the Mesoamerican models of non-selective in situ management. This practice is an

indication that licuri individuals are indiscriminately tolerated in open areas for the development of agricultural activities. It was also verified, only for the open areas, that the individuals are protected (“zelados”), especially regarding the beetle that parasites the licuri coconuts (Silva et al., 2019). The difficulty to move in closed areas was pointed out by all respondents as one of the main reasons for little licuri extractive activity in vegetation areas. Therefore, accessibility, as already highlighted, was the determining factor. When analyzing the variables related to the intensity of fruit extraction, it was found that it is an activity related to men and women concentrated in the age group of 46 to 60 years (Table 4), who have a great knowledge of uses attributed to licuri. It also identified a negative relationship in the collection intensity with respect to people under the age of 30 years (Table 4).

Phenotypic pattern of licuri individuals in managed and natural areas

Principal Component Analysis (PCA) of the two (2) *S. coronata* populations showed that the PC1 and PC2 cumulative explained variance of 94.39% of the data (Table 5). The phenotypic characteristics of *S. coronata* in natural habitat showed greater measures when compared to the managed habitat (Fig. 3).

Plants in managed habitat were located towards the left side from first axis, which is mainly related to higher diameters at both breast height and ground level (Fig. 3). On the other hand, plants in natural habitat were located mostly toward the right side from first axis, which is related to more vigorous fruits, i.e., length, weight, thickness and width (Fig. 3). According to ANOVA results, the type of habitat significantly affected the phenotypic characteristics of *S. coronata* ($F = 21.34$; $p < 0.001$). This evidence is corroborated by the fact that the main form of management exercised in the locality is non-selective in situ management and, in this way, results in the indiscriminate tolerance of licuri individuals. However, it is clear that individuals in natural areas are of greater stature when compared to those in open areas, the latter being a facilitating characteristic of the collection.

DISCUSSION

Knowledge and use of licuri

In general, the relevance of some palm trees has been attributed to the multiplicity of uses of the species (Balick, 1984; Byg and Baslev, 2001). Informants from Jiboia

settlement, despite knowing other ways of using the licuri, focus attention on the commercial use of the fruit. In the study by Campos et al. (2015), many uses were attributed to the babassu palm (*Attalea speciosa*). However, the number of uses was also much lower than the known ones. These authors also emphasize that the commercial use is the most recurrent. Analogous scenario was observed in the Jiboia settlement. Despite the small number of uses, the licuri is heavily exploited in the settlement. Considering the selectivity and capacity of our memory, we store and use (retrieve) more information that offers us a greater survivability (Mace & Jordan 2011). Thus, episodic recollections may be more adaptive (Silva et al., 2019) and focusing on the small number of uses might be the best strategy. This aspect may explain that despite the versatility of uses attributed to licuri, the residents of the settlement can only remember a small number. Another issue to consider is the influence of the commercial use of the licuri, as it enhances the fitness not only of people in the settlement but also of the species with respect to other natural resources.

The knowledge structure about the licuri needs to be considered as it helps in understanding the relationship of people with the resource. In this sense, the distribution of knowledge between genders is one of the main factors evaluated. Specifically for palm studies, Martins et al. (2013) found in their study that women, due to their greater involvement with resources, naturally have a greater knowledge of uses when compared to men. This result is also evidenced in the relationship of people with the licuri in the Jiboia settlement, in which women show a greater diversity of use, especially those over 40 years old, when compared to men of the same age. This result is associated with the fact that women are directly involved in activities such as preparing traditional recipes and extracting coconuts for sale. In turn, men demonstrated a lower diversity of uses, justified by the fact that these are restricted to another point of the extractive chain, specifically the activities of licuri commercialization, such as transportation and negotiations in street markets. The number of uses and age positively influenced the amount of resources extracted, establishing a certain logic, since the greater the uses attributed to resources, the greater the access to them (Albuquerque et al., 2019). In addition, the licuri extraction activity in the community is attributed to women over 40 years old, which resulted in the influence of age on the practice of extraction. In a recent study by Campos et al. (2019), education was the factor that most influenced the knowledge of people who use the licuri for art creations. It is noteworthy that the cited author analysed the influence of socioeconomic variables on knowledge and non-extractive activity and that the conditions of use of the licuri by the

people studied by Campos et al. (2019) are different, being restricted to the use of leaves only for craft creations.

In the study by Araújo and Lopes (2011), the use of the leaves of the palms *Attalea speciosa* and *Oenocarpus bacaba* for the construction of roofs is mentioned. Such use was also verified for licuri leaves in the Jiboia settlement. In both studies, this is explained by the great availability of the resource and the low economic cost of this practice. However, in the Jiboia settlement the preference for use is directed to the fruits, especially due to the trade associated to this resource, similar to that observed by González-Pérez et al. (2012) for the extraction of babassu. However, there are regions where the use of licuri predominantly concentrates on the leaves, as mentioned above. This fact was found by Andrade (2016) in the Raso da Catarina Ecoregion, where artisans use the licuri leaves to comply with the norm 191/2008, established by IBAMA/ICMBio, which determines the removal of the leaves and fruit without the felling of the plant.

As discussed previously, the fruits of the licuri are traded at fairs and markets in the city, which is the main form of supplementing the families' income. In the study by Chaves et al. (2017), the act of trading the babassu is characterized as an important increase in family income. The commerce category also was significant in a study about the extraction of pequi (Sousa Júnior et al., 2013) and umbu (Lins Neto et al., 2010; Lins Neto et al., 2014). This economic relationship between people and plants is a major factor in maintaining the resource. Thus, for the extractive practice to be maintained over time, the trade associated with the resource is shown to be the most relevant factor when compared to the consumption of human food, as people's consumption needs change over time, while the market practice persists.

Fruit management of licuri

In the studied community, the collection of licuri occurs preferentially in managed areas, where the larger and better tasting fruits are the most important characteristics for the maintainers, when compared to the populations of licuri palms from unmanaged areas. These results have also been observed for other perennials species in dry forests (Casas et al., 1999; Rodrigues Arévalo et al., 2006; Lins Neto et al., 2010). In a study in the Araripe Forest, Sousa Júnior et al. (2013) obtained a similar result for pequi (*C. coriaceum*) collected in managed and open areas, the resource areas that presented the most productive individuals, with larger and healthier fruits. Because of these characteristics, these trees

receive greater attention from some people, who adopt the term "zelado" to refer to this special attention given to the pequi trees. The term "zelado" was also recorded in the Jiboia settlement and refers to the care of the environment in which the licuri palms occurred.

Among the forms of in situ management, tolerance is the most prominent in the settlement. According to the informants, the licuri palm is preserved whenever the vegetation is cleared for pasture formation. The residents of the settlement justify the permanence of the licuri by explaining that they not only do not interfere in farming practices, but also provide fruits for community consumption and, above all, marketing. A similar situation was observed by studies conducted with other species in the northeast region, such as umbu (Lins Neto et al., 2010, 2014), pequi (Sousa Júnior et al., 2012) and babassu (Campos et al., 2015), as well as by several other studies conducted in the mesoamerica region (Casas et al., 2016; Avendaño et al., 2006). Thus, it is evident that for the case of licuri, the management is in situ and not selective.

As previously discussed, the present study detected characteristic that are similar to other studies conducted in the northeast region of Brazil with perennial species of economic importance (Lins Neto et al., 2010; Sousa Junior et al., 2013; Campos et al., 2015). Beyond the local economic value, the studies are more similar to each other because they were conducted in rural communities, where the extractive practice is the main way to obtain the resource and accessibility is a determining factor for in situ management, which is conducted in a non-selective way (indiscriminate tolerance) (Lins Neto et al., 2014; Casas et al., 1997). In all the cases previously mentioned, knowledge is well distributed within the community (Lins Neto et al., 2010; Sousa Júnior et al., 2013; Campos et al., 2015), a factor that favors resilience. In this study, specifically, age influenced on the extractive practice of licuri, an activity that is mostly conducted by people over forty years old. Although plants are indicated for a large number of uses, basically the commercialization of the targeted parts, which in most cases are fruits and their derivatives, exemplified by pequi oil (Sousa Júnior et al., 2013) and babassu (Campos et al., 2015), is the main factor that delineates the relationship of people with these resources. Another aspect that brings together studies with palm trees is the use of leaves in construction and art crafts (Araújo and Lopes, 2012; Campos et al., 2015, 2019), which also generates an excellent source of income, as highlighted by Andrade et al. (2015) in her study conducted in Raso da Catarina. Despite some variations in the results of other studies for which socioeconomic factors, such as gender, age and residence time, may influence knowledge and use (Araújo and Lopes 2012), it is clear that the

relationship between people and plant species of economic importance are very similar. By evaluating the factors influencing the intensity of food plant management, Gonzales-Insuasti et al. (2008) concluded that the strongly managed species in the areas studied by the authors are those found in communal areas where there is a long history of consumption and commercial use of these resources. Also according to Gonzales-Insuasti et al. (2008), distance, i.e. accessibility, and productivity were the determining factors for the management of plants that have commercial importance.

Final considerations

The licuri has a great economic and cultural importance for the Jiboia settlement, and this can be verified by the relevance of the trade category, a key factor for the maintenance and distribution of knowledge among people. Regarding knowledge and evenness of use, it was concluded that women older than 40 years have greater knowledge. It was also observed that the people of the settlement prefer to collect the licuri in managed areas, since in these environments the individuals present the most interesting phenotypic characteristics concerning the extractive practices. The case of licuri, as well as other species of economic value, fit, with certain exceptions, approaches the maximum return model (Albuquerque et al. 2019). In that sense, among the forms of in situ management, tolerance is the most prominent in the Jiboia settlement, where the licuri palm is preserved whenever the vegetation is cleared for pasture formation, influencing the maintenance of the activity. In most of the previously described studies, extractive practices are mainly conducted by women, who manage the resource in situ, tolerating individuals indiscriminately; the main collection sites are accessible areas, not used much, despite having a versatility of uses, concentrating on commercial use. Completing these shared characteristics, these species present low functional redundancy, but high resilience, conferred to them by the high local economic value. This set of characteristics demonstrates an type of equivalence of these species, which perform the same socioecological function, however in different locations. Thus, we suggest to future studies to test the hypothesis, named for us, of “socioecological equivalence” to try explain the possible pattern observed in studies conducted with perennial species of high local economic value. It is noteworthy that the relationship observed here is specifically given to studies developed in the northeastern semiarid region of Brazil, but seems to repeat in other regions of Brazil (Santos et al., 2009; Araújo et al., 2012; Martins et al., 2014; Oliveira et al., 2017). However, it is necessary to broaden the perspective to evaluate in detail the hypothesis proposed, but not

yet tested, here, ascertaining whether this pattern is consistent even in different socioecological conditions.

If this pattern is confirmed, actions aimed at the conservation of these species will be more efficient, since the understanding of the pattern of knowledge and use will subsidize more accurate and adequate interventions. Understanding the factors related to the selection and collection of these extractive target resources will also be useful in genetic improvement programs and projects aimed at enhancing the extraction practice, especially by making it more sustainable. However, future studies need to be conducted in different socioecological systems to verify if there are changes in these observed patterns and if the hypothesis of socioecological equivalence is confirmed.

ACKNOWLEDGEMENTS

We are grateful to the Postgraduate Program in Health and Biological Sciences at the Universidade Federal do Vale do São Francisco (UNIVASF). We are grateful to all of the residents of rural community of Jiboia settlement. This study was partially financed by the Coordination for the Improvement in Higher Education Personnel - Brazil (CAPES) Finance Code 001.

TABLES:

Table 1. Measures of use and local knowledge calculated for *Syagrus coronata* (Mart.) Becc. (See Byg & Baslev 2001; Monteiro *et al.* 2006).

Index	Calculation	Description	Reference
Interviewee diversity value (ID) $ID = U_x/U_t$	ID, number of use-citations by a given informant (U_x) divided by the total number of uses (U_t).	Measures how many interviewees used a given species and how this knowledge is distributed among the interviewees.	Byg and Baslev (2001)
Interviewee equitability value (IE) $IE = ID/ID_{max}$	IE, diversity value (ID) divided by the highest value diversity index found (ID_{max}).	Measures the degree of homogeneity of the interviewee's knowledge.	Byg and Baslev (2001)
Consensus value	CTU, number of times	Measures the degree	Monteiro <i>et al.</i>

of use types (CTU) = (TU/Ut)/S	in which a given use is reported (TU) divided by the number total of uses (Ut). This value is then divided by the types of use separated within each category (food, coal, firewood, etc.)(S).	of concordance among the interviewees in regards to the uses of a given species	(2006)
Consensus value for the collection site (CCS) CCS = Sx/St	CCS, number of times that a certain area (managed area and native vegetation) was mentioned (Sx) divided by the total number of citations for all the areas (St).	Measures the degree of concordance among the interviewees in regards to the areas where the species is collected.	Monteiro et al. (2006)
Use–diversity value (UD) UD = Ucx/Uct	UD, the number of indications registered for each category (food, construction, fuel, etc.) (Ucx) divided by the total number of indications for all of the categories (Uct).	Measures the importance of the use–categories and how they contribute to the local use value.	Byg and Baslev (2001)

Table 2. Quantitative measures of knowledge about *Syagrus coronata* (Licuri) in the Jiboia settlement.

Total number of interviewees	35
Types of use	11
Diversity Value of the informant (ID)	Average ± Standard Error
ID total	0.267 ± 0.110
ID total for women	0.306 ± 0.116
ID for women <40 years–old	0.299 ± 0.140
ID for women ≥40 years–old	0.315 ± 0.081

ID total for men	0.208 ± 0.071
ID for men <40 years–old	0.208 ± 0.045
ID for men ≥40 years–old	0.208 ± 0.102
Equitability value of the informant (IE)	Average ± Standard Error
IE total	0.457 ± 0.189
IE total for women	0.524 ± 0.199
IE for women <40 years–old	0.357 ± 0.122
IE for women ≥40 years–old	0.512± 0.239
IE total for men	0.540 ± 0.139
IE for men <40 years–old	0.357 ± 0.076
IE for men ≥40 years–old	0.357 ± 0.175

Table 3. Usage Diversity Value (UDV), Consensus Value for Usage Types (CVUT) and Consensus Value for Collection Location (CVCL) for informants in the Jiboia settlement.

Use Categories	Citation	UDV
Human food source	35	0.443
Commerce	35	0.430
Animal feed	5	0.063
Construction	3	0.038
Technology	2	0.025
Uses	Citation	CVUT
Licuri milk	35	3.318
Fruit (commerce)	34	3.091
Sweets	16	1.455
Fruit (<i>in natura</i>)	11	1.000
Licuri oil	5	0.455

Cattle feed	4	0.364
House Coverage (leaves)	2	0.182
Ranch building (leaves)	1	0.091
Ceramics Manufacturing	1	0.091
Broom Manufacturing	1	0.091
Chicken Feed	1	0.091
Collection sites	Citation	CVCL
Managed areas	35	0.875
Native vegetation	5	0.125

Table 4. Effects of socioeconomic and cultural variables on the extraction intensity of the fruits of *Syagrus coronata* L.

Explanatory Variables	Estimate	STD error	Z value	P
Intercept	2.90259	0.09216	31.497	< 2e-16***
Age_class 46-60	0.18061	0.07408	2.438	0.014769*
Age_class below 30	-0.37460	0.10377	-3.610	0.000306***
Number of uses	0.14101	0.02281	6.181	6.37e-10***

Table 5. Eigenvalues and contributions of the main components of the PCA.

Component	Eigenvalues	% of variance	Cumulative %
PCA1	19,255	75,375	75,375
PCA2	4,858	19,018	94,393
PCA3	1,270	4,971	99,364

FIGURES:

Figure 1. Map of the Jiboia settlement, highlighting agrovillages 1 and 2 (4km distance between them) (font of figures: IBGE cidades – 2010; GoogleEarth).

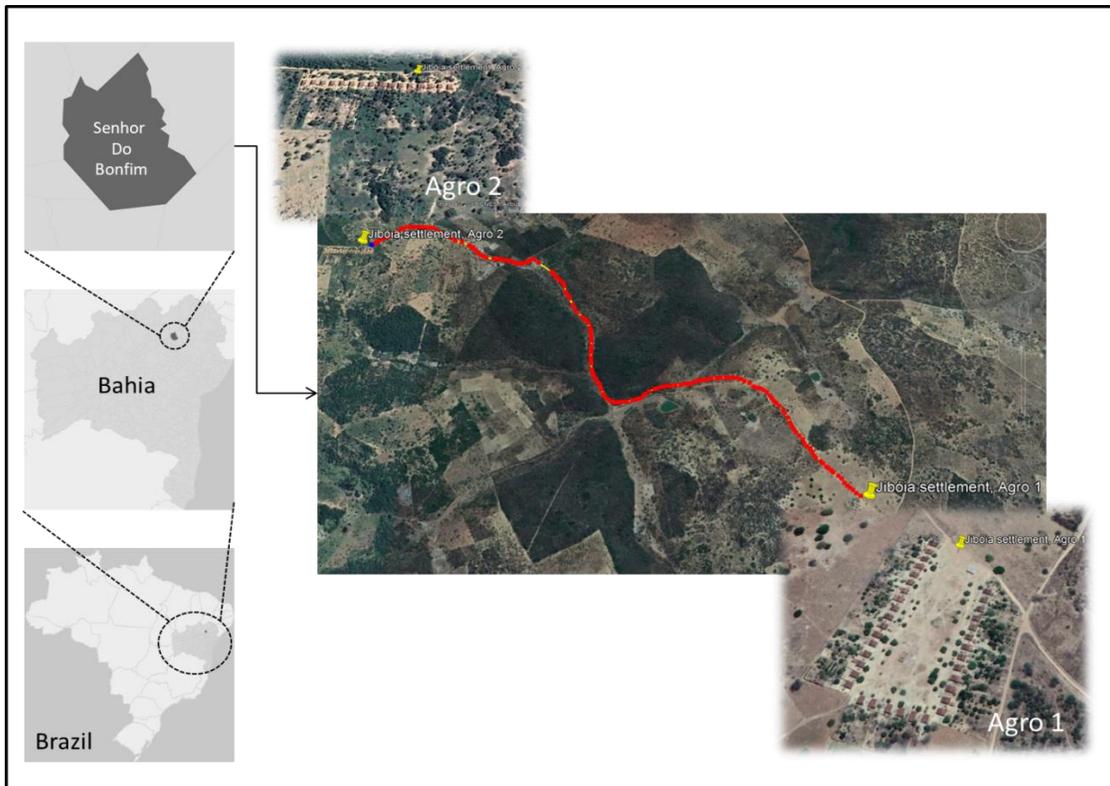
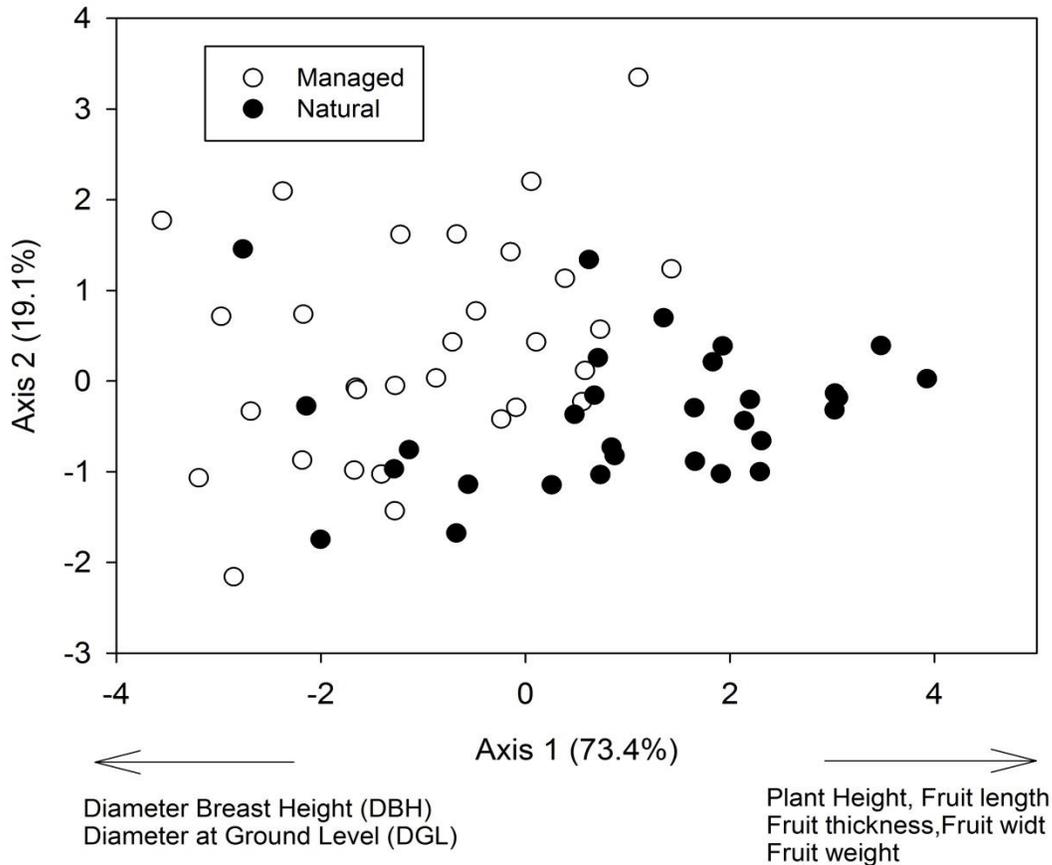


Figure 2. Constructions made from the leaves of *Syagrus coronata* (Licuri). Ranch made with Licuri leaves to provide shelter to animals (A) and a shelter made from licuri leaves (B).



Figure 3. Principal components analysis (PCA) of the phenotypic characteristics of *S. coronata*.



REFERENCES

Albuquerque, U.P.; de Medeiros, P.M.; Ferreira Júnior, W.S.; Silva, T.C.; Silva, R.R.V.; Souza, T.G. Social-Ecological Theory of Maximization: Basic Concepts and Two Initial Models. *Biol Theory* 14, 73–85, 2019.

Alves, V.P.; Santos, D.B.; Silva, A.P.S. Análise dos recursos hídricos no assentamento Jiboia, município de Senhor do Bonfim-BA. *Revista Ouricuri* 4: 1-31, 2014.

Araújo, F.R.; Lopes, M.A. Diversity of use and local knowledge of palms (Arecaceae) in eastern Amazonia. *Biodiversity and Conservation* 21(2): 487-501, 2012.

Andrade, W.M.; Ramos, M.A.; Souto, W.M.S.; Bento-Silva, J.S.; Albuquerque, U.P.; Araújo, E.L. Knowledge, Uses and Practices of the Licuri Palm (*Syagrus Coronata* (Mart.) Becc.) around Protected Areas in Northeastern Brazil Holding the Endangered Species Lear's Macaw (*Anodorhynchus leari*). *Tropical Conservation Science* 8(4): 893-911, 2015.

Byg, A.; Balslev, H. Diversity and use of palms in Zahamena, e astern Madagascar. *Biodiversity & Conservation* 10(6): 951-970, 2001.

Campos, J.L.A.; Silva, T.L.L.; Albuquerque, U.P.; Peroni, N.; Araújo, E.L. Knowledge, use, and management of the Babassu Palm (*Attalea speciosa* Mart. Ex Spreng) in the Araripe region (Northeastern Brazil). *Economic Botany* 69(3): 240-250, 2015.

Campos, J.L.A.; Lima Araújo, E.L.; Gaoue, O.G.; Albuquerque, U.P. Socioeconomic factors and cultural changes explain the knowledge and use of Ouricuri Palm (*Syagrus coronata*) by the Fulni-ô Indigenous People of Northeast Brazil. *Economic Botany* 1-13, 2019.

Casas, A.; Caballero, J.; Mapes, C.; Zárata, S. Manejo de la vegetación, domesticación de plantas y origen de la agricultura em mesoamérica. *Boletín de la Sociedad Botánica del México* 61: 31-47, 1997.

Casas, A.; Caballero, J.; Valiente-Banuet, A.; Soriano, J.A.; Dávila, P. Morphological variation and the process of domestication of *Stenocereus stellatus* (Cactaceae) in Central Mexico. *American Journal of Botany* 86(4): 522-533, 1999.

Casas, A.; Pickersgill, B.; Caballero, J.; Valiente-Banuet, A. Ethnobotany and domestication in xoconochtli, *Stenocereus stellatus* (Cactaceae), in the Tehuacán Valley and la Mixteca Baja, México. *Economic botany* 51(3): 279-292, 1997.

Chaves, M.E.; Bastos, E.M.; Neto, J.R.A.; Santos, K.P.P.; Vieira, F.J.; Barros, R.F.M. Aspectos etnobotânicos da palmeira babaçu (*Attalea speciosa* Mart. Ex Spreng.) em comunidades extrativistas no Piauí, nordeste do Brasil. *Gaia Scientia* 11(3): 196-211, 2017.

Franco, E.A.P.; Barros, R.F.M. Uso e diversidade de plantas medicinais no Quilombo Olho D'água dos Pires, Esperantina, Piauí. *Revista Brasileira de Plantas Medicinai*s 8(3): 78-88, 2006.

González-Pérez, S.E.; Coelho-Ferreira, M.; Robert, P.D.; Garcés, C.L.L. Conhecimento e usos do babaçu (*Attalea speciosa* Mart. e *Attalea eichleri* (Drude) AJ Hend.) entre os Mebêngôkre-Kayapó da Terra Indígena Las Casas, estado do Pará, Brasil. *Acta Botanica Brasilica* 26(2): 295-308, 2012.

Lins Neto, E.M.F.; Peroni, N.; Albuquerque, U.P. Traditional knowledge and management of Umbu (*Spondias tuberosa*, Anacardiaceae): na endemic species from the semi-arid region of Northeastern Brazil. *Economic Botany* 64(1): 11-21, 2010.

Lins Neto, E.M.F.; Peroni, N.; Maranhão, C.M.C.; Maciel, M.I.S.; Albuquerque, U.P. Analysis of umbu (*Spondias tuberosa* Arruda (Anacardiaceae)) in different landscape management regimes: A process of incipient domestication? *Environ Monit Assess* 184(7):4489-99, 2012. doi: 10.1007/s10661-011-2280-7. Erratum in: *Environ Monit Assess*. 2012.

Lins Neto, E.M.F.; Oliveira, I.F.; Britto, F.B.; Albuquerque, U.P. Traditional knowledge, genetic and morphological diversity in populations of *Spondias tuberosa* Arruda (Anacardiaceae). *Genetic Resources and Crop Evolution* 60:1389–1406, 2013.

Lins Neto, E.M.F.; Peroni, N.; Casas, A.; Parra, F.; Aguirre, X.; Guillén, S.; Albuquerque, U.P. Brazilian and Mexican experiences in the study of incipient domestication. *Journal of Ethnobiology and Ethnomedicine* 10:33, 2014.

Mace, R.; Jordan, F.M. Macro-evolutionary studies of cultural diversity: A review of empirical studies of cultural transmission and cultural adaptation. *Philosophical Transactions of the Royal Society B: Biological Sciences* 366(1563): 402-411, 2011.

Macía MJ (2004) Multiplicity in palm uses by the Huaorani of Amazonian Ecuador. *Botanical Journal of the Linnean Society* 144(2): 149-159.

MacArthur, R.H.; Pianka, E.R. On optimal use of a patchy environment. *The American Naturalist* 100(916): 603-609, 1966.

Martins, R.C.; Filgueiras, T.S.; Albuquerque, U.P. Ethnobotany of *Mauritia flexuosa* (Arecaceae) in a maroon community in central Brazil. *Economic Botany* 66(1): 91-98, 2012.

Martins, R.C.; Filgueiras, T.S.; Albuquerque, U.P. Use and diversity of palm (Arecaceae) resources in central western Brazil. *The Scientific World Journal*, (3):942043, 2014. DOI: <http://dx.doi.org/10.1155/2014/942043>.

Monteiro, J.M.; Albuquerque, U.P.; Lins Neto, E.M.F.; Araújo, E.L.; Amorim, E.L.C. Use patterns and knowledge of medicinal species among two rural communities in Brazil's semi-arid northeastern region. *Journal of Ethnopharmacology* 105(1-2): 173-186, 2006.

Oliveira, R.L.C.; Scudeller, V.V.; Barbosa, R.I. Use and traditional knowledge of *Byrsonima crassifolia* and *B. coccolobifolia* (Malpighiaceae) in a Makuxi community of the Roraima savanna, northern Brazil. *Acta Amazonica* 47(2): 133-140, 2017.

Pinheiro, C.U.B.; Santos, V.D.; Ferreira, F.R.R. Usos de subsistência de espécies vegetais na região da baixada maranhense. *Amazônia: Ciência & Desenvolvimento* 1(1): 235-250, 2005.

R Core Team (2022) R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>.

Rodríguez-Arévalo, I.; Casas, A.; Lira, R.; Campos, J. Uso, manejo y procesos de domesticación de *Pachycereus hollianus* (FAC Weber) Buxb. (Cactaceae), en el Valle de Tehuacán-Cuicatlán, México. *Interciencia* 31(9): 677-685, 2006.

Rufino, M.U.D.L.; Costa, J.T.D.M.; Silva, V.A.D.; Andrade, L.D.H.C. Knowledge and use of ouricuri (*Syagrus coronata*) and babaçu (*Orbignya phalerata*) in Buíque, Pernambuco State, Brazil. *Acta Botanica Brasilica* 22(4): 1141-1149, 2008.

Silva, R.H.; Ferreira Júnior, W.S.; Medeiros, P.M.; Albuquerque, U.P. Adaptive memory and

evolution of the human naturalistic mind: Insights from the use of medicinal plants. PLOS ONE 14(3): e0214300, 2019.

Sousa Júnior, J.R.; Albuquerque, U.P.; Peroni, N. Traditional Knowledge and Management of *Caryocar coriaceum* Wittm. (pequi) in the Brazilian Savanna northeastern Brazil. Econ Bot 67:225–233, 2013.

Sousa Júnior, J.R.; Collevati, R.G.; Lins Neto, E.M.F.; Peroni, N.; Albuquerque, U.P. Traditional management affects the phenotypic diversity of fruits with economic and cultural importance in the Brazilian Savanna. Agroforestry Systems 92:11–21, 2018.