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Matheus Gabriel Lopes Botelho[1] | Alfredo Kingo Oyama Homma[2]
Antônio José Elias Amorim de Menezes[3] | Maria da Cruz Chaves Lima Moura[4]
Ana Cláudia Caldeira Tavares-Martins[5]

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[1] PhD student in Environmental Sciences (UFPA).
Belém – PA, Brazil.
Email: math.botelho2194@gmail.com

[2] PhD in Applied Economics (UFV).
Researcher at Embrapa Amazônia Oriental.
Visiting Professor at the University of the State of Pará.
Belém – PA, Brazil.
E-mail: alfredo.homma@embrapa.br

[3] PhD in Family Agricultural Production Systems (UFPEL).
Researcher at Embrapa Amazônia Oriental,
Belém – PA, Brazil.
E-mail: antonio.menezes@embrapa.br

[4] PhD in Phytotechnics (UFV).
Professor at the Federal University of Maranhão.
São Luís – MA, Brazil.
E-mail: maria.moura@ufma.br

[5] PhD in Botany (IP/JBRJ).
Professor at the University of the State of Pará.
Belém – PA, Brazil.
Email: tavaresmartins7@gmail.com

ABSTRACT

This article seeks to carry out an economic evaluation of production systems with a focus on extractive and managed collection of bacuri fruit (Platonia insignis Mart.) in selected properties of small producers in the Mesoregion of Marajó. The research was carried out in the municipalities of Soure, Salvaterra, Cachoeira do Arari and Ponta de Pedras. The methodological procedures were based on a quali-quantitative analysis. Semi-structured questionnaires were applied to 52 small bacuri producers. According to the results, most of the interviewees have areas smaller than 1 hectare (ha) (55,8%), which configures the greater use of small areas and the mini-foundry process that is taking place in the Mesoregion of Marajó. As for the typology of production systems, 5 types were found: bacuri and roça; bacuri and fruit trees; bacuri and fishing; bacuri and pigs; and bacuri and social benefits. The production systems attributed to the group of bacuri and fruit trees obtained an Added Value of R$ 21.471,29/year. The group based on social benefits reached the lowest value for Agricultural Income, totaling R$ 3.281,83. It was observed that in the bacuri and garden production

system, the annual contribution from the sale of bacuri and pulp to agricultural income was 32,0% and 15,0% for total income. In relation to the group of bacuri and social benefits, this participation was 94,0% and 17,0%, respectively. Therefore, the system defined as bacuri and fruit trees, is the one with the greatest economic return for small producers, due to diversification in the production and sale of fruit and pulp.

Keywords: Regional Development. Natural Resources. Extractivism. Bacurizeiros. Bioeconomy.

RESUMO

Este artigo procura realizar a avaliação econômica dos sistemas de produção com foco na coleta extrativa e manejada do fruto de bacuri (Platonia insignis Mart.) em propriedades selecionadas de pequenos produtores da Mesorregião Marajó. A pesquisa foi realizada nos municípios de Soure, Salvaterra, Cachoeira do Arari e Ponta de Pedras. Os procedimentos metodológicos foram baseados numa análise quali-quantitativa. Realizou-se a aplicação de questionários semi-estruturados para 52 pequenos produtores de bacuri. Segundo os resultados, a maior parcela dos entrevistados possui áreas menores que 1 hectare (ha) (55,8%), o que configura a maior utilização de pequenas áreas e o processo de minifundização que está ocorrendo na Mesorregião Marajó. Quanto à tipologia dos sistemas de produção, foram encontrados 5 tipos: bacuri e roça; bacuri e frutíferas; bacuri e pesca; bacuri e porcos; e bacuri e benefícios sociais. Os sistemas de produção atribuídos ao grupo de bacuri e frutíferas, obtiveram o Valor Agregado (VA) de R$ 21.471,29/ano. O grupo fundamentado em benefícios sociais alcançou o menor valor para a Renda Agrícola (RA), totalizando R$ 3.281,83. Observou-se que no sistema produtivo de bacuri e roça, a contribuição anual da venda de bacuri e polpa para a renda agrícola foi de 32,0% e para a renda total de 15,0%. Em relação ao grupo de bacuri e benefícios sociais, essa participação foi de 94,0% e 17,0%, respectivamente. Portanto, o sistema definido como bacuri e frutíferas, é o que possui o maior retorno econômico para os pequenos produtores, devido a diversificação na produção e venda de frutos e polpas.

Palavras-chave: Desenvolvimento Regional. Recursos Naturais. Extrativismo. Bacurizeiros. Bioeconomia.

INTRODUCTION

Extractivism of bacuri fruit (*Platonia insignis* Mart.) is part of the group of "invisible products" that are extracted from anthropized forests such as the tucumanzeiro (*Astrocaryum vulgare* Mart.) and bacabeira (*Oenocarpus bacaba* Mart.) which are important in the survival strategy of small producers and collectors, however, are not included in official statistics from the Brazilian Institute of Geography and Statistics (IBGE) (HOMMA, 2014; MENEZES et al., 2016). It is noticed that in addition to the lack

of economic information, there is a lack of research on income generation strategies adopted by small producers and collectors (MARTINOT; PEREIRA; SILVA, 2017), and a lack of work on the economic evaluation related to the extractive and managed collection of bacuri fruits in the Amazon Region.

The presence of extractive populations in the Marajó Mesoregion is essential, as is their knowledge about the management and conservation of natural resources. However, in the State of Pará, there are few studies with regard to small producers and collectors of bacuri fruits, their way of life and if they occur in a sustainable way. Research on economic evaluation allows assessing the degree of sustainability of the development of various social groups, as well as proposing projects, programs and policies that promote the guarantee of sustainability (SOUSA, et al., 2020).

With regard to the use of Amazonian biodiversity elements, management and extractive collection of bacurizeiro fruit have been carried out by small producers and collectors in the Marajó Mesoregion, as a survival strategy (RODRIGUES, 2018). In this way, research on the production and commercialization of bacuri fruits can contribute to the understanding of the economy of natural resources in the Amazon (HOMMA, 2014).

The bacuri fruit provided benefits for small producers and collectors who adopted the practice of managing native bacuri trees. Several producers in the Amazon cultivate cassava (*Manihot esculenta* Crantz) as the main source of income. Therefore, they need a financial complement when they are not in the cassava harvest season. In this context, the sale of bacuri fruit is an economic alternative for these small producers and collectors (HOMMA, 2014; SOARES et al., 2018). However, it should be noted that the integration of the bacuri fruit into the market does not occur uniformly, as the strategies of small producers and collectors are different, leading to different levels of production and commercialization in the Amazonian municipalities (MIGUEL, 2010; MENEZES; HOMMA, 2012).

According to the 2017 Agricultural Census, there are 1.329 agricultural establishments related to bacuri production in Pará. Thus, the State corresponds to 49,2% in terms of the existence of 2.700 agricultural establishments in Brazil that produce bacuri. The bacuri fruit and pulp market dynamics are favorable for the State of Pará. However, the structured production of bacuri to meet the demand for the product is unfeasible, since its production is mostly extractive or managed (BOTELHO et al., 2020).

Of the bacuri fruit, the pulp constitutes only between 10 and 15% of the weight, implying the need for processing in communities instead of transporting the fruit in natura (HOMMA, 2014). According to CEASA/PA (2020), the price of bacuri pulp varied from January 2017 to January 2020. The lowest price reached R$ 30,00/kg in January 2020 and the highest reached R$ $41,29/kg in August 2017, purchasing an average of R$37,79 per kg of pulp in that period.

Some beer industries have carried out innovative processing in their production line, using the aroma of Amazonian fruits such as açaí (*Euterpe oleracea* Mart.), cupuaçu (*Theobroma grandiflorum* (Willd. ex spreng.) Schum.), cumaru (*Dipteryx odorata* (Aubl.) Willd.), priprioca (*Cyperus articulation* L.), taperebá (*Spondias mombin* L.) and the cupulate. The Amazon Craft Brewery Beer, located in Belém (PA), produces one that has a bacuri aroma resulting from the maturation of the fruit (HOMMA, 2014).

The companies Beraca and Natura Cosméticos are some Brazilian enterprises that use bacuri seeds in small quantities, with the purpose of extracting the oil to produce cosmetics. Several products such as jellies, sweets, ice cream and bonbons are made from bacuri pulp, and can be found in supermarkets, as they are sought after by tourists (BOTELHO et al., 2020).

Agroextractive production systems are established when practices such as agriculture, fishing, cultivation of fruit trees, among others, are associated with extractive activities, such as the collection of bacuri fruits carried out by collectors and small producers in the Marajó Mesoregion, characterizing an income generation strategy (HOMMA, 2014; RODRIGUES, 2018). This information is significant for understanding aspects of social and economic sustainability of these social actors that make up the Amazon Region (MOURA, 2007; HOMMA et al., 2013).

There is a lack of research on the economic aspects related to the extractive and managed collection of bacuri fruits in the Amazon region. Thus, this article seeks to carry out an economic evaluation of production systems with a focus on the extractive and managed collection of the bacuri fruit in selected properties of small producers and collectors in the Marajó Mesoregion.

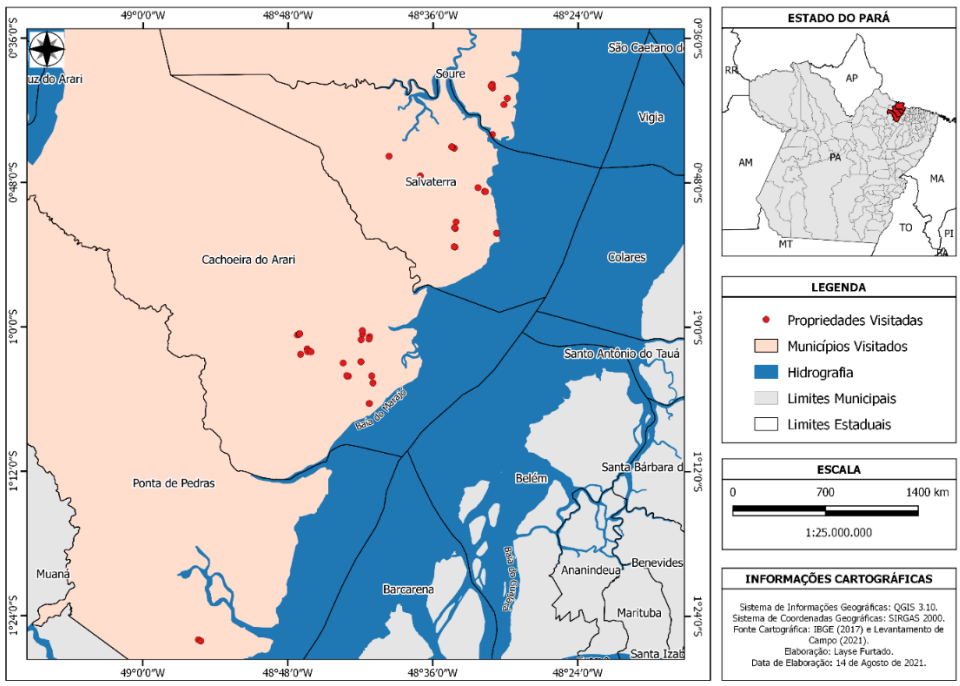
MATERIAL AND METHODS

STUDY AREA

The Marajó Mesoregion is defined as the largest river-maritime island in the world. This territory has a diversity in its natural composition, consisting of areas of forests and fields that characterize the place as a unique region in the regional, national and global scenario. This area is called the Marajó Archipelago, as it is a region formed by a group of islands that are located in the State of Pará, with a territorial dimension of 49,6 thousand km² larger than the State of Espírito Santo (BRASIL, 2007; BRASIL, 2020).

The choice of the Marajó Mesoregion (Figure 1) as the study area was due to current information that it is a producing area that accounts for part of the supply of bacuri fruits (HOMMA, 2014). The research was carried out in the municipalities of Soure, Salvaterra, Cachoeira do Arari and Ponta de Pedras, as they are the main bacuri producing municipalities in the Marajó Mesorregion (IBGE, 2017). According to IBGE (2019), the population of the Archipelago consists of a total of 564.199 inhabitants, representing about 6% of the population of Pará.

Figure 1 | Municipalities studied in the Marajó Mesoregion, with the location of the agricultural properties of the small producers and collectors interviewed, 2021.



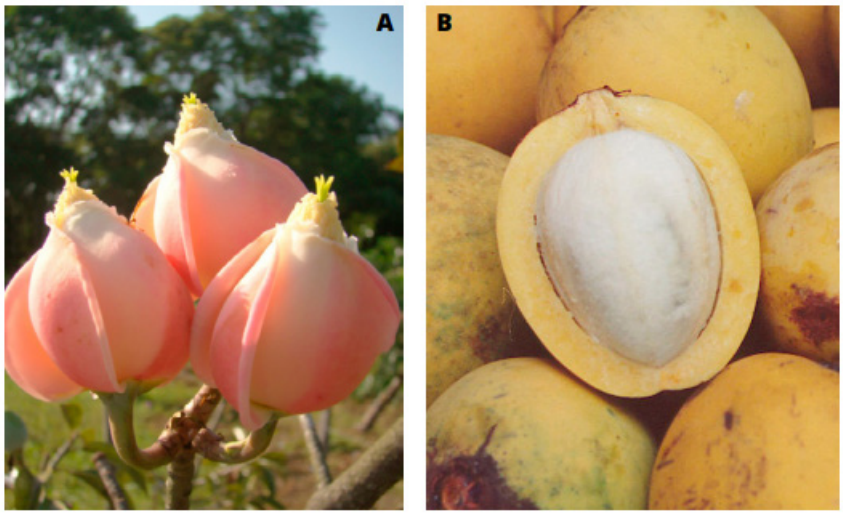
Source: Field research, 2021.

SAMPLE OF SMALL PRODUCERS

An intentional sampling was used (MARCONI; LAKATOS, 1996), to consider only small producers who had at least 50 bacuri trees on their rural properties, as well as those who practice extractive and managed collection of bacuri. This sampling method was performed to portray the most significant spatial distribution possible.

Bacuri is the common name of the fruit most used in areas of natural occurrence. However, it is possible to verify in the literature several other common names, such as: bacuri-açu, bacuri grande, bacori, bakury, bocori, bacoriba and among others (MOURA, 2007; HOMMA et al., 2013; HOMMA, 2014). In Figure 2, you can see the flowers of the bacuri tree and its fruits.

Figure 2 | A) Flowers. B) Fruits.



Source: Carvalho and Nascimento (2018).

DATA COLLECT

The methodological procedures were based on a quali-quantitative analysis. Semi-structured questionnaires with objective and subjective questions were applied to 52 small bacuri producers and collectors, distributed among the municipalities that were studied in the Marajó Mesoregion, with 25 interviewed in Cachoeira do Arari (48,0%), 2 in Ponta de Pedras (3,9%), 15 in Salvaterra (28,8%) and 10 in Soure (19,3%). Field data collection was carried out in two periods. The first took place from 12/14 to 12/18/2020, and the second from 07/05 to 07/13/2021.

With regard to the socioeconomic profile, the questionnaire was composed of questions related to issues such as: gender, age, primary and secondary occupation, and education of respondents and family members. The data collection instrument also portrayed the cropping system and the size of smallholder properties.

TYPOLOGY OF PRODUCTION SYSTEMS

A typology of production was carried out after systematizing the data obtained from the questionnaires, with the aim of facilitating a more detailed understanding of the different production arrangements. Well, this typology allows evaluating small producers in different groups, since they have significant differences, however, with similarities between them (GARCIA FILHO, 1999). The main criterion to carry out the typology was the primary source of income of the small producers that was obtained in the survey, and the types found were: Bacuris and Roça; Bacuris and fruit trees; Bacuris and Fishing; Bacuris and Pigs; and Bacuris and Social Benefits (Bolsa Família, Seguro Defeso, Aposentadorias, Bolsa Verde and among others). This typology was also carried out to identify the contribution of the bacuri fruit to the family income of small producers.

ECONOMIC EVALUATION OF PRODUCTION SYSTEMS

The economic evaluation allows the researcher to evaluate the socioeconomic relations that define each type of production unit, as well as the agrarian system in a comprehensive way (GARCIA FILHO, 1999). After surveying the typologies identified in the previous phase, an analysis and comparison of the income of small producers who manage bacuri trees and sell bacuri was carried out. For this, it was considered:

a) Added Value, using the formula:

VA = PB – CI – D. Where:

PB = Gross Product, which is defined as the total monetary value of what is produced, either for sale or for family consumption;

CI = Intermediate Consumption, are bags for transporting fruit, plastic bags for pulp, cloth and others that can be defined as the inputs that the small producer used to produce;

D = Depreciation, it can be agricultural tools, chainsaws, refrigerator and freezer to freeze the pulp, and others that may represent the wear and tear of goods to the detriment of the time of use that the small producer used in production;

b) Agricultural income (RA) can be calculated using the following formulas, which will depend on the case found in the municipalities, where S are wages, in the case of hiring labor:

RA = VA – S – I – J – RT

RA = PB – CI – D + Sub – S – I – J – RT,

Despite their non-existence, the following are mentioned for theoretical formality:

I represents taxes, which are fees paid to the State for the right to produce;

J is the interest, which can be defined as the fees paid by the small producer in exchange for the advances granted by the banks;

RT is characterized as land rent (leases); and Sub are subsidies, which represent the amount received by the State or by banks to finance production.

Income per farmer (RA/UTf) and Income per unit of area (RA/SAF) were also estimated to obtain results on the opportunity cost, as the same would be obtained by comparing the agricultural income per family worker, along with income from other potential sources. Calculations were performed to estimate the NRS (Simple Reproduction Level), which had the opportunity cost of work as an indicator, which was calculated using the minimum wage per Man Work Unit (UTH).

Also, the relation of the total economic performance of each type of production system that was found was carried out, together with the expected reproduction level. The Agricultural Income is the measure of the economic result that evaluates the performance of the system, and the NRS indicator can be defined as the equivalent of the value of a monthly minimum wage per worker (Salário Mínimo/UTH), during the year.

ETHICAL ASPECTS

The researchers and interviewees involved in this research signed a Term of Free and Informed Consent - TCLE based on the guidelines contained in Resolution nº 466/2012, of December 12, 2012, of the National Health Council, of the Ministry of Health, so that the researched data are used and publicly demonstrated, with the purpose of using and disseminating the content made available by the individuals involved.

This research was approved by the Research Ethics Council (CEP) of the State University of Pará (UEPA), of the Center for Biological and Health Sciences (CCBS), with Certificate of Presentation for Ethical Appreciation (CAAE): 44593021.9.0000.5174 and by the Biodiversity Authorization and Information System – SISBIO (authorization nº 78288-1 / authentication code: 0782880120210513).

RESULTS AND DISCUSSION

As for the socioeconomic profile of the interviewees, the results show that 59,6% of small producers and collectors are male, and 40,4% are female. Regarding age, 50,0% are aged between 40 and 50 years old, 30,8% belong to the age group between 51 and 60 years old, 15,4% are aged between 61 and 70 years old, and 3,8% reported being over 80 years old.

With regard to the primary and secondary profession of small producers, 15,4% reported that they are farmers and civil servants, 25,0% declared that they are farmers and fishermen, 27,0% reported that they are farmers, housemaids and fisherwomen, 5,7% stated that they are farmers and technicians in agriculture or agroindustry, 3,8% stated that they are farmers and weavers of fishing nets, 9,7% declared that they are farmers and self-employed, and 13,4% reported that they are agricultural, domestic and self-employed.

The social actors that make up the rural Amazonian environment, such as family farmers, small producers, collectors and extractivists, carry out agricultural and non-agricultural activities as income generation strategies to support their families (SOARES et al., 2018).

Regarding the educational level of respondents and family members, most small producers and collectors (61,5%) and family members (52,2%) have incomplete Elementary School (Table 1).

The socio-environmental impacts on rural communities in the Amazon are directly linked to the low level of education of the various social actors that make up the Amazonian rural space, such as family farmers and extractivists, since the lack of knowledge about the principles of sustainable development is one of the main causes of unsustainability in the relationship between man and nature (MARTINS; CÂNDIDO, 2012; SILVA; CAVALCANTE; SILVA, 2014).

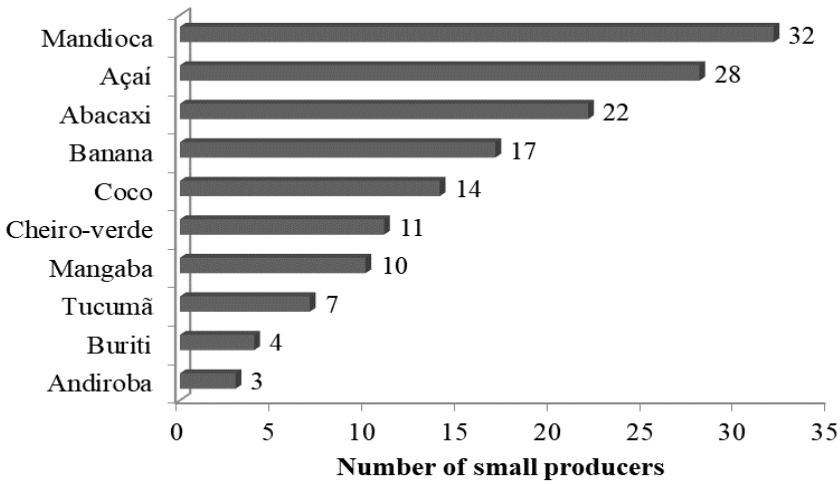
Table 1 | Level of education of small producers and collectors interviewed and family members, 2021.

level of education	Interviewed	%	family members	%
Incomplete primary education	32	61,5	128	52,2
Complete primary education	8	15,4	52	21,3
Incomplete high school	8	15,4	44	18,0
Complete high school or technical	3	5,7	19	7,7
complete higher education	1	2,0	2	0,8
Total	**52**	**100,0**	**245**	**100,0**

Source: Field research, 2021.

As for the cultivation system, 10 species were identified on the properties of small producers, as shown in Figure 3.

Figure 3 | Other species exploited and traded, 2021.



Source: Field research, 2021.

It was observed that 61.5%, 53.8% and 42.3% of small producers grow and sell mandioca or cassava (*Manihot esculenta* Crantz), açaí (*Euterpe oleracea* Mart.) and abacaxi or pineapple (*Ananas comosus* L.), respectively (Figure 3). These are the crops commonly traded by the majority of respondents, during the period that the bacuri trees are not in the harvest period. It is possible that small bacuri producers implement agroforestry systems on their properties, through cultivation between the rows of bacuri trees, with traditional crops such as cassava (HOMMA et al., 2013; MENEZES et al., 2016).

Regarding the size of the properties, most of the interviewees have areas smaller than 1 hectare (ha) (55,8%), which configures the greater use of small areas and the mini-funding process that is taking place in the Marajó Mesoregion. The existence of bacuri trees is restricted to backyard trees and "reboleiras" (concentrations) of bacuri trees scattered on medium and large properties. Other parts of the informants reported that they have their agricultural establishments in the size of 1 to 10 ha (13,5%), 11 to 20 ha (9,6%), 21 to 50 ha (7,7%), 51 to 100 ha (5,8%), greater than 100 ha (3,8%), and 3,8% were unable to inform (Table 2). It was observed that there is a variation in the size of the lots regarding the area destined to the management of bacuri trees, however, in general it corresponds to up to 25% of the size of the properties

Table 2 | Size of properties, 2021.

Property size (ha)	Interviewed	%
< 1	29	55,8
1 to 10	7	13,5
11 to 20	5	9,6
21 to 50	4	7,7
51 to 100	3	5,8
> 100	2	3,8
they didn't know how to inform	2	3,8
Total	**52**	**100,0**

Source: Field research, 2021.

It was noted that 67,3% of respondents acquired their properties through inheritance, and 32,7% through purchase. According to Carneiro (2001), patrimonial succession can be characterized as a fundamental process for small producers, since it establishes the transmission of security and responsibilities for social reproduction, not just a transfer of land.

According to the Agricultural Census (2017), the municipalities of Cachoeira do Arari, Salvaterra and Ponta de Pedras, mostly have agricultural establishments with up to 10 hectares, with 78,1%, 64,3%, 74,2%, respectively. The town of Soure mostly has properties larger than 100 hectares, with 65,9% of rural establishments (Table 3).

Table 3 | Sizes of properties, according to the Agricultural Census, 2017.

Property size (ha)	Cachoeira do Arari	%	Salvaterra	%	Ponta de Pedras	%	Soure	%
< 1	95	11,6	72	21,0	921	32,4	0	0.0
1 to 10	543	66,5	149	43,3	1.189	41,8	10	8,3
11 to 20	51	6,3	22	6,4	277	9,8	7	5,8
21 to 50	39	4,8	27	7,8	288	10,1	9	7,5
51 to 100	25	3,1	12	3,5	98	3,5	6	5,0
> 100	61	7,5	22	6,4	67	2,4	79	65,9
Producer without area	2	0,2	40	11,6	1	0,0	9	7,5
Total	**816**	**100,0**	**344**	**100,0**	**2.841**	**100,0**	**120**	**100,0**

Source: Agricultural Census, 2017.

Table 4 shows that the municipalities of Cachoeira do Arari, Salvaterra, Ponta de Pedras and Soure, have their highest concentrations of areas in properties larger than 100 hectares, with 91,5%, 61,9%, 28,4% and 99,8%, respectively. The total areas of properties smaller than 10 hectares represented only 3,2% in Cachoeira do Arari, 5,7% in Salvaterra, 14,0% in Ponta de Pedras and only 23 hectares in Soure (Agricultural Census, 2017).

Table 4 | Areas of properties, according to the Agricultural Census, 2017.

Property area (ha)	Cachoeira do Arari	%	Salvaterra	%	Ponta de Pedras	%	Soure	%
< 1	4	0,0	36	0,5	225	0,7	0	0,0
1 to 10	1974	3,2	342	5,2	4.310	13,3	23	0,0
11 to 20	592	0,9	289	4,4	3.581	11,0	90	0,0
21 to 50	1.190	1,9	881	13,5	8.792	27,2	257	0,1
51 to 100	1.523	2,5	940	14,5	6.277	19,4	389	0,1
> 100	57.310	91,5	4.034	61,9	9.216	28,4	198.136	99,8
Total	**62.593**	**100,0**	**6.522**	**100,0**	**32.401**	**100,0**	**198.895**	**100,0**

Source: Agricultural Census, 2017.

As for the typology of production systems, 5 types were found, namely: bacuri and roça; bacuri and fruit trees; bacuri and fishing; bacuri and pigs; and bacuri and social benefits. The bacuri trees only carry out fruit production in the maximum period of 4 harvest months, from January to April. However, although some small producers declare that their main source of income comes from the sale of fruits and bacuri pulp, it is considered that this crop alone is not enough to maintain the livelihood of families throughout the year. In this way, the relationship between the areas of bacuri trees and other agricultural activities that provide income was determined, characterizing agroextractivism in transition among small bacuri producers, which can be understood by the change in the mode of production, which began to be carried out for the integration of extractive products and agricultural crops over the years.

With regard to the bacuri and roça production system, only small producers and collectors who cultivate cassava and pineapple were considered, representing 61,5% and 42,3% of respondents, respectively. The small producers and collectors who cultivate cassava on their properties produce flour for subsistence and commercialization, in addition to selling the roots.

Regarding the production system of bacuri and fruit trees, it was determined that this group

belongs to small producers and collectors who have areas with bacuri trees associated with other fruit trees, such as coco or coconut, banana and açaí, represented by 27,0%, 32,7% and 53,8% of respondents, respectively.

With regard to the bacuri and fishing group, 25,0% of the informants reported that they have fishing as a constant profession, and that they perform the practices of collecting bacuri fruits.

It was found that raising free-range pigs is a common practice among most of the community members interviewed in the municipalities that were visited, constituting the production system for bacuri and pigs. Therefore, Table 5 shows that 61,5% raise and sell pigs, and 38,5% do not. Respondents who sell, stated that they sell to consumers in local communities, for a price of R$ 15,00 to R$ 25,00/Kg of meat. The raising of small animals is commonly found in the productive practices of small producers and collectors of the bacuri fruit, in the municipalities of the Marajó Mesoregion (RODRIGUES, 2018). Most informants (48,1%) reported having 1 to 10 pigs loose on their properties (Table 6). Also, 15,4% of small producers stated that they used to fence off cassava swiddens to prevent pigs from entering. This is an unusual practice, generally, it is up to breeders to arrest their animals.

Table 5 | Breeding and marketing of free-range pigs, 2021.

Breeding and sale of free pigs	Interviewed	%
carry out	32	61,5
do not perform	20	38,5
Total	**52**	**100,0**

Source: Field research, 2021.

Table 6 | Number of pigs released on properties, 2021.

loose pigs	Interviewed	%
1 to 5	11	21,1
6 to 10	14	27,0
11 to 20	4	7,7
21 to 30	3	5,7
don't have pigs	20	38,5
Total	**52**	**100,0**

Source: Field research, 2021.

As for small producers and collectors who belong to the bacuri group and social benefits, it was observed that 84,6% of respondents receive social benefits from the government, such as retirement, family allowance, emergency aid, closed season insurance and pension, and 15,4% do not receive. It was noted that some small producers may be grouped in more than one typology of the production systems found.

The competence of the productive systems in generating new wealth can be presented by the Added Value (AV), where it is possible to quantify the net production of the property in the year, and the profitability evaluated by the Agricultural Income (AR).

It was observed that the productive systems that have the highest Agricultural Income (AR) and high family income, are the ones that have the highest level of diversification of species with the greatest capacity to generate income. These are the production systems attributed to the Bacuri and Frutíferas group, which achieved an Added Value (AV) of R$ 21.471,29/year (Table 7). This fact can be explained by the organization of families in the production of seasonal fruit pulps, such as açaí and bacuri, and fruits produced throughout the year, such as coconut (*Cocos nucifera* L.), which are destined for commercialization of processed products that add value to the final production.

Table 7 | Economic Results of Added Value (AV) and Income from the sale of bacuri fruits and pulp, by type of production systems, 2021 (R$).

types	Added Value	Income from the sale of fruits	Income from pulp sales
Bacuri and Roça	10.114,85	1.652,32	998,31
Bacuri and Fruit trees	21.471,29	1.118,75	3.457,04
Bacuri and Fishing	8.981,42	804,91	2.009,85
Bacuri and Social Benefits	3.752,11	2.007,04	1.862,77
Bacuri and Pigs	2.504,55	1.103,72	895,29

Source: Field research, 2021.

It appears that the total value generated by the productive systems is not limited to the establishments of small producers and collectors, since a portion of this value is converted outside the system in the form of fees, wages, taxes and others. Even in smaller proportions, it is notorious

to observe that most of the production systems enjoy some income outside the property, due to the hiring of per diems for weeding and harvesting practices (roça).

According to Table 8, the group based on social benefits was the one that reached the lowest value for Agricultural Income (AR), setting a total of R$ 3.281,83. This profit comes from the sale of bacuri fruits, since this group largely used their cropping systems for the subsistence of families, with no significant commercialization of other agricultural products.

Table 8 | Economic results of Agricultural Income (AR), Non-Agricultural Income (RNA) and Family Income (RF), by type of production systems, 2021 (R$).

types	Agricultural Income	Non-Farm Income	Family income
Bacuri and Roça	9.224,58	13.571,08	22.254,97
Bacuri and Fruit trees	21.781,44	18.902,56	40.581,03
Bacuri and Fishing	8.852,17	18.782,21	26.992,59
Bacuri and Social Benefits	3.281,83	17.009,47	20.905,82
Bacuri and Pigs	4.119,02	11.402,78	18.347,05

Source: Field research, 2021.

Regarding the contribution of the bacuri fruit to the family income of small producers and collectors, the income obtained from the sale of fruits *in natura* and also from the commercialization of the pulp was considered. It was observed that in the bacuri and roça production system, the annual contribution of the sale of bacuri and pulp to agricultural income was 32,0% and 15,0% to total income. With regard to the bacuri group and social benefits, this participation was 94,0% and 17,0% respectively (Table 9).

Table 9 | Participation of bacuri (%) in Agricultural Income (AR) and Total Income (RT), 2021.

types	Participation of bacuri fruit in AR (%)	Participation of bacuri fruit in RT (%)
Bacuri and Roça	32,0	15,0
Bacuri and Fruit trees	30,0	12,0
Bacuri and Fishing	25,0	10,0
Bacuri and Pigs	21,0	8,0
Bacuri and Social Benefits	94,0	17,0

Source: Field research, 2021.

It appears that the income from the sale of bacuri fruits *in natura* or in pulp is of fundamental importance for the reproduction and maintenance strategies of small producers and collectors, since these results of average contributions to agricultural income are very significant, considering that it is a species that has a harvest period of only 3 months.

The 2030 Agenda is an action plan document adopted by member countries of the United Nations (UN) that have committed to taking transformative measures, with the aim of achieving sustainable development in the coming years. This plan indicates 17 Sustainable Development Goals (SDGs), with 169 goals that aim to promote a sustainably viable and economically habitable planet, addressing issues related to social, economic, agronomic, environmental, institutional and sustainable development dimensions (ONU, 2023).

Sustainable Development Goal 15 (Terrestrial Life) aims to promote the implementation of sustainable management of all types of forests, combat deforestation, as well as restore degraded forests and increase reforestation globally (ONU, 2023). In this way, the bacuri trees in the Marajó Mesoregion are related to SDG 15, as they are elements of the Amazonian biodiversity that generate environmental advantages, such as reforestation, recovery of degraded areas and sustainable maintenance of terrestrial ecosystems, enhancing the bioeconomy and regional development of the Marajó, generating a considerable source of income for small producers and collectors of bacuri (HOMMA, 2014; ONU, 2023).

FINAL CONSIDERATIONS

There are 5 types of production systems among the interviewees, namely: bacuri and roça; bacuri and fishing; bacuri and fruit trees; bacuri and social benefits; and bacuri and pigs. Since the system defined as bacuri and fruit trees, is the one with the highest economic return for small producers and collectors, due to diversification in the production and sale of fruits and pulps.

The contribution of bacuri to the income of small producers and collectors is significant in all typologies of production systems found, demonstrating a minimum average participation in agricultural income of 21,0%, in the system of bacuri and pigs.

Most smallholder properties and interviewed collectors present areas that characterize smallholdings or backyards (55,8%), which follow the size profile of properties in the municipalities visited, with the exception of Soure, in the Marajó Mesoregion.

The survey showed that the expansion of management of bacuri trees should focus on two fronts. One aimed at small producers and collectors with a reduced average area and with a large contingent and another aimed at medium and large producers with a large concentration of land. This research also showed the importance of determining research priorities on the management and planting of bacuri trees conducted by Embrapa Amazônia Oriental.

It appears that the sale of bacuri fruit pulp represents a significant social reproduction strategy for small producers and collectors in the Marajó Mesoregion, since this contribution to income is considerable for food security and for aspects of social and economic sustainability of small producers and collectors, causing improvements in quality of life conditions, considering that it is a fruit that has a short harvest period.

There is a lot of discussion about the bioeconomy in the Amazon, but the solutions are specific and the results of this study can collaborate to carry out other research focused on bacuri management, which can contribute to reducing poverty, backwardness and economic lethargy of small producers and collectors, enhancing the regional development of bacuri producing localities, such as the Marajó Mesoregion.

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