ANALYSIS OF BIOECONOMY PRODUCTS OF THE BRAZILIAN AMAZON

Boosting the forest-friendly entrepreneurial ecosystem

Amazon Investors Coalition

Earth Innovation Institute

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1. INTRODUCTION

This report presents the results of a study of Amazon products, forest and aquatic, that have the potential to provide the economic base for the development of the Amazon bioeconomy. The focus is on the sustainable development of the Amazon's sociobiodiversity, a concept which seeks to capture both the ecological biodiversity of the Amazon rainforest biome, and the local, technical and scientific knowledge of traditional and indigenous peoples, scientists and professionals who are essential to developing an Amazon bioeconomy.

This document aims to serve as a catalog to help "wikify" market data on priority Amazon forest/farm/fish opportunities that restore ecological and food systems and benefit source communities (a living crowd-sourced information highway). Towards this end the research team has developed summaries of available information on 21 "bioeconomy products."

One issue, also noted in a key TNC 2021 report, was the difficulty finding data on the production and commercialization of all but a few Amazon products. In this connection, the TNC report presents a useful classification of the products based on the economic importance of the product, production and market trends, and the available data.

The TNC classifications are: 1: Products with increasing production among the most Important (7). 2: Products with stagnant or declining production but among the most Important (3). 3: Promising products with low production but positive trends in growth (4). 4: Products without information about scale or growth (16)

This classification system shows that of the 30 most relevant products for the Amazon bioeconomy, there are little or no data on the production, supply chains or markets of more than half of them (TNC 2021).

Our experience confirms this observation. These products are largely invisible to the government and to the formal economy because there is no quantitative information that can be evaluated and compared with information on other products. There is little or no official record of how or where and in what quantities they are produced or collected, processed, traded and consumed. Consequently, there is virtually no quantitative information to provide a basis for investment decision-making.

With a few exceptions, the list we produced is almost identical to that included in the TNC report, which reflects the fact that these are, more or less the best-known products of the Brazilian Amazon. There are many others, which may someday gain prominence. There are also many other important forest products in the Panamazon countries not included in this report, such as those from Bolivia, Peru, and Colombia.

One other aspect of our classification is the potential of a product to drive the transition towards a low emission development trajectory, a fundamental objective of a bioeconomic development strategy. Here the question is, of the 30+ most promising Amazon products, which have the potential to drive the transition to an Amazon bioeconomy that not only values the conservation of the Amazon forest, but is also able to reduce and eventually halt Amazon deforestation? This consideration is missing from the prevailing discussion of an Amazon bioeconomy. Instead, the explicit

assumption seems to be that the transition to a bioeconomy based on these and other forest products will be achieved through a combination of government enforcement of the Forest Code, suppression of illegal deforestation and the growing value of the forest driven by investment in developing markets for forest and agroforestry products. Presumably, this will encourage farmers to reduce investment in large scale extensive production strategies such as beef and grains, and shift investment towards forest-based productions systems such as agroforestry, silvopasture and forest management. Here the issue is not if that's possible, but given our experience thus far, how long will it realistically take, and how much more forest will be lost before it succeeds in stopping Amazon deforestation and forest degradation.

In our portfolio of bioeconomy products, we have included two fish species - tambaqui for aquaculture and pirarucu for managed fisheries. Aquaculture uses only about 10% of the area beef requires to produce the same amount of animal protein, while studies have shown that the productivity of floodplain fisheries increases with forest cover, 10% more forest cover, 10% more fish. If landowners shift from beef to aquaculture and managed fisheries, they not only reduce pressure on forests, but they can also convert large areas of pasture to tree and forest-based production systems, while maintaining and even increasing farm income. In the case of floodplain fisheries, the positive relationship between forest area and fishing productivity can work as an incentive to encourage floodplain farmers to reduce investment in low productivity, extensive cattle ranching and invest in reforestation and forest management instead. Fish, then, are an example of a potentially transformational product, one that can make possible a large-scale shift in Amazon land use that eventually eliminates deforestation as a central challenge to sustainably developing the Amazon.

A key starting point for the project was a one-page list of topics that should be covered in a two-page summary. In the end the average is closer to four pages as we added a few other topics on environmental and social issues associated with each product. Another reason for the length, is ironically, the difficulty of finding the precise information necessary to succinctly describe each product. Finally, regarding our approach in this report. We are not trying to sell these products. Rather, we seek to present an objective assessment of each product, including those points that an investor should be aware of in deciding whether or not to take a deeper look.

Another important point is that, by definition, this is a work in progress. It is intended as a first step in developing a wiki-catalog of bioeconomy products for those interested in investing in an Amazon bioeconomy. It is not intended to be a definitive source. Our aim is to provide those interested in developing the potential of Amazon forest products, with some useful basic information to help them decide if they want to dig deeper and learn more about a product or move on to another one. The intent is to get the ball rolling and hope that others will jump in to build on these initial summaries. Here we are fortunate to have the examples and experience of Wikipedia and many other wiki-related initiatives. If we are successful in attracting volunteers to this effort, then we can begin to think seriously of the next steps involved.

The products included here are not easily placed in one or another use categories. Many have various uses in the traditional economy and researchers discover new uses as they learn more about the chemical compositions and potential applications in our modern industrial economy. Very roughly, there are 13 products primarily used as a

food, 12 that are primarily used for the oil in their seeds and or pulp and at least 2 that are materials. Many of those classified as food or oil are used for both and several of these also produce useful fibers. This simple categorization does not do justice to the wide variety of current and potential uses these products have. These are some of the products that are important in the economic life and food security of Amazon people.

The four members of the team involved in this project, have different backgrounds and professional experience, but all have lived and worked in the Brazilian Amazon for several decades in areas that overlap with the objectives of this project. As a result of our experience, we all know a lot about a few of these products and at least a little about all of them. From here on, we hope that those who do know a lot about some of these products feel motivated to contribute their knowledge to correcting our errors, and omissions, and producing more accurate and useful summaries of the potential of these and other Amazon products.

Assessing the Performance of Key Dimensions of Bioeconomic Development

To overcome the absence of data, a key objective of the project is to develop a rating system that can help investors identify which products are most compatible with the principles of a bioeconomy that seeks to sustainably develop the forest and aquatic resources of the Amazon. Here the difficulty is the multi-dimensional nature and often incommensurability of the different attributes that must be taken into account in developing a ranking system. Given the absence of data, such a system must necessarily be largely qualitative and should also not seek to reduce the attributes of a product to a single letter. Instead, we opted for a qualitative assessment of the products based on their performance on the major dimensions/ attributes of each product from a bioeconomy perspective.

Bioeconomy producers, investors and entrepreneurs are encouraged to consider the following criteria as a lens to A) Make assessments about product development opportunities, and B) Identify indicators for tracking economic, social, and environmental impact.

A. Economic Assessments and Indicators

A1. Generation of employment and income: Potential for increasing employment and incomes in the short to medium term, substantially improving the quality of life of a significant proportion of the Amazon population.

A2. Time to reach scale: The amount of time required for the scale of activity involved in the production, processing and marketing of the product to have a significant impact on the Amazon bioeconomy.

A3. Level of Infrastructure Investment: The level of investment in supply chain infrastructure required to modernize the entire supply chain so that it can efficiently deliver an economically significant quantity of high quality product to markets.

B. Social Assessments and Indicators

B1. Shift to more equitable agrarian structure: Products that can be efficiently produced individually, or as part of multi-species production systems, at a scale that can lead to significant reductions in land concentration favoring small and medium scale producers.

B2. Support Indigenous and Traditional People: Products that directly support local development that significantly improve the livelihoods of indigenous and traditional peoples and can help them fulfill their aspirations.

B3. Beneficial for smallholders: Products that can be produced at a scale and with the level of capital investment available to smallholders and enable them to significantly improve their quality of life.

C. Environment Assessments and Indicators

C1. Conservation of biodiversity: Products that can be produced through economic strategies that conserve biodiversity and the forest and aquatic systems that they are part of.

C2. Forest Code & Ecosystem Function Compliance: Products that can be produced without coming into conflict with the forest code (20% of property may be cleared and

80% must be in natural forest or tree-based productions), ensuring the integrity of hydrological processes and the role of the forest in maintaining the precipitation regime that sustains the Amazon ecosystem.

C3. Transformational: Potential for significantly reducing the rate of deforestation and driving development of the Amazon bioeconomy.

Preliminary Observations

Through the process of collecting information on the products presented here, we have identified a number of concerns regarding the proposal of building an Amazon bioeconomy based on developing the potential of the Amazon's sociobiodiversity.

1.Throughout the last century one trend that has been observed is that the Amazon basin has few, if any, comparative advantages in developing the economic potential of the basin's biodiversity or sociobiodiversity. For example, Southeastern Brazil, especially the Atlantic Forest has similar agronomic conditions with far better infrastructure and access to markets.

2. Rather than comparative advantages, the Amazon region has comparative disadvantages, which include the presence of diseases that affect promising Amazon species, such as the rubber tree (leaf blight) and cocoa (witches broom). It has inadequate or nonexistent supply chain infrastructure for efficiently interacting with markets. And, the technological capacity for developing the potential of Amazon products is also limited when compared to other areas of Brazil and elsewhere in the world.

3. Most of the products we have included here have multiple sub-products and uses that can be developed to capture their full potential.

4. As noted earlier, there is little quantitative information available on the production, harvesting and processing of these products, nor is there much data on the size and potential of the markets where they are consumed. Consequently, a first task in developing a bioeconomy based on the products of Amazon sociobiodiversity will be the collection and analysis of information that is needed to develop the potential of thee products.

5. Finally, far too many of these products are still harvested by relatively poor families using simple and inefficient technology. The products still pass through rudimentary value chains to reach modern markets where they are valued in millions and even billions of dollars. There is a real danger that the Amazon bioeconomy will help to make wealthy regions of the world wealthier while having little positive impact on the Amazon peoples who make this wealth possible.

2. MOST RELEVANT PRODUCTS OF THE BIOECONOMY OF THE BRAZILIAN AMAZON

2.1 AÇAI (*Euterpe Oleracea*) – ACAI-FRUIT

The açaí palm is native to the Brazilian Amazon and occurs throughout the delta and inner estuary of the Amazon River, as well as, on the floodplain of the Amazon River, especially along the lower portions of streams flowing into the Amazon floodplain. A beverage made from the pulp of the acai berry is an important food for local people while higher quality acai is also much appreciated by middle and upper class consumers. Because of its anti-oxidant qualities it has become a popular beverage for health and fitness advocates throughout the world.

Acai fruit

Acai tree

Processing of açaí

PRODUCTS

The main product is the pulp of the acai berry, which is used to produce a nonalcoholic beverage called “açaí wine” (vinho de açai), the most common form of consumption in the Amazon region. Numerous other products are derived from the pulp and seeds as well as the growing core of the palm (palm heart). The fruit pulp is used to produce a variety of other products such as liquors, jellies, sweets, fillings, ice cream and cremes; the seeds are processed into flour and mixed with bread dough and are used in civil construction, the seed can be transformed into a sludge used in the production of cosmetics and the fibers also have a wide variety of uses.

CURRENT MARKET SIZE

The global acai berry market was valued at US$ 4.99 Bn. in 2021 (MMR, 2023). In 2021 Brazilian production of açaí totaled 507,583mt, 55% from cultivated plants and 45% from managed açaí stands (IBGE, 2017, 2021). The state of Pará is the largest producer with 78% of total production (396.249t). The second largest producer is Amazonas with 13% of Brazilian production. Pará is also responsible for 94% of Brazil's açaí exports, which grew by 14,380% in the last 10 years, from 41mt in 2010 to 5,937mt 2020 (IBGE, 2017, 2020; CONEXSUS, 2021, ABRAFRUTAS, 2023; IJAERS 2021).

PROJECTED FUTURES MARKET SIZE

The global acai berry market is expected to grow by 11.5% per year between 2022 and 2029 to reach nearly US$ 11.93 Billion (MMR, 2023).

VOLUMES SOLD/CONSUMED

Of total production in the state of Pará, 60% is consumed in the state, 35% goes to other regions of Brazil and 5% is exported. Exports totaled 56.6 tons in 2020 ($252,333). The main consumer countries (besides Brazil), were the USA (40% of the açaí exported), Japan (236 t - 2021 and Australia (194t - 2017-2018) (FSC, 2020; CONEXSUS, 2021).

PRICE TREND

In 2023, wholesale prices on the internet for frozen açai pulp ranged from US$ 999.99 for a 35lb bag to US$4,342.58 for a 100kg (NATURAL FOODS, 2023).

Average price per kg of açaí exported in 2020 US$ 4.47 (COMEXSTAT/MDIC, 2023).

HISTORY

Acai as a beverage has been a major element of the diet of ribeirinho populations in the delta and upper estuary regions of the mouth of the Amazon for centuries. Since the 1970s acai has been widely consumed by middle and upper income urban populations. In the 1980s and 1990s açai's reputation as an antioxidant and as an energy drink (high fat content and virtually zero sugar) led to growing national interest and açai became a popular health beverage associated with sports and fitness centers. The growth of international demand for acai developed during the 1990s and 2000s. The export market continues to develop, driving further transformations in açãi production and processing as research has sought to develop new products from acai berries for the food, beverage and pharmaceutical industries. See also (SILVA, 2021; IBGE, 2017, 2020; ABRAFRUTAS, 2023).

PRODUCTION SYSTEMS AND ENVIRONMENT: AGROFORESTRY, WILD HARVESTING, PLANTING

In recent years, the wild harvest of açaí berries has averaged about 181,290 tons per year about 38% of total berry production (IBGE, 2020). Traditionally, acai has been cultivated in house gardens and in agroforests surrounding houses, often mixed with cocoa and cupuaçu and other useful shrubs and tree species. The 2017 census estimates that there are 165,742 hectares of cultivated acai, including agroforests and more or less pure stands (IBGE, 2017). The consortium with perennial crops (cupuaçu, cocoa and coffee) makes possible the planting of forest species to recover and enhance the ecosystem (EMBRAPA, 2022, 2016). Açaí grows in multi-stemmed clumps making possible management strategies that combine açaí berry production with culling of some stems when they reach optimal size for palm heart.

TERM OF MATURITY

The açaí tree begins its fruit production cycle between 3 and 4 years. Flowering occurs during all months of the year, peaking between February and July. The palm tree can reach

up to 25m in height and produce three to four bunches per year, with 3 kg to 6 kg of fruit (SEDAP, 2016). Açai palms can continue growing for several decades, but as they get higher harvesting berries becomes more risky and many producers prefer to harvest palm heart.

PRODUCER PROFILE AND SOCIAL IMPACTS

T Açai production has been largely dominated by small scale producers and local, small scale intermediaries. In some areas smallholders live and farm on the land of large landowners and have various shareholding arrangements. As the acai market has developed and demand for acai has grown incomes have increased, depending on local land tenure arrangements. Further investment is needed to improve labor productivity so producers and their families can continue to benefit from the development of the acai economy (FSC, 2020).

PRODUCTION PROBLEMS

Açai palms are vulnerable to a variety of pests and diseases. More research is needed to identify and find solutions for the most important pests. Child labor is another issue as açai berry collection has traditionally depended on family labor involving school age children. Efforts are underway to eliminate this problem and ensure children stay in school (EMBRAPA, 2022; LAMB, 2020).

SUPPLY CHAIN ISSUES

The acai berry is quite perishable and must be processed and refrigerated within 24 hours and the pulp must be consumed within 24-36 hours of processing to avoid oxidation. For longer periods the pulp must be frozen or freeze dried. Sanitary issues are mostly associated with local consumption as contamination of acai pulp occurs primarily in local markets where processing of pulp is based on artisanal methods and often uses filtered or even unfiltered water. Sanitation is far less of a problem in acai that is destined for national and international markets, where water quality and hygiene practices are closely monitored (FSC, 2020).

CREDIT POTENTIAL/CARBON SEQUESTRATION

Açaí has high potential, as an element of agroforestry systems with other perennial species probiding fruit and timber (MIRANDA et al., 2012).

CERTIFICATION PROGRAMS

CERTIFICATION	BY-PRODUCTS	COMPANY	TYPE
ORGANIC BRAZIL	Virgin acai oil Pasteurized Organic Acai Berry Acidified Acai Berry Acai Biodoversity area	ECOCERT FSC	Allows organic commercialization within Brazil;
Organic farming Europe (EU)			It allows marketing of organic products in the European Union, applies to agricultural raw materials and food products;
USDA-ORGANIC – Agricultura orgânica nos EUA -USDA NOP			Allows marketing of organic products in the United States;
Fair for life			Social Certification and Fair Trade - Allows the commercialization of products from Fair trade

	Acai and prepared on fruit		worldwide
ECO CERT COSMOS ORGANIC			Allows the commercialization of organic or natural cosmetics worldwide;
IBD ORGÂNICO			Guarantees the quality and origin of organic products
ORGANIC FARMING – European Commission (EC)			Marketing of organic products that meet the standards established to the European Union market;
KOSHER – PARVE			Ensures that manufactured products meet the specific standards governing the Orthodox Jewish food diet
HACCP – APCC			Food safety in the processes regarding risks and hazards, ensuring the standard of quality, integrity and safety of the products to consumers

RELEVANT SECTORS

Food and beverage, Nutraceutical and Cosmetic. Demand for organic and sustainable products: Veganism, Slow food, Superfoods, Indication of doctors, nutritionists and fitness influencers (FSC, 2020).

Retailers

Retailer	Site
Frutalí	https://www.frutali.com.br/
Sambazon do Brasil Agroindustrial Ltda	https://www.sambazon.com.br/
Amazon Pulps	https://organis.org.br/associado/amazon-polpas/
Top Açaí Indústria e Comercio de Polpas de Frutas Ltda	fiscal@gscontadores.com.br
De Marchi Indústria e Comercio de Frutas Ltda	https://www.demarchi.com.br/
Açaí Tropical Amazon Ltda	https://acai-tropical-amazon.negocio.site/
Acre Fruit Pulps Ltda	
Distribuidora Norte do Açaí	file:///C:/Users/user/Downloads/Cat%C3%A1logo%20Portfolio%20-%20Norte%20do%20a%C3%A7a%C3%AD%20.pdf
Acai Selfsy	https://www.selfsy.com.br/produtos/acai/
Qprime foods	https://qprimeacai.com.br/catalogo/
Petruz Acai	https://marketing.petruz.com/safra-fabrica-de-acai-para?gclid=CjwKCAjwx7GYBhB7EiwA0d8oe1Rua56KRyWWsxzZHAiiNYrW1-uNuw1ZsMG9rQRaUmw0iRZOp-f-7BoCXqgQAvD_BwE
Acai Town	https://acaitown.com/br/nossos-produtos/
Amazon Oil Ind. and Com. of Eireli Vegetable Oils	https://www.amazonoil.com.br/
Xingu Fruit Pulps of Fruits Industry and Commerce Ltda	https://www.xingufruit.com.br/

IMPORT/EXPORT AND COMPLIANCE FEES

The tariffs will be given according to trade agreements, tariff preferences and legislation applicable to foreign trade (BRAZIL, 2023).

BIOCULTURAL PROTECTIONS OF COMMUNITIES OF ORIGIN (NAGOYA PROTOCOL/CGEN/ETC.)

The Brazilian adherence to the Nagoya Protocol, Legislative Decree No. 136 of 08/11/2020, ratified by the national executive that took place in March 2021, can leverage the production chain of Açaí due to the use and exploitation of genetic heritage by other countries.

REGULATORY INFORMATION

inci Name: Euterpe Oleracea

Harmonized System Code: 2007.99 - other (20.07 - Jams, jellies, marmalades, fruit purees and pastes, obtained by cooking, whether or not with added sugar or other sweetening matter)

NCM: 2007.99.21

2.2 AÇAÍ (*Euterpe oleracea*) – AÇAÍ-PALM HEART

The açaí heart of palm is native to the Amazon rainforest. As the açaí produces multiple stems, the heart of palm extraction is less aggressive than that of the juçara palm. Farmers can manage the stands of both, collecting fruit every year and harvesting the stems when they reach a certain size to take advantage of the high quality heart of palm without affecting fruit production.

fresh hearts of palm

fresh hearts of palm

Açaí palm tree

PRODUCTS

The heart of palm is the growing "core" of the palm tree, in the shape of a cylinder, white in color and with layers of fibers that have a soft and smooth texture. It is considered a by-product of the açaí tree, exploited after several years collecting the açaí fruit, the main product. Heart of palm is marketed *in natura* in regions close to cultivation or canned in a local cannery. The main ways of commercializing canned goods are: stalk, which prioritizes the highest quality heart of palm stem (noble); the larger diameter part can be sliced or minced into small pieces.

CURRENT MARKET SIZE

In the period from 2000 to 2017, Brazil 27,868 mt annually, 3.35% of global production of 831,881 mt. Brazil was one of the 4 major exporting countries behind Ecuador, Costa Rica and Bolivia. Annuakl Braziliam palm heart production was valued at US$ 108,658,837, 6.11% of the world total of US$ 1,778,377,038. The main destinations for Brazilian canned heart of palm, in the period 2000-2017, are: United States, Japan, Lebanon and France (BITTENCOURT, KC, 2020).

PROJECTED FUTURE MARKET SIZE

Market analysts predict that the volume of Brazilian exports will continue to fall while the price of heart of palm may rise (TNC, 2022).

VOLUMES SOLD/CONSUMED

In 2021, Brazil produced 114,918 tons of heart of palm, around 4,140 tons from wild stands and 110,778 tons cultivated system. The total value of Brazilian palm heart was US$

58,678,790 (IBGE/EVS, 2021; Silvicultura , IBGE 2021). About 90% of production of Brazilian production is exported and only about 10% is sold in the domestic market (TNC, 2021).

PRICE TREND

While the amount of heart of palm produced annually is expected to fall, the price of heart of palm is expected to increase. Price growth, on the other hand, can increase by up to 14% and should average 8% to 1.4% per year (TNC, 2022). According to UN COMTRADE data (2019), palm heart had the highest added value (965%) among sociobiodiversity products.

HISTORY

The açaí tree *(Euterpe oleracea Mart.)* is native to the northern region of Brazil, growing naturally in the flooded areas of the estuary of the Amazon and Tocantins rivers and other rivers in the region. The distribution of açaí extends from the lower Amazon to the Guianas and Venezuela, and is part of the diet of riverine populations, who traditionally use its fruits in the production of açaí wine, a highly energetic and nutritious drink. Beginning in 1968, the açaí heart of palm gained increasing economic importance, due to the decrease in the supply of Juçara (*Euterpe* Mart.), a palm tree native to the South and Southeast regions of Brazil. From the 1990s onwards, heart of palm began to lose its extractive and clandestine nature, giving way to the more rational and sustainable production of cultivated palm heart (BITTENCOURT, KC, 2020).

PRODUCTION SYSTEMS AND ENVIRONMENT: AGROFORESTRY, WILD HARVESTING, PLANTING

All Brazilian regions participate in the production of heart of palm (extractive and cultivated). The north region is dominant in palm heart extraction, strongly represented by the state of Pará, where it is an important source of employment and income, while cultivation predominates in the south, southeast and northeast regions (Bittencourt, KC, 2020) . In the past the extraction of palm hearts from wild stands often threatened the supply of açaí berries. However, more efficient management systems have been developed that optimize the production of palm hearts from stems that are culled when they reach a certain size, reflecting the increasing demand for berries. These management systems provide increased financial returns for the producers (TECNOLOGIA E TRAINING, 2017). Açaí trees are often grown in agroforestry systems including with numerous other tree species, such as rubber trees, cocoa and cupuaçu, or in monocultures (MANEJE BEM, 2021).

TERM OF MATURITY

In general, açaí stems are harvested when they reach five years of age. This ensures softer and smoother heart of palm. The yield of heart of palm at this size is roughly 200 grams per stem (MANEJE BEM, 2021).Açai fruit production increases until stems reach 8-9 years of age.

PRODUCER PROFILE AND SOCIAL IMPACTS

Açai production has been largely dominated by small scale producers and local, small scale intermediaries. In some areas smallholders live and farm on the land of large landowners and have various share holding arrangements. As the acai market has developed and demand for acai has grown incomes have increased, depending on local land tenure arrangements. Further investment is needed to improve labor productivity so producers and their families can continue to benefit from the development of the acai economy.

PRODUCTION PROBLEMS

Unsustainable extraction of açaí for palmito. Lack of applied research, credit and technical assistance for producers.

SUPPLY CHAIN ISSUES

Despite strict control by the food industry, canned heart of palm can be contaminated with ***C. botulinum***. This is especially likely if the heart of palm is derived from illegal harvesting operations that do not meet the sanitary and hygiene standards of INMETRO and ANVISA (Food Safety Brazil , 2015) .

RECOMMENDATIONS FOR PROCESSING AND DIMENSIONS

Recomendations include increasing inspections; promotion of certification; and investing in modern supply chain infrastructure. Another recommendation is the creation of tax incentives for socio-biodiversity products, application of a differentiated rate for interstate trade and export to other countries; tax exemption on heart of palm processing operations; and the creation of a specific fund for investment in the development and strengthening of local value chains.

CREDIT POTENTIAL/CARBON SEQUESTRATION

With a pricing policy that recognizes the social benefit of stored carbon, the share of Added Value generated by the heart of palm sector could increase from 10% to 67.8% by 2040. National retail taxes could be reduced from 33% to 12% .5% (ICMS). This demonstrates the importance of measures to distribute the revenue resulting from carbon pricing by producers to other agents in the local production chain, as this produces positive externalities associated with the conservation of native vegetation, increasing the volume of stored carbon (TNC, 2022).

CERTIFICATION PROGRAMS

At the end of the 1990s, some quality seals were created by ANVISA, attesting to the safety of products for consumption in response to botulism outbreaks resulting from the consumption of canned hearts of palm. Today, heart of palm must be certified by IBAMA and the manufacturer must have a permit from the Sanitary Surveillance (Food Safety Brazil , 2015).

CERTIFICATION	BY-PRODUCTS	COMPANY	TYPE
HACCP	canned	QIMA/WQS	The Hazard Analysis and Critical Control Points, is a

	hearts of palm		certification that focuses on product quality, verifying the company as a whole, that is, it evaluates from the human resources sector, to the planting conditions

RELEVANT SECTORS

Aggregators/suppliers

The heart of palm segment is highly fragmented. There are currently around 170 companies working in the country (INACERES, 2022). The Palm Heart Industry Union of Pará (Sindpalm) brings together 28 companies, 90% of them located in the largest industrial center of its kind on Ilha do Marajó.

exporters

In the international market, the largest purchases are made by the United States (Sindpalm, 2019).

importers

The main Brazilian importers of heart of palm are located in the South and Southeast regions of the country.

IMPORT/EXPORT AND COMPLIANCE FEES

According to data from UN COMTRADE (2021), Brazil exported 411,367 kg of heart of palm for a total value of US$ 1,776,478 (4.32 US$/kg); and imported 15,905 kg, at US$ 81.127 (5.10 US$/kg) in 2021. The price of Brazilian heart of palm is higher than that of other exporting countries. Among the factors that contribute to the higher value of the heart of palm in Brazil are: transportation, as the country's road network is very deficient (SILVA *et al.*, 2017).

BIOCULTURAL PROTECTIONS OF COMMUNITIES OF ORIGIN (NAGOYA PROTOCOL/CGEN/ETC.)

Brazilian adherence to the Nagoya Protocol, Legislative Decree No. 136 of 08/11/2020, ratified by the national executive in March 2021, can leverage the açaí production chain due to the use and exploitation of genetic heritage by other countries.

REGULATORY INFORMATION

Harmonized System Code: 2008.91: Canned heart of palm

2.3 ANDIROBA (*Carapa guianensis*) - ANDIROBA OIL

Andiroba is an Amazonian fruit discovered and used by indigenous peoples. Its name comes from the Tupi term ãdi'roba, which means "bitter taste", which along with its strong smell are striking characteristics of andiroba oil. Other names: andirova, andiroba-saruba or carapá.

Fruit of andiroba

Andiroba Oil

Tree of andiroba

PRODUCT

Virgin andiroba oil

Timber: extraction of andiroba trees for timber can compete with almond collection and processing for oil.

BY-PRODUCTS

Virgin and refined oil are considered by-products, widely used in the phytocosmetics and phytotherapics industry, it is also a valued timber species.

Andiroba oil is an important traditional medicine. Due to its anti-inflammatory, antiseptic and healing properties, it can be used to treat worms, skin diseases, fever and inflammation, it is used as a massage oil for muscle relaxation, relieves muscle pain and inflammation. It is also used as a moisturizer and in hair proucts, competing with other Amazonian vegetable oils such as: copaíba, Brazil nut oil, patauá, murumuru, açaí (COSTA *et al.*, 2015).

CURRENT MARKET SIZE

Andiroba oil is an input for the cosmetic and pharmaceutical industries, in various personal hygiene, beauty and health-related products. Andiroba oil is sold in the Brazilian market and is exported to the United States and European countries, such as Germany, Spain and France (CONAB, 2022).

SIZE OF THE PROJECTED FUTURE MARKET

The size of the global Andiroba Oil market was estimated at US$95.1 million in 2021 and is projected to reach US$145.02 million in 2028 (53% in 7 years), assuming a CAGR of 6.21% during the forecast period. However, production trends in recent years suggest that this forecast may be optimistic.

VOLUMES SOLD/CONSUMED

In 2020, production was 115.5 tons, an amount 5.5% lower than in 2019, distributed in the states of AM, MA and PA, especially the states of Amazonas and Pará, which accounted for about 87% of national production, and the state of Maranhão with the remaining 13%. The drop wasmainly avoided by restrictions caused by the global COVID-19 pandemic, hitting local businesses, paralyzing logistics and processing (CONAB, 2022).

PRICE TRENDS

The price paid to producers for andiroba oil is quite variable over time and from place to place, ranging in recent years between R$ 0.77/kg and R$1.62 kg (CONAB, 2022).

Wholesale prices on the international market for andiroba oil vary from $170.78 to $213 per gallon gallon, to between $711.58 and $889.48 per 44lb containers (EBAY, 2023).

HISTORY

The Andirobeira, *Carapa guianensis* Aubl, occurs throughout the Amazon basin, primarily in lowland environments. It also occurs on Caribbean islands, southern Central America and northern South America (Ferraz et al., 2003). The Andirobeira has been an important source of timber that competes with its value as a source of high quality oil. Fortunately, the Andiroba tree grows quite rapidly and is less vulnerable to logging pressure. It is increasingly used in agroforestry systems for its oil (LAMEIRA *et al., 2022*).

PRODUCTION SYSTEMS AND ENVIRONMENT: AGROFORESTRY, WILD HARVEST, PLANTATION

Where sustainable management practices have been adopted, the andirobeira also contributes to the sustainable use and ecological resilience of the forest as a whole (CONAB, 2022). The Andirobeira is an important species in agroforestry systems for both its timber and the oil obtained from almonds harvested annually as trees grow. The value of andiroba wood can be a threat to wild stands in areas where forest governance is weak.

MATURITY TIME

It is a medium to large tree, with a cylindrical and straight trunk and thick bark. The fruit is a globular, dehiscent capsule (fruits, when ripe, open to expose the seed) of four valves that separate when they fall to the ground releasing four to twelve seeds, which weigh an average of 21g. An adult tree can produce up to 120 kg of seeds (average 50 kg). In general harvest occurs between January and June and can vary from one year to another depending on rainfall patterns.-

As with many Amazon forest trees, andiroba nuts are adapted to germinate soon after dispersal. As a result, storage for extended periods of time is not feasible without compromising oil extraction, and harvest areas tend to be concentrated in areas close to local processing plants (CONAB, 2022).

Almonds contain 43% fat, but yield depends on the extraction methods used. For example, 1 liter of oil requires 12 kg of almonds with manual extraction, 4kg of seeds with mechanical extraction and 3kg of seeds with the use of solvents. The average yield of oil from an andiroba tree ranges from 10 liters with manual extraction up to 30 liters with more intensive extraction methods.

PRODUCER PROFILE AND SOCIAL IMPACTS

Andiroba almond collection and oil extraction are largely practiced by traditional and indigenous people in those areas with access to local processing plants. In these areas, the collection and processing of andiroba oil can be a significant income source for rural families in these areas (MENDONÇA; FERRAZ, 2006).

PRODUCTION PROBLEMS

As with other socio-biodiversity products, logistics is the main bottleneck for producing and marketing andiroba oil. The relatively high prices for andiroba almonds in Amazonas and Pará is a result of increasing demand for oil; fragility in the supply chain, a reflection of the informality in the activity, from almond collection oil production; the perishability of the fats in almonds can compromise quality and quantity of the oil; and low value added of the final product (CONAB, 2022).

SUPPLY CHAIN PROBLEMS

Natural medicinal products require certification by the National Health Surveillance Agency (ANVISA) to ensure products comply with quality standards, the absence of the quality seal restricts the amount of andiroba and copaiba oils that can be sold by individual establishments (COELHO *et al.*, 2014).

Brazil is a major supplier of essential oil to the US market, but suffers from chronic problems such as variable quality of the oil, low national representation and low government investment in the sector (BIZZO *et al.*, 2009; SOUZA *et al.*, 2010).

CREDIT POTENTIAL/CARBON SEQUESTRATION

Andiroba trees can be an important income source from forests managed for nontimber forest products and also plays an important role in agroforestry systems. Forest carbon credits could be an added incentive for the sustainable management of andiroba in local forests.

CERTIFICATION PROGRAMS

CERTIFICATION	BY-PRODUCTS	COMPANY
ORGANIC BRAZIL	Andiroba virgin oil organic refined oil	Amazon Oil Ind. and with. of Eireli Vegetable Oils
USDA-ORGANIC – Organic Agriculture in the USA -USDA NOP		Beraca Natural Ingredients Ltd
ECOCERT cosmos organic		100 (Percent) Amazônia Exportação e Representação Ltda
ORGANIC IBD		Association of Small Agroforestry Producers of the Reca

		Project and the Agricultural and Forestry Cooperative of the RECA Project
ECOCERT cosmos organic		Symbiosis Amazon

RELEVANT SECTORS

Almond -> Oil (pharmaceutical and aesthetic industries)

In the Manaus region, there are only a few plants processing andiroba, generating a dynamic of low demand, which in the case of extractive products can result in low supply since extractive producers are not prepared to carry out the collection in the forests. The production of the Juruá/AM region is purchased by almost every pela Natura company, along with USAID/Brazil, the Plataforma Parceiros pela Amazônia (PPA) and the Bioversity/CIAT Alliance (CONAB, 2022).

Aggregators/suppliers

Retailers

ORGANIZATION	CONTACTS
The wall Association of Rural Working Women united for Freedom, Humanity and Love	(68) 99965-1946 Nataíres (68) 99968-9961 Aldeli womenamuralha@gmail.com https://amuralha.ac.amazoniativa.com/
ASPROJU Jutaí Producers Association	(97) 3425-1056
Association of Agroextractivists Ribeirinhos do **Rio Araguari**	(96) 3118-4477
COOPFITS Cooperative of Producers and Beneficiaries of Medicinal Plants, Phytotherapeutics and Phytocosmetics of Manaquiri	(92) 9627-7327
copronate Amazon Natural Products Cooperative	(92) 2528-2088 rubemgoes@bol.com.br
Socio-environmental Institute of **Amapá – Cumaú**	(96) 99190-6008
RECA Association of Small Agroforestry Producers of the RECA Project and the Agricultural and Forestry Cooperative of the Project	(69) 3253-1046/(69) 3253-1007 WhatsApp: (69) 98471-0234 projectorreca@yahoo.com.br https://www.projetoreca.com.br/

IMPORT/EXPORT AND COMPLIANCE RATES

Disaggregated data on the export and import of andiroba essential oil are not available, as vegetable oils are accounted for together.

BIOCULTURAL PROTECTIONS OF COMMUNITIES OF ORIGIN (NAGOYA/CGEN/ETC. PROTOCOL.)

The Brazil adheres to the Nagoya Protocol, Legislative Decree No. 136 of 08/11/2020, signed into law in March 2021. This legislation can add value to the andiroba production based on the use and exploitation of Brazil's genetic heritage by other countries (Amazonoil, 2022).

REGULATORY INFORMATION

IUPAC Name : *Carapa Guaianensis* Seed Oil is the fixed oil expressed from the seeds of *Carapa guaianensis* , Meliaceae
Harmonized System Code : 4407.29.02.40 - Andiroba (*Carapa guianensis and C. procera*)
CAS Number : 352458-32-3 / 223748-14-9

2.4 BABAÇU (*Attalea speciosa Mart. ex Spreng*) – BABASSU OIL

Babassu, one of the main products of Amazon sociobiodiversity, is a palm tree of the family Aracaceae. It is found predominantly in floodplain areas and valley bottoms and depressions and occurs in several regions of Brazil, mainly in the states of Pará, Maranhão, Tocantins and Piauí, in transitional areas between the Cerrado, Caatinga and Amazon forest biomes. It is also called the coconut-palm, coconut de-macaco, coco-pindoba, baguaçu, uauaçu, among other names. The collection and processing of babassu cocunts is practically the only source of support for a large part of the landless interior population of the regions where babassu occurs, especially in the State of Maranhão. The extraction of babassu almonds involves more than 300 thousand families, primaritly women accompanied by their children: the "breakers" (quebradeiras), as they are called (MOREIRA, 2013).

Babaçu Fruit

Babaçu Tree

Babaçu Coconut

PRODUCT

The fruit or coconut has a number of uses. The shell, known as epicarp, is used to make xaxim, an organic fertilizer or serves as a fuel in homemade ovens. The edible mesocarp has great nutritional value and is an important element of the local diet.

BY-PRODUCT

Seed or almond: Almonds from 3 to 5 in each fruit - are extracted manually and sold to local crushing industries and producers of crude babassu oil.

Natural vegetable oil: The oil extracted from almonds, which constitutes 65% of the weight of almonds, has great market and industrial value. It is produced for two purposes: edible oil is used in cooking (similar to coconut oil, with the potential to compete with other vegetable oils); and for industrial purposes (lauric oil) used in the manufacture of soap, detergents, cosmetics, lubricants, biodiesel and herbal medicines. **Refined and solidified oil:** produced at low temperatures known as "azeite babaçu", produced with roasted almonds, adding water for future evaporation. In the refining process, the oil needs to undergo a calculation, after the separation of the "azeite babaçu" from the dough (BARBOSA, 2022; DOMINGUES, ARAÙJO, SILVA, 2017).

CURRENT MARKET SIZE

The global market value of babassu oil was USD219.2 million in 2021, and increased to USD 227.7 million in 2022 (3.9% growth rate). Paradoxically, national production of babassu oil declined from 48,706 tons in 2019, to 32,074t in 2021. The trend may be a related to the covid epidemic.

Main destinations in 2016 were: Netherlands, Germany, Uruguay, Paraguay and the United Kingdom, together totaled 1.72 million value in exports. The Brazilian lauric oil market is currently the main market for babassu oil. The industries of the hygiene, cleaning and cosmetics segments absorb 35 thousand tons of raw babassu oil annually (EMBRAPA, 2021; CONAB, 2022).

PROJECTED FUTURES MARKET SIZE

Despite recent trends in national production of babassu oil, the value of the global babassu market is expected to increase by CAGR of 4.3% to reach $347 million by 2032.

VOLUMES SOLD/CONSUMEDS

As noted production of babassu oil ranged from 48,706 tons in 2019, to 32,074t in 2021 most of which was exported.

PRICE TREND

The average price on the national babassu almond market is R $ 2.67 / kg. In Maranhão, Ceará and Piauí, the trend observed in the high prices in the annual variation (2019/2020). In 2020 the price indices of babassu almonds had considerable variation between markets, with the most significant increase occurring in Tocantins, 29%, followed by Ceará and Piauí. The pressure of demand on supply was the main reason for the increase in prices (CONAB, 2021).

HISTORY

There may be two trends in motion today. Historically, the expansion of the babassu market was dependent on growth of the cleaning industry, such as soap, this expansion may be compromised by competition with palm kernel oil, which is similar to babassu oil but has higher productivity and a much lower production cost than babassu. The expansion of oil palm production and the import of palm oil could outcompete babassu oil in a large segment of the cleaning industry. This is a point in the commercial scenario of babassu that should be observed when talking about the decrease in production and yield of coconut breakers (EMBRAPA, 2021; OLIVEIRA et al., 2022; CONAB, 2021). The lauric oils market has become the main market for babassu almonds, but it suffers competition with palm oil kernel and coconut oils (CONAB, 2022).

There is growing interest in organic and natural cosmetics. Babassu oil is rich in fatty acids, which is a key ingredient of soaps, creams and shampoos, has antimicrobial and anti-inflamatory properties, and is rich in antioxidants that can prevent skin damage. There is a growing interest in the babassu value chain due to international demand for products

originating from fair trade relations. One example of this trend may be Natura Cosméticos, one of the largest buyers of babassu coconut crude oil, purchased 24 tons of babassu oil in 2020 and is expected to increase purchases to around 130 tons in coming years (FUNDO AMAZÔNIA, 2023; NATURA, 2020; ASSEMA, 2021).

The Babassu value chain seems to be moving from the traditional market to one that specifically values the social and environmental aspects of babassu, providing ecosystem services to local populations and supporting continued development of organizational capacity, support for the culture of babassu producers and the inclusive modernization of their value chain so they become fully integrated into the evolving bioeconmy.

PRODUCTION SYSTEMS AND ENVIRONMENT: AGROFORESTRY, WILD HARVESTING, PLANTATION

The babassu palm is closley integrated into regional agroforestry systems. The cultivation of annual crops and animal grazing occurs under the palm trees that self-propagate. Despite its abundance, it is not uncommon to see the planting and management of babassu in agricultural areas, which take place during the rainy season. The consortium of babassu trees with annual crops such as rice, corn, beans, cassava, as well as animal pastures, constitute an efficient and sustainable management system for the babassu biome. At the same time the adaptive capacity of babassu palms can be effective in reforesting excessively dry and nutrient-poor lands (FUNDO AMAZÔNIA, 2019; ABIERO, et al., 2017). It is one of the most abundant palms in the Amazon and the Brazilian Cerrado biomes. The species is adapted for colonizing areas following deforestation. The diversity of economically useful products and relatively production contribute to the babassu palm importance in relation to other wild species.

MATURITY TIME

Babassu palms have an average life span of 35 years. They begin producing fruit when they reach 8 to 10 years of age and attain full production by the 15th year. They produce 3 to 6 bunches of fruit over the year and each bunch has between 150 and 300 coconuts each of which contains an average 3 almonds. Trees usually produce between three and five bunches of yellowish flowers. The peak flowering occurs between January and April and the fruits ripen between August and December. As they ripen the fruits fallto the ground, and are collected by the “coconut breakers”, women from traditional agroextractive communities. In addition to collecting and processing the nuts, the coconut breakers have had to organize to fight for recognition of their territorial right to manage babassu trees on public and private lands **(**PAES-DE-SOUZA et al., 2011).

PRODUCER PROFILE AND SOCIAL IMPACTSS

Babassu almonds are obtained, primarily through the work of the so-called "coconut breakers", including traditional peoples and communities, as well as indigenous groups that also maintain a relationship with this palm tree. The *babassu coconut* breakers, or *breakers*

(Quebradeiras), and there relationship with the *Babaçu* are part of the highly biodiverse ecosystem located in the eastern transition zone between the Amazon Forest and cerrado biomes.

Now as the bioeconomy is elevated to a national priority in the research, development and innovation agenda, the babassu and the management system these communities have developed have much to offer and to gain from involvement in programs that promote the sustainable use of the products of Brazilian biodiversity. For hundreds of rural communities and tens of thousands of vulnerable families, the babassu almond is still an essential source of monetary income (PORRO, 2019).

PRODUCTION PROBLEMS

One of the technical bottlenecks of babassu production is the primitive technology and low productivity of babassu harvesting, extraction and processing to produce babassu oil so that a large part of the value of the supply chain is captured higher up the chain.

SUPPLY CHAIN PROBLEMS

Babassu almonds are channeled to a relatively small number of processing industries. The expansion of the babassu market is quite dependent on the growth of cleaning industry and this expansion may be compromised by competition with oil palm kernel oil, which has higher productivity and much lower costs than babassu. Competition from imported oil palm oil could cause a decline in demand for babassu.

RECOMMENDATIONS FOR PROCESSING AND SIZING

Seeking to achieve legally binding biodiversity targets will influence the GVCs of companies that rely on natural resources found in regions inhabited by protected communities within specific socio-cultural and economic contexts.

Investment in processing equipment (such as the vegetable oil extraction press) could replace the far less efficient manual extraction.

Studies of the implementation of processing plants for some by-products; characterization of the technical-economic feasibility of derivatives processing; study of the production quality of natural vegetable oil and refined and solidified oil.

Development of more productive commercial techniques for the exploitation of babassu products and conservation of the Babaçu Forest (OLIVEIRA et al., 2022)

These opportunities for investment to address bottlenecks could contribute to the developent of a more inclusive and equitable babassu bioeconomy.

CARBON CREDIT/SEQUESTRATION POTENTIAL

The babassu is an important element of the transitional landscape they occupy that plays an important direct and indirect role in carbon sequestration (OLIVEIRA, 2022).

CERTIFICATION PROGRAMS

CERTIFICATION	BY-PRODUCTS	COMPANY	TYPE
ORGANIC BRAZIL	Drinkeo de babaçu	ECOCERT FSC QIMAIBD	Allows organic commercialization within Brazil;
Fair Trade Certified (2000)			Fair trade. Andestablish direct contact between the producer and the buyer, reducing bureaucracy in trade and sparing them from dependence on middlemen and the instabilities of the global commodity market.
USDA-ORGANIC – Agricultura orgânica nos EUA -USDA NOP			Allows marketing of organic products in the United States;
IBD ORGÂNICO			Guarantees the quality and origin of organic products
Agriculture Orgânic Europe			Permite that its organic products are marketed in the European Union

RELEVANT SECTORS

Retailers

Retailer	Site
Central do Cerrado – (cooperative of a group of producers)	https://www.centraldocerrado.org.br/
Cooperativa dos Pequenos Produtores Agroextrativistas de Lago do Junco LTDA (COPPALJ)	https://www.coppalj.com.br/
Association of Rural Women Workers of Lago do Junco and Lago dos Rodrigues (AMTR)	Phone: +55 99 9172-4139 | 99 3642-2152
Interstate Cooperative of Women Breakers of Coconut Babaçu (CIMQCB)	https://www.miqcb.org/
Cooperativa dos Pequenos Produtores Agroextrativistas de Esperantinopolis LTDA (COPAESP)	Email – coopaesp1@ig.com.gbr

IMPORT/EXPORT TARIFFS AND COMPLIANCE

For export/import, the traded value of babassu as a non-chemically modified vegetable oil is UR$ 3.9/kg (COMTRADE, 2021).

BIOCULTURAL PROTECTIONS OF COMMUNITIES OF ORIGIN (NAGOYA/CGEN PROTOCOL/ETC.)

The Nagoya Protocol "strengthens opportunities for fair and equitable sharing of the benefits deriving from: a) the use of genetic resources derived from native species and b) the traditional knowledge and practices associated with the use of native species by local communities." One of these native species is the babassu palm, ranked third among the top 8 non-timber forest products (NMFP).

REGULATORY INFORMATION

inci Name: *Attalea speciosa* Mart. ex Spreng

Harmonized System Code: 15.13 - Oils of coconut (copra), palm kernels (palm kernels) (coconote) or babassu, and their fractions, whether or not refined, but not chemically modified.

NCM: 1513.21.20

2.5 BACURI (*Platonia insignis*)

The bacuri occurs in the Amazon region, it is also found in the Cerrado biome in the states of Maranhão and Piauí. The species, in the past, was not seen as a fruitful plant, but exploited for having a resistant wood for building boats and houses. One of the most valued bacuri products is its pulp, which is sweet, aromatic and highly sought after in the local market (ISPN, 2023).

Bacuri fruit pulp

Bacuri fruit

Bacuri tree

PRODUCT

Pulp – food industry (juices, liqueurs, jellies, sweets and ice cream) and in the medicine industry (anti-inflammatory and healing).

BY-PRODUCT

Wood – construction of boats and houses;

Oil or 'bacuri lard' – taken from the seeds, with medicinal and cosmetic value;

Fruit residues – used in animal feed.

CURRENT MARKET SIZE

In Belém, trade in *fresh fruit*, followed by ice cream, juices and smoothies, is quite significant. In 1994, the trade in bacuri fruits moved a total of US$1,610,000 (7 million fruits at a price of US$0.23 each), and in 10 years (2004), the volume of this market grew, at least, by 3 times. Bacuri is found both in more peripheral markets and in large supermarkets. Most ice cream parlors and snack bars also serve ice cream, fruit juices and smoothies.

Of the product that enters the market, 97% is sold *in natura* and 3% in the form of pulp. Of these, 68% are sold at the fair, direct to the final consumer; 14% is sold to pulp processors who pass it on to snack bars and ice cream parlors; 5% go directly from the farmers to snack bars and ice cream parlors (generally smaller ones that are responsible for pulping the fruit) and 10% are intermediated to external markets, mainly in Belem (MEDINA; FERREIRA, 2004).

The total VA generated in 2019 of BRL 11.5 million represents 3.5 times the original value of rural production, of BRL 3.3 million; this can be considered a primary chain multiplier. The arrangements that, in the local economy, produce bacuri absorbed 100% of the VA generated: they are, therefore, strongly pro-local chains. Of the participation of the local

economy, 97% stayed in the interior – they are chains, therefore, strongly pro-interior (TNC, 2021).

PROJECTED FUTURE MARKET SIZE

The bacuri market began to gain strength from the year 2000 onwards. The fruit was used by collector farmers only for domestic consumption. Many farmers today are already starting to reserve small areas, until then destined for shifting cultivation, for the regeneration of capoeira with the bacuri tree.

In Pará, the trade chain has diversified, producing municipalities already buy and sell bacuri to other municipalities and export part of their production mainly to Belém. The growth in demand has led to an increase in prices and all points in the chain are earning enough income to stimulate the expansion of the market (MEDINA; FERREIRA, 2004).

The bacuri rural production supply regime is characterized by a strongly inelastic production response, since a variation of 1 percentage point in the (current) price results in an increase of 0.239 percentage points in the quantity produced. The growing evolution of the real price paid to the producer, in turn, at 3.9% pa, indicates that supply has grown at a slower pace than demand (TNC, 2021).

However, it is worth mentioning that a large part of this increase in demand is due to domestic trade. There were no significant increases in bacuri exports to other states and shipping to other countries is unknown. From a strategic point of view, it seems much more interesting to invest in the local market, which involves lower risks and still has great growth potential (MEDINA; FERREIRA, 2004).

VOLUMES SOLD/CONSUMED

Based on field studies, the TNC sociobiodiversity team estimate that bacuri production grew at an average rate of 4.4% per year between 2006 and 2019 with total production reaching 1.8 thousand tons in 2019 (TNC, 2021). The gross value of bacuri production is estimated to have grown at 8.2% per year over the same period, reaching R$3.3 million in 2019.

PRICE TREND

There is considerable variation in the price of bacuri fruit, influenced mainly by the size and shape of the fruit, as well as seasonal variation in prices related to the harvest period (MEDINA; FERREIRA, 2004). In November, 2022, the price per kg of bacuri pulp ranged from US$ 5.96 to US$ 9.95 in Belém-PA. The price in São Luís-MA during the same period was around US $ $5.37/kg.

HISTORY: The bacurizeiro is native to the Brazilian Amazon but is widely distributed throughout northern and central Brazil from the Guianas and the states of Pará, Maranhão and Piauí to Paraguay. The bacuri is also known as acuri, bacuri- guaçu, bacuri-grande, pacurinha, pacuru. Its name, in tupi, means “what falls as soon as it ripens”, and it is for this reason that the fruit is harvested only when it falls from the tree. In the first two centuries of

Amazon colonization, the bacurizeira was more important as a timber species than as a fruit tree. In recent years as the bacuri gained value as a fruit tree logging pressure has declined. Until the mid-1960s, bacuri was more popular than cupuaçu. However, as cultivation of cupuaçu became wisespread in the 1990s, it abundance and popularity have somewhat eclipsed that of the bacuri (Toda Fruta, 2016).

PRODUCTION SYSTEMS AND ENVIRONMENT: AGROFOREST, WILD HARVESTING, PLANTING

Because of difficulty propagating bacuri seedlings and its extended juvenile phase, commercial cultivation of bacuri is rare and the majority of fruit still comes from wild stands of bacuri. As a result of their exploitation for timber and the virtual absence of management or cultivation, bacuri trees are not as abundant as they were in the past (Toda Fruta, 2016).

MATURITY TIME

Bacuri is a leafy tree that can reach 40 meters in height and two meters in diameter. With pink or white flowers, the species can reproduce in two ways: by seeds or sprouting from the roots. In areas with open vegetation, bacuri densities, at the beginning of regeneration, can reach 40,000 individuals per hectare. The bacuri fruit is a berry, voluminous and ovoid to rounded, or subglobose in shape, weighing between 350 and 400 g, reaching up to 1,000 g. The fruit has a thick skin, 1 to 2 cm thick. The pulp is soft and delicate and has a white-yellowish color, with a very pleasant smell and taste, rich in vitamin C, phosphorus, iron and calcium.

Fruiting occurs between September and February in Piauí and Maranhão, with fruit harvest between December and March/April and peaks in February and March. Bacuri trees begin to produce at around 10 years of age. The average production per adult tree in an upland area is 400 fruits per year. The skin makes up about 68% of the fruit, the pulp 15% and the seeds about another 15%, with higher yields in yellow-skinned fruits than in green-skinned ones (ISPN, 2023). The production varies from year to year with years of high production followed by years of low production. Consequently, there is an enormous year to year variation in the volume of fruit reaching the market (MEDINA; FERREIRA, 2004).

PRODUCER PROFILE AND SOCIAL IMPACTS

In Pará, bacuri collected from surrounding areas, has a greater participation in food security and income of producing families. Families with surplus production (generally with more than 10 trees producing annually), sell the fruit to supplement household income. The total income (monetary and non-monetary) of the families is around US$2,470 per year. On average, the consumption and/or sale of bacuri contributes only about 2% of the total. In families with greater access to the market and with more than 10 trees, bacuri represents less than 10% of total income.

PRODUCTION PROBLEMS

The bacurizeiro is a rustic plant that needs little cultural treatment. Management begins only after the trees have started to produce and consists of one annual clearing to facilitate the

collection of the fruits. More recently, with the increasing importance of the fruit and its derivatives, some farmers have begun to manage the trees and surrounding area from early in the bacuri lifecycle (MEDINA; FERREIRA, 2004).

SUPPLY CHAIN PROBLEMS

There is no specific legislation for the sale and processing of bacuri products. The few small companies that process bacuri do not have any special support and also no impediment. However, bacuri seems to be gaining recognition and increasing commercial value. Agents specialized in transforming the fruit into pulp and reselling it to snack bars and ice cream parlors are beginning to gain importance. Ice cream parlors and snack bars are working with a much higher turnover of the product; and bacuri pulp is now sold during harvest periods on a daily basis (MEDINA; FERREIRA, 2004).

RECOMMENDATIONS FOR PROCESSING AND SIZING

There are few botanical and ecological works on the bacuri tree, and research aimed at perceiving the species as an integral part of the farmers' production system is practically non-existent in the Amazon. Field work that seeks to rescue the knowledge of farmers who have been using forest products, including bacuri, is essential (MEDINA; FERREIRA, 2004).

Implementation of rural development policies: Science, Technology and Innovation (CT&I), credit and technical assistance; Creation of a continuous product value chain database system;

Creation of tax incentives for socio-biodiversity products and application of a differentiated rate for interstate trade operations and exports to other countries, as these are specific products linked to the biodiversity of the biome (TNC, 2022)..

CREDIT POTENTIAL/CARBON SEQUESTRATION

In the itinerant cultivation cycle, bacuri regeneration plays an important role in biomass production. Due to its regenerative vigor, which is due to the intense process of root regrowth, the bacuri grows very quickly after burning and, after a year, already covers the entire surface of the land with trees over one meter high. This characteristic demonstrates that it is a species with relevant potential for carbon sequestration (MEDINA; FERREIRA, 2004).

CERTIFICATIONS PROGRAMS

CERTIFICATION	BY-PRODUCTS	COMPANY	TYPE
ORGANIC BRAZIL	Licor de Bacuri Orgânico Geleia de Bacuri Orgânico Caroço do Bacuri	ECOCERT	Allows organic commercialization within Brazil;
Organic farming Europe (EU)			It allows marketing of organic products in the European Union, applies to agricultural raw materials and food products
Agricultura Familiar PA000071/19 BRASIL			National Seal of Family Agriculture – SENAF identifies the products of family farming in Brazil.
USDA-ORGANIC – Agricultura orgânica nos			Allows marketing of organic products in the United States;

EUA -USDA NOP			

RELEVANT SECTORS

Because of the low level and dispersed nature of bacuri management and fruit collection, processing and distribution there is virtually now systematic and continuous monitoring of the supply chain or of the volume of fruit produced, processed and marketed. As with many traditional extractive products in the Amazon, they are virtually invisible to the formal economy.

Retailer	Site
Fazenda Bacuri	https://www.fazendabacuri.com.br/

IMPORT/EXPORT AND COMPLIANCE RATES

Data for bacuri are aggregated for tropical fruits.

BIOCULTURAL PROTECTIONS OF COMMUNITIES OF ORIGIN (NAGOYA/CGEN/ETC. PROTOCOL)

Brazilian adherence to the Nagoya Protocol, Legislative Decree No. 136 of 08/11/2020 , ratified by the national executive in March 2021, can leverage the bacuri production chain due to the use and exploitation of genetic heritage by other countries.

REGULATORY INFORMATION

inci Name: *Platonia insignis*

Harmonized System Code: 2007 - Doces, geleias, marmelades, purês e pastas de fruta, obtidos por cozimento, mesmo com adição de açúcar ou de outros edulcorantes. 2007.9

NCM: 2007.99.10 – (Geleias e marmeladas)

2.6 BORRACHA NATURAL (*Hevea brasilensis*) - NATURAL RUBBER

Natural rubber includes rubber produced on plantations and rubber extracted from trees in the Amazon rainforest. Natural rubber is sold in three forms: Latex -> Liquid; Cernambi Virgin Pressed (CVP) and Liquid Smoked Leaf (FDL).

Latex (natural

Liquid Smoking Sheet

Rubber tree

SUBPRODUCTS

rubber allows the production of multiple products for different uses: gloves, boots, tires, inner tubes, sealants in general, adhesive tapes, condoms, electrical wires, there are more than 40,000 products for the most diverse applications.

CURRENT MARKET SIZE

According to estimates by the Association of Natural Rubber Producing Countries (ANRPC), world production of natural rubber was 14.0 million tons with a total value of US$ 22.360 million in 2018 (CONAB, 2019). Asian countries are responsible for about 90% of global production. Brazilian production of natural rubber was estimated at 399 , 751 tons in 2021 (IBGE,2021).

PROJECTED FUTURE MARKET SIZE

World rubber production (natural and synthetic) grew at an average annual rate of 2.8%, totaling 29.04 million tons in 2018 (ANRPC). The value of the *natural rubber market is projected to reach* US$26.350 million by the end of 2027, an increase of almost 18% over 5 years or 3.5% per annum.

PRICE TRENDS

In February 2022, the reference price for importing natural rubber was US$ 2.69/kg, indicating a drop of 8.37% compared to the previous month (IEA, 2022).

HISTORY

Species of the genus *Hevea* occur naturally in the Pan Amazon (Brazilian, Peruvian, Bolivian and Venezuelan). Hevea *brasilenesis*, the main species responsible for the Asian production, occurs naturally almost exclusively in the Amazon rainforest and especially along the main trunk of the Amazon River and along its southern tributaries. Charles Marie de La Condamine is credited with introducing samples of rubber to the scientific community in 1736. Over the

next few decades a number of useful discoveries were made that opened the way for wider uses of rubber. The major discovery that gave it a key role in the later stages of the industrial revolution was the discovery of vulcanization by Charles Goodyear which improved its resistance and elasticity at low temperatures. Two major changes in transportation first the bicycle craze and later the rise of the automobile transformed rubber into one of the key materials of the modern economy. In 1876 Henry Wickham smuggled 70,000 seeds from Brazil to Kew Gardens, England, from where seedlings were sent to India, Sri Lanka and Indonesia, Singapore and Malaysia. Over the next few decades plantation production steadily grew. Finally in 1912, the scale and low cost of SE Asian plantation rubber broke the Amazon's extractive rubber economy and by 1920 the Amazon was a marginal player in the expanding rubber market. Today more than 30,000 products have some rubber content.

PRODUCTION SYSTEMS

The predominant production model is extraction of latex from trees in naturally occurring groves, areas where the density of trees is higher. In many cases these groves are the result of indigenous and traditional forest management actions. The monoculture plantation system is still not viable in the Brazilian Amazon due to the South American leaf blight, *Microcyclus ulei* that spreads easily from one tree to another and significantly reduces the productivity of the affected trees, making plantations economically unviable.

MATURITY TIME

The extraction of wild rubber occurs in mature forests, where there is a greater density of rubber trees in the adult and productive phase. The rubber tree has a long life cycle and can produce for 40 years, depending on the care taken in extracting the latex/milk. The time to implement an enterprise and reach sustained production is relatively short because the trees are already in the production phase (Ambiente Brasil, 2021).

PRODUCER PROFILE AND SOCIAL IMPACTS

According to the Confederation of Agriculture and Livestock of Brazil (CNA), the Brazilian productive sector of natural rubber and its derivatives, generates **more than 100,000 direct jobs in the field** and with that, income for countless families that live from the activity (CropLife, 2020).

Currently there are more than 93,000 families involved in the collection and initial processing of rubber, rubber production takes place in a family system and the communities of rubber families are composed of a set of settings. Historically, placement income has been very low and rubber tappers were among the poorest and most marginalized populations in Brazil with low educational levels and equivalent health conditions.

This situation began to change in the 1990s with the conquests of the forest peoples movement, specifically in this case the rubber tappers movement with the creation of extractive reserves of different types, government investments in education and health, payment programs for environmental services , such as the Bolsa da Floresta program and

various types of subsidies included in the price of latex harvested by rubber tappers. In this new system of sustainable exploitation of the Amazonian forests by traditional and indigenous communities, the rubber tree has a central role as one of the main sources of income.

PRODUCTION ISSUES

The main production issues are related to the challenge of extracting latex from isolated groves of wild trees dispersed throughout the forest. The quality of latex extracted from groves of wild rubber trees is a major problem. Exposure to the sun, excessive use of coagulants, dirt, delays in collection and other incorrect procedures degrade the latex.

Another major problem is the high cost of labor costs. The government of Acre has created financial incentives that significantly increase the price paid to tappers. The stimulus reached approximately 7 thousand families of rubber tappers and increased the production of wild rubber to around 5 thousand tons/year, reactivating plants and rubber extraction throughout the State of Acre. However, this type of incentive alone is not sufficient to further increase production and ensure the sustainability of the sector.

In the last fifteen years there has been a significant improvement in the quality of rubber processed in Brazil, mainly due to the demands of rubber industries. The current market imposes rules that must be met by agribusinesses and the quality of the rubber must be guaranteed from the rubber grove to processing.

SUPPLY CHAIN ISSUES

The full integration of wild rubber in the Amazon bioeconomy depends on the transformation of all links in the chain. The work of collection, initial processing, storage and disposal to local industries is quite onerous and the necessary labor is secured in the rubber plantation through significant economic and social subsidies. To make the sustainable exploitation of wild rubber economically and socially viable, there is a need to invest in modern technology that progressively increases the productivity of labor in rubber extraction. **Significant improvements have been made in local processing. During the last 15 years** production area has increased five-fold and productivity has doubled. Furthermore, Brazil has the technology to further leverage these numbers and achieve significant gains in competitiveness (ABRABOR, 2017).

RECOMMENDATIONS FOR PROCESSING AND SIZING

Some challenges to face:
Reactivate research with rubber trees in the Amazon in plantations and in natural forests, including the development of varieties that are more resistant to the SALB fungus.
Promote the addition of value to extractive rubber: handicrafts, etc.
Associate the image with a green seal/certification of geographic identity.
Protect extractive production through a value supplement, adding subsidy for its social and environmental importance.

CREDIT POTENTIAL/CARBON SEQUESTRATION

A rubber tree has the capacity to neutralize 22 tons of carbon in one year. The main product extracted from the tree is natural rubber, without the need to deforest the area to obtain the product to be processed. Carbon credits are considered by the São Paulo Rubber Producers and Beneficiaries Association (Apabor) and by the Brazilian Rubber Producers and Beneficiaries Association (Abrabor) as an additional resource for rubber growers and sector workers. Highlighting that a rubber tree produces for more than 40 years (InvesteSP , 2021).

CERTIFICATIONS PROGRAMS

Natural rubber is one of the world's most important commodities, so best practices are crucial to ensure long-term sustainable supply. In July 2017, Brazil had 248,664 hectares, in 3 certified properties (FSC, 2018). It is an essential condition for supplying the pneumatic industry with ISO 9001:2000 certification. The ABNT 11,597 standard defines the specifications for natural rubber, but the pneumatic industries usually adopt their own specifications to approve suppliers.

RELEVANT INDUSTRIES

Processing Plants: There are 16 rubber processing plants in Brazil. The State of São Paulo has 7 of these plants (Bálsamo: Indústria Braslatex; Jaci: Industry Hevea -Tech; Urupês: Industry Northwest Rubber; Barretos, Cedral, Guapiacu, Parapuã and), 3 plants are located in Bahia, 1 in Espírito Santo, 4 in Mato Grosso and 1 in Pará.

Pneumatic Industry: The pneumatic industries usually have their own specifications for suppliers. With the requirement of ISO 9001:2000, the natural rubber supplier must achieve continuous improvements in efficiency and quality. This sector consumes around 70% of the natural rubber on the market.

Artifacts Industry: the rubber artifacts industry in Brazil has been growing at a faster rate than the pneumatics industries. The activity is responsible for the domestic consumption of 20 to 25% of natural rubber.

IMPORT/EXPORT AND COMPLIANCE RATES

According to data from UN COMTRADE (2022), Brazil exported 107,459 t, US$ 212,428,762 (1.98 US$/kg). The quantity exported in the last decade showed an increase in volume of 1,009.6% compared to 2012 data: 1,192,353 t, US$ 2,679,515,334 (2.25 US$/kg).

BIOCULTURAL PROTECTIONS OF COMMUNITIES OF ORIGIN (NAGOYA/CGEN/ETC. PROTOCOL)

Brazilian adherence to the Nagoya Protocol, Legislative Decree No. 136 of 08/11/2020, ratified by the national executive in March 2021, can leverage the rubber tree production chain due to the use and exploitation of genetic heritage by other countries.

REGULATORY INFORMATION

Harmonized System Code : 4001 1 0
CAS Number : 9006 -046

2.7 BURITI (*Mauritia flexuosa*) – BURUTI - FIBER

The buriti is a palm tree widely found in South America, reaching up to 40m in height in the Amazon region; known as moriche in Colombia and aguaje in Peru. In Brazil, it occurs in the North (Acre, Amazonas, Pará, Rondônia, Tocantins), Northeast (Bahia, Ceará, Maranhão, Piauí), Midwest (Federal District, Goiás, Mato Grosso do Sul, Mato Grosso) and Southeast (Flora of Brazil, 2017). Buriti stands out due to the uses of different parts of the plant, its diversity of uses made it known as the "Tree of Life": in Brazil the main products sold are: the fiber - in the Amazon; pulp and cosmetic oil - in the Cerrado (FERREIRA, 2018).

Confeccão de fibra de

Fibra de buriti

Palmeira de

PRODUCT

Leaf fibers – "linen or silk" for mats, ropes, hats, handicrafts.

BY-PRODUCT

Pulp – food, animal feed and beverage industry, by fermentation;
Pulp oil – food, cosmetics and fuel industries, in popular medicine (healing);
Petiole – furniture and utensils;
Leaves – covering of houses;
Wood – bridges, stilt houses, houses;
Almond - sturdy crafts (small sculptures);
Seed oil - industry of products for hygiene, cleaning and cosmetics;
Heart of palm - little used.

CURRENT MARKET SIZE

The fiber is the buriti product that has the largest volume sold in the country, which are delivered to the domestic and foreign markets. Exports primarily to the European market, as fiber or handicrafts. Fiber handicrafts have been publicized and sold at national and international fairs, such as in Germany and Italy.

In 2013, in non-timber extractive production, the group of Food products accounted for 71.3% of the total value of non-timber production, followed by Waxes (10.6%), Oilseeds

(10.4%) and Fibers (6 .8%) and most non-timber plant extraction is concentrated in the north of the country (REMADE, 2014).

PROJECTED FUTURE MARKET SIZE

In 2009, Brazil produced 803 tons of buriti fiber, which generated a value of US$ 702,843.41 (0.87 US$/kg); in 2021, total production was 473 t, generating BRL 556,626 (1.18 US$/kg), in 12 years there was a 59% decrease in production and a 136% increase in price.

Buriti is considered a promising product, whose production exists on a low scale, but has growth potential. Growing at 1.6% pa since 2006, the gross value of rural buriti production reached R$ 2.7 million in 2019. As a result of an average increase of 3.5% pa over the same period, the quantity produced in that year was 1.4 thousand tons. The proportion of the product consumed in the local economy was 89% – these are domestic chains, with export-based components (TNC, 2021).

VOLUMES SOLD/CONSUMED

The Brazilian states that produce buriti fiber are: Pará, Maranhão, Tocantins, Bahia, Amazonas and Ceará. In 2021, the amount of buriti fiber produced in Brazil was 473 t with a value of US$ 556,627, the states of the Amazon contributed with almost the total of this production (97% of the volume produced (458 t), the value was US$ 549,212, 99% of the total value the largest states producing buriti fiber in the Brazilian Amazon were: Pará (271 t) and Maranhão (116 t) (IBGE, 2021).

Regarding the projected quantity for 2040, a potential production of 1,332 tons is expected, with an average decrease of 0.3% pa (TNC, 2022).

PRICE TREND

In a comparative analysis of estimated prices between Brazilian states, in 2021, values for a kilo of buriti fiber ranged from US$ 0.43 (Amazonas) to US$ 2.44 (Maranhão), with an average of US$ 1. 18, in the national calculation. The explanation for this variation lies in the logistics in these two states, which is an obstacle to better pricing of the raw material (AFONSO, 2010).

The minimum price approved for the 2022 harvest of buriti, in the North region, was R$ 1.66/kg. This policy allows the generation of income, strengthening the families that make a living from the activity, and contributes to the sustainable development of biodiversity, through an instrument to support commercialization, known as the Direct Subsidy to the Extractive Producer - SDPE, thus encouraging the recovery and conservation of the several biomes, where extractive activity is present, through organized exploration (CONAB, 2022).

It is projected that the Value Added (VA) for each link in the buriti chain, as well as the quantity produced, in 2019, the total VA absorbed in the chain was around R$ 3.8 million, in 2040, it is expected a generation of income of BRL 55.4 million, that is, an average growth of

generated income of 11% pa Unlike the projected increasing income, there will be a drop in physical production, in the first year and from 2029 onwards (TNC, 2022).

HISTORY

In Brazil, buriti occurs in the Cerrado, western Caatinga, Pantanal and Amazon biomes. It also occurs in Bolivia, Peru, Ecuador, Colombia, Venezuela, Trinidad and Tobago, Guyana, Suriname and French Guiana. The southern limit of the distribution is Mato Grosso do Sul and the Andes Mountains to the west.

The importance of vegetable fibers dates back to primitive man, and many of the current commercial fibers have been economically used since ancient times. The fibers originating from young buritis leaves, still closed, are quite resistant and used mainly for making hammocks and ropes, and the less resistant fibers are used for making various handicrafts, such as purses, bags, baskets, hats, sandals, mats, brooms, placemats, cutlery holders, among others. The adult buriti leaves are used to cover rustic houses.

Buriti occurs naturally in swampy areas where the soil remains saturated throughout the year, such as low lying rivers banks, lakes, streams and especially swamps (igapó) (SAMPAIO, 2011).

In general, the species has well-defined anthropological, ornamental and economic importance for the populations of South America. Products made from buriti are widely used in indigenous and extractive communities in the Amazon; and commercial use in cities in the north and northeast of Brazil (AFONSO, 2010).

PRODUCTION SYSTEMS AND ENVIRONMENT: AGROFOREST, WILD HARVESTING, PLANTING

Harvesting the fruit is laborious, requiring ripe fruit to be picked from the ground after it has fallen naturally. Some collectors cut the ripe bunches at the buriti tree, as soon as the fruits ripen and begin to fall, to avoid being attacked by insects. Flowering begins when the palm tree is about 8 years old.

To use the fiber, the leaf is harvested and each part of the leaf has a different use. Some craftsmen are specialized in making furniture with the buriti stem, others make baskets and tapiti with the splint (hard fiber that covers the stem). There are those who use the entire straw to cover the roof. The "silk" or "ribbon" is removed from the eye, which is a very fine fiber that covers the straw. Silk is used to sew handicrafts, such as golden grass, or to make ropes.

The green leaves that are already open and the new leaves that are still closed, also known as eyes, are collected mainly from the buritis that are between 4 and 10 m high, but in some places the collectors climb the larger buritis to collect the leaves. Harvesting is done throughout the year, whenever there is a need, in the marshes closest to the house, usually less than 5 km away. To cut the leaf, the collector climbs the buriti tree, using the stalks of the dry leaves as a ladder, and makes a cut at the base of the stalk with a machete.

Buriti can produce up to five eyes (or new leaves) in a year, but most produce between three and five eyes per year, that is, it takes about four months for a buriti to produce an eye. Each eye yields about 100 g of silk. Leaf production does not stop in drought or rain. As long as a maximum of 50% of the eyes produced are harvested, harvesting the eyes does not kill the buriti tree and neither accelerates nor reduces the production of new leaves (SAMPAIO, 2011).

The occurrence of buriti is associated with areas periodically or permanently flooded or with poor drainage, and it is common to find the species on the banks of rivers, igapós, igarapés, springs, paths, swamps, wet clean fields, riparian forests and gallery forests. The buriti, in its natural environment, can occur with dispersed individuals or forming high-density populations, in swampy areas, it can be found forming extensive monospecific populations or together with other palm species, such as Euterpe oleracea Mart. (Açaí) and species of Oenocarpus (Bacaba) (FERREIRA, 2018).

MATURITY TIME

Solitary stem palm tree, without thorns. It reaches up to 40 meters in height, has large leaves, a rounded crown and yellowish flowers. It blooms almost all year round, but mainly from March to August. Fruit production is intense: according to data from Embrapa, five to seven bunches are produced per year, each of these with 400 to 500 fruits, the longevity of buriti can reach 85 years.

Flowering begins when the palm tree is about 8 years old; some studies report flowering between 5 and 11 years. Flowering is annual, producing 3 to 8 interfoliar inflorescences/year. Flowers produce pollen but not nectar; the palm tree has a very remarkable inflorescence with a strong fragrance, with coleopteran insects as its main pollinators (FERREIRA, 2018).

There are male and female buritis. The former produce bunches that only result in flowers; in females, the flowers turn into fruits. Its reddish-brown ellipsoid-shaped fruits have a surface covered with shiny scales. Even so, it is necessary to wait approximately one year for the fruits to be ripe and ready for harvesting, which happens between the months of December and February. The pulp of the fruit is tasty and orange in color, usually accompanied by a pit, which is the seed of the species. In some cases, however, two lumps or none can be found, rich in vitamin C and is an energy food (Cerratinga, 2023).

The buriti lives alone or in communities, which require an abundant supply of water in the soil. It is the waters that carry and spread the seeds of the buriti palm. The hard bark of the buriti tree is a natural protection against predators and the ingress of water.

PRODUCER PROFILE AND SOCIAL IMPACTS

In the region of Lençóis Maranhenses, up to 30% of the rural population has income generated by the sale of handicrafts made with buriti silk.

Silk is also of great importance in the Jalapão region (east of Tocantins), where it is widely used to sew golden grass handicrafts.

In addition to the economic aspects, the use of buriti, especially its fibers, is considered a cultural and identity symbol of the way of life of artisans who use this product (SAMPAIO, 2011).

PRODUCTION PROBLEMS

There are several limitations faced for the development of the buriti production chain: market consolidation, the small social and productive organization, the high perishability of the pulp, the high production cost of the oil due to the scarce knowledge of its extraction technologies, in addition to the irregularity in supply and demand for the product, since the collection period is short , generating uncertainty in the investment to improve the scenario as a whole, here understood from collection to final processing (CONAB, 2022).

Inadequate handling or intense removal of the leaves called “eye” can lead to the death of the individual. The ascent process is a stage of great danger for the "shooter" who, in addition to the risk of falling, can find venomous animals such as snakes and spiders at the top of the buritizeiro. Linen treatment is also still quite rudimentary and done manually in the artisans' homes (Artesanato com Design, 2011).

SUPPLY CHAIN PROBLEMS

The collection of the bud and the extraction of the flax from this buriti leaf, the preparation of the flax with or without dyeing, the removal of the adult leaf for other uses of the fiber, are artisanal manual processes that need tax incentives and training in good practices, as there is the possibility of predatory exploitation and the processes are very rough, demanding strenuous labor.

Existing public policies are incipient, and the resulting craft products or fibers, although they play a relevant role in the country's production chain, the commercial valuation practiced in the Brazilian domestic market and, consequently, the reduced remuneration of producer associations, put the continuity of transmission of this knowledge in traditional communities, as values are depreciated (CATTANI, 2016).

RECOMMENDATIONS FOR PROCESSING AND SIZING

Among the main actions that could be encouraged, we highlight investments in fiber processing within municipalities or producing centers, community strengthening and opening and stimulation of consumer markets.

The adoption of actions and guidelines that help to structure the buriti production chain, such as technical assistance in the management of enterprises, logistics for production flow, standardization and certification of production, in addition to raising the quality of the product, strengthening the Minimum Price Guarantee for Sociobiodiversity Products (PGPM-

Bio), will enable the necessary evolution towards fairer commercialization for all links in the chain (CONAB, 2022).

CREDIT POTENTIAL/CARBON SEQUESTRATION

The buritizais play a fundamental role in the balance of ecosystems, contributing to the maintenance of soil moisture and water bodies, especially in dry seasons, in addition to helping to contain the erosion of hydromorphic soils (high humidity), preventing the silting of rivers, they work as carbon stocks and act as a source of food and a place of shelter and reproduction for the fauna.

In the scenario with a pricing policy for the social benefit of stored carbon, the share of Added Value generated in the production sector goes from 47.6% to 72%, the rural processing industry would go from 18.8% to 22.6% and the rural transformation industry would increase from 1.3% to 1.9%. On the other hand, the other agents in the chain would have a reduced participation in the total VA generated. The remuneration of the production sector with and without the incorporation of carbon pricing. It is observed that the producer's VA projected with carbon pricing increases the producer's income, and in 2040, it is expected to reach an income of R$ 37.7 million, while without the pricing policy the projected income would be in around BRL 19 million (TNC, 2021).

CERTIFICATIONS PROGRAMS

CERTIFICATION	BY-PRODUCTS	COMPANY	TYPE
Certification organic	Buriti and products derivatives	Imocert	Certification based in ISO 17065

RELEVANT SECTORS

The entire process of extraction to the production of fibers, including cooking, bleaching, and dyeing of the fibers, is carried out by small associations or cooperatives in an artisanal way, which sell the product directly. There are also specialized companies in the commercialization of various types of fibers that sell wholesale, with an average cost of US$ 16.98 per kilogram of fiber. (SISALSUL, 2013).

IMPORT/EXPORT AND COMPLIANCE RATES

Data for buriti fibers are aggregated with other natural fibers.

BIOCULTURAL PROTECTIONS OF COMMUNITIES OF ORIGIN (NAGOYA/CGEN/ETC. PROTOCOL)

Brazilian adherence to the Nagoya Protocol, Legislative Decree No. 136 of 08/11/2020, ratified by the national executive in March 2021, can leverage the buriti fiber production chain due to the use and exploitation of the genetic heritage by other countries.

REGULATORY INFORMATION

Harmonized System Number: 5305 Coconut, abaca, ramie, and other vegetable textile fibers not specified elsewhere.

2.8 CACAU (*Theobroma cacao*) – COCOA-ALMONDS

Andiconic species of the Amazon that can bring enormous benefits to the region. From the environmental point of view, it is a perennial plant and native to that biome, when cultivated in agroforestry systems, it can promote the recovery of degraded areas, the recomposition of legal reserves and the capture and storage of carbon. From an economic point of view, its production has enormous potential for income generation. From a social point of view, cocoa cultivation has excellent potential to generate jobs and strengthen family farming. The cocoa value chain is important for its ability to build regional economies from the generation of jobs and absorb labor in rural and urban industries in industries. Cocoaproducts can be used as raw material for different industrial segments, making the chain relatively competitive to the detriment of other agro-industrial chain (AMAZÔNIA 2020, 2023).

Cacao fruit *in natura*

Cocoa butter

Cocoa tree

PRODUCT
Cacoa almonds
SUBPRODUCT
Cocoa powder; cocoa paste; cocoa butter, fat and oil; and waste.

CURRENT MARKET SIZE

Record world production of 5,024 million tons was achieved in the 2020/21 harvest. In terms of share of total world production, Africa is expected to remain the largest cocoa producing region, accounting for 77% of world cocoa production. The shares for the Americas; and Asia and Oceania are likely to be 17% and 6%, respectively (ICCO, 2021). Currently Brazil is ranked seventh in cocoa production, with 265,000 tons (2020). The North (Amazon) region leads national production with 140,450 tons, 53% of Brazilian production (Banco do Nordeste, 2021). In 2020 the total value of cocoa production in the Brazilian Legal Amazon was US$ 736,496,756.25 (58%), with the state of Pará contributing 93% (IBGE, 2021).

PROJECTED FUTURE MARKET SIZE

Growth of global production is forecast to average around 2% per year, below the 20-year average of 3%, while growth in global consumption will be approximately 3%, similar to previous averages (Banco do Nordeste, 2021).

VOLUMES SOLD/CONSUMED

Brazil is the fifth largest cocoa producer in world trade (2022). The state of Pará accounts for almost half of national production. The planted area in the state is estimated at about 210,000 hectares.

In the last ten years (2011-2020), in real terms, with values deflated by the FGV IGP-DI, the VBPA-Cocoa increased by 53%, from R$2.5 billion in 2011 to R$3.8 billion in 2020. This performance was driven by the state of Pará, where the value of total production increased by 204%, compared to the 6% increase registered by producers in Bahia (FIESP, 2021). In 2020, the main categories of products sold by value were 1) cocoa powder (48%), 2) cocoa paste (28%), 3) cocoa butter, fat and oil (22%) and 4) residues (2%) (Mercado do Cacau, 2022).

PRICE TRENDS

Prices paid to producers varied among Amazon states. In July 2022, for example, the price per kilo varied from a low of R$/kg 8.84 in Amazonas to a high of R$/kg 11.56 in Pará, with an average price of R$/kg 10.30 for the region (CONAB , 2022). The global market price in December of 2022 was $2.51/kg (INDEXMUNDI, 2023).

HISTORY

Cocoa originates from the Amazon River, from where it expanded in two main directions. The 'Criollo' spread northward to the Orinoco River, into Central America and southern Mexico, cultivated by the Aztecs and Mayans. The 'Forastero' spread through the Amazon basin, towards the Guianas. During much of the colonial period, cocoa was the main export product of the Brazilian Amazon. Systematic cultivation in Brazil began at the end of the 17th century, but most of the cacao during this phase was collected from the wild until the beginning of the 19th century (HALLA, 2020).

At the beginning of the 20th century, the center of cocoa production moved to SE Bahia, where a plantation system was developed that reached its peak in the 1960s, when the country was the global leader in this market, with an average annual production of 165 thousand tons. In the 1970s, leadership in cocoa production was taken over by the Ivory Coast. During this period, the planted area in Brazil remained relatively stable, with 441 thousand hectares, a drop of 5% in relation to the 60's.

Currently, the largest Brazilian cocoa-producing states are Pará and Bahia, which together account for 95% of the planted area and 93% of national production. Although the area of cocoa planted in Bahia is much larger than that in the Amazon, its low productivity, only 244 kg per ha, compared to the national average of 435 kg/ha, combined with the effects of the Witch's broom disease. contributed to a 30% decline in Bahian production from 156,000 tons in 2011 to 110,000 tons in 2020. As a result, the state lost national leadership to Pará (IBGE – PAM and LSPA), which experienced significant gains in cultivated area and productivity. Between 2011 and 2020 cocoa production in Pará increased 76% in planted area (from 85 thousand to 150 thousand hectares) and 126% in production, from 64,000 to

144,000 tons, reflecting the increase in average productivity from 750 kg/ha in 2011 to 964 kg/ha in 2020 (IBGE, 2021).

PRODUCTION SYSTEMS & ENVIRONMENT: AGROFORESTRY, WILD HARVEST, PLANTATION

There are three main cultivation systems for cocoa in Brazil, agroforestry systems (SAF), the cocoa-cabruca system (planted directly in the forest) and cultivation in full sunlight; the first occurs predominantly in the North region and the last two are used in Bahia.

Agroforestry Systems

SAFs are a preferred land use option due to their high potential to provide higher returns from the variety of plants included in the system. Shade is essential to ensure optimal performance of young cacao trees. Consequently, cocoa has always been cultivated in agroforestry systems in the Amazon region. Traditional agroforestry Systems combine production of commercial crops and food crops such as cassava, açaí palm and rubber trees, with cocoa. There has been relatively little commercial exploitation of forest reserves, where cocoa trees could be planted together with other local species such as Brazil nuts, essential oils and fruits native to the region in semi-extractive systems (GONTIJO, 2020), pink cedar (*Cedrela odorata*) and Brazil nut (*Bertholletia excelsa*).

TERM OF MATURITY

Cocoa trees vary in height from 5 to 10 meters. Flowers insert directly into the trunks and branches. The fruits are large capsules, ovoid to oblong in shape, with a thick, dense shell. Each capsule contains between 20 and 40 almonds covered in an acidic pulp. The cocoa tree begins to produce in its second year and between the 2nd and 5th year trees fruit throughout the year. The harvest takes place twice a year, the main harvest runs from October to early December, while the early harvest occurs from May to September. After five years of intense production, the pace of production slows and trees generally produce only twice a year. Between the 12th and 14th year trees reach their highest level of production and continues to produce at this level for several decades. Production begins to decline when trees are around sixty or seventy years old.

PRODUCER PROFILE AND SOCIAL IMPACTS

According to the IBGE, cocoa production generates around 340,000 direct and indirect jobs in Pará and generates up to R$ 1.7 billion per year (Mercado do Cacau, 2022). Consequently, cocoa production plays an important socioeconomic role in SE Bahia and Pará. According to the 2017 Ag Census there are 93 thousand establishments producing cocoa in the country, with 69,000 in Bahia (74% of the total) and 18 thousand in Pará (19%), which together represent 93% of all agricultural properties dedicated to cocoa production. On average, each establishment employs 3 people, so the crop generates 269,000 direct jobs, and an unknown number of part-time jobs during the harvest period (IBGE, 2017).

PRODUCTION and Supply Chain ISSUES: The vast majority of cocoa producers are family farmers who cannot afford to pay an employee. Consequently, farmers depend on family

labor, especially during harvest periods, which often means removing children from school. The low price paid by middlemen is one of the determining factors for the occurrence of child labor. Other issues include, slow development of the cocoa supply chain is attributed to the lack of financing for supply chain managers and farmers; who need "bankable" special purpose vehicles; Longer-term offtake commitments and links to agribusiness are needed to unlock finance and operate at scale; Finally there is a need to consolidate small farms (OIT/MPT, 2018).

Disease: Cocoa production in Brazil still faces the problem of witches' broom disease. This disease decimated the Brazilian cocoa industry in 1989/1990 in Bahia and national production has still not fully recovered. Before 1990, Brazil was among the three largest producers in the world.

CARBON CREDIT / SEQUESTRATION POTENTIAL

Based on the current prices paid per ton of carbon on the international market, the value of carbon credits for cacao, approximately R$241,000,000, could be added to cocoa's market value, 61% of which would be concentrated in the state of Pará.

CERTIFICATION PROGRAMS

Latin America is the leader in the premium segment of world cocoa production, called “fine” or “flavored” by the International Cocoa Organization (ICO. Fine or flavored cocoa can have a premium price of up to 20% above the global price and is highly sought after by luxury chocolate manufacturers.

Currently, only Cocoa only 3% of Brazilian production qualifies for the quality market (Mercado do Cacau, 2021). Currently, only three states produce fine cocoa: Bahia, Espirito Santo and Pará, but several produce types of cocoa, such as organic, wild and bulk (GIVAGO, 2010). While global market growth is low, there is growing demand for *premium chocolate*, and boutique brands are on the rise.

RELEVANT INDUSTRIES

The main chocolate producing industries in the world are installed in Brazil, such as Nestlé, Garoto, Mars, Ferrero, Mondelez and Arcor. This advantage gives the country the possibility of adding value and internalizing the jobs and income generated in the activity. The trading, processing and manufacture of cocoa are concentrated in a few international companies. The AIPC is formed by companies Cargill, Barry Callebaut and Olam, which together process 95% of Brazilian cocoa (IBGE, 2020).

CGEN/NAGOYA BIOCULTURAL RIGHTS AND PROTECTION CONCERNS

The Brazilian adhesion to the Nagoya Protocol, Legislative Decree No. 136 of 11/08/2020 was ratified by the national executive only in March 2021

REGULATORY INFORMATION

INCI Name: Theobroma cacao seed butter

Harmonized System Code: Cocoa beans, whole or broken, raw or roasted HS Code 180100
EINECS/ELINCS No.: 283-480-6
CAS Number: 84649-99-0 / 8002-31-1

2.9 CASTANHA DO BRASIL (*Bertholletia excelsa HBK*) - BRAZIL NUTS

The tree nut tree is one of the largest in the Amazon forest and Brazil nuts are an important forest product that is a significant seasonal income source for traditional and Indigenous peoples in some parts of the Amazon. The Brasil nut has high nutritional value, rich in calcium, phosphorus, magnesium and potassium and also has a relatively high selenium content, the main constituent of antioxidant enzymes. Because it takes around 16 years to begin producing nuts, with a few important exceptions, virtually the entire annual crop is collected from groves in the forest. Brazil nuts have a well-established export market, with significant potential for growth (SILVA JÚNIOR, 2016).

Brazil Nuts Tree

Améndoas with bark

Almonds without shell

PRODUCTS AND SUBPRODUCTS

Brazil nuts: Brazil nuts are an important component of mixed nuts and are widely used as an ingredient in candies.

Brazil nut oil: Is a clear, yellowish oil with a light texture. It used in a variety of high-end skincare products.

Brazil nut wood: while Brazil nut wood is of high quality, felling of trees for timber is illegal in Brazil

CURRENT MARKET SIZE

The total production of Brazil nuts in the Amazon region is around 69,658 metric tons comes from three countries, Brazil (33,118 mt), Bolívia (30,843 mt) and Peru (5,697). The total value of Brazilian production was R$98,551,000 in 2020. The largest producer is the State of Amazonas (11,707mt, with a total value of R$ 34,785,000), virtually all of which is harvested from the forest. Approximately, 75% of Brazil nuts harvested in Brazil are used by the food industry. Brazil's participation in the international market is low, representing only 5% of national production (IBGE, 2020; INTERELOS , 2022).

PROJECTED FUTURE MARKET SIZE

While global consumption of nuts grows at 7% per year, national production of Brazil nuts is stagnant. In recent years the exports of Brazil nuts has declined from around 70% of national production to only 20% reflecting increased consumption in the domestic market. In part this

shift to the domestic market is due to the presence of aflatoxins, which has largely closed the European market to Brazilian Brazil nuts (CONAB, 2022; INTERELOS , 2022) .

VOLUMES SOLD/CONSUMED

The total value of Brazil nut exports from the Amazon is (US$) 12 million. Exports to the global market totaled 24 million in the period 2017-2019. Exports are predominantly shelled nuts (Bertoholletia excelsa) and the main destinations are Peru (38%) and Bolivia (16%) (AMAZÔNIA2030, 2021).

PRICE TREND

The average price paid to the producer is R$5.4/kg (CONAB, 2022; INTERELOS, 2022) May /22. In 2021, wholesale prices in international markets: the average import price for Brazil nuts is $1,577 per ton, Price of smaller quantities: 25 lbs at US$ 6.50/lb

HISTORY

Mature Brazil nut trees grow almost exclusively in primary forest and as remnants in degraded forests and pastures. Brazil nut trees are among the tallest tree species in the forest, can live for up to 800 years and reach 60m in height and 3 m in diameter. Brazil nut trees grow in groves, called castanhais, which are thought to be evidence of indigenous forest management practices, which often involves planting seeds of important trees species in abandoned swiddens. For much of the last couple of centuries Brazil nut groves have been controlled by local land owners and traders. The collection and sale of Brazil nuts was organized in the traditional paternalistic system, known as the aviamento system, a system of debt peonage In which many local Indigenous and traditional peoples through which local traders and landowners controlled labor and organized the collection and extraction of the forest products that sustained the Amazon economy. During the 20th century a significant proportion of the Brazil nut trade in Brazil was controlled by a single family. With the expansion of the agricultural frontier and associated deforestation from the mid 20th century on, many important Brazil nut groves in the eastern and southern portions of the basin were destroyed and the land converted to pasture. While the government prohibited the felling of Brazil nut trees and the sale of Brazil nut wood in an attempt to stop this destruction, these efforts were only partially effective. The Castanha do Pará is now called the Castanha do Brasil and the main Brazil nut producing areas today are in the western and southwestern portions of the basin. With the great increase in the number and total area of Indigenous Territories and Extractive reserves in the last few decades, much of the remaining area of Brazil nut groves is now protected in reserves and responsibility for managing groves and collecting and processing Brazil nuts has been taken over by community associations and cooperatives.

PRODUCTION SYSTEMS AND ENVIRONMENT: AGROFORESTRY, WILD HARVESTING, PLANTING

Because Brazil nut trees take an average of 15 years to begin producing, there ha been very few efforts to cultivate Brazil nut trees. However, they can be a promising species for certain

kinds of agroforestry systems. For example, in the RECCA project in western Rondônia colonists developed agroforestry systems that included Brazil nut trees, cupuaçu and pupunha, among other species. Planting of Brazil nut trees has been encouraged as an agroforestry component in reforestation programs. Brazil nut trees are also included in integrated forestry consortiums (CFI) with andiroba and ipê. While much more is needed there is considerable research and innovation seeking to improve management systems as well as develop technology for harvesting, processing and marketing Brazil nuts (COSTA et al., 2009; EMBRAPA, 2022).

TERM OF MATURITY

Brazil nut trees reach heights between 30m and 50m with diameters between 1m and 2m, or more. Its fruit take more than a year to mature, reach an average weight of 2 kg, and contain between 8 and 24 seeds. Brazil nut collection takes place during the rainy season, between December and June when the nut pods mature and fall to the ground (WWF-Brasil, 2022; BEGIATO, MENEGHINI, 2013).

PRODUCER PROFILE AND SOCIAL IMPACTS

Since the rise of the Rubber Tappers and Forest Peoples Movements in the 1980s, the size and organizational and administrative capacity of cooperatives and community associations has greatly improved. Today in Acre and other areas, most Brazil nut groves are managed through these local organizations, which are developing new products and innovative solutions in processing, and packaging to increase the value of Brazil nuts and eliminate sanitary problems such as aflatoxins.

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CERTIFICATION PROGRAMS

CERTIFICATION	BY-PRODUCTS	COMPANY	TYPE
ORGANIC BRAZIL	Brazil nut with shell Brazil nuts without shell	ECOCERT FSC	Allows organic commercialization within Brazil;
Organic farming Europe (EU)			It allows marketing of organic products in the European Union, applies to agricultural raw materials and food products;
USDA-ORGANIC – Agricultura orgânica nos EUA -USDA NOP			Allows marketing of organic products in the United States;
FDA			Ensures that your items meet all necessary safety and quality standards
ECO CERT COSMOS ORGANIC			Allows the commercialization of organic or natural cosmetics worldwide;
IBD ORGÂNICO			Guarantees the quality and origin of organic products

ORGANIC FARMING – European Commission (EC)			Marketing of organic products that meet the standards established to the European Union market;
KOSHER – PARVE			Ensures that manufactured products meet the specific standards governing the Orthodox Jewish food diet
HACCP – APCC			Food safety in the processes regarding risks and hazards, ensuring the standard of quality, integrity and safety of the products to consumers
FSC Certification			Promotion of its responsible forest management and the commercialization of wood-based products from certified forests

CREDIT/CARBON SEQUESTRATION POTENTIAL

As one of the largest trees in the forest, and it's use in reforestation scheme Brazil nut trees could be of relevance in sequestering carbon (EMBRAPA, 2022).

IMPORT/EXPORT TARIFFS AND COMPLIANCE

Brazil nuts are GRAS compliant in the US (widely sold for consumption) and have strict import restrictions in Europe and the US regarding above acceptable concentrations of aflatoxin. Tariffs are at 0% in the US and EU, but at 32.8% in Korea (VIEIRA *et. al*,. 2022; CNA,2021).

RELEVANT INDUSTRIES

Food: Brazil nuts are used as ingredients in processed foods such as chocolate bars/cereals, cakes, biscuits, in nut mixes, snacks (appetizers with dried and salted nuts); porridge and biscuits). health and health foods and consumed in trail mixes with dried fruit and grains and included in Kosher diets, and exported to Israel.

Cosmetics: Brazil nuts are also used in the cosmetics industry (presence of selenium, antioxidant element), (CONAB, 2022; BEGIATO, MENEGHINI, 2013)

Retailers

Retailers	Site
COOPAVAM - Cooperative of Rural Farmers of the Vale do Amanhecer	https://coopavam.org.br/
Borello Alimentos Ltd. – EPP	https://www.facebook.com/borello.castanhas/
Go Health Foods Ind. And with. Food Ltd.	https://www.ghf.com.br/
Beraca Ingredients natural Ltd	http://www.beraca.com/
Children 's Association Project Agroforestry _ Reca and Cooperativa Agriculture, Livestock and Forestry of the RECA Project	https://www.projetoreca.com.br/

REGULATORY INFORMATION

Inci name : Bertholletia excelsa seed oil

Harmonized System Code : 1515.90

EINECS No : 310-127-6

number : 356065-50-4

2.10 CUMARU (*Dipteryx odorata*) – CUMARU'S SEED

The Cumaru, also known by a number of popular names: Iron cumber; cumarurana; cumaru-true; yellow-cumaru; large-leaf ridge; muimapagé; champagne; Amazon cumaru; cumaruzeiro; cumbaru; cumaru-de-cheiro, is a plant exclusive to the Amazon rain forest. I Native species, not endemic to Brazil, are distributed in the North (Acre, Amazonas, Amapá, Pará, Rondônia, Roraima), Northeast (Maranhão) and Midwest (Mato Grosso) regions.

Cumaru seed

Cumaru Tree

Cumaru Oil

PRODUCTS

Almonds/Seed: Also known as tonka bean or tonka bean, it has a high concentration of the aromatic coumarin, which is used in the preparation of anticoagulant drugs such as bishydroxycoumarin (dicumarol) and wafarin (coumadin).

BY-PRODUCT: Natural oil and extract: Coumarin, an aromatic essential oil widely used in the perfumery and cosmetics industry, with great demand in the international market.

Beer: The beer company Amazon Beer, produces beer of citrus and fruity aroma matured with Cumaru seeds and 5.7% of alcohol content (IPA Cumaru) (BRAZIL, 2022; BREJAS, 2019) .

CURRENT MARKET SIZE

The Brazilian plant extraction of cumaru, 2020/2021 harvest, totaled 233tons with an estimated production value of R$5.7 million. The states of Pará (167t) and Amazonas (63t) are responsible for 98.7% (230t) of this production. The commercialized production of cumaru runs through short local supply chains and long extra-local supply chains, destined for the Brazilian market, and countries such as Japan, the United States and Europe (IMAFLORA, 2021, IBGE, 2021).

PROJECTED FUTURE MARKET SIZE

In the period 2010/2021, Brazilian production of cumaru grew 1.5% annually, with a forecast of maintaining this growth in the coming years (IBGE, 2021). In the Amazon region, mainly in the state of Pará, the projection for 2040, average production growth of 3% p.a., and

average growth of income generated of 6% p.a., reaching up to 10% at the end of the period (2040) (TNC, 2021).

VOLUMES SOLD/CONSUMED

In 2020, 3.5 tons of dried seeds were sold, generating R$ 177.8 thousand (marketed to an English company for cosmetic and medicinal use). In 2019, the total VA absorbed in the chain was around R$ 566.4 thousand (TNC, 2021).

PRICE TREND

Price per ton (R$/t) (1994-2016) averaged R$ 5514.30/t. The average value corrected in R$ / kg by the IPA wholesale price index was R$ 6.2/kg. For projects aimed at fair markets, such as the Origins Brazil project that supports direct trade between community associations and cosmetics industries, the price has reached US$ 15.00 per kilogram of dry seed in 2016 and 2017 (MOTA, 2018).

HISTORY

Cumaru seeds are widely used in the production of essential oils, perfumes, cosmetics, medicines, food, tobacco and beverages, due to its aromatic and therapeutic properties. The seeds of cumaru contain an aromatic essential oil widely used in the perfumery and cosmetics industry, with great demand in the international marketl. Coumarin is often used to replace vanilla in recipes that take milk, such as puddings, cakes, pies, in addition to other foods and beverages, such as beer (MOTA, 2018).

PRODUCTION SYSTEMS AND ENVIRONMENT: AGROFORESTRY, WILD HARVESTING, PLANTING

Although cumarin is obtained primarly from natural forests, it can also be produced in commercial plantations, in agroforestry systems through reforestation projects. Despite its wide distribution in the Amazon Region, Dipteryx odorata is on the list of priority species for conservation in the Amazon Biome), due to deforestation and its value as a timber species (MOTA, 2018).

TERM OF MATURITY

Its flowering occurs from August to October, in Pará, from September to October, in the Amazon and the ripe fruits occur from April to July, in Pará. In the Amazon, this species begins fruit production at 4 or 5 years of age. The number of seeds per kilogram is approximately 245 units. It annually produces abundant amount of viable seeds. The medium of dispersal of its seeds occurs barochorically (by gravity) due to its weight, and also by means of rodents and bats (CUMARUM AMAZÔNIA, 2023).

PRODUCER PROFILE AND SOCIAL IMPACTS

The collection of Tonga beans is usually organized by local associations and cooperatives of family farmers. The commercialization of the production generates income and benefits the local economy. The collection of cumaru is carried out by the entire family. Collection of

cumaru fruits/ beans does not affect the trees and is consideres to be sustainable (TNC, 2021; MOTA, 2018).

PRODUCTION PROBLEMS

Because the species ocurrs at low densities averaging 3 trees per hectare, the establishment of community cumaru plantations could increase local production while reducing the time spent in collecting the beans. Because coumarin can be toxic at high concentrations, coumarin cannot be ingested or inhaled, and people involved in collecting and processing beans should follow strict protocols. Because of pressure from deforestation and logging, local associations and cooperatives should establish management systems to conserve local stands (MOTA, 2018).

SUPPLY CHAIN ISSUES

I do not encourage fair marketing for communities so they don't rely on middlemen. To ensure product quality and expand access to the international market, community associations should construct warehouses and install seed dryers so their product meets international market standards (MOTA, 2018).

RECOMMENDATIONS FOR PROCESSING AND DIMENSIONS

Andall of productive viability as well as conservation of the species are important for regional development.

Further study of the cumaru market can help to understand how it is possible to stimulate demand and add value to the regional product, with competitive market prices compared to the substitutes already existing in the market.

CREDIT POTENTIAL/CARBON SEQUESTRATION

While cumaru trees represent a considerable volume of forest carbon, some authors argue that carbon offsets would have little impact on the distribution of value added or the projected gross income (TNC, 2021).

CERTIFICATION PROGRAMS

CERTIFICATION	BY-PRODUCTS	COMPANY	TYPE
Origens Brasil	Seed of cumaru	Origens Brasil°	Network that promotes sustainable business in the Amazon in priority areas of conservation, with guarantee of origin, transparency, traceability of the production chain and promoting ethical trade.

RELEVANT SECTORS

Retailer

Retailers	Site
Cooperativa Mista dos Povos e Comunidades Tradicionais da Calha Norte (COOPAFLORA)	https://www.instagram.com/coopaflora/
Manioca Brasil	maniocabrasil.com.br
Flor de Jambu	flordejambu.com

IMPORT/EXPORT TARIFFS AND COMPLIANCE FEES

The tariffs will be given according to trade agreements, tariff preferences and legislation applicable to foreign trade (BRAZIL, 2023).

BIOCULTURAL PROTECTIONS OF COMMUNITIES OF ORIGIN (NAGOYA PROTOCOL/CGEN/ETC.)

The Brazilian adherence to the Nagoya Protocol, Legislative Decree No. 136 of 08/11/2020, ratified by the national executive that took place in March 2021, can leverage the production chain of cumaru due to the use and exploitation of genetic heritage by other countries.

REGULATORY INFORMATION

Inci Name: Dipteryx odorata

Harmonized System Code: Has only Global Product Classification - CGP

2.11 CUPUAÇU (*Theobroma grandiflorum*)

Native fruit of the Amazon region, it belongs to the Sterculiaceae family (same as cocoa) with production concentrated in most of the states of the northern region: Amazonas, Pará, Acre, Rondônia and Roraima. Used in Brazilian cuisine, with excellent industrial use. It has several cultivars - BRS Careca (BRS 337), BRS Fartura (BRS 338), BRS Duquesa (BRS 340), BRS Curinga (BRS 346), BRS Goliath (BRS 349) - with high productivity and good resistance to diseases produced by the Brazilian company Embrapa Amazônia Oriental, as a technological reinforcement and value addition inputs for positioning cupuaçu with a market in national and international expansion with potential as an important bioeconomy asset, forest preservation and local development (EMBRAPA, 2022; 2019).

Cupuaçu tree

Cupuaçu fruit

Cupuaçu pulp and almonds

PRODUCTS

Pulp - Rich in proteins, carbohydrates, fibers and enzymes, marketed in frozen form and / or used in the preparation of food. **Seed** (almonds with high fat content a) - extraction of butter for the cosmetic and pharmaceutical industry, and production of cupulate, a product similar to chocolate, being more advantageous bythe lower price, contains less theobromine than cocoa (substance more stimulating than caffeine) , and has 33.44% more protein in relation to cocoa (EMBRAPA, 2022).

CURRENT MARKET SIZE

Cupuaçu production reached 21,240 tons in 2017 (annual), with a total value of R$ 54. 822. 000. The largest producer was the State of Amazonas (6,002t, with a valor of R $ 16,646,918) (IBGE, 2017).

PROJECTED FUTURES MARKET SIZE

Growth of 10.3% p.a., (2019). The global market is expected to reach $62 million by 2030 (primarily cupuaçu butter), with a CAGR (**Compound Annual Growth Rate)** of approximately 6.3% between 2020-2030 (TNC, 2021).

VOLUMES SOLD/CONSUMED

Exports totaled 8.8 tons in 2021 (US$ 28,407), the average price per kg was US$ 3.2 d the cupuaçu pulp (4th Level- 20079926 – PURÊS/POUPA DE CUPUAÇU), having as main buyer

countries: Africa, Oceania, Angola, Liberia, Marshal Island, United States, Netherlands and others (AGROTAST, 2021).

PRICE TREND

The export price is on average UR$ 3.2 per kg of pulp (AGROTAST, 2021).

HISTORY

The cupuaçu, related to cocoa, has long been a cultivated in Amazonian house gardens, in agroforestry systems and fruits have been collected from the wild where they are available. In the late 1980s and early 1990s there was great interest in cupuaçu as an important new export crop and cultivated area expanded rapidly throughout the Amazon. The fruit is quintessentially Amazonian, with a powerful, exotic and alluring flavor, and is widely consumed in ice cream, cremes, juices and cakes. Production suffered from the lack of cold chain infrastructure to handle the abundance of pulp during the harvest season and up to 40% of the harvest rotted in the fields as colonist isolated by impassable roads during the rainy season were unable to get their harvest to market. More recently, production has been affected by infestations of witches broom. EMBRAPA has developed technology with cultivars of high productivity, resistance to witch's broom disease and advantages in terms of yield that can reach 14 tons per hectare (EMBRAPA, 2022; 2019). It remains to be seen if with the resolution of supply problems and greatly improved cold chain infrastructure, demand for cupuaçu products takes off. Thus far, cupuaçu's nonfood uses such as cupuaçu butter made from the seeds have driven growth in demand. Perhaps now with the resolution of production and supply chain issues cupuaçu will finally live up to earlier expectations.

PRODUCTION SYSTEMS AND ENVIRONMENT: AGROFORESTRY, WILD HARVESTING, PLANTING

Cupuaçu is largely produced in agroforestry systems, approximately 14,805 tons (2017) wide adaptability and high potential for expanding production using large-scale intercropping to restore of degraded areas. The Supply of wild harvested cupuaçu is stagnant overall and in decline in many areas due to habitat loss, the higher labor costs of extraction and logistical challenges of delivering fresh fruit to market (OLIVEIRA, 2013; IBGE, 2017).

TERM OF MATURITY

The production of fruits occurs from two to three years after planting, with a long shelf life, more than a decade of production after the first harvest, can reach on average 12 fruits per tree. The fruit can reach 30cm in length with an average of 1.2 kg in weight (EMBRAPA, 2022; 2019).

PRODUCER PROFILE AND SOCIAL IMPACTS

Cupuaçu has traditional been cultivated by small scale producers and processed and marketed through local associations and coperatives. Cupuaçu has had strongly positive impacts on smallholder livelihoods including increased income from agroforestry systems

and employment in local processing operations and through strengthening of local associations and cooperatives (EMBRAPA, 2019).

PRODUCTION PROBLEMS

The main problem has been witches broom, a fungus (*Monoliophthora perniciosa (Stahel))* , which attacks the leaves of cupuaçuzeiros, and reduces the productivity of affected plants. Traditionally, farmers have avoided the problem through consortia that separate inidividual plants. Development of resistant varieties is likely to eventually eliminate the problem and make possible more intensive production systems (EMBRAPA, 2022; 2019).

SUPPLY CHAIN ISSUES

Cupuaçu production and marketing have been plagued by supply chains issues related to sanitary issues and harvest losses due to inadequate cold chain infrastructure. Lack of hygiene with manual separation of pulp from seeds ha been a frequent problem, which has been largely resolved through mechanical pulp extraction and through educational programs in best hygiene practices. Greater access to local refrigeration facilities and improved rainy season roads have helped reduce loss of product after harvest. Other problems are related to the absence of investment and tax incentives, technical assistance and the absence of financial mechanisms to pay for environmental services that provided by agroforestry systems (EMBRAPA, 2022; 2019).

RECOMMENDATIONS FOR PROCESSING AND DIMENSIONS

To achieve higher productivity, it is recommended to adopt cultural treatments available for the crop, so that the cultivars expose their productive potentials, and for processing the installation of agro-industries for larger-scale production and product quality assurance. It is necessary rural development policies in science, technology and innovation, credit and technical assistance directed to traditional communities based on agroforestry systems, and creation of certification seals of environmental services, in order to prove the origin of the product and sustainability in its production, adding value to the chain (EMBRAPA, 2022; 2019).

CREDIT POTENTIAL/CARBON SEQUESTRATION

Cupuaçu has the potential for better consortiums, especially in agroforestry systems, due to the selectivity of cultivation in environments that promote the restoration of productivity in degraded areas. With investment in technology and research in bioeconomy, Brazil presents potential in the global agenda of sustainability and carbon economy. But there is an absence of pricing policy and payment for the carbon stored and avoided emission, which enables the aggregation of value of the products of sociobiodiversity produced in the territories of common use (EMBRAPA, 2022; 2019).

CERTIFICATION PROGRAMS

CERTIFICATION	BY-PRODUCTS	COMPANY	TYPE
ORGANIC BRAZIL	Manteiga de	ECOCERT	Allows organic commercialization

	cupuaçu		within Brazil
USDA-ORGANIC – Agricultura orgânica nos EUA -USDA NOP			Allows marketing of organic products in the United States

RELEVANT INDUSTRIES

Food, cosmetics and pharmaceuticals.

Retailer	Site
Amazon Oil Ind. and Com. of Eireli Vegetable Oils	https://www.amazonoil.com.br/
From Mendes Chocolate da Amazônia	https://www.demendes.com.br/amabela-65
Flor of Jambu	https://flordejambu.com/para-empresas/
COOPAVAM - Cooperative of Rural Farmers of the Dawn Valley	https://coopavam.org.br/

IMPORT/EXPORT TARIFFS AND COMPLIANCE

Tariffs will be given according to trade agreements, tariff preferences and legislation applicable to foreign trade (BRAZIL, 2023).

CGEN/NAGOYA BIOCULTURAL RIGHTS AND PROTECTION CONCERNS

The Brazilian adherence to the Nagoya Protocol, Legislative Decree No. 136 of 08/11/2020, ratified by the national executive that took place in March 2021, can leverage the production chain of cupuaçu due to the use and exploitation of genetic heritage by other countries.

REGULATORY INFORMATION

Name INCI: Theobroma grandiflorum

Harmonized System Code: 2007.99 - other (20.07 - Jams, jellies, marmalades, fruit purees and pastes, obtained by cooking, whether or not with added sugar or other sweetening matter)

NCM: 2007.99.26

2.12 MURUMURU (*Astrocaryum murumuru*)

Murumuru is a small palm with a thorny trunk, *Astrocaryum murumuru*, also known as mumbaca or mambacuçu. Currently its main use is in the cosmetics industry. The oil extracted from murumuru almonds is transformed into a semi-solid fat, called murumuru butter and used in the manufacture of soaps, creams and shampoos by companies such as Natura (CONAB, 2022).

Mumuru plant

Mumuru fruit

Mumuru butter

PRODUCT

Seeds or almonds – the oil extracted from murumuru almonds is transformed into a semi-solid fat, murumuru butter, and used in the cosmetics industry to make soaps, creams and shampoos and in the paint industry as a dryer. It is also used in the pharmaceutical industries.

BY-PRODUCT

Pulp – not used commercially, despite being edible, slightly sweet; oil can also be extracted and used in human and animal food;

Biofuel: Biodiesel produced from murumuru oil has good ignition quality and high oxidative stability.

Uses from other parts of the plant - fertilizer, handicrafts, fiber, forage, commercial wood, cover straw, as an ornamental plant.

CURRENT MARKET SIZE

The global murumuru butter market was valued at $802 million in 2021, and is projected to reach $1.8 billion by 2031, growing at a CAGR of 8.4% from 2022 to 2031 (ANINDITA; ROSHAN, 2022).

Despite that value of the global murmuru market, murumuru was classified, in a study carried out by TNC (2021), as a product without information on scale or growth.

The TNC 2021 study of bioeconomy products in Pará estimated the gross value of rural murumuru production at U$ 11.1 thousand in 2019. The total added value was estimated at U$ 24.4 thousand; 0.002% of the total (TNC, 2021).

PROJECTED FUTURE MARKET SIZE

The global market for murumuru is projected to reach $1.8 billion by 2031, growing at a CAGR of 8.4% from 2022 to 2031(ANINDITA; ROSHAN, 2022).

In recent years there has been an increase in demand for murumuru seed, mainly from the United States, which orders large volumes, generating greater demand than the current supply, which does not exceed five to six thousand tons per year, well below industrial demand (EMBRAPA, 2022).

VOLUMES SOLD/CONSUMED

Murumuru butter is produced primarily in the states of Pará, Amapá, and Acre In the last decade approximately 25 thousand tons of murumuru coconuts (EMBRAPA, 2022) were exported.

Conab conducts a survey on the sale of murumuru fruit in markets in the states of Acre and Pará. In the annual assessment, in the state of Acre, the price per kilo of murumuru fruit varied by 40%. A factor that has been decisive for the development of the supply chain is the market demand from large cosmetics companies, which are very interested in murumuru seeds. Murumuru sales volume and prices have been highly dependent on the activities of these large companies operating in the region. This activity has been more intense in the Pará region due to the presence of representatives of cosmetics and pharmaceutical companies (CONAB, 2022) .

PRICE TREND

In the competitive international cosmetics market, Brazilian murumuru fat or butter has been sold in the wholesale sector with prices ranging from US$12.95 to US$16.69/kg, and orders ranging from 200 to 50,000 kg. For retail purchases, the price of a kilogram of butter has already been quoted at US$85.00/kg (EMBRAPA, 2022) .

Examples: Wholesale prices for murumuru butter found on the internet:

> 3.5 lbs, $118.63, 7.5 lbs, $209.86 and 44 lbs, $1,108.43 (Natural Sourcing, 2023).
>
> Murumuru Butter - Natural Unrefined - 39.7 lb (18 Kg) -$839.00
>
> offered by Paris Fragrances & Cosmetics Supplies, INC Store (AMAZON, 2023).

A cooperative in Acre, Coopercintra, produced 16,530 kg of murumuru butter in the 2017/2018 harvest and 23,735 kg in the 2018/2019 harvest; the market price for murumuru butter was US$ 6.99/kg in 2017/18 increasing to US$ 7.94/kg in 2018/19.

The total value of the harvest was to the coop was US$115,000 in the first period and US$ 188,000 in the second. At an exchange rate of R$5:$1 this would be R$500,000 in the first period and almost a million in the second.

HISTORY

At the beginning of the 20th century through World War II, Brazil exported around 40 different types of vegetable oils extracted from plants native to the Amazon. After the second war, the demand for vegetable oils from the Amazon fell sharply leading to the

complete extinction of the existing industrial complex in Belém. This trend remained unchanged until the end of the 20th century, when there was a growing interest in vegetable oils from extraction and production systems that caused low environmental impacts, the so-called sustainable exploitation (GONZALEZ et al., 2008). Because it has numerous economic uses, the murumuru (Astrocaryum murumuru) generates demand for the supply of raw material, for both the vegetable oil and biofuel industries (Oliveira De, M. C., et al. 2016). Teixeira et al. (2010) also point out the viability of murumuru as a possible raw material for biodiesel production, which could generate additional income for local farmers in rural communities.

PRODUCTION SYSTEMS AND ENVIRONMENT: AGROFOREST, WILD HARVESTING, PLANTING

The murumuru palm is distributed throughout the Amazon ecoregion from Colombia, Ecuador, Peru, Bolivia, Guyana, French Guiana, Suriname, Venezuela.

In Brazil, it occurs in the Amazon states of Amapá, Acre, Amazonas, Pará and Rondônia. With Amapá and Pará the main producers.

Murumuru is largely harvested from the forest. The murumuru palm usually grows in humid and temporarily flooded areas, close to rivers and lakes. It is a light demanding species, so thinning forest cover by removing larger trees can favor management for commercial purposes. In a floodplain forest inventoried in Pará, its spatial distribution pattern was considered random and the use group as non-commercial. On the other hand, it was considered to be an important species due to its environmental and socioeconomic functions, as its fruits are widely consumed by fauna (GAMA et al., 2000).

There is great spatial variation in the number of murumuru palms per hectare within a region and between different regions. In the State of Acre there are reports of the occurrence of 10 to 28 plants/ha in some areas, and as many as 100 plants/ha in others.

In Acre, a murumuru palm produces an average of four bunches/year and each bunch has an average of 300 fruits for a total of 1,200 fruits/palm tree/year or 189 kg of coconuts. In Amapá, each bunch averages 243 fruits/bunch. In the states of Amazonas, Pará and Amapá, the murumuru harvest occurs over a 6 month period from January to June. When the fruits ripen, the entire bunch falls to the ground, serving as an important food source for the local fauna. The fruits pulp decomposes rapidly on the moist floodplain soil (EMBRAPA, 2022) .

MATURITY TIME

As murumuru is managed in standing forests with established murumuru populations, the amount of time needed to establish a murumuru management system is relatively short, especially where there are local organizations already collectively managing local forests for harvest of murumuru almonds/seed.
Murumuru seeds take 6 to 12 months to germinate. Seedling growth is slow, taking about 4 to 5 years to start producing fruit. At the beginning of production, the bunches are small and bear few fruits, but over time they become larger and produce more fruits (EMBRAPA, 2022).

PRODUCER PROFILE AND SOCIAL IMPACTS

Murumuru is collected by families in riverine communities. Income from murumuru complements that from other sources. With growing demand for murumuru, there is the possibility that increased income from murumuru management could significantly improve livelihoods of murumuru collectors (EMBRAPA, 2022).

To encourage collection of murumuru fruit, the Government of the State of Acre has a policy of paying subsidies for the collection of murumuru fruit, which is integrated into the REDD+ project implemented by the State, supported by the Governments of Germany and Norway. The subsidy is a successful experiment in paying producers for the environmental services they make possible and encourages continuity in sustainable production chains. Benefited families are concentrated in riverine areas of forest reserves.

The measure complies with Law 1,277/1999, and acts as an incentive for these families as part of a forest preservation and conservation policy. A total of US$ 601.3 thousand, was paid to 965 extractivist families, for the production of 462 tons of rubber and murumuru in the period from 2018 to 2020 (Revista Acre pelo clima, 2021).

PRODUCTION PROBLEMS

One of the most serious problems that limits the economic exploitation of murumuru is the lack of access to oil extraction and processing technology. In addition, further research is needed to develop management guidelines for propagation, cultural practices, harvesting and processing of the fruits, to ensure sustainability and collection of higher quality the fruit. Mapping studies and development of sustainable management systems for wild populations should also be prioritized.

Another bottleneck in the supply chain concerns the cost of transporting production to processing sites, generally located in urban centers. Murumuru fruits are usually transported in small vessels as the freight charged for transport in larger vessels is prohibitive given the price paid for the fruits (EMBRAPA, 2022).

In Pará, the removal of almonds is often carried out manually, by women and children under contract, and receiving low wages. Each person can sort between 60 to 100kg of almonds in an 8-9 hour shift. The average yield of almonds for each 100kg of dry kernels is 27-29kg, with a humidity of 12 to 15% (EMBRAPA, 2022). There is a need for development of more efficient and accessible technology for extracting murumuru almonds.

Research is oalso needed on the potential for developing agroforestry systems including murumuru palms and other more intensive production systems that could ensure that local populations benefit from the growing demand for murumuru butter and other products and continue to play an important role in in developing supply chains.

SUPPLY CHAIN PROBLEMS

Processing is another problematic link in the supply chain. The kernels have variable sizes and, after drying, these are mixed, and small kernels, when overdried, become very fragile

and brittle, while the large ones, are not completely dried and part of the almond may still be adhered to the shell, which complicates separation and compromises the quality of the fat.

RECOMMENDATIONS FOR PROCESSING AND SIZING

There is an urgent need to develop and disseminate appropriate processing technology that enables families and communities managing and collecting murumuru seeds to benefit from the development of markets for murumuru products. Public policies, such as the subsidy the government of Acre pays for murumuru collection, have proven to be a successful that encourages the continuity of sustainable production chains.

The adoption of policies to structure the murmuru production chain, include: 1) technical assistance in project management, 2) logistics planning for production flow, and 3) standardization and certification of products. These measures will improve product quality and strengthen the Minimum Price Guarantee for Sociobiodiversity Products (PGPM-Bio), facilitating the necessary evolution towards a fairer income distribution across all links in developing supply chains (Sociobiodiversity Bulletin, 2022).

CREDIT POTENTIAL/CARBON SEQUESTRATION

As a palm species, which can significantly improve returns from forest management and also be integrated into agroforestry systems, it can play an important role in forest carbon offset initiatives.

CERTIFICATIONS PROGRAMS

CERTIFICATION	BY-PRODUCTS	COMPANY	TYPE
Certification organic	Murumuru and products derivatives	Imocert-Bolivia	Certification based on ISO 17065 Ensures that all production is carried out with low environmental impact, without the use of pesticides, ensuring fair payment for each family.

RELEVANT SECTORS

Major companies involved in thee murumuru supply supply chain include: are Jarchem industries, Inc., Liberty Natural Products, Caribbean Natural Products Inc, BERACA INGREDIENTS NATURAIS SA, LUSH RETAIL LIMITED, NSI Group, LLC, Vigon International, Inc, Hallstar Company, H.F.Ed. Meyer GmbH & Co. KG , O&3 Limited

BIOCULTURAL PROTECTIONS OF COMMUNITIES OF ORIGIN (NAGOYA/CGEN/ETC. PROTOCOL)

Brazilian adherence to the Nagoya Protocol, Legislative Decree No. 136 of 08/11/2020 , ratified by the national executive in March 2021, can leverage the murumuru production chain due to the use and exploitation of genetic heritage by other countries.

REGULATORY INFORMATION

CAS Number: 356065-49-1 – murumuru butter - category emollients, skin conditioners

INCI Name (CTFA): *Astrocaryum murumuru seed butter*

2.13 COPAÍBA (*Copaifera spp.)* - COPAIBA OIL

The copaiba tree is known as “pau-de-oil”, “miracle tree” and “diesel oil tree” because it produces oil that can be extracted from the trunk. Copaiba oil is known as the antibiotic of the forest. It is one of the most important medicinal plants in the Amazon, used mainly to treat inflammation, but also numerous other ailments. It has long been used by Indigenous groups throughout Amazon who discovered the healing power of copaiba oil long ago. Because of the highly variable and somewhat unpredictable nature of copaiba oil production and limited research effort. Virtually all Copaiba oil is extracted from trees in natural forests.


Copaiba tree


Copaiba fruit


Copaiba oil

PRODUCT

Oil-resin - used to extract essential oils for cosmetic and herbal purposes.

Biofuel: Copaiba oil could become a promising biofuel if production challenges could be resolved.

Other Products

Wood – The wood is highly resistant to decay and is used locally in civil construction and furniture production.

CURRENT MARKET SIZE

In 2009, Brazil produced 538 tons of copaiba oil, which generated a value of US$ 2,076,492 (3.86 US$/kg); in 2021, total production was 170 t, generating US$ 916,589 (5.39 US$/kg), in 12 years there was a decrease in production by -68% and an increase in price by 19%.

PROJECTED FUTURE MARKET SIZE

The copaiba market is expected to grow at 5.4 % from 2022 to 2029, to reach nearly US$ 3.51 Bn (MMR, 2023). Available data on copaiba production in the Brazilian Amazon suggest that this estimate is overly optimistic, but may be justified by production in other South American countries. There is no doubt that Copaiba tree is an important species with significant economic potential.

VOLUMES SOLD/CONSUMED

Production of copaiba oil varies considerably year to year. For example production in the Brailian Amazon reached 580 tons in 2010 and fell to 214 mt in 2011. Estimated production in Brazil in 2021 was 170mt with a total market value of US$ 916,589. The state of Amazonas was the largest producer with 140 t (82% of the total, with a total value of US$705,097.

Estimates of production for the other major producing states: Pará (16 t), Rondônia (8 t) and Mato Grosso (6 t) (IBGE, 2021).

PRICE TREND

Wholesale prices for Copaiba essential oil found on the internet: 5lbs for $431 (WHOLESALE BOTANICS, 2023) $86 per pound and 396 Lbs priced at $12,671.99 or US$ 32 per pound(3).

HISTORY

Copaiba tree is a plant native to South America, occurring mainly in Brazil, Venezuela, Guianas and Colombia. Indigenous people discovered the medicinal properties of the plant long ago. Amazonian Indians apparently used the oil to grease their bodies after combat as a way of healing their wounds, a behavior probably arising from the observation of animals that, when injured, rubbed against the trunks of the copaiba trees. Knowledge of the medicinal properties was passed on to European colonists and was soon a basic element of traditional medicinal knowledge throughout the Amazon and much of Brazil (MUNDO EDUCAÇÂO, 2023). The first European record of extracting oil from the Copaiba tree was in a work published in 1625, which stated that ". . . a single tree is said to yield about 40 litres" (Grieve 1931 in (OIL SEED CROPS, 2023). A 1979 report cited in the same article states that it was possible to "collect 15-20 liters of oil every six months" (OIL SEED CROPS, 2023). However, a 2003 study found that actual yields were considerably lower, and that even among those trees in the optimal size range (55-65cm) none produced a liter a year (WIKIPEDIA, 2023). made in developing economically viable Copaiba plantations. While developing biofuels from Copaiba has not panned out, it seems that the development of the Copaiba's medicinal and health properties have been far more successful.

PRODUCTION SYSTEMS AND ENVIRONMENT: AGROFOREST, WILD HARVESTING, PLANTING

Thus far, virtually all Copaiba oil is obtained from trees in natural forests and as yet there is no established system for managing groves of trees for their oil production. Copaiba tree densities are quite low and average densities for trees above 45cm dbh range from 0.14 to 1.13trees per hectare. Copaiba trees seem to produce oil only when they reach about 45 cm dbh. Tappers drill into the tree with an auger to extract the oil and then plug the hole with clay to prevent infection. Tappers will return to the tree periodically to extract more oil from the same hole. However, Copaiba trees are notoriously unreliable as sources of oil. Studies document that the first extraction invariably yields the largest amount and following yields are considerably lower. A three year tapping cycle seems to be optimal.

Another possible strategy is to integrate copaiba trees into agroforestry systems with other faster growing species that generate returns while Copaiba trees are growing, much as RECCA has done with agroforestry systems integrating Brazil nut trees. It may be that the best option is to use Copaiba trees in consortia for restoring degraded lands (EMBRAPA, 2021).

MATURITY TIME

The Copaiba trees are relatively slow-growing, reach a maximum height of 40 meters and can live up to 400 years. Trees seem to only produce oil when they reach about 45cm dbh. Production reaches a maximum in trees between 55 and 65cm dbh and then declines in trees above that size. During the productive phase the yield of copaiba oil per tree can vary from 100 milliliters to 60 liters per year, however, not all trees produce oil.

PRODUCER PROFILE AND SOCIAL IMPACTS

Copaiba oil is collected by small scale farmers in forested area and families that depend on forest extraction and are integrated into the supply chains for Copaiba that are fairly specialized compared to those for traditional agricultural and forest products. In this context, middlemen often have an important role, which can reduce the profit margin for producers.

PRODUCTION PROBLEMS

As noted throughout this text, copaiba oil production is notoriously fickle. Thus far, there is little indication in the literature that the challenges of developing production systems that can provide a consistent and economically viable quantity of oil have been developed.

SUPPLY CHAIN PROBLEMS

Among the problems of the supply chains are: poor infrastructure, little social organization, lack of training for sustainably extracting the oil and little support for ensuring that the quality of the is maintained along the supply chain.

RECOMMENDATIONS FOR PROCESSING AND SIZING

Copaiba oil is clearly a valuable substance and the Copaiba trees could be a major source of value added for managed forests and in reforestation projects and perhaps eventually in agroforestry systems, but significant, long term investment in research will be needed to develop the economic potential of Copaiba trees.

CREDIT POTENTIAL/CARBON SEQUESTRATION

No particular role in carbon offset schemes.

CERTIFICATIONS PROGRAMS

To fractionate, refill and/or repackage inputs such as vegetable oils, essential oils and butter to resell to stores and end consumers, companies need an Operating Permit from the Ministry of Health, inspected by ANVISA.

CERTIFICATION	BY-PRODUCTS	TYPE
IBD organic seal	copaiba oil _	Certified natural and/or organic raw materials

RELEVANT SECTORS

Retailer	Site
Projeto RECA	https://www.projetoreca.com.br/produtos/oleo-de-copaiba/

Associação Agroextrativista das Comunidades da RDS do Rio Uatumã (AACRDSU)	contabil_ney@yahoo.com.br
Amazônia Hub	https://amazoniahub.com/inatu/

IMPORT/EXPORT AND COMPLIANCE RATES

Data for copaiba are aggregated with other vegetable oils and resins.

BIOCULTURAL PROTECTIONS OF COMMUNITIES OF ORIGIN (NAGOYA/CGEN/ETC. PROTOCOL)

Brazilian adherence to the Nagoya Protocol, Legislative Decree No. 136 of 08/11/2020, ratified by the national executive in March 2021, can leverage the copaiba oil production chain due to the use and exploitation of genetic heritage by other countries.

REGULATORY INFORMATION

HS nº for import and export of copaiba – nº 3301 – essential oils; and nº 3004 – medicines for therapeutic/homeopathic use

2.14 DENDÊ (*Elaeis guineensis*) - OIL PALM

Palm oil is the dominant edible oil in global trade and is used in a wide variety of products and industrial processes. The oil palm is by far the most productive source of edible oil in terms of production per hectare. Palm oil production is also well suited for small scale production through outgrower or contract farming arrangements between processing companies and small-scale producers. Palm oil could play an important role in providing a sustainable source of income to small scale farmers, such as those in colonist settlements. While palm oil is associated with social conflicts and large-scale deforestation in Southeast Asia, safeguards in place have largely enabled Brazil to avoid these problems. The challenge facing oil palm development in the Amazon is to overcome existing bottlenecks that have slowed the growth of oil palm production thus far.

Palm fruit and oil

Palm tree

Palm cultivation

PRODUCT

Palm Oil: The red, unrefined oil extracted from the mesocarp of the oil palm is the main product and in its unrefined form is called dendê in Brazil and is used widely in traditional cuisine in Northeast Brazil, Africa and SE Asia. Crude oil palm oil is refined, neutralized, bleached and deodorized, including removal of carotenoids, to produce RBDPO (Refined, bleached and deodorized palm oil). Palm oil has a high unsaturated fats content and is semi-solid at room temperature.

RBDPO is widely used in food, personal care and cleaning products and is refined into a biofuel.

SUBPRODUCTS

Kernel: Palm kernel oil is a second product. While palm oil from the mesocarp is 49% saturated, palm kernel oil is 81% saturated.

Products:

Food: Used widely in food requiring a solid fat, such as pastry dough and baked goods

Nonfood: Around 70% of personal care and cleaning products use palm oil.

Biomass and biofuels: Palm oil is used to produce methyl ester and hydrogenated biodiesel. However, it generates far greater emissions than fossil fuels. Organic waste from processing oil palm can be compressed into pellets and used as a biofuel.

CURRENT MARKET SIZE

Global

Global palm oil production was estimated to be 77.559 million metric tons in 2023 (USDA/IPAD 2023) with Indonesia and Malaysia accounting for 84% of the total (IPAD, 2022). Total revenue in 2021 was estimated at $63.54 billion (2). Colombia is the largest producer in South America with 4% of global production.

Brazil/National: Brazil ranks 10th with 1% of global production or 570,000mt.

PROJECTED FUTURE MARKET SIZE

Brazil palm oil market size reached a volume of 915 KT in 2021 and is expected to grow at a CAGR of 6.0% during the forecast period of 2023-2028. The market interest and demand are growing due to the awareness of the health benefits of palm oil (EMR, 2023). It is projected that the revenue of Crude palm oil in Brazil will amount to approximately US 76.33 million dollars by 2025 (STATISTA, 2021). The global palm oil market was valued at US 63.54 billion dollars in 2021, and assuming a CAGR of 5.20 % could reach US 90.61 billion dollars by 2028 (GLOBONEWSWIRE, 2022).

VOLUMES SOLD/CONSUMED

In 2022, the consumption of palm oil in Brazil was approximately 935,000 metric tons, up from 895,000 metric tons in 2021 (STATISTA, 2022). Of this total Brazilian production accounted for 540,000 MT, 60% of total consumption, indicating that there is considerable space for expansion of domestic production.

At present the edible oil market in Brazil is dominated by soy oil. However, the far higher productivity of oil palm compared to soy and other oil seeds means that palm oil is highly competitive with soy in a significant portion of the domestic market for soy oil.

PRICE TRENDS

Between 2014 and 2020 the average annual price of palm varied between varied between US 837 and US 601 dollars per metric ton. The price per ton increased to US 1,275 dollars in 2022 and is expected to average around US 1050 per MT in 2023-24. It should be noted that Brazilian production costs, especially labor, are higher than those of SE Asian countries, so Brazilian producers have difficulty competing with other countries in the global market.

HISTORY

Oil palm is native to west Afrca where cultivation began some 5,000 years ago and continues to be both a staple of West African diets and one of the region's major export crops. Oil

palm was introduced into Bahia/NE Brazil in the 16th century as the trade supplying enslaved African labor to Brazilian sugar plantations intensified. It has become a central element of Bahian cuisine. Commercial oil palm production in the Brazilian Amazon began in the mid 1970s with the establishment of Denpasa in 1974 in an area near Belém. In the eighties and nineties oil palm production grew with increasing company investment stimulated by SUDAM incentives. By 1995, 52,058 hectares of oil palm were being produced in NE Pará.

During 2000s government interest in palm oil as a biofuel and the increase in the price of palm oil in global markets, stimulated additional investment. In 2010 the government created the *Sustainable Palm Oil Production Programme (SPOPP)* to stimulate outgrower/contract farming arrangements similar to those in SE Asia where smallholders produce for local processing mills. A 2010 agroecological study by EMBRAPA identified 29 million ha in 10 Amazon states appropriate for oil palm production currently, although only a small fraction of this area is under production today (EMBRAPA, 2010).

PRODUCTION SYSTEMS & ENVIRONMENT: AGROFORESTRY, WILD HARVEST, PLANTATION

In Brazil oil palms are cultivated primarily as monocultures much of it in large scale plantations (BRANDÃO, 2015). However, a small but significant percent of Brazilian production comes from smallholder farms often through contract farming arrangements with local processing companies.

Agroforestry

There are a number of initiatives seeking to develop sustainable and profitable agroforestry systems integrating oil palms, results thus far indicate that these agroforestry systems can be economically viable, but thus far there are few examples of commercial agroforestry systems integrating oil palms.

TIME TO MATURITY

Oil palm begins producing around 3yrs of age and continues producing for 25 years.

PRODUCER PROFILE & SOCIAL IMPACTS

In Brazil, large scale plantations dominate total palm oil production. However, small scale producers are responsible for only a small percent of total area/total production through various kinds of outgrower arrangements. While there are challenges to developing and implementing contract farming arrangements between companies and smallholders, studies have found that long term contracts can provide smallholders with good incomes and considerable economic stability for the duration of their contracts (BRANDÃO, 2021). This production model could be especially beneficial for smallholders in colonist settlements that have appropriate agronomic conditions.

PRODUCTION AND SUPPLY CHAIN ISSUES

Disease: The oil palm is vulnerable to several diseases in the Amazon and research is underway to reduce threats through development of more disease resistant varieties better

adapted to Amazon conditions. While deforestation is not a significant issue for the palm oil supply chain in Brazil, there are concerns related to land tenure issues and pollution of local waterways from the application of chemicals.

CARBON CREDIT/SEQUESTRATION POTENTIAL

The oi palm has significant potential for carbon sequestration and carbon credits as monocultures and in agroforestry systems.

CERTIFICATION PROGRAMS

Roundtable for Sustainable Palm Oil. RSPO was created to promote best practices in oil palm cultivation and processing to increase the sustainability of oil palm production and processing of oil palm products. Best practices are also applied in out-grower programs to ensure equitable contracts with producers and adoption of sustainable production practices.

RELEVANT INDUSTRIES

Retailer	**Site**
ABRAPALMA, Associação dos Produtores de Óleo de Palma	http://www.abrapalma.org/en/
Agroindustrial Palmasa S/A	www.palmasa.com.br
Agropalma	https://www.agropalma.com.br/en/
Belém Bioenergia Brasil S/A	www.belembioenergia.com.br
Biopalma da Amazônia S/A Reflorestamento, Industria e Comércio	brasilbiofuels.com.br
Denpasa – Dendê do Pará S/A	www.denpasa.com.br
Marborges Agroindustria S/A	www.marborges.com

REGULATORY INFORMATION

INCI Name: Hydrogenated Palm Oil, Elaeis Guineensis (Palm) Kernel Oil, Elaeis Guineensis (Palm) Oil.

Harmonized System Code: HS Code 15119099 - Palm, oil, liquid - Tariff Number

EINECS No:

CAS Number: Palm oil | CAS 8002-75-3

2.15 PATAUÁ (*Oenocarpus bataua Mart*.)

The Patauá palm is found in much of Northern South America especially in the Amazon and Orinoco river basins. Populations in many areas were devastated in the last century, so it is now rare in some portions of its original distribution. It occurs in the states of Acre, Amazonas, Pará, and Rondônia. The Patauá palm inhabits humid lowland forests, especially gallery forests along streams and rivers. The great potential of this species lies in the oil extracted from the fruit. Unlike most palms it is highly unsaturated, with 75-80% monounsaturated fatty acids and approximately 3% polyunsaturated, very similar to olive oil. This fatty acid composition makes possible the use of Patauá oil to produce soap, cosmetics, medicinal treatments and biodiesel.

Seed of Patauá

Patauá Tree

Patauá Oil

PRODUCTS

Oil –Patauá oil is used in cosmetics as a tonic to soften hair. In the pharmaceutical industry it can be used in the composition of ointments, balms, and kerates. It is also used in folk medicine as a laxative, remedy for tuberculosis, asthma and other respiratory problems.

Biofuel - It is a highly efficient source of diesel oil.

Palm heart – is used in salads and consumed fresh (EMBRAPA, 2004; OLIVEIRA, 2017; OLIVEIRA et al., 2022).

CURRENT MARKET SIZE

There is very little information that could be used to estimate the size of the patuá market. Producers and local intermediaries sell the fruit in informal markets in cans of 14.5kg and 30 kg. During the harvest period in Acre about 1,500 cans are sold per week in local markets (MACIEL, 2018; EMBRAPA, 2004). The processing of the fruit is similar to açaí.

SIZE OF THE PROJECTED FUTURES MARKET

Despite the current small demand as a food plant, patauá oil is gaining ground in the cosmetics industry. For example, the Natura company has an exclusive line called Natura Ekos Patauá; Cosmetics companies such as L'Occitante au Brésil, are investing in projects such as "Oil Houses" in the state of Pará, which is organizing the supply chain of patauá oil

through the construction of infrastructure for the artisanal production of patauá oil and has developed product lines using Patauá oil.

VOLUMES SOLD/CONSUMED

PRICE TREND

Wholesale prices for Patauá oil sold online range from 25kg for $1,065 to $3,876.6 for 100kg.

The sale of patauá oil in the state of Acre, went from 10kg (R $ 700.00) in 2018 to 500kg in 2019 (R $ 19,000), an increase of R $ 18,300.00 in the revenue generated from its sale (SEMA-ACRE, 2018). It is unclear what the trend has been between 2019 and the present. Patauá oil (extracted by boiling the pulp) is found on the market at R$60.00/kg (SEMA-ACRE, 2018; COOPFRUTOS, 2023).

HISTORY

Patauá, has been used for decades by indigenous and traditional peoples due to the medicinal properties of the oil extracted from the fruit. Because it has a taste, odor and chemical composition similar to olive oil, in past decades patauá oil was extracted manually and marketed as a substitute for olive oil in fried foods and salads. It was also exported to Italy, Spain and Portugal. The commercialization of the oil as a substitute for olive oil was quite significant during WWII. Between 1939 and 1945 more than 200mt/year of oil was exported to Europe, but the low quality of the oil led to the collapse of the export market. At the same time, the predatory exploitation of palm trees for fruit depleted local populations on the supply end. Currently, patauá fruit are harvested to produce oil for companies producing cosmetics. The pulp is also consumed in natura and used to manufacture popsicles and ice cream. The demand for edible oil is restricted to local and traditional populations. In other South American countries the oil market is still very strong. The Natura company identified a bioactive capable of promoting hair growth. Research institutions located in the North Region have also been interested in the domestication of patauá, targeting the oil and pulp markets. (QUEIROZ et al., 2016; OLIVEIRA et al., 2022).

PRODUCTION SYSTEMS AND ENVIRONMENT: AGROFORESTRY, WILD HARVESTING, PLANTING

Patauá occurs in floodplain, igapó and terra firme habitats, but has a preference for floodplain soils. It occurs in high densities with from 100 plants/ha up to 900 plants/ha and produces about 11mt of fruit/ha/year. It can be grown in altered areas of terra firme, preferably in agroforestry systems (SAF's) or in consortia with other fruit trees or food crops. In experimental planting in monocultures, its growth was slow, but with little evidence of pests and diseases. Despite predatory exploitation in the past, it is still possible to find large populations, especially in the Lower Tocantins area (EMBRAPA, 2004; OLIVEIRA et al., 2022).

PRODUCER PROFILE AND SOCIAL IMPACTS

The extraction of patauá is carried out by riverine and extractive populations, it is a supplemental income source for these families. The development of management systems for wild stands and integration of patauá into agroforestry systems combined with

development of the patauá value chain could have a significant impact on rural families and their communities.

PRODUCTION PROBLEMS

Deforestation is still a challenge in the production of Patauá. The challenge for the use of patauá oil on an industrial scale lies in finding a development model that favors the sustainable management of wild patauá stands.

SUPPLY CHAIN PROBLEMS

Lack of equipment for oil removal and processing is an important constraint. Fragility of the cold chain for storage and transport of the fruit is another problem. The productivity of oil extraction is limited by traditional methods. The lack of standardization in the extraction of the oil means that oil production and quality are extremely variable.

RECOMMENDATIONS FOR PROCESSING AND SIZING

Research is needed on all phases of the patauá supply chain from developing more productive varieties, sustainable management systems and cultivation practices, to accessible technologies for producing high quality oil at commercial scale are among the priorities (BRASIL, 2022).

CARBON CREDIT/SEQUESTRATION POTENTIAL

Patauá management is consistent with a low low carbon forest economy.

CERTIFICATION PROGRAMS

ECO CERT ORGANIC COSMOS

RELEVANT SECTORS

Retailer	Local
Amazon Forest Trade	https://amazonforestrading.com.br/produto/extratos-e-oleos/oleo-da-amazonia-de-pataua-natural/
Amazon Symbioze	https://simbiozeamazonica.com/products/pataua's oleo-lidimo-30ml1/
Amazonoil	https://www.amazonoil.com.br/produtos-da-floresta/pataua-oenocarpus-bataua/
Cooperative of Native Fruit Pulp Producers of Mâncio Lima (COOPFRUTOS)	https://coopfrutos.webnode.page/

IMPORT/EXPORT TARIFFS AND COMPLIANCE

The tariffs will be given in accordance with trade agreements, tariff preferences and legislation applicable to foreign trade (BRAZIL, 2023).

BIOCULTURAL PROTECTIONS OF COMMUNITIES OF ORIGIN (NAGOYA/CGEN/ETC PROTOCOL)

The Brazilian adherence to the Nagoya Protocol, Legislative Decree No. 136 of 11/08/2020, ratified by the national executive in March 2021, can leverage the Patauá production chain due to the use and exploitation of genetic heritage by other countries.

REGULATORY INFORMATION

Pearl name: Oenocarpus bataua Mart.

Harmonized System Code: Patauá does not have a specific HS code.

2.16 PIMENTA DO REINO (*Piper nigrum L.)* - BLACK PEPPER

Black pepper, also known as round pepper and, in Brazil, as black pepper, is one of the oldest and most well-known spices.

black pepper

Dried & ground black pepper

Black pepper plants

PRODUCT

Pepper (from the genus piper) dried in grains, crushed or powdered

OTHER PRODUCTS

Piperine and oleoresin, substances used in the sausage, perfume and pharmaceutical industries.

CURRENT MARKET SIZE

In 2022 the global black pepper market was valued at $4.1 billion. Brazilian pepper production in 2021 was between 114.75 and 118.1 million tons, with a total market value of US$ 333.6 million, Espirito Santo was the largest producer and the state of Pará second largest. Brazilian exports of black pepper in 2021 were 92.3 million mt, second to Vietnam which was responsible for 41.5% of global exports.

PROJECTED FUTURE MARKET SIZE

The projected future market size in 2028 is US$ 5.5 Billion based on a CAGR of 4.3%. In the longer term, however, the outlook is more problematic as the global market for black pepper will come under increasing pressure from oversupply. The largest producers, such as Vietnam and Brazil, have been increasing production in recent years, while demand has only increased by 2 – 2.5% / year (ProCampo, 2020).

Vietnam, the largest producer of peppers, has been reducing the amount of production and this vacuum could be filled by Brazil, the second largest producer. The competitiveness of Brazilian black pepper in the international market is related to the quality of Brazilian black pepper, free of physical, chemical and biological contaminants, and to Brazil's competitive production costs (ALVES et al., 2017).

VOLUMES SOLD/CONSUMED

In 2021, the production of black pepper in Brazil reached around 118.1 thousand metric tons, valued at US$ 333.6 million. This is more than double the production of 54.4 thousand metric tons registered in 2016 (IBGE, 2021). Of this total 92.3 thousand metric tons were exported, which with imports of 278 mt indicates that domestic consumption may have been roughly 23,000 mt in 2021.

PRICE TREND

Between 2021 and 2023 the price per ton for black pepper declined about 12% from U$3,335 USD/MT to US$ 2,950 USD/MT. The increase in production registered above was a response to growing demand and rising prices in the global market in recent years. However, production is now greater than demand, leading explaining the 12% decline in the price of Brazilian pepper exports (PARTELLI, 2020).

The price paid to producers in June 2022 varied among the 3 largest produce states in Brazil,: Pará R$/kg 8.84; Espírito Santo R$/kg 10.51; and Bahia R$/kg 11.56 (CONAB, 2022).

HISTORY

Originally from India, black pepper was introduced to Brazil in the 17th century. Black pepper was introduced to the Amazon in the 1950s and production grew rapidly once appropriate cultivation systems were developed. However, in the sixties black pepper production was devastated by fusaria that attack the roots after about 7 years of cultivation. Japanese farmers eventually succeeded in managing the problem and pepper production gradually recovered in Pará and once again constitutes an important export crop for Amazon farmers.

PRODUCTION SYSTEMS AND ENVIRONMENT: AGROFOREST, WILD HARVESTING, PLANTING

Black pepper in Pará is cultivated in two different systems, intensive monocultures and in AFS. In Southwest Pará pepper producers have adopted a more intensive monoculture under full sunlight with 1,600 plants/ha sun. This system with irrigation and balanced fertilization can produce over 5t of dry black pepper per year. Productivity varies from 2.5 kg to 4.0 kg/plant (SítioDaMata , 2023). Southwest Pará obtained the highest growth in productivity, 5.79% per year from 1998 to 2008. In Northeast Pará, where Amazon pepper production began, is grown primarily in agroforestry systems and production grew at 2.25% per year. The use of SAFs decreases the number of plants and more shade reducing productivity (ROSARIO, 2017).

TIME TO MATURATION

Black pepper plantations reach maturity in the third to fourth year. The first harvest occurs in the second year, but income usually does not to cover costs. Pepper production begins to make a profit from the third year onwards and thereafter provides fairly consistent economic returns. Production in the third and fourth year ranges from 1.5 kg to 3.0 kg per plant, and 2,400 kg and 4,800 kg per hectare (DUARTE, 2004)..

PRODUCER PROFILE AND SOCIAL IMPACTS

The black pepper tree is cultivated by small scale producers who use family and hired labor on a seasonal basis. In pepper producing areas, large numbers of temporary workers are hired during the harvest season

Black pepper is an important source of income for rural families, and helps maintenance families in rural areas, contributes to continuity in their way of life. The black pepper producers employ around 50 thousand people during the harvest period, and foreign exchange around US$ 50 million per year through exports (EMBRAPA, 2004).

PRODUCTION PROBLEMS

High cost of wood for tutor stakes and the reduction of the useful life of plantations caused by root diseases which tend to infect pepper plantations after about 7 years, raises production costs (MARTINS, 2018) .

The cultivation of black pepper using live stakes (gliricidia), replacing wooden stakes, which are more expensive and suffer from environmental restrictions, increases the longevity of the pepper plantation and reduces the environmental impact of the activity. Gliricidia is a fast-growing leguminous tree, native to Central America and contributes to increasing carbon sequestration in a pepper plant, improves soil condition by fixing nitrogen and incorporating organic matter. Potential that must be explored (CanalRural , 2021).

The competitiveness of the Brazilian product in the international market is related to the quality of the black pepper produced, free of physical, chemical and biological contaminants, and to compatible production costs so that it is economically viable (ALVES, 2017). The indiscriminate use of pesticides in crops and incorrect handling of the spice has created trade barriers, especially in European Union countries.

This problem has been addressed through regulations implemented in September, 2021 NORMATIVE INSTRUCTION MAPA No. 12, OF SEPTEMBER 6, 2021 (DOU Section 1 No. 175, 09/15/2021). However, it may take some time for producers to fully comply with the new regulations.

SUPPLY CHAIN PROBLEMS

Harvesting and drying: the ears are harvested manually and placed in cloth bags that the workers carry on their shoulders. Clean bags must be used, the same bag must not be used without being sanitized, before the next harvest. Producers should be alert to the presence of human or animal fecal material in the harvesting or processing environment (EMBRAPA, 2004).

RECOMMENDATIONS FOR PROCESSING AND SIZING

Some alternatives for pepper production would be intercropping, organizing producers to sell with volumes and quality in processing (drying and cleaning) and the production of differentiated products, such as white pepper, which has a higher price. By investing in new technologies, research to develop productive and resistant varieties, and technical assistance to producers are factors that could contribute significantly to the competitiveness of Amazonian black pepper producers.

CREDIT POTENTIAL/CARBON SEQUESTRATION

Black pepper plantations offer a good opportunity for carbon sequestration, sinceit is a plant that adapts quite easily to the soil and does not require many specific care and restrictions, the implementation of carbon dioxide neutralization strategies in black pepper plantations is easie

CERTIFICATIONS PROGRAMS

Normative Instruction MAPA nº 12, of 09/06/2021, establishes the mandatory and recommended criteria to increase the quality of the Integrated Production of Black Pepper.

Important Suppliers

Retailer	Site
Cooperativa Agrícola Mista de Tomé - Açu	https://www.camta.com.br/index.php/pimenta-do-reino

BIOCULTURAL PROTECTIONS OF COMMUNITIES OF ORIGIN (NAGOYA/CGEN/ETC. PROTOCOL)

Brazilian adherence to the Nagoya Protocol, Legislative Decree No. 136 of 08/11/2020, ratified by the national executive only in March 2021. Black pepper does not originate in Brazil.

REGULATORY INFORMATION

CAS number: 84929-41-9

EINECS/ELINCS No.: 284-524-7

COSING REF No.: 40918

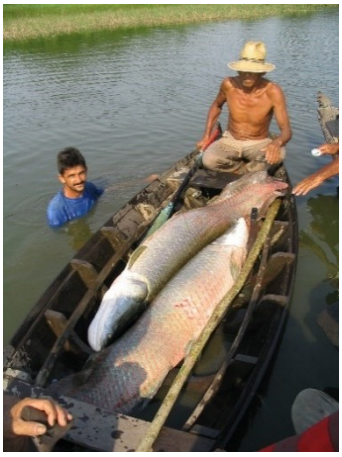
Chemical/IUPAC Name: Piper Nigrum fruit Oil is the volatile oil distilled from the dried ripe fruit of black pepper, Piper nigrum L., Piperaceae

2.17 PIRARUCU (*Arapaima spp.)*

Also known as paiche in Peru

The pirarucu is the largest fish with scales in the Amazon basin and can reach 3+ meters in length. Dried salted pirarucu was a major staple of intraregional trade in the Amazon throughout the Colonial period. Centuries of commercial exploitation led to the severe depletion of pirarucu stocks by the 1980s, leading to its inclusion in Appendix II of CITES. Thanks to a highly effective management system developed and implemented in the state of Amazonas in the early 2000s, stocks in some areas began to recover as the management system has been disseminated throughout the state. Annual harvest of sustainable pirarucu is estimated to be around 3,000 tons and increasing. Today fresh, iced pirarucu is one of the most highly priced food fish in the Amazon (TAVARES, 2014).

The taxonomy of the pirarucu is in flux. For most of the last 100+ years, the Arapaima was believed to consist of one species named Arapaima *gigas*. In the last two decades some specialists have argued that there are several distinct species and at least one has been accepted as a new species.



BY-PRODUCTS

Fresh, iced and frozen pirarucu_are the main forms of pirarucu sold in markets and supermarkets today.

Dried salted: In the past this was the dominant form. The availability of dried salted pirarucu is much reduced and can be of variable quality. There have been some initiatives to produce and sell high quality dried and salted pirarucu that is comparable to high quality dried salted cod.

Smoked pirarucu: There has been a surge of interest in smoking pirarucu, in part due to the proliferation of home systems for smoking meat, poultry and fish. Smoked pirarucu is available in some restaurants and may be available in some supermarkets.

Pirarucu leather: There is growing interest in fish skin processed into leather and used in shoes and pocketbooks/purses.

Minor products: fish scales used as nail files and the boney tongue used as a rasp

CURRENT MARKET SIZE

Total production from sustainably managed lakes reached 2,600 tons in 2019 and may exceed 3,000 by 2023 (McGrath et al., 2020). The total amount of pirarucu harvested annually is difficult to estimate because the main producing state, Amazonas, has banned commercial fishing of pirarucu outside areas with government authorized management plans. Despite the ban, there is a significant trade in pirarucu coming from unmanaged lakes, including fish below the legal minimum size and fish caught out of season (between December and June.

PROJECTED FUTURE MARKET SIZE

Based on the trend since the managed pirarucu fishery was established in 2003, we can expect the total supply of legal pirarucu to increase to at least four thousand tons by 2030. If there are significant improvements in supply chain infrastructure and increased demand for managed pirarucu in national and international markets, the size of the pirarucu market could be considerably larger.

SOLD/CONSUMED VOLUMES

Because of the significant amount of illegal fish entering the market and the low level of government effort to monitor fish landings, there is only fragmentary data on the total volume of pirarucu entering the market in the Brazilian Amazon.

PRICE TRENDS

The pirarucu is a high value species and its retail price is among the highest priced fish species in Amazon markets, similar to that of the tambaqui, tucunaré and piraiba (filhote). Because of supply chain bottlenecks between managed lakes and major markets, the price of managed pirarucu is significantly lower than it should be.

Fresh and frozen Arapaima: R$45-R$50 per kilo. $9-$10 per kilo depending on exchange rate

Smoked arapaima: R$60/kg ($12)/kg. Minimum purchase 40kg

Dried salted arapaima: R$95-R$145 ($19-$29/kg),

HISTORY

The pirarucu was an important staple in Amazon trade from early in the Colonial era (1600s) into the 1970s. During this period virtually all pirarucu was traded in the form of dried salted filets (called mantas) extending the length and breadth of the fish. Since the seventies there has been a shift in the commercial fisheries from dried salted fish to fresh iced and frozen fish. This trend was accompanied by the intensification of commercial fishing pressure resulting in a significant decline in commercial pirarucu landings between the 1970s and

2000s. This trend has been reversed in some regions of the state of Amazonas with the development of a highly effective community based management system in the late 1990s, based on counting individual pirarucu as they rise to the surface at regular intervals (CASTELLO, 2004). Now community management groups can accurately monitor lake populations, and define and harvest annual catch quotas, that ensure increasing incomes, local employment and healthy, growing pirarucu populations.

MANAGEMENT SYSTEMS & ENVIRONMENT

The management system for pirarucu has the potential to transform the management of floodplain fisheries and land use. Successful pirarucu management systems improve conditions for other fish species and aquatic biodiversity in general (CAMPOS-SILVA; PERES, 2016). Research has shown that the productivity of floodplain fisheries is directly related to the extent of floodplain forest cover. Ten percent more forest, results in a 10% improvement in fishing productivity (CASTELLO et al., 2017). This creates an incentive for fisher farmers to reduce the number of cattle and allow the recovery of floodplain forests, thereby not only increasing the productivity of local fisheries. but also generating additional income through forest management.

PRODUCER PROFILE & SOCIAL IMPACTS

The pirarucu management system involves almost exclusively traditional and indigenous communities, composed of families that engage in a variety of productive activities including fishing and farming, forest collection and especially in the eastern Amazon small scale cattle raising.

Pirarucu Value Chain: Growth in the volume of sustainably managed pirarucu has stimulated the transformation of the traditional pirarucu fishery and is pressuring the supply chain to reinvent itself as a modern cold value chain that delivers wild, sustainably managed pirarucu from community lakes deep in the Amazon to regional and national consumer markets with minimal loss of quality. Towards this end, local pirarucu management organizations are joining forces to organize regional supply chains, while several private sector initiatives are investing in key components of a modern supply chain infrastructure. A third aspect of the supply chain involves digitizing the existing chain of custody system to ensure that pirarucu from unmanaged lakes are unable to enter the pirarucu supply chain.

Market: As the total catch of managed pirarucu grows, efforts are ramping up to develop markets to absorb the growing volume of sustainably managed pirarucu in Brazil and in promising international markets in the US, Europe and Asia.

CARBON CREDIT/SEQUESTRATION POTENTIAL

The productivity of Amazon floodplain fisheries is directly related to floodplain forest cover, the greater the forest cover around a lake, the higher the productivity of lake fisheries. Forest carbon credits can provide an additional incentive to motivate floodplain fisher-farmers to make the transition from fish and cattle to managing floodplain fisheries and forests.

CERTIFICATION PROGRAMS

The pirarucu management system has had difficulty satisfying certifiers, in large part, because pirarucu management is a decentralized community level system that violates a central element of the MSC's and other certifiers "whole stock principle". This position ignores two decades of scientific research showing the steady growth in pirarucu populations in managed lakes even as the total catch and the number of fishers also increases. Another indicator that lakes can be effective management units is the striking contrast in pirarucu populations between adjacent lakes, one managed with pirarucu densities of 35+ individuals per km and the other unmanaged lakes with densities below 5 individuals per km2.

CITES

The pirarucu is also cited in Appendix II of CITES. Appendix II includes species for which there is insufficient data on the status of the species. However, the CITES Livelihood Fact Sheet (2019) on the pirarucu, notes that "Community-based harvest and trade can be a more effective contribution to species conservation and the fight against illegal trade than relying on bans and law enforcement measures, even for a species seriously depleted by illegal harvest and trade. . . Key success factors here include local leadership and experimentation, support from the relevant government agencies, existing community socio-political organisation, and integration of traditional knowledge (CITES; LIVELIHOODS CASE STUDY, 2019).

THE ORIGINS CERTIFICATION

Pirarucu management associations in the state of Amazonas have adopted the Origins Certification system (FEMAPAM, 2020). This is not a certification of the management system but rather, as the name implies, an affirmation of the cultural and ecological legitimacy of the pirarucu management system, an example of the potential of collaborations between scientists and experienced pirarucu fishers.

RELEVANT INDUSTRIES

Aggregators/Suppliers

Retailer	Site
Association of Rural Producers of Carauri (ASPROC)	R. Castelo Branco, 380 - Centro, Carauari - AM, 69500-000, Brazil https://asproc.org.br/#
Mamirauá Sustainable Development Institute	https://www.mamiraua.org mamiraua@mamiraua.org.br +55 (97) 3343-9700, headquartered in Tefé (AM) or (91) 3086-9184, office in Belém (PA)

Processors / Exporters / Importers

Retailer	Site
Friolins	Manaus, AM Friolins Pescados Ltda. is located at: R. Duque de Caxias, 266 - São Francisco, Manacapuru - AM, 69400-380, Brazil., +55 92 3361-1425
Frigopesca	2472 Avenida Correnteza, Manacapuru, AM 69400-000

REGULATORY INFORMATION

INCI Name : Arapaima *spp*.
Harmonized System Code :
EINECS No :
CAS Number :
NCM: 302.89 e 303.89

2.18 PUPUNHA (*Bactris gasipaes*)

The Peach Palm or Pupunha is a perennial palm tree, native to the tropical region of the Americas that is cultivated for both its fruit and palm heart. In northern Brazil, the nutritious fruit are widely consumed and much appreciated. In Southeastern Brazil varieties of pupunha developed by EMBRAPA are cultivated for their palmito, which is yellow in color and sweeter than the palmito of other well known species such as Juçara and Açaí. The market for pupunha is growing and there is considerable potential for developing Amazon

Planta da pupunha - palmeira

Fruto pupunha

Fruto pupunha e palmito

varieties and production systems for both fruit and palm heart.

PRODUCT

Fruit – food industry, consumed *in natura* and is also processed into a flour;

Heart of palm - food industry, consumed *in natura* and canned.

BY-PRODUCT

Peach palm oil – is extracted from the fruit of the pupunha and is consumed in the Amazon region (contains a higher amount of unsaturated fatty acids than palm oil, but is not exploited industrially);

Wood - hard and weather resistant, it is used in the manufacture of musical instruments, tool handles, flooring, handicrafts, pulp for paper and cellophane.

CURRENT MARKET SIZE

The global market for pupunha fruit was valued at US $4.19 in 2021 (TRIDGE, 2023).

PROJECTED FUTURE MARKET SIZE

The TNC report estimates that the value of the pupunha supply chain increased by 4.7% pa between 2006 and 2019 (TNC, 2021). The Peach palm (pupunha) is considered a 'relevant and dynamic' product, and is among the most important bioeconomy products of the state of Pará in terms of production value in 2019 and had high positive growth rates.

VOLUMES SOLD/CONSUMED

Total pupunha fruit production in the Brazilian Amazon is estimated to be 5,386 mt. Approximately 43% of peach palm fruit production is sold by local retailers to local consumers; the remaining 57% is consumed in large urban centers of the Amazon. Given how widespread pupunha consumption is and how diffuse production, this is most certainly an underestimate (BRANDÃO et al., 2021).

According to the 2017 Agricultural Census the estimated value of the pupunha fruit market in Brazil was US$ 8,689. Of this total, the estimated value of the Amazonian market was US$ 5,252 (EMBRAPA, 2019). According to the 2021 TNC report on bioecnomy products of Pará, based on detailed field research on the pupunha value chain in Pará, the gross value of the production of pupunha in the state is estimated to have reached BRL 4.4 million in 2019. We did not find comparable data for the entire Amazon region on the value of the market for pupunha palm heart, which is primarily produced in southeastern Brazil.

PRICE TREND

Pupunha fruit production is estimated to have grown at 4.2% pa since 2006 (TNC, 2021).

HISTORY

Pupunha originates in the Ucayali River basin and in the upper Madeira River basin of southeastern Peru. It was disseminated throughout Brazil by indigenous people. The geographic distribution of pupunha reveals the trade and migration routes of pre - Columbian times to the North Pacific regions of South America (Ecuador and Colombia), the Caribbean (Colombia and Venezuela), the Upper Amazon region (Bolivia , Brazil and Peru) and Central America (Panama, Costa Rica and Nicarágua) (Portalvidalivre, 2022). Researchers at EMBRAPA developed varieties adapted to SE Brazil for palmito production.

PRODUCTION SYSTEMS AND ENVIRONMENT: AGROFOREST, WILD HARVESTING, PLANTING

The area planted with peach palm trees for the production of heart of palm in Brazil is estimated at 26,000 hectares with most of the planted area concentrated in northeast and southeast Brazil (CI ORGÂNICOS, 2015).

< https://ciorganicos.com.br/biblioteca/pupunha-e-opcao-de-renda-para-agricultura-familiar/ >

In the Amazon region, the pupunha is almost exclusively a source of fruit. It is grown in house gardens and managed agroforests. Fruit are also collected from palm trees in secondary vegetation often associated with abandoned fields. Production is sufficient to meet local demand with any surplus sold to intermediaries for sale in urban markets (EMBRAPA, 2023).

MATURITY TIME

Each plant produces multiple stems forming a clump or tussock. The stem may or may not contain thorns. Fruit production begins in the 3-4th year and continues for the productive life of the palm (at least 10-20 years). Peach palms can produce up to 8 bunches per year, each with about 100 fruits depending on their size (Colecionandofrutas, 2023; Portalvidalivre, 2022).

PRODUCER PROFILE AND SOCIAL IMPACTS

The profile of pupunha producers in general is of small scale family farmers who maintain pupunha palms in house gardens and surrounding secondary vegetation. Fruits are primarily consumed by the family with excess sold to intermediaries or directly in local markets. Pupunha can be an important source of food security and cash from the sale of pupunha fruit contributes to cash purchases (TAVAREs, R. K., 2019).

PRODUCTION PROBLEMS

The peach palm is vulnerable to several diseases. Among the pathogens that occur in the peach palm, include fungi Colletotrichum gloesporioides, Bipolaris bicolor, Curvularia eragrostides, Pestalotiopsis sp., Dreschlera incurvata, Phomopsis sp. And Alternaria sp. that cause leaf spots mainly in plants with water stress or nutritional deficiency.

Another difficulty is obtaining pupunha seeds that breed true, especially with regard to stems without thorns, as there is no guarantee that seeds extracted from palm trees without thorns will generate smooth peach tree trunks. Due to this factor, many producers are unable to expand their plantings, since it is unfeasible to work with trees with spines (TAVARES, 2019).

SUPPLY CHAIN PROBLEMS

The lack of machinery to automate production and harvesting are major problems, since basically all steps from planting to processing are done manually (RIOS et al., 2019). Other problems identified in the supply chain: Location of raw materials and transport; Difficulties in registering with the Ministry of Agriculture; Low production scale and high costs (BERGO, 2005).

RECOMMENDATIONS FOR PROCESSING AND SIZING

There is an important opportunity for developing pupunha varieties without thorns that produce both fruit and high quality palm heart, increasing economic returns from pupunha production. Also, there is little information on production of subproducts of pupunha including flour and oil.

CREDIT POTENTIAL/CARBON SEQUESTRATION

Research on agroforestry systems integrating pupunha palms have potential for carbon sequestration. After 5 years of implantation of agroforestry systems with 68.8% of peach palm; 9.4% mutamba cotton; 3.1% cashew; and 18.7% of orange trees, had an annual rate of carbon storage in the aerial biomass, in the soil and in total respectively of 28.3; 1.9; and 30.2 tC /ha-1/year (ALVARADO, 2007).

CERTIFICATIONS PROGRAMS

CERTIFICATION	BY-PRODUCTS	COMPANY	TYPE
Organic certification – BR/EU/US: Product Organic Brazil	Canned heart of palm	Biodynamic Institute (IBD)	Meets all organic certifications made by IBD Certifications in the domestic market and is used in conjunction with the seal of organic products from Brazil
Organic certification – BR/EU/US: USDA Organic Certification			Meets all certifications made for the North American Market (USA), and IBD is accredited with the adoption of USDA/NOP standards

RELEVANT SECTORS

IMPORT/EXPORT AND COMPLIANCE RATES

No information found

BIOCULTURAL PROTECTIONS OF COMMUNITIES OF ORIGIN (NAGOYA/CGEN/ETC. PROTOCOL)

Brazilian adherence to the Nagoya Protocol, Legislative Decree No. 136 of 08/11/2020, ratified by the national executive in March 2021, can leverage the peach palm heart of palm production chain due to the use and exploitation of the genetic heritage by other countries.

REGULATORY INFORMATION

NCM Harmonized System Code: 2008.91.00 – heart of palm

2.19 TAMBAQUI (*Colossoma macroponum*)

Tambaqui is a large, fruit and nut eating fish, one of the most popular food fish in the Amazon. The tambaqui exemplifies the symbiotic relationship between Amazon fish and floodplain forests. Wild populations have been much depleted by overfishing. However, in the 1990s and early 2000s, the tambaqui the main focus of efforts to develop varieties of native Amazon fish species for aquaculture. Today, the tambaqui is the most important fish species produced by Amazon fish farmers (VALENTI et al., 2021).

PRODUCT

Roundfish (Peixe Redondo): The tambaqui is one of three species of characin (Tambaqui, Pirapitanga, and Pacu) used in aquaculture along with two hybrids (Tambacu and Tambatinga) that are crosses of tambaqui with the other two species. This group of fish, referred to collectively as Roundfish (peixe redondo) accounted for 93% of total Amazon aquaculture production in 2020, with other native and nonnative fish species accounting for the remainder (PEIXE BR, 2021).

SUBPRODUCTS

Farmed tambaqui are usually harvested when they reach 1.2-3 kg and are sold as whole fish or split into two halves which are sold separately. The ribs of the tambaqui are much appreciated as is the loin and these parts are increasingly marketed separately.

CURRENT MARKET SIZE

Amazon aquaculture produced 234,000 tons of fish in 2021, roughly similar to the total commercial catch of Amazon fisheries. Roundfish account for around 90% of Amazon aquaculture production (roughly 210,000 tons) (PEIXE BR, 2021).

VOLUMES SOLD/CONSUMED

The Amazon region, especially those areas that were settled before the 1970s, have among the highest per-capita fish consumption rates in Brazil. However, the rate of fish consumption in the Amazon has declined considerably due to the widespread availability of poultry, beef and pork, but is still far higher than the national average.

PROJECTED FUTURE MARKET SIZE

While tambaqui production has stagnated in recent years, exports of tambaqui to the US have shown strong growth, increasing from US$ 75,185 in 2019 to US$ 562,809 in 2020 (PEIXE BR, 2021). In March, 2023, Tambaqui Ribs, won the top prize at the Seafood Expo North America (KEARNS; SCALIA-BRUCE, 2023) This trend, underscores the potential of expanding into the US and other international markets where consumers eat more fish and are more open to trying new species. Assuming tambaqui production grows at the same rate as Brazilian aquaculture 5%/yr, the national market for tambaqui could reach 350,000 tons for the "roundfish" group as a whole. If producers are successful in developing demand for tambaqui in the US, total sales could be far higher.

PRICE TRENDS

Tambaqui: Retail price of US$10-US$12/kg in Brazil. Whole sale price in US, $3.95/lb, minimum order 2000 lbs/900kg from Netuno USA, Fort Lauderdale, USA.

HISTORY

The Amazon fisheries sector is undergoing a major transition. Originally based on the capture of wild fish, it is increasingly based on fish produced through aquaculture. This shift was precipitated in part by state environmental legislation implemented around 2006, which prohibited farming of exotic species in Amazon states. Aquaculture researchers shifted to Amazon fish species, especially the tambaqui and related species, among other popular amazon fish species. Production of farmed fish has grown to fill the gap left by the depletion of largely unregulated wild fisheries. Wild tambaqui once the dominant species in Amazon fish markets is now largely absent from the major urban markets and has been replaced by tambaqui and other round fish produced by Amazon fish farmers.

While aquaculture producers have been successful in taking over the Amazon market for wild fish, expansion into national and international markets has been far more difficult. Brazilian consumers outside the Amazon tend to have low per capita rates of fish consumption and are unacquainted with amazon fish species. Amazon fish are priced at the high end of the market for fish and consumers prefer better known species of similar price. In addition to familiarity, other factors low productivity and relatively high production costs give amazon fish little margin for competing with hybrid tilapia, salmon and other high productivity exotics.

PRODUCTION SYSTEMS & ENVIRONMENT

The main contribution of tambaqui aquaculture and more generally Amazon aquaculture is that it is a far more intensive land use system than conventional beef production. The same amount of fish protein can be produced on 5% of the area required by beef (McGrath et al., 2020). Therefore, producers who shift from beef to aquaculture can obtain the same total returns while freeing up excess pasture for agroforestry and forestry production and actually increase total farm income, while conserving forest.

TIME TO MATURITY

Farmed tambaqui reach marketable size of 1.2-2 kg in 8-12 months and over 2kg in 18 to 24 months.

PRODUCER PROFILE & SOCIAL IMPACTS

Aquaculture is practiced at a wide range of scales and producer profiles from smallholders to large commercial enterprises. According to the 2017 census, 97% of Brazilian aquaculture producers have between 0.1 and 5ha of ponds (IBGE, 2017). This size range also characterizes Amazon producers. In fact, the average area of aquaculture ponds in two of the main producing states, Paraná and Rondônia, is only about 2-3 hectares. In both states a significant percent of producers also produce other commodities such as soy and or beef. In fact the development of aquaculture in the Amazon state of Rondônia was driven by small and medium scale beef producers who, discouraged by returns from beef, invested in aquaculture.

PRODUCTION ISSUES

Aquaculture with native species such as the tambaqui is a relatively new production system, and much research and development needed in virtually all areas of the production system (McGrath et al., 2020). A major priority is the development of tambaqui genotypes that can be used in selective breeding programs to develop high performing varieties adapted to specific conditions. Feed is another area where research is needed to develop types of feed that are optimal for different phases in the life cycle. Regulatory issues are another challenge that involves both inadequate regulations and the high transaction costs of obtaining environmental licenses.

Processing

If tambaqui is to increase demand in markets outside the Amazon, processors must develop the more sophisticated cuts of tambaqui that consumers prefer. An example is the marketing of tambaqui ribs that won the top prize in the 2023 Seafood Expo North America

SUPPLY CHAIN ISSUES

A major challenge in the Amazon is the development of cold chains that can reliably maintain temperatures that conserve quality and ensure that fish reach the final consumer in optimal condition. In many areas the cold chain infrastructure is fairly rudimentary and unreliable.

MARKETS

Numerous specialists have noted that tambaqui and other amazon fish species have great export potential. Given low rates of fish consumption in Brazilian markets, export to markets in the US and Europe with higher rates of per capita fish consumption may be a more promising alternative. Consumer interest in US and European markets could be enhanced by marketing strategies that emphasize the production of Amazon fish as an alternative to beef.

CARBON CREDIT/SEQUESTRATION POTENTIAL

There is considerable potential for carbon credits and sequestration arrangements that take advantage of the high productivity and land use intensity of aquaculture relative to beef production (McGrath et al., 2020). Forest carbon credits/offsets can provide incentives for producers to shift from beef to aquaculture, releasing up to 90% of the pasture dedicated to beef production. This area of pasture can be returned to forest, tree crops and/or agroforestry systems, depending on compliance with the Forest Code. The developing REDD+ jurisdictional carbon offset market that state governments are now preparing to enter could at least partially finance producers interested in investing in fish who reforest excess pasture or convert to silviculture and/or agroforestry.

CERTIFICATION PROGRAMS

Certification programs for tambaqui aquaculture in Brazil are not widely available. However, Peixe BR and other industry groups recognize the importance of certification and are working with producers to improve production systems and come into compliance with international standards for certification.

RELEVANT SECTORS

Suppliers

Suplliers	Site
Zaltana Pescados, Ariquemes, Rondônia	https://zaltana.com.br/en/produtos/tambaqui/; Contato@zaltanapescados.com.br
Pescados do Vale	Rodovia 364, Linha C-40 - Ariquemes/RO comercial@pescadosdovalero.com.br

Exporters

Exporters	Site
Friolins	Manaus, AM Friolins Pescados Ltda. is located at: R. Duque de Caxias, 266 - São Francisco, Manacapuru - AM, 69400-380, Brazil., +55 92 3361-1425

US based Suppliers

Suppliers	Site
Netuno USA, Ft Lauderdale	https://netunousa.com/

REGULATORY INFORMATION

NCM: 0302.89.4, 0302.44, 0303.89.64, 0303.89.6

2.20 TAPEREBÁ (*Spondias mombin L.)*

Taperebá is a fruit species native to tropical America and is common in the Amazon region, where it occurs in the wild state, and also in the Northeast where it is known as cajá, cajá-mirim, cajá-pequeno, yellow mombin, jobo, true caja. The Taperebá tree occurs both in floodplain forest and on dry land. The fruit pulp has high economic potential and growing demand in the North and Northeast regions of Brazil.

Taperebá is among the Amazonian fruits that generates great interest in the national and international markets. Due to the lack of commercial plantations, agroindustries are totally dependent on the production obtained from the extraction of plants in areas where it ocurs naturally. Despite the significant potential of this species, its participation in the domestic market is very small and the commercialization of fruits for export is minimal (TSUKUI, MATIIIETTO, NEVES, VEIGA, 2012).

Tree Taperebá

Fruit Taperebá

Pulp of Taperebá

PRODUCT

Fruit: The fruits are marketed and can be consumed "in natura".

Pulp: Frozen pulp is the main form of the product for the retail market and is widely available in supermarkets. The pulp has a yield of up to 60% and can be used in the production of juices, jellies, ice cream, nectars, popsicles that are widely accepted in the market due to their excellent flavor and high nutritional value.

BY-PRODUCT

There has been as yet little development of subproducts derived from the taperebá fruit (CARVALHO, 2003; LOPES, 2023; RIBEIRO, 2022).

CURRENT MARKET SIZE

Taperebá is generally consumed locally or sold in nearby markets; only about 4% of processed products reach consumers, mostly in the form of frozen pulp or pasteurized fruit juice (TNC, 2021). We were unable to find sources of data on state or national production of taperebá.

SIZE OF THE PROJECTED FUTURE MARKET

There is very limited data available on state and national taperebá prodution. However, taperebá pulp and conserved juice are already widely available in the Amazon region and in northeast Brazil. Of the lesser known Amazon fruits, taperebá probably has the best prospects for accessing the national and international market. It is delicious and unlike cupuaçu has a flavor that is immediately attractive to most people (TNC, 2021).

VOLUMES SOLD/CONSUMED

In 2021, the local processing industry generated a gross production value estimated at BRL 144.61 thousand, resulting from sales to local consumers of the final product from the fruit (juices and ice cream). The urban retail sector obtained R$ 60.74 thousand as Gross Production Value (GPV), largely originating from the sale of the fruit in pulp and/or in natura to final consumers. Rural retail produced a VBP of R$9.20 thousand, mainly due to sales made at the local level, in which the urban retail sector was the main buyer (TNC, 2021).

PRICE TREND

Local processing industry, variation according to market activity of the agents that compose it. The sale price per association established by the Pnae was R$ 2.40/kg. Other sales in the sector were carried out by cooperatives, which, in addition to supplying the local market (sold to the processing industry and urban retail sectors, at R$ 2.88/kg and R$ 2.19/kg, respectively), was the only agent to sell to the domestic market, at R$1.54/kg for urban retailers (IPEA, 2016).

HISTORY

Amazonian fruit, of great nutritional and economic value, characterized by its unique aroma and flavor, which has been increasingly used in the manufacture of various products, such as sweets, juices and drinks, characteristics that make it an ingredient with great potential for use in the brewing industry. An incipiently domesticated species, the Amazon is one of the largest producers of the fruit, with production directed towards the diet of the extractive farmer himself and the remainder goes to the local market. The taperebá fruit is harvested not only to meet the demands of the local market in the production region, but also in other parts of the country, where it is highly appreciated and marketed mainly as frozen pulp (ANICETO, 2017; RIBEIRO, 2022).

PRODUCTION SYSTEMS AND ENVIRONMENT: AGROFORESTRY, WILD HARVESTING, PLANTING

As it is a perennial fruit tree in the final stages of domestication, much of the taperebá produced in the Amazon region occurs in house gardens and surrounding agroforests. Taparebá is often planted with cocoa (Theobroma cacao , L.), in agroforestry systems (MACÊDO, 2007) in which the taperebá provides shade for the cocoa plants. In many areas farmers plant seedlings of important tree species, such as taperebá, in abandoned fields to enrich the secondary forest that develops on the site. In Northeast Brazil more intensive, partially mechanized production systems have been developed to supply local processing plants producing taperebá pulp and juice. These systems can be up to 5 times more

productive per hectare than conventional extensive systems. Given the popularity of taperebá as a fruit juice, the trend towards more intensive systems supplying local processors is likely to gain momentum.

PRODUCER PROFILE AND SOCIAL IMPACTS

Currently, taperebá is produced mostly by family farmers with varying degrees of commercial orientation and marketed through local intermediaries, which reduces the profit margin of the producers (IPEA, 2016).

PRODUCTION PROBLEMS

Bringing species from its wild state to sustainable production and leaving dependence on the extractive system. In the production of fruits destined for the juice industry, emphasis should be placed on technologies that give the fruits a high juice yield, good consistency and high sugar and acidity content. Experience in NE Brazil demonstrate the potential improving production by cloning improved varieties.

SUPPLY CHAIN ISSUES

Identification of propagation materials that have high productive capacity and improved fruit quality characteristics in agronomic models. Lack of production technologies, is one of the main obstacles to commercial exploitation (GONZAGA FILHO, 2018) and distance from processing facilities to produce juice and frozen pulp.

CARBON CREDIT/SEQUESTRATION POTENTIAL

Since carbon is an important indicator in the context of combating climate change, Taperebá is a native tree of the Amazon Basin with the potential to increase the forest carbon stock through agrforestry systems and in the reforestation of degraded areas.

CERTIFICATION PROGRAMS

Product that does not hold certification.

RELEVANT INDUSTRIES

Food and beverage. Demand for organic and sustainable products.

Retailer	Site
Cooperativa Agrícola Mista de Tomé Açu (CAMTA)	Belém: https://www.camta.com.br/index.php/tapereba

IMPORT/EXPORT TARIFFS AND COMPLIANCE

Tariffs will be given according to trade agreements, tariff preferences and legislation applicable to foreign trade (BRAZIL, 2023).

CGEN/NAGOYA BIOCULTURAL RIGHTS AND PROTECTION CONCERNS

The Brazilian adherence to the Nagoya Protocol, Legislative Decree No. 136 of 08/11/2020, ratified by the national executive that took place in March 2021, can leverage the production chain of Açaí due to the use and exploitation of genetic heritage by other countries.

REGULATORY INFORMATION

Name inci: Spondias mombin L.
Harmonized System Code: It has no specific code, identified as: Preparations of vegetables, fruits or other parts of plants - with NCM code: 2008.97.10.

2.21 URUCUM (*Bixa orellana*) - ANNATTO

Urucum or Colorau is the fruit of the urucuzeiro or urucueiro, a species of the Bixaceae family, native to tropical America, which is used to produce natural dyes. The annatto dye can be produced in the form of powder, paste, suspension or solution. The coloration varies from yellow-orange to reddish-brown.

Annatto plant

Seeds for the preparation of annatto

Processed annatto

PRODUCT

Seeds – pigment extracted from the outside of its seeds, rich in carotenoids, is a natural dye used in the food, cosmetic and textile industry.

CURRENT MARKET SIZE

The global market for annatto was valued at USD 227.53 million in 2022 (Fact.MR, 2023).

In 2021 Brazil produced 12,252t (R$65,551,000) of annatto. The Amazon region accounted for 18% of the national total (2,240t) with the states of Pará (940t) and Rondônia (806t) the main Amazonian producers (IBGE, 2021).

PROJECTED FUTURES MARKET SIZE

The global market for annatto is expected to grow at a CAGR of 5% between 2022 and 2032 to reach USD370.62 million in 2032 (Fact.MR, 2023).

VOLUMES SOLD/CONSUMED

From 2009, production of urucum grew by 20%, from 12,472t (2009) to 15,637t (2019). Production decreased from 2019 to 2021 (12,279t) this may have been a result of disruption caused by the covid pandemic. Despite growing demand for natural dyes, producers find it difficult to market their output due to bottlenmecks in supply chain for industries in the state of São Paulo (IBGE, 2021; ARMCHAIRIERI; BOTELHO, 2006).

TRENDS IN PRICES

In a comparative analysis of estimated prices in Brazilian states in 2021, the values for a kilo of annatto seed ranged from US$ 1.80 (Espírito Santo) to US$ 0.26 in the adjacent state of Rio de Janeiro. For the states of the Brazilian Amazon, the values ranged from US$ 0.95 (Pará) to US$ 0.28 (Amazonas), with a national average value of US$ 1.05 (IBGE, 2021).

HISTORY

Annatto was the first vegetable dye exported from the Americas to Europe on a large scale. The word annatto originates from the Tupi-Guarani language transliterated "uru-ku" and means "red". In Spanish-speaking countries it is known as 'achiote'. It is traditionally used by the Brazilian Indians and Peruvians, as a source of raw material for red tinctures, used many purposes, among them, to protect the skin against the sun and from insect bites. The artisanal processes of obtaining the dyes from annatto seeds, learned from the Indians, was used for a long time (Agrospice, 2023).

PRODUCTION SYSTEMS AND ENVIRONMENT: AGROFORESTRY, WILD HARVESTING, PLANTATION

Urucum is a medium-sized tree/shrub that produces for more than 20 years. The main product extracted from the urucum trees/shrubs is bixin, a substance that is found in the seed cover layer. Of the pigment mass existing in the pericarp of annatto seeds, 80% consists of a carotenoid called bixin, which has a coloring property that can be extracted via vegetable oils or a chemical base. For commercial crops, it is important to use cultivars that present at least 3% bixin to be viable. The annatto has also been shown to be an excellent option for cultivating in agroforestry systems, adaptable to various types of management (Emater, 2021; FABRI et al., 2016) .

MATURITY TIME

The productivity of the annatto tree is quite varied and depends on the soil conditions, the age of the plant, the type and cultivar, and also the cultural treatments used throughout the year. Fruiting can begin in the first year and gradually increases, until the fourth year, when the level of production stabilizes. The expected production of an adult annatto is at least 1,500 kg/ha of dried seeds. The capsules appear at the tips of the branches, forming clusters, which are cut approximately 20 cm below the beginning of the capsules.

In northern and northeastern Brazil, harvesting begins approximately 90 days after the opening of the flower. The time for harvesting is when 20% of the bunches are dry. The subsequent operation consists of drying the capsules in the sun, taking care that the seeds contained in the capsules are not exposed to heat, which causes a loss in the quality and quantity of pigment (Emater, 2021).

PRODUCER PROFILE AND SOCIAL IMPACTS

Annatto is produced by small scale farmers, who rely on middleman to market their crop, which reduces the farmers' profit margin. It can be an important component of farmer income. The income generated, in turn, is distributed among the different actors of the value chains. The chain is strongly pro-local economy, which highlight the importance of this crop in generating rural income and employment (TNC, 2022).

PRODUCTION PROBLEMS

Diseases and insect predation are the main problems. The annatto is a very demanding of plant nutrients, and requires balanced fertilization in the nursery phase to ensure the formation of seedlings with greater development capacity in the field (Emater, 2021).

SUPPLY CHAIN PROBLEMS

The adoption of best practices in cultivation and initial processing are essential as they have a direct influence on the quality of the final product (Emater, 2021).

RECOMMENDATIONS FOR PROCESSING AND SIZING

Implementation of rural development policies: Science, Technology and Innovation (ST&I), credit and technical assistance; Creation of a continuous database system of the product value chain;

Creation of tax incentives for sociobiodiversity products and application of a differentiated rate for interstate trade operations and exports to other countries, as these are specific products linked to the biodiversity of the biome (TNC, 2022).

CARBON CREDIT/SEQUESTRATION POTENTIAL

Cultivated urucuum has been shown to be an excellent alternative for inclusion in agroforestry systems and can adapt to various management systems in which it is used as a perennial species (FABRI et al., 2016).

CERTIFICATION PROGRAMS

RELEVANT SECTORS

Aggregators/suppliers

Retailer	Site
Amazon Forest Trading	https://amazonforestrading.com.br/produto/extratos-e-oleos/extrato-natural-da-amazonia-de-urucum/
Amazon Florals	https://floraisdaamazonia.com.br/flores/urucum/
Amazonoil	https://www.amazonoil.com.br/produtos-da-floresta/urucum-bixina-orellana/

IMPORT/EXPORT TARIFFS AND COMPLIANCE

Data for annatto are added to other dyes of plant or animal origin.

BIOCULTURAL PROTECTIONS OF COMMUNITIES OF ORIGIN (NAGOYA/CGEN PROTOCOL/ETC.)

The Brazilian adherence to the Nagoya Protocol, Legislative Decree No. 136 of 08/11/2020, ratified by the national executive in March 2021, can leverage the production chain of annatto seeds due to the use and exploitation of genetic heritage by other countries.

REGULATORY INFORMATION

HS No. for import and export of annatto – No. 3203 – Colouring matters of vegetable or animal origin (including colouring extracts, but excluding animal black)

NCM No. (Common Nomenclature in Mercosur) – 2106.90.30