

Knowledge of producers and traders about the Açaí production chain in the Middle Solimões River

Conhecimento de produtores e comerciantes sobre a cadeia produtiva do Açaí no Médio Rio Solimões

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Abstract:

Açaí fruit in the middle of the Solimões River is responsible for a large proportion of the farm economy in the Amazon region. This work aims to show data on the extractivist and production chain system of the Amazonian Açaí, *Euterpe precatoria*, and *Euterpe oleraceae* sold in the countryside of the Middle Solimões (Coari, Codajás, Tefé, and Alvarães). That is a cross-sectional study with exploratory, descriptive, and investigative characteristics, with a qualitative and quantitative approach. There was a questionnaire and non-formal interviews with açaí producers and traders, and the results showed that açaí marketing and price is responsible for providing income for families in rural and riverside areas. The importance of the production and trade of açaí for the local development and economy, as well as the need for public government subsidies in the production chain and the creation of agricultural cooperatives and farmers' organizations.

Keywords: Amazon, *Euterpe* sp., Non-Forest Non-Timber Product, Amazon products

Resumo:

O fruto do açaí no meio do rio Solimões é responsável por grande parte da economia agrícola da região amazônica. Este trabalho tem como objetivo apresentar dados sobre o sistema extrativista e da cadeia produtiva do açaí amazônico, *Euterpe precatoria* e *Euterpe oleraceae* comercializados no interior do Médio Solimões (Coari, Codajás, Tefé e Alvarães). Trata-se de um estudo transversal com características exploratórias, descritivas e investigativas, com abordagem qualitativa e quantitativa. Foi realizado questionário e entrevistas não formais com produtores e comerciantes de açaí, e os resultados mostraram que a comercialização e o preço do açaí são responsáveis por proporcionar renda às famílias da zona rural e ribeirinha. A importância da produção e comercialização do açaí para o desenvolvimento e economia local, bem como a necessidade de subsídios públicos governamentais na cadeia produtiva e a criação de cooperativas agrícolas e organizações de agricultores.

Palavras-chave: Amazônia, *Euterpe* sp., Produto Não Florestal Não Madeireiro, Produtos Amazônicos

1. Introduction

The production of açaí has been increasing, making it an attractive product of national extractives and one of the main ones responsible for the visibility obtained from products from the Amazon biota. Whether through the energy drink or non-alcoholic juice called in the Amazon region as wine or açaí food products are breaking national barriers and taking proportions that make this fruit known as a Brazilian celebrity. Products made from pulp include the production of juices, energy (sports drinks), snacks, desserts and ice cream, dairy products, sweets, and in general (Conab, 2016).

The commercialization of açaí in the Amazon region is responsible for a large part of the population's income. It is found from north to south and is practically present in almost the entire Amazon ecosystem. Among the well-known producers of açaí, the State of Pará stands out, followed by the State of Amazonas in second place with the highest production for processing, supplying both the local and international markets. In the world market, the United States, Canada, and European countries project as the most representative (IBGE, 2019; Conab, 2019).

The açaizeiro is a Non-Forest, Non-Timber Product (NFNTP) that is growing in demand for the food industry in the palm heart. NFNTPs are natural resource products obtained from native forests, agroforestry systems, and plantations without damaging the biota from which this material is extracted (Paes-de-Souza *et al.*, 2011; Afonso, 2022).

The açaís native to the Brazilian Amazon belong to the Arecaceae family and *Euterpe* genus, containing three species of agro-industrial interest: *E. edulis*, *E. oleracea*, and *E. precatoria*, in which only the last two have commercial prominence (Afonso, 2022).

Euterpe precatoria Mart is popularly known as açaí do Amazonas, found in the Solimões River basin, on firm ground or lowland areas. The *Euterpe oleracea* Mart species is found mainly in lowland and igapó lands on the Amazon River, with the advantage of tillering (Yuyama *et al.*, 2011; Santos *et al.*, 2021).

The leaves, stems, and roots are used in folk medicine to obtain herbal tea (Yamaguchi; Souza, 2020). The indigenous people and the riverside population describe the stems of the leaves and the roots as a therapeutic source against muscle pain, treating malaria, liver and kidney infections, and snake bites (Yamaguchi *et al.*, 2015; Laurindo *et al.*, 2023).

The fruiting period is related to the species investigated and may occur throughout the year, with the rainy season (December to May) being the most incredible abundance period (Lopes *et al.*, 2022). Both pulps have antioxidant and anti-inflammatory properties with bioactive metabolites such as anthocyanins, flavonoids, and phenolics superior to those detected in other fruits, such as grapes, blackberries, blueberries, and strawberries (Yuyama *et al.*, 2011; Baptista *et al.*, 2021; Laurindo *et al.*, 2023).

The demand for açaí pulp is growing, contributing significantly to the family income of riverside and rural communities in the Amazon, being a source of economic and social development in the region. Herein, we aimed to describe the dynamics of production and commercialization involved in the production chain of Açaís Amazônia in the cities of the Middle Solimões, contributing with information about the primary sector and collaborating with the development of this agro-industrial sector.

2. Materials and Methods

This work is a cross-sectional study, and the methodology adopted is exploratory, descriptive, and investigative, with a qualitative and quantitative approach (Marconi; Lakatos, 2017). There was the application of a semi-structured questionnaire and non-formal interviews with small and medium-sized producers and traders who provided relevant information about the açaí extractive chain.

The data were collected in the municipalities of Coari, Codajás, Tefé, Anori, and Alvarães (Figure 1) and participated in 78 subjects. Initially, visits were made to trade, production (processing), and planting sites. During the methodological trajectory, the ethical and legal aspects following Resolution n. 466/2012 of the National Health Council (CNS) (Brasil, 2012). The questionnaire was registered with the Research Ethics Committee of the Federal University of Amazonas (CAAE: 97439918.5.1001.5020).

Figure 1. Data collection locations in Amazonas, Brazil. (Software IbisPaint, version 9.4.8)

Figura 1. Locais de coleta de dados no Amazonas, Brasil. (Software IbisPaint, versão 9.4.8)



The questions were prepared as Sachs (2000) described, assessing the environmental, social, and economic balance of extractivism to obtain the sustainable development of the raw material. The questionnaires were semi-structured, with 20 objective and descriptive questions with general information about the origin of the fruit, production, marketing, difference between species, and consumption of açai, including sales aspects and product characteristics, such as shelf life and price.

3. Results

In this study, we observed that the age of the participants ranged between 15 and 75 years. The range detected showed the highest percentage between 46 and 55 years old (25.6%). The production chain and extractivism were mostly presented as patriarchal activities performed by men (70.5%). The results can be seen in Table 1. The analyses were divided into extractive/culture data (Question 5), processing (Questions 12-16), commercialization (Questions 4, 7, 11, and 17-19), and general data (Questions 1-3, 6, 8, 9, 10).

Table 1. Questionnaire results with acai traders and producers. As n=78 and the same for all questions, do present % only
Tabela 1. Resultados de questionário com comerciantes e produtores de açaí. Como n=78 e igual para todas as questões, apresenta apenas %

No.	Question	Options	Answers (N)	Answers (%)
1	Age	15 - 24 years old	3	3.8
		25 - 35 years old	15	19.2
		36 - 45 years old	18	23.1
		46 - 55 years old	20	25.6
		56 - 65 years old	15	19.2
		66 - 75 years old	7	9.0
2	Gender	Masculine	55	70.5
		Feminine	23	29.5
3	What is the origin of açaí?	Urban area	39	50.0
		Countryside	39	50.0
4	What is the average price of açaí?	Up to 4 reais	10	12.8
		5 to 7 reais	56	71.8
		More than 8 reais	12	15.4
5	What is the method of collecting açaí?	With peconha, shoe and machete	56	71.8
		With peconha, barefoot and knife	11	14.1
		With peconha, shoe and knife	10	12.8
		Without peconha and shoe, but with a knife	1	1.3
6	Which part of the production chain do you belong?	Trader, processor and extractive farmer	13	16.7
		Trader and processor	46	59.0
		Trader	13	16.7
		Extractive farmer and seller	4	5.1
		Extractive farmer e processor	1	1.3
		Extractive farmer	1	1.3
7	What part of açaí do you sell?	Pulp	58	74.4
		Pulp and fruit	14	17.9
		Only fruit	6	7.7
8	Do you know how many types of açaí?	One	0	0
		Two	58	74.4
		Three or more	20	25.6
9	What types of açaí do you know?	Acai-do-Amazonas and acai-do-Pará	56	71.8
		Acai-do-Amazonas, acai-do-Pará and acai-do-mato	20	25.6
		Acai-do-Amazonas	2	2.6
10	What is the difference between them?	Colour, flavour and yield	13	16.7
		Colour, flavour, yield and texture	3	3.8
		Colour, flavour and texture	1	1.3
		Flavour and yield	7	9.0
		Colour and yield	1	1.3
		Colour and flavour	33	42.3
		Flavour	8	10.3
		Yield	1	1.3
		Colour	2	2.6
		Others	8	10.3
		I don't know	1	1.3
11	What type of acai do you sell?	Açaí-do-Amazonas, açaí-do-Pará and açaí-do-mato	3	3.8
		Açaí-do-Amazonas and açaí-do-Pará	22	28.2
		Açaí-do-Amazonas	53	70.0
		Açaí-do-Pará	0	0.0
		Yes	61	78.2

No.	Question	Options	Answers (N)	Answers (%)
12	Are you the one who extracts the pulp from the açai berry yourself?	No (relatives, friends, etc)	17	21.8
13	How is the pulp extracted?	Machine	74	94.9
		Manually	0	0.0
		Both	4	5.1
14	What is made with the açai seed?	Is discarded	37	47.4
		Fertilizer	9	11.5
		Food for animals	9	11.5
		Fertilizer and food for animals	8	10.3
		Craftsmanship	2	2.6
		Others (used in brick factory)	13	16.7
15	How is açai pulp stored?	Styrofoam box	57	73.1
		Freezer	18	23.1
		Refrigerator	3	3.8
16	How long does it take from the preparation of açai do its commercialization?	One at five hours	59	75.6
		Six at twelve hours	15	19.2
		One day (24 hours)	4	5.1
17	Is the sale of a açai your only source of income?	Yes	44	56.4
		No	34	43.6
18	What is done with açai when it is not sold?	It is consumed	38	48.7
		It is consumed and donated	11	14.1
		It is donated	9	11.5
		Lower the price to sell everything	1	1.3
		It is icy for another day	9	11.5
		No leftovers	10	12.8
19	How many times a year is açai available for sale?	One time	31	39.7
		Twice	14	17.9
		Three times	3	3.8
		Four times	3	3.8
		Whole year	27	34.6

It was possible to identify seven actors in the açai production chain: I) extractive farmer – owns the plantation; II) extractive beneficiary farmer – cultivates and processes but does not sell to the consumer; III) extractive farmer and trader – plants and sells the pulp, but outsources the processing; IV) Processor and trader – produces the pulp and sells it to consumers, but does not have a plantation; V) seller – sells the pulp that has already been processed and VI) extractive farmer, processor, and trader – participates in the entire production chain and the middleman – only intermediates the commercialization.

Most traders only process and sell açai, meaning very few are growers and resellers of the pulp in the form of “wine.” The high percentage of this survey of beneficiary/trader respondents (59%) and the lower number of extractive farmers are related to the origin of the plantations. Açai is obtained both in rural and urban areas identically. It is recorded that the cities investigated are small, and some açai plantations are located in areas of difficult access, with a route only by the river in small boats (canoe), being a limiting factor of this research the lack of access to these areas places. In this way, the difficulty of marketing and selling the products is evidenced, which justifies that in the capitals, the prices of a liter of açai are higher.

The collection method described by the interviewees is traditional, where the individual climbs the palm tree with the tools of a peconha, machete, and shoes. The peconha provides security and stability when climbing the açai tree; the shoe prevents injuries or burns both when going up and down, and the machete is used to cut the stem of the bunch at the time of harvest. The steps of this procedure can be seen in Figure 2.

Figure 2. Açaí. A) Açaí plantation; B) Traditional açaí harvest and C) Açaí fruit
Figura 2. Açaí. A) Plantação de açaí; B) Colheita tradicional do açaí e C) fruto do açaí



Regarding the economic aspects (Question 4), it was found that the price of a liter of açaí varies depending on the amount available per harvest. The average price was 5 to 7 reais. As informed, the lowest price (up to 4 reais) is demonstrated at the height of the harvest, and the values above eight reais, in the off-season.

The values detected were lower than those reported by other studies in which the average price of açaí is as high as 20 reais. It is also observed that, unlike what happens in the state of Pará, in Amazonas, there is no subdivision into denser açaí (thick açaí) and less dense (thin açaí). It is not excluded that there are different characteristics between sellers and little standardization related to mass/volume concentration; however, in the investigated work, there was no explicit subdivision in the sales of each merchant.

According to the Ministry of Agriculture, Livestock, and Supply (Brasil, 2018), the processing of açaí pulp can be classified according to the content of Total Soluble Solids (TSS), being “thick açaí” with TSS greater than 14%, “medium açaí” with TSS between 11% and 14%, and “fine açaí” with content between 8 and 10%.

Most producers/beneficiaries are from family farming, small businesses, and without employees responsible for the processing. The açaí is processed in a pulper (95%) and stored in styrofoam boxes with ice (73%). The highest percentage of traders depends exclusively on açaí as a source of income, which highlights the importance of açaí in the economic sector of families. Of those who sell açaí (question 7), 75% sell the processed pulp (açaí wine), and a smaller percentage (17.9%) sell the fruit (seed with pulp) and also process the pulp. There is a consumer preference for “fresh pulp”; respondents stated that the time after processing and trading is a maximum of 5 hours. For the majority (56%), it is the only source of income; when it is not marketed, it is consumed or donated. This data reflects the consumption of açaí by the Amazonian population. The traders will primarily carry out the pulp extraction process through a mechanical process, using extraction machines, considering that the process is faster and more efficient than manual extraction, in addition to minimizing the possibility of contamination.

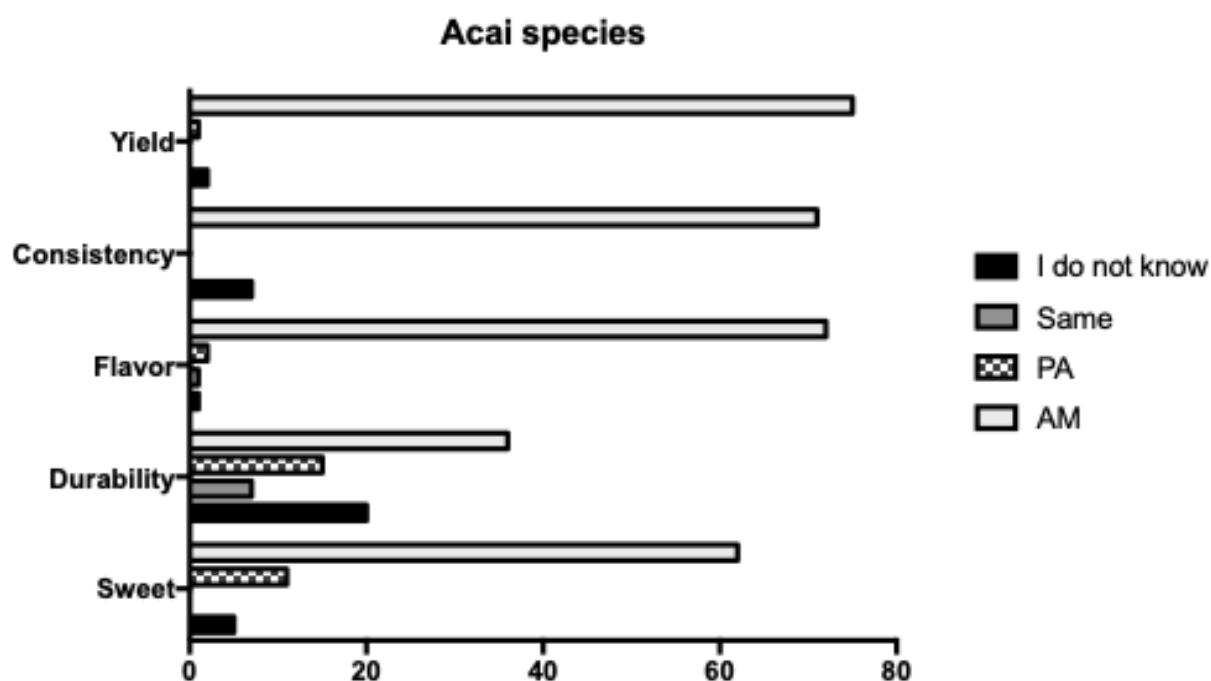
In the Amazon region, how açaí is consumed is divided between “açaí wine” as a dessert, in pure form, with sugar or condensed milk and a white flour called “tapioca”, or in the main meal, accompanied by shrimp, fish or meat. The difference between these customs will be due to the culture between the states of Amazonas and Pará, which are the leading producers and exporters of this fruit and is explained by the fundamental difference and little known to consumers outside the region who receive the product. There are two species of açaí, *Euterpe precatoria* and *Euterpe oleraceae*. In the general analysis, participants in the production chain know that there are different species of açaí.

However, most only mention the two commercial species: açaí do Amazonas (*Euterpe precatoria*), also known as açaí do jussara, and açaí do Pará (*Euterpe oleracea*).

When harvesting, the species can be differentiated through the tree's botanical characteristics. Still, when prepared for consumption, it is not always possible to be sure about the type of açaí being consumed. As its name suggests, *Euterpe oleracea*, known as açaí do Pará, has a more significant amount of fat, which makes the accompaniment with proteins more balanced. On the other hand, *Euterpe precatoria* has a slightly sweet flavor. According to the data obtained, the açaí trade in the Middle Solimões is mainly *E. precatoria* (Amazonas açaí), and only 32% of those investigated stated that they also use *E. oleracea* concomitantly. In addition to the sensory differences, residents cite the difference in yield and pulp durability between the two species (Figure 3).

Figure 3. Difference between acai species from the perspective of the participants in the production chain

Figura 3. Diferença entre espécies de açaí na perspectiva dos participantes da cadeia produtiva



When asked about the difference between the types of açaí, many answered that it was just the color and the flavor. Still, when asked about higher yield, more excellent texture, better taste, outstanding durability, and sweeter, the açaí from Amazonas preferred these qualities. It is known that the species of *E. oleracea* are commonly found in the region of Pará, while in the Amazon region, the species of *E. precatoria* prevails. However, in recent years the domestication of the species has been increasing, with no distinction for pulp sales, being commonly sold only as “açaí.” Both have values of beneficial substances for the human body and regardless of whether one species or another is produced, scientific studies show that they have antioxidant and anti-inflammatory properties and the presence of bioactive metabolites.

The seeds are generally discarded, even though they represent the most significant amount of fruit mass (Question 14). Regarding the destination given to the seed, many dump it in rivers or forests, others use it as food for animals, and others, discard it in bags to be taken to be incinerated in a brick and ceramic factory to serve as fuel. The last two are attractive solutions to avoid inappropriate disposal on public roads, causing visual pollution of the city and may also cause damage to society such as clogging of drains or environmental compromise.

4. Discussion

Perspectives of new business opportunities motivate the valuation process due to the expectations generated regarding the future of the region's socioeconomic development and açaí production. Few data are available in the literature on this fruit's production chain, and the data compiled cannot always be related. Studies suggest that research on NFNTF is poorly developed in the Amazon region, and this is a fact that should be further worked on, given that this form of trade makes it possible to maintain the forest (Conceição *et al.*, 2017; Afonso, 2022).

In parallel, research on the benefits of açaí for the human body is growing, but one cannot fail to understand the socioeconomic development that guides this production. Understanding the role of the subjects involved is useful and collaborates with the development of this productive sector that promotes commercialization to broader levels, where it is observed that the consumption of açaí has the breadth of the international market.

The exploration of NFNTFs is fundamental for the riverside and traditional populations of the Amazon region, offering economic and social subsidies for local development to occur without damaging biodiversity, which is a way of survival for the residents near the conservation areas. In addition, this practice contributes to the commercialization of products with a sustainable organization and conservation from an environmental point of view, in addition to offering food resources to low-income populations (Fachinello, 2010; Moreira *et al.*, 2011; Afonso, 2022).

The production and trade of açaí are one of the most evident activities of the primary sector in the Amazon region. In the research carried out, different from what is described by other authors, the presence of the "middleman", the individual who links the producer/processor and the consumer, represented a lower percentage than those described for other NFNTF fruits, such as copaíba, andiroba, Brazil nut, and piquiá (Conceição *et al.*, 2017; Silva *et al.*, 2013; Afonso, 2022). This result may be related to the fact that the information was collected in rural areas, which is one of the limitations of the research. However, it is known that there is a more significant number of these actors in capitals and metropolitan cities, where primary production is increasingly scarce.

The data on extractive and commercialization of açaí detected in this work is corroborated by other studies. However, it is noteworthy that the research in the literature focuses mainly on the *Euterpe oleracea* and in the states of Pará, Amapá, and Acre.

Euterpe precatoria is described with few species and data related to extractivism in the Amazon and none in the municipalities of the Middle Solimões. It is common to describe that in primary extractivism, which involves production, processing, and local trade, the show is family-run, which is a strategy to minimize economic costs and a way of absorbing the labor of family members (Conceição *et al.*, 2017; Silva *et al.*, 2013; Rocha *et al.*, 2022).

The price of a liter of the minimally processed product (wine) in Pará is between 12.00 and 18.00 reais, which varies depending on the origin and resale (Santos *et al.*, 2016). In Acre, Rondônia, and Amapá, this value ranged from 5.00 to 10.00 reais (Maciel *et al.*, 2015). The issue of seasonality was a common fact because açaí is a source of food. So, this is an aggravating factor for the populations that depend on this raw material.

Paes-de-Souza *et al.* (2011) evaluated the açaí (*Euterpe oleracea*) production chain in the state of Rondônia, in the municipalities of Porto Velho, Guajará-Mirim, Machadinho D'Oeste, Ariquemes, and Costa Marques. The authors describe that the bottlenecks in production and trade are related to the flow and little collaboration between the fruit producers. Complementing this analysis, Ramos & Euler (2019) point out that the exclusive dependence on açaí generates support that makes the participants of this chain vulnerable to price fluctuations and difficulty in planning and financial maintenance in the off-season.

The participants described no form of government incentive, nor did the formation of agricultural cooperatives or associations, demonstrating the limited organization of the actors involved in the açaí production chain in the Middle Solimões.

Tagore *et al.* (2018) report that in the state of Pará, policies to encourage the production of açaí, through the National Program for the Strengthening of Family Agriculture (PRONAF),

contribute considerably to the strengthening of the cultivation and extraction of açaí from Pará (*Euterpe oleraceae*), with investments accessible to all participants in the production chain. However, this is not a common scenario detected for other raw materials, and this is a recurring problem in the production chain of NFNTPs in the Amazon region, where there is little practical assistance from government agencies and development agencies in monitoring the extractive production process and in the development and promotion of productivity in the production chain (Moreira *et al.*, 2011; Paes-de-Souza *et al.*, 2011).

It is observed that this scarcity extends beyond the Amazon region and is reported in different Brazilian states as the babassu production chain lacks public policies aimed at the extractive sector focusing on stimulating the growth of the production chain and meeting the needs of extractive families (Oliveira *et al.*, 2017; Saraiva *et al.*, 2019).

The economic appreciation of açaí should be taken advantage of as an element of recognition of extractive activity, respecting the principles of sustainability and the development of extractive (Tagore *et al.*, 2018). In this way, an incentive is necessary so that this agricultural sector can be strengthened, contributing to the insertion of technologies that can add value to the açaí production chain, making it possible to improve the income generation of the population that survives from this resource, in addition to clarification measures that collaborate with the good practices of cleaning and handling the product, providing the valorization and quality of the product obtained and encouraging the creation of cooperatives and agricultural associations.

5. Conclusion

The açaí production chain in the Middle Solimões is responsible for the income of many Amazonian residents and involves three main participants: farmer/extractor, beneficiary, and trader. It was found that the collection is still carried out traditionally, using peconha, machete, and footwear. However, the form of processing occurs using the pulper. Producers and traders are aware of the different types of açaí species, with a preference for the species *Euterpe precatoria*, popularly known as açaí do Amazonas. It was found that such importance is associated with flavor and correlated with sensory characteristics, consistency, and yield. This work is the first study of the açaí production chain in the Middle Solimões region. The continuation of the research is encouraged to investigate aspects related to the difficulties of farmers and traders and public policies to promote production. Extension projects are to contribute to the clarification of the subjects involved in the planning and development of agricultural associations and cooperatives that could contribute to developing the local economy.

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Conflict of Interest

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