iema
Instituto de Energia
e Meio Ambiente

MAPPING THE SOCIO-BIOECONOMY

Foundations for energy inclusion policies in the Legal Amazon

November, 2025

Institute for Energy and the Environment (IEMA)

MAPPING THE SOCIO-BIOECONOMY: foundations for energy inclusion policies in the Legal Amazon

November 2025

Technical team:
Fabio Galdino dos Santos
Vinicius Oliveira da Silva

Technical review:
André Luis Ferreira

Editing:
Isis Rosa Nóbile Diniz

Communications:
Isis Rosa Nóbile Diniz
Nicole Dejarmes Silva

Graphic design:
Ana Paula Campos (Estúdio Voador)

Illustration:
Daniela Chun

English Version:
Edoardo Lobl

Support:
Charles Stewart Mott Foundation

About IEMA:
The Institute for Energy and the Environment (IEMA) is a Brazilian non-profit organization, founded in 2006 in Brazil. Its purpose is to qualify decision-making processes so that transport and energy systems in Brazil ensure the sustainable use of natural resources with social and economic development.

Who we are:
André Luis Ferreira
Anton Altino Schwyter
David Shiling Tsai
Fabio Galdino dos Santos
Felipe Barcellos e Silva
Gabrielly de Castro Alves
Helen Sousa Ingrid Graces
Isis Rosa Nóbile Diniz
Mariana Calviello Meira Ramos
Meiriele Alvarenga Cumplido
Mônica Takeda
Nicole Dejarmes Silva
Raíssa Gomes
Ricardo Lacerda Baitelo
Vinicius Oliveira da Silva

twitter.com/iema_instituto
linkedin.com/company/instituto-de-energia-e-meio-ambiente
facebook.com/institutoenergiaeambiente
instagram.com/energiaeambiente

Rua Artur de Azevedo, 1212, 9th floor, room 91, Pinheiros, São Paulo – SP, CEP: 05404-003
energiaeambiente.org.br | energiaeambiente@energiaeambiente.org.br | Phone: +55 (11) 3476-2850

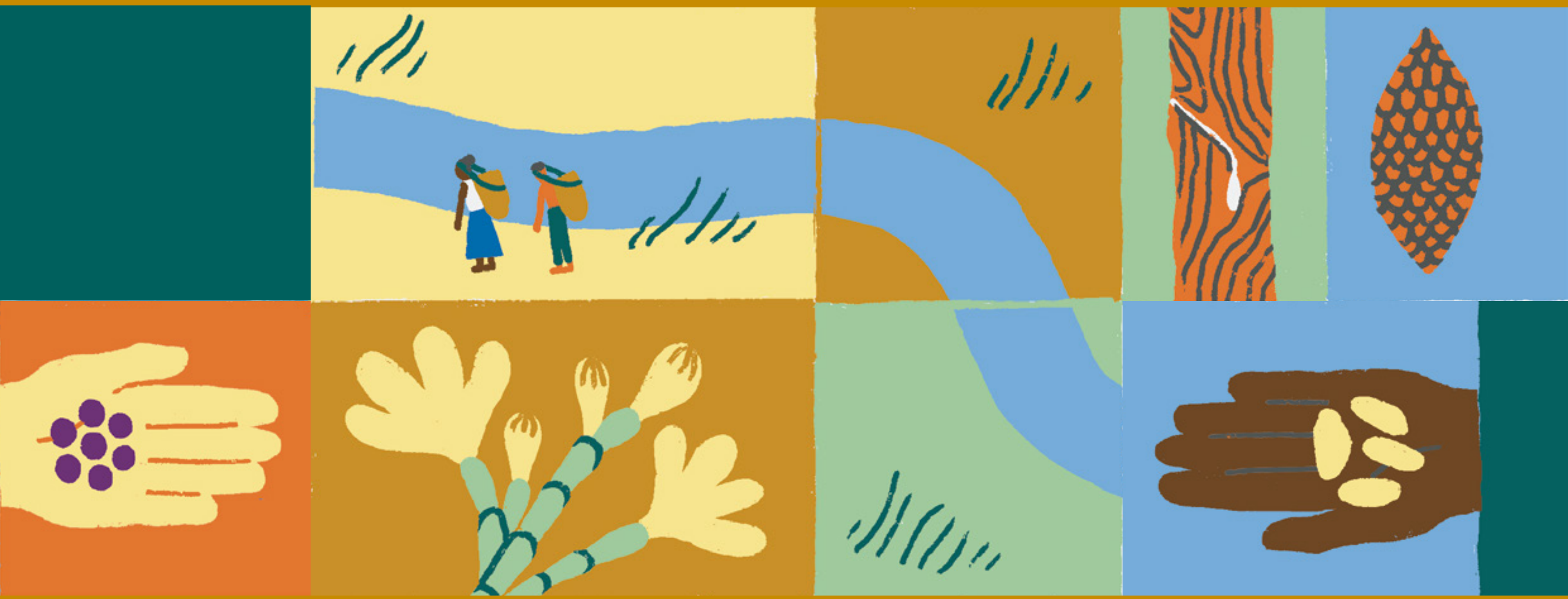
TABLE OF CONTENTS

LISTS

FIGURES

TABLES

BOXES



EXECUTIVE SUMMARY

CONTEXT

- This technical report represents a pioneering effort to systematize quantitative and qualitative evidence on the extractive territories of the Legal Amazon, their production, and their access to electric infrastructure, based on data from the Brazilian Institute of Geography and Statistics (IBGE).

- In the Legal Amazon, thousands of families carry out forest-based productive activities, playing an essential role in income generation and food security and in anchoring populations in the territories where they live.

- Forest-based productive activities, especially when associated with family farming, are grounded in the sustainable use of biological resources and are intrinsically linked to the cultural and social diversity of local communities.

- These activities form the basis of the socio-biodiversity economy, known as the socio-bioeconomy, and, when conducted under a family farming model, are recurrently associated with preventing aggressive changes in land occupation and use.

- Understanding the correlation between plant extractivism, electrical exclusion, and the capacity for productive use of energy in the territories of the Legal Amazon, with a view to proposing data- and evidence-driven public policy guidelines, is fundamental for the region's socioeconomic development, especially by strengthening the standing-forest economy—a development model that ensures the well-being of local communities without compromising forest integrity.

- Inequality in access to electric power compromises the processing of socio-biodiversity products and limits the capacity for productive inclusion of traditional populations.

- Formulating public policies for the socio-bioeconomy of the Legal Amazon faces structural challenges related to the absence of disaggregated data, low institutional capillarity, and the energy exclusion of extractivist communities.

- This study also sought to identify the main structural and informational bottlenecks to sustainable development based on the socio-bioeconomy.

KEY FINDINGS ON ELECTRICAL EXCLUSION IN THE SOCIO-BIOECONOMY'S PRODUCTIVE ACTIVITIES

- Based on the map of exclusion from access to electric power in the Amazon developed by the Institute for Energy and the Environment (IEMA) [2020], more than 74 thousand agricultural establishments lie outside the area served by the public electric power service, constituting one of the main obstacles to the expansion of the socio-bioeconomy.

- The special data request to the 2017 Agricultural Census, whose information on electric power use in productive establishments was obtained from the questions "Does the establishment use electric power?" and "What was the total amount of expenses incurred by the establishment with electric power?", followed by IEMA's processing, indicated that more than 84 thousand agricultural establishments in the region have no access to electric power of any kind.

- The methodology adopted by the Agricultural Census for collecting information on access to electric power proves insufficient to support public policies for access to electricity. Simply checking for the presence or absence of power at establishments does not make it possible to qualify whether that access is adequate, continuous, sufficient, and compatible with the demands of productive activities.

- From the available data, it is not possible to identify whether establishments with access are connected to the public electric power service, an informational limitation for designing and targeting public policies for access to electric power and rural productive development.

- **The state of Pará leads in absolute numbers of exclusion, with 45% of its extractivist establishments un-electrified.**
- **In Amazonas, 66% of extractivist establishments remain without access to electric power, especially in Indigenous lands and hard-to-reach areas.**
- **Roraima has the highest proportional rate of energy exclusion, with 74% of agro-extractivist establishments without electrification.**
- **Municipalities such as São Gabriel da Cachoeira (AM) and Cametá (PA) concentrate the largest electrical exclusion hubs, each exceeding 4 thousand unserved establishments.**

KEY FINDINGS ON THE AVAILABILITY OF DATA ON THE SOCIO-BIOECONOMY

- Current census data do not qualify the type of electricity supply (public, intermittent, sufficient for productive purposes), limiting the formulation of effective public policies.
- The Survey of Plant Extraction and Forestry Production (PEVS) and the Municipal Agricultural Production Survey (PAM), although useful for annual monitoring, lack territorial granularity for precise mapping of the socio-bioeconomy.
- The Agricultural Census is the most robust database available on the socio-bioeconomy, even though access to electric power is not its central focus.
- The absence of electric power in extractivist territories directly affects the preservation of perishable products, the use of machinery, and value addition in productive chains.
- Spatial analysis shows that the main productive hubs of the socio-bioeconomy are disconnected from the federal road and rail infrastructure grid, which prioritizes commodity flows.

KEY FINDINGS ON SOCIO-BIOECONOMY PRODUCTION

- The Legal Amazon concentrates about 865 thousand agricultural establishments, approximately 170 thousand of which are directly associated with plant extractivism.
- 85% of the region's productive establishments are small rural units linked to family farming.
- The four main forms of productive use of forest products are plant extractivism, agricultural production in permanent and temporary crops, and silviculture.
- Permanent and temporary crops in the Legal Amazon represent, respectively, 3% and 11% of national production, with approximate volumes of 1.8 million tonnes for permanent crops and 98.2 million tonnes for temporary crops.
- This volume accounts for only 33% of the region's total production of permanent crops and about 0.61% of production from temporary crops.
- In the region, silviculture production (basically timber extraction) represents 34% of national production, with 8,730 thousand m^3 of timber extracted.
- Plant extractive production in the Legal Amazon totals around 600 thousand tonnes per year, corresponding to 73% of the sector's national production.
- Açaí (*Euterpe oleracea*) is the main product of the regional socio-bioeconomy, with 450 thousand tonnes annually, representing 75% of total extraction.

- Babassu (*Attalea speciosa*) and Brazil Nut (*Bertholletia excelsa*) are the next most important products, with 77 thousand tonnes (13%) and 27 thousand tonnes (4%), respectively.
- Production is carried out mostly by small establishments: 43% of production comes from areas of less than five hectares.
- 54 thousand tonnes are extracted by extractivists without formal land tenure, operating in public and protected areas.
- Most production is concentrated in riverside zones, highlighting the importance of river logistics for distribution and the supply of communities.
- The correlation between river proximity and production density reinforces the need for integrated waterway logistics planning.
- The data also indicate low production diversity in several municipalities: 113 hubs produce only one product and 118 produce two products, with emphasis on Maranhão, Pará, and Tocantins.

MAIN CONCLUSIONS

- Mapping the socio-bioeconomy enabled a comprehensive analysis of extractive production, production concentration, and associated infrastructure, revealing challenges and opportunities for strengthening the sector.
- Unequal access to electric power in extractivist territories directly compromises the socio-bioeconomy's capacity to expand.
- Current energy infrastructure does not meet productive-use needs, restricting regional development and deepening socioeconomic inequalities.
- The absence of qualifying variables in census instruments hinders energy planning geared to socio-biodiversity chains.
- When integrated and properly analyzed, existing data can guide more effective policies, provided they are accompanied by improvements in the breadth of data collection and availability.
- The predominance of subsistence extraction demonstrates its importance for local income generation and for maintaining traditional productive systems. This scenario reinforces the need for public policies that promote land regularization and the strengthening of small producers, ensuring access to markets, infrastructure, and appropriate technologies to expand productive and marketing capacity.

- **The concentration of production by establishment reveals disparities in the distribution and scale of activities. The states of Pará, Amazonas, and Maranhão concentrate the main productive hubs of the regional socio-bioeconomy.**

- **There is high variation in average productivity per establishment among subdistricts, even in areas with high density of productive units. This variation reflects inequalities in access to critical infrastructure such as energy, transport, and storage, and evidences different levels of organization, operational efficiency, and specialization.**

- **The existence of localities with fewer than ten productive establishments per subdistrict—often suppressed in IBGE databases due to anonymization criteria—compromises the granularity and diagnostic precision of analyses. This limitation reinforces the need for strategies that improve access to disaggregated territorial data, which are fundamental for planning effective public policies, especially in regions with vast territorial extension.**

- **Production concentration in certain hubs also points to opportunities to promote Local Productive Arrangements (APLs), which can be strengthened through investments in logistics infrastructure, digital inclusion, technical assistance, and energy suited to the profile of extractivist activities.**

MAIN RECOMMENDATIONS

- Recognize access to electric power as a structuring vector of the socio-bioeconomy's development geared to productive inclusion, the fight against regional inequalities, and the strengthening of sustainable productive chains in the Legal Amazon.
- Overcome informational gaps on energy infrastructure in extractivist territories and family farming.
- Redesign IBGE census instruments, such as the Agricultural Census, including variables that allow qualifying energy access, such as available power, purpose, and regularity of supply.
- The redesign of the Agricultural Census needs to occur between 2025 and 2026 to be applied in the next survey in 2027.
- Use IBGE data as a basis for strategic mapping, overcoming current informational gaps and enabling more effective public policies oriented to productive and territorial inclusion.
- Integrate territorial data on extractive production and family farming into energy planning, ensuring that access-to-energy and rural electrification policies overcome structural barriers to the socio-bioeconomy's sustainable development.

- **Review the technical and operational criteria of the Light for All Program (LPT), expanding its scope to meet energy demands for the productive use of electric power in remote regions.**

- **Strengthen inter-ministerial and inter-institutional coordination among the Ministry of Mines and Energy (MME), the Brazilian Institute of Geography and Statistics (IBGE), the Ministry of Agrarian Development and Family Farming (MDA), and the Ministry of Environment and Climate Change (MMA) to promote territorially grounded energy planning focused on the socio-bioeconomy.**

PRESENTATION

ACCESS TO ELECTRIC POWER, IN THIS CONTEXT, SHOULD BE UNDERSTOOD AS A STRATEGIC MECHANISM FOR EMPOWERING TRADITIONAL PEOPLES AND COMMUNITIES.

Inequality in access to electric power significantly compromises the socioeconomic development of communities in remote regions of the Legal Amazon. This limitation restricts initial processing of production and hinders local industrialization of socio-bioeconomy products, reducing competitiveness and making it difficult for producers to enter broader markets geographically distant from productive hubs.

The socio-bioeconomy presents a concrete alternative to reconcile environmental conservation and economic development in the Legal Amazon. Valuing this activity contributes to employment and income generation, reducing social inequalities and strengthening local economies, with the potential to replace predatory practices and increase the region's economic resilience.

However, its consolidation depends on integrated public policies that guarantee infrastructure, credit, technical assistance, and access to energy. Inclusion of extractivism and family farming in energy planning is essential to overcome structural challenges and drive sustainable development in the Legal Amazon.

Access to electric power, in this context, should be understood as a strategic mechanism for empowering Traditional Peoples and Communities (PCTs), promoting well-being and acting as a factor in curbing deforestation and pressure on natural resources.

Formulation and implementation of robust public policies aimed at supplying electric power for socio-bioeconomic activities require, as a precondition, identification of productive chains and surveying unmet associated energy demands. This is a complex task, given the territorial, cultural, ecological, and productive diversity that characterizes the Legal Amazon.

This study is part of an effort to identify access and energy exclusion in productive establishments and to map plant extractivist production in the Legal Amazon, with the goal of supporting, at a later stage, the estimation of the energy deficit for productive activities and public policies aimed at overcoming this inequality.

This methodological scope intentionally excludes temporary and permanent crops that may not have access to the public electricity service, focusing exclusively on extractive and agro-extractive chains of strategic interest to the socio-bioeconomy—the standing-forest economy.

This mapping is central to territorial planning and sustainable development in the region, as it provides qualified inputs for formulating public policies for access to electric power, based on the specificities of each productive activity and territory.

Measuring, mapping, and monitoring production conditions are fundamental stages to structuring policies that include mechanisms for management, training, goal-setting, and allocation of technical and financial resources—elements essential for ensuring the long-term sustainability of productive units and their marketing networks.

1. INTRODUCTION

The Legal Amazon, a region of more than 5.015 million km² corresponding to approximately 59% of Brazil's territory (IBGE 2022), is composed of municipalities located in states with the Amazon biome, as shown by the blue region in Figure 1[1,2].

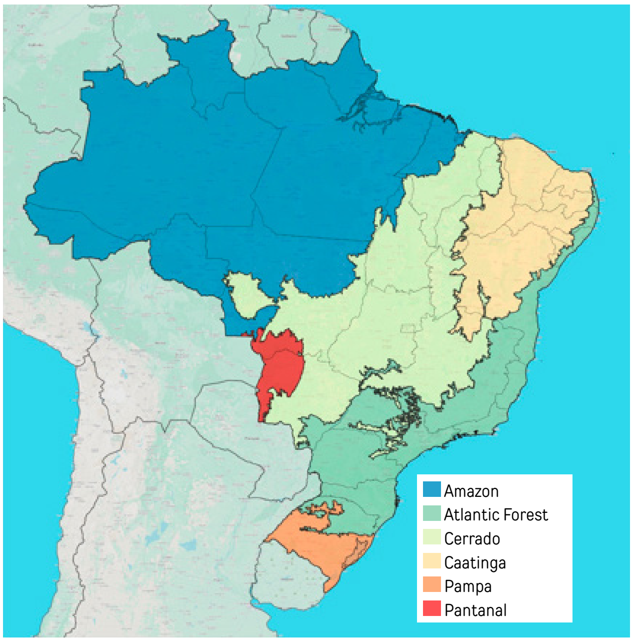


Figure 1. Brazilian biomes and the Legal Amazon.

1. Brazil has an area of 8.5 million km² and is divided into five regions: Center-West (CO), Northeast (NE), North (N), Southeast (SE), and South (S). The North Region is the largest, covering 45% of the national territory (IBGE 2024a), while the Legal Amazon territory encompasses an area representing 58.9% of the national territory (IBGE 2022).

2. Brazil is home to six biomes: Amazon, Cerrado, Caatinga, Atlantic Forest, Pantanal, and Pampa. The Amazon biome covers 6.7 million km² and extends across eight South American countries (Brazil, Peru, Colombia, Venezuela, Ecuador, Bolivia, Guyana, Suriname) plus French Guiana, an overseas territory of France (WWF 2024). Approximately 60% of the biome is located within Brazil, followed by Peru (13%), Colombia (10%), and others (17%). It is present in all states of the North Region – Acre (AC), Amapá (AP), Amazonas (AM), Pará (PA), Rondônia (RO), Roraima (RR), and Tocantins (TO) – in addition to Maranhão (MA), in the Northeast Region, and Mato Grosso (MT), in the Center-West region (CO) (IBGE 2024a).

In this extensive territorial area, thousands of families carry out forest-based productive activities, playing a fundamental role in income generation and food security, as well as in sustainable management and ecosystem preservation (Hornborg 2019; IBGE 2024b; Silva et al. 2018; Da Silva Júnior et al. 2023; Torres 2020).

According to the Brazilian Institute of Geography and Statistics (IBGE) (2024b), the four main forms of rural production in the Amazon biome are plant extractivism, agricultural production in permanent and temporary crops, and silviculture, each with specific characteristics, as shown in Table 1. Among these, only plant extractivism is fully linked to the collection of forest products, carried out from the spontaneous growth of native species in natural ecosystems, with sustainable management techniques and without the need for deforestation.

Agricultural production in permanent and temporary crops, in turn, refers to systematic cultivation in deforested areas, with intensive management and continuous production cycles. Although they may, in some cases, include the cultivation of native forest species, not all crops are necessarily related to forest products.

Table 1. Technical definitions of the main forms of rural production in the Legal Amazon.

PRODUCTIVE MODALITY	TECHNICAL DEFINITION	RELATION TO FOREST PRODUCTS
Plant Extractivism	Productive activity based on the collection of plant products obtained directly from native forests, without planting and without vegetation suppression. It includes fruits, seeds, oils, resins, fibers, among others.	Integral: depends on maintaining the standing forest and on natural regeneration.
Permanent and Temporary Crops	Systematic agricultural cultivation of plant species. Temporary crops have a short cycle (e.g., cassava, maize), whereas permanent crops occupy the soil for several years (e.g., açaí, orange). They generally occur in deforested areas.	Partial: some crops may involve native forest species (e.g., cultivated açaí and cassava) but not necessarily.
Silviculture	Activity focused on cultivating tree species for economic purposes, including reforestation with native or exotic species. It may involve sustainable management of native forests or planted systems.	Variable: depends on the type of species and model adopted (native vs. exotic; managed forest vs. monoculture).

FOREST-BASED PRODUCTIVE ACTIVITIES, ESPECIALLY WHEN LINKED TO FAMILY FARMING, INTEGRATE THE SOCIO-BIODIVERSITY ECONOMY, OR THE SO-CALLED SOCIO-BIOECONOMY.

Silviculture[3], finally, may encompass both the management of native forests and the systematic planting of native or exotic species in already deforested areas, oriented to timber production.

Forest-based productive activities, especially when linked to family farming, integrate the socio-biodiversity economy, or the so-called socio-bioeconomy, as illustrated in Figure 2. These activities include food cultivation, sustainable extraction of nuts, fruits, and vegetable oils, artisanal fishing, community-based tourism, among others.

This production model is centered on valuing and sustainably using biological resources associated with the cultural and social diversity of local communities (Aracaty and Silva 2023), emphasizing the importance of interactions among local communities, biodiversity, and economic production, with emphasis on the knowledge and practices of Traditional Peoples and Communities (PCTs).

The socio-bioeconomy's production plays a strategic role in the Amazonian economy (Abramovay et al. 2021), since 85% of the region's productive establishments are small rural units linked to family farming (IBGE 2017d) and are recurrently associated with preventing aggressive changes in land occupation and use in the region (CEAM 2005; Cotag 2024; Mello and Dias 2003).

Studies show that Amazonian municipalities with a higher number of cooperatives and establishments linked to family farming tend to have lower deforestation rates. Conversely, municipalities dominated by large rural establishments and with greater relation to the market economy record the highest deforestation rates (Mariosa et al. 2022).

The strategic role of family farming and the wealth of knowledge among Indigenous and traditional peoples of the Amazon contrasts with the persistent socioeconomic vulnerabilities faced by these groups (Amazon Concertation (Uma Concertação pela Amazônia) 2024). Although they are protagonists of sustainable practices essential for forest conservation, these peoples remain in a situation of structural inequality.

3. Only legal timber activity considered.

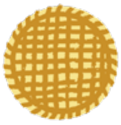
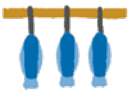
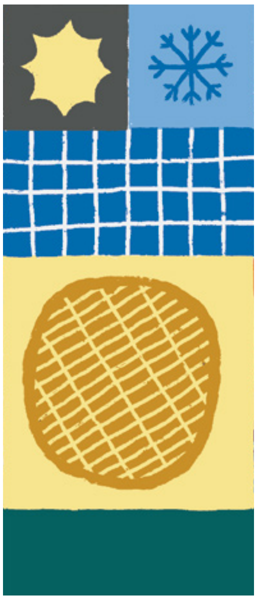
	ACTIVITIES	PRODUCTION
	**Family farming and agro-extractivism**	• Cultivation of traditional agricultural products. • Sustainable extraction of forest resources such as fruits, nuts, oils, and medicinal plants.
	**Handicrafts and local culture**	• Production of handicrafts using local materials. • Preservation of cultural practices and traditional knowledge.
	**Environmental education and research**	• Educational projects to raise awareness of the importance of biodiversity. • Scientific research in partnership with local communities.
	**Community forest management**	• Practices of sustainable forest management. • Active participation of communities in the management of conservation areas. • Certification of forest products. • Combating illegal exploitation and deforestation.
	**Traditional medicine and phytotherapy**	• Use of medicinal plants in traditional medical practices. • Preservation and appreciation of knowledge about medicinal plants.
	**Community organization**	• Creation of cooperatives and associations to strengthen community participation. • Defense of territorial rights and access to resources.
	**Artisanal fishing**	• Traditional fishing practices. • Sustainable management of fishery resources.
	**Agroforestry systems**	• Integration of agricultural and forest species to promote biodiversity and productivity.
	**Sustainable tourism**	• Development of tourism activities that promote environmental and cultural conservation. • Encouragement of community-based tourism.

Figure 2. Key activities in the production and management chain of native biodiversity.

This condition is evidenced by the lower Municipal Human Development Index (MHDI) scores recorded in the municipalities located in the states of the Legal Amazon, which cover both rural and urban areas, with values ranging from 0.676 to 0.736, below the national MHDI[4] of 0.766, as illustrated in Box I (IBGE 2024f).

According to IBGE, it is worth noting that 46% of the region's population, composed of 29.5 million inhabitants, of whom 16% live in rural areas[5], lives below the poverty line, with 9.2% below the extreme poverty line[6] (IBGE 2024f). In rural areas, this scenario tends to be even more critical. In the absence of income transfer policies, these rates would be even higher: 51% in poverty and 16.4% in extreme poverty, as shown in Box I.

Faced with this reality, there is a growing call from scientists, researchers, public managers, social movements, and local communities for the ongoing establishment of a territorially just, environmentally sustainable, and socially inclusive development model for the Amazon. This model must prioritize biodiversity conservation,



4. The MHDI – Municipal Human Development Index – assesses the long-term evolution of the population's living conditions based on three dimensions, according to the UNDP: health (longevity or life expectancy at birth), education (years of schooling of the adult population), and per capita household income. The index ranges from 0 to 1, where values closer to 1 indicate greater human development for the country or region. The MHDI classification levels are:

- Very high: MHDI greater than 0.8 (MHDI > 0.8);
- High: MHDI between 0.70 and 0.80 (0.7 ≤ MHDI ≤ 0.8);
- Medium: MHDI between 0.55 and 0.7 (0.55 ≤ MHDI < 0.7); and
- Low: MHDI below 0.55 (MHDI < 0.55).

5. Rural population data estimated from the proportion established in the 2010 Census (IBGE 2010).

6. The IBGE – Brazilian Institute of Geography and Statistics – through the Continuous PNAD (Continuous National Household Sample Survey), collects information on per capita household income to monitor the socioeconomic conditions of the population. This data allows for identifying the proportion of individuals living below the poverty line and the extreme poverty line, offering a detailed view of the level of social vulnerability in the country. The definition of the poverty and extreme poverty lines follows parameters established by the World Bank, occasionally adjusted by the Brazilian government. The Purchasing Power Parity (PPP) metric compares the amount of currency (money) needed to purchase goods and services in one country relative to other countries, considering price variations for a basket of products. The reference year for PPP corresponds to the period when the data used in the calculation was collected.

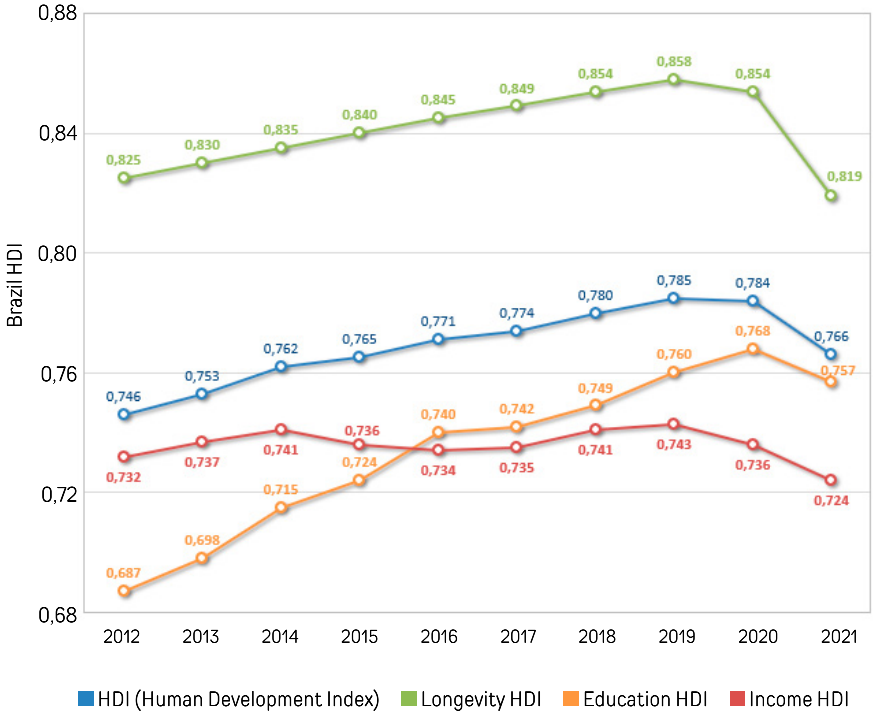
1. INTRODUCTION

Box I. HDI and poverty in Brazil and in the states of the Legal Amazon.

In 2021, Brazil was classified as a country with high human development, recording a Municipal Human Development Index (MHDI) of 0.766 — a 2.3% reduction compared to 2020, returning to the 2015 level. Income and health (longevity) indices in 2021 were lower than those of 2012, reaching 0.724 and 0.819, respectively (UNDP 2024), as shown in Figure 3 (a). These indices surpass those of all states of the Legal Amazon, as evidenced in Figure 3 (b), ranging between 0.030 and 0.090 (or 4.08% and 13.31%) below the national average.

The states of Pará (PA), Amapá (AP), and Maranhão (MA) are classified as having medium human development, while all other states fall under the high human development category.

Across the three dimensions of the index — income, education, and longevity — all state scores are below the national levels (except for the Education Index of Mato Grosso (MT)), as indicated by the dashed lines in Figure 3 (b). For income, again with the exception of MT, all states are classified as having medium human development, with values between 0.004 and 0.121 (or 0.56% to 20.07%) below the national index.



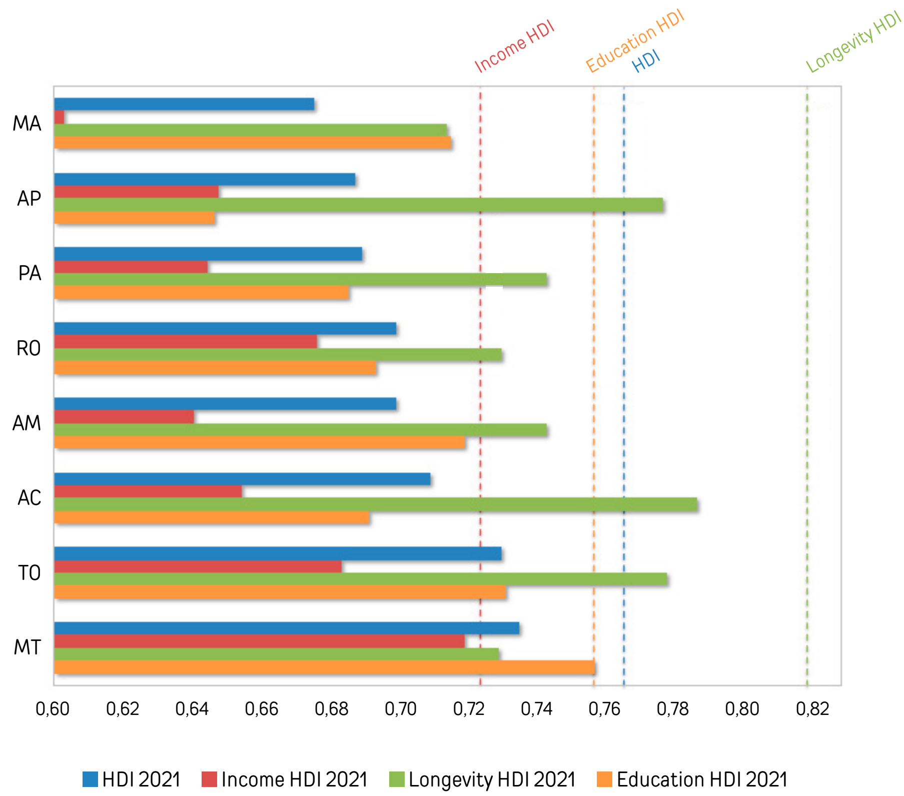


Figure 3. (a) MHDI time series and (b) total MHDI, income, education, and longevity for the states of the Legal Amazon.

Source: Prepared by the authors based on UNDP (2024).

1. INTRODUCTION

Box I. IDH e pobreza no Brasil e estados da Amazônia Legal.

The poverty line is defined as a per capita household income below US $ 6.85 per day (2017 PPP), and the extreme poverty line as below US $ 2.15 per day (2017 PPP) (IBGE 2024f), equivalent to monthly per capita incomes of R$ 667 and R$ 209, respectively (IBGE 2024c). These thresholds guide social assistance programs such as Bolsa Família, Auxílio Gás, Social Electricity Tariff (TSEE), My Home My Life Program (MCMV), National School Feeding Program (PNAE), Food Procurement Program (PAA), and Continuous Cash Benefit (BPC), which aim to provide financial support to economically vulnerable families.

Figures 4 (a) and (b) illustrate poverty and extreme poverty rates, which range from 22.1% to 56.7% of the population and from 4.1% to 15.0%, respectively, in the states of the Legal Amazon (AMAL) — higher than the national rates of 5.9% to 31.6%. These figures would be even higher without direct and indirect income transfer programs. In their absence, poverty would affect between 25.0% and 62.3% of the population, and extreme poverty between 5.8% and 25.2%. Currently, only the states of Rondônia (RO) and Mato Grosso (MT) record poverty rates below the national average; in the case of extreme poverty, Tocantins (TO) joins this group (IBGE 2024d).

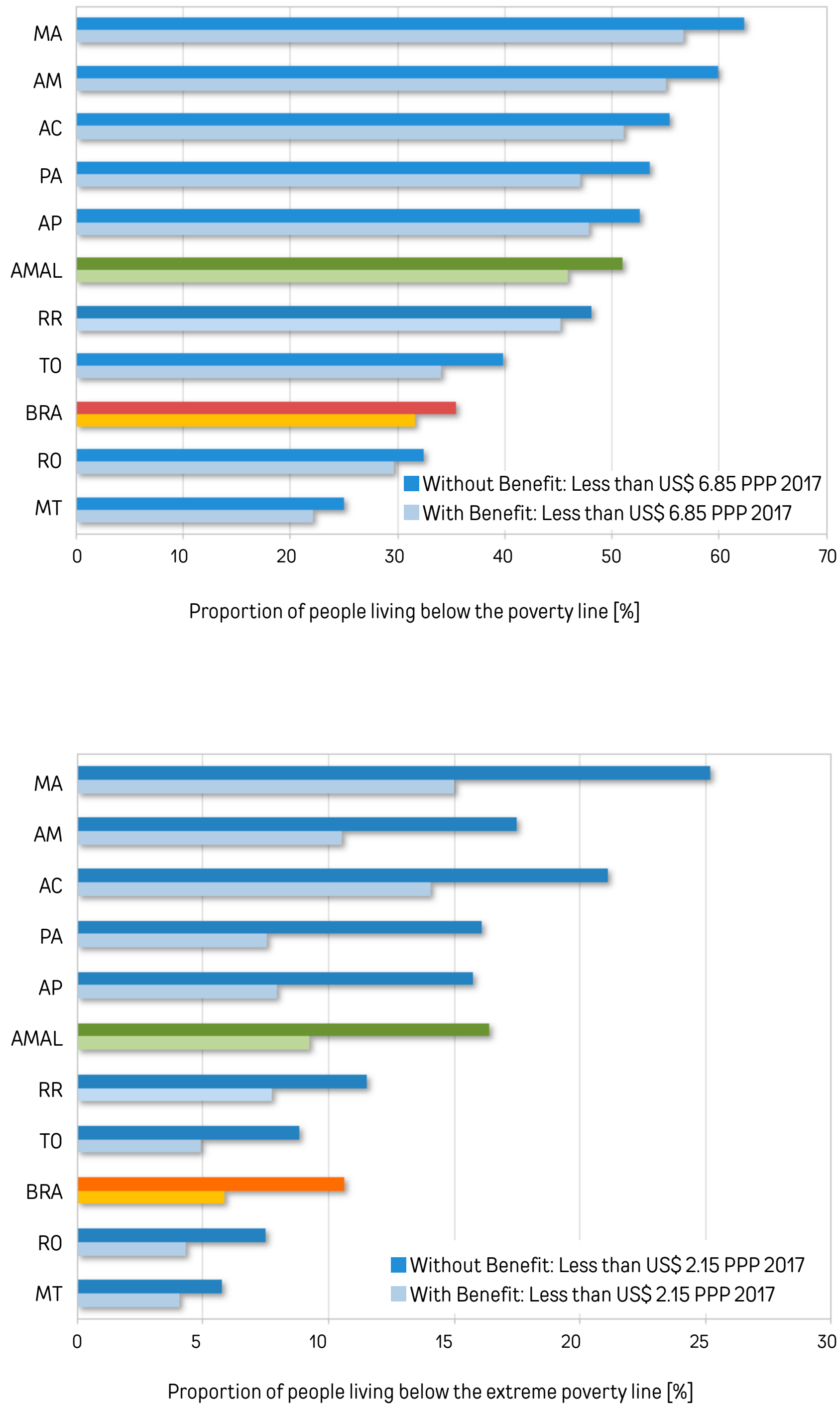


Figure 4. People living below the (a) poverty line and (b) extreme poverty line in 2022.

Source: Prepared by the authors based on IBGE (2024d).

ALTHOUGH THE REGION IS AT THE CENTER OF THE GLOBAL ENVIRONMENTAL, CLIMATE, AND ECONOMIC DEBATE, THE BENEFITS OF ITS CONSERVATION HAVE NOT YET TRANSLATED INTO DECENT LIVING CONDITIONS FOR ITS INHABITANTS.

ecosystem services, and traditional knowledge[7], valuing products and services originating in the territories and promoting infrastructures designed for the Amazon, and not merely in the Amazon.

Although the region is at the center of the global environmental, climate, and economic debate, the benefits of its conservation have not yet translated into decent living conditions for its inhabitants. The productive chains of socio-biodiversity remain practically invisible in public policies. The traditional way of life associated with extractivism and family farming is often neglected and excluded from access to basic infrastructure services, such as access to electric power, and transport logistics infrastructure.

Access to the public electric power supply service, for example, is a basic condition for the operation of schools, health posts, and productive units, as well as for strengthening the socio-bioeconomy and promoting the standing-forest economy.

Such localities require specific attention from the State, reinforcing the urgency of territorial mapping and analysis instruments that reveal the real conditions of access to energy and the unmet demands of the socio-bioeconomy. The lack of disaggregated and updated data on the use of electric power in productive establishments, especially those linked to plant extractivism and family farming, limits the effectiveness of public policies aimed at productive inclusion, environmental conservation, and sustainable development in the Legal Amazon.

7. It is important to differentiate the economic activities of the bioeconomy from the activities of the socio-bioeconomy. Both are related to the sustainable use of biological resources and are considered alternatives for sustainable socioeconomic development. The distinction involves conceptual nuances, focus, and scope of action. The bioeconomy has a broad focus, including any economic use of biological resources, from activities based on transformation and technological uses to activities with subsistence and commercialization purposes (Abramovay et al. 2021). Its scope involves the application of economic principles to optimize the use of these resources in industrial activities, aiming for the production of goods and services. The bioeconomy also incorporates technological approaches, such as biotechnology, biomaterials, biochemicals, biofuels, and other innovations (OECD 2009). According to Olihano and Kröger (2023), the bioeconomy is a term that encompasses diverse interests and guides global forest and agricultural policies, led by developed countries, with a focus on regulation and intellectual property rights over the technological use of global genetic heritage (OECD 2009).

In this sense, this report seeks to help fill this gap by systematizing and analyzing information from the IBGE Agricultural Census, segmented by productive activity, territory, and condition of access to electricity. By providing empirical evidence on energy exclusion affecting strategic productive chains of the socio-bioeconomy, it is expected to support government decisions and guide the formulation of more effective, fair, and territorially sensitive public policies capable of promoting universal access to electric power and, thus, strengthen the well-being of Amazonian populations and the valorization of the standing forest.

To this end, this document is organized into six chapters. In addition to this introductory chapter, the document is structured into five additional chapters. Chapter 2 presents the Brazilian Electricity System (SEB) and discusses exclusion from the public electric power supply in the Legal Amazon and its main impacts on essential services and productive activities, presenting, through maps and indicators, the estimated magnitude of this exclusion. Chapter 3 describes the methodology adopted in the research, including data systematization procedures, interviews with strategic actors, and initial results obtained. Chapter 4 presents and analyzes the main public databases related to productive activities of socio-biodiversity and electrical exclusion in the Amazon, focusing on their coverage, quality, and limitations. Chapter 5 consolidates the results of geospatial analysis on the types of production, the territorial distribution of products originating from plant extractivism, and the correlation between electrical exclusion and productive establishments linked to these chains. Finally, Chapter 6 consolidates conclusions and recommendations to improve public policies aimed at strengthening the Amazonian socio-bioeconomy, with emphasis on public and quality access to electric power in Amazonian territories.

2. ACCESS TO ELECTRIC POWER IN THE LEGAL AMAZON

2.1 SCOPE AND LIMITATIONS OF THE BRAZILIAN ELECTRICITY SYSTEM

The Brazilian Electricity System (SEB) comprises all power generation infrastructure—Hydroelectric Power Plants (UHE), Thermal Power Plants (UTE), Solar Photovoltaic Power Plants (UFV), Wind Power Plants (EOL), among others—transmission and distribution installed in the national territory, as well as the electric power commercialization market. This market is divided into two environments: (i) the Regulated Contracting Environment (ACR), in which consumers served by distribution utilities (captive) purchase electricity through tariffs set by the regulator[1]; and (ii) the Free Contracting Environment (ACL), in which large consumers can freely negotiate price and supply conditions directly with generators or traders (Silva et al. 2021). The SEB also includes, in some cases, cross-border integrations with neighboring countries (Silva 2022), as illustrated in Figure 5.

1. The SEB is regulated by the National Electric Energy Agency (ANEEL), which establishes the rules for the sector's agents. The National Electric System Operator (ONS) is responsible for managing the real-time operation of the National Interconnected System (SIN). The Electric Energy Commercialization Chamber (CCEE) handles the settlement of financial transactions among generators, transmitters, distributors, traders, and electricity consumers (Silva et al. 2021).

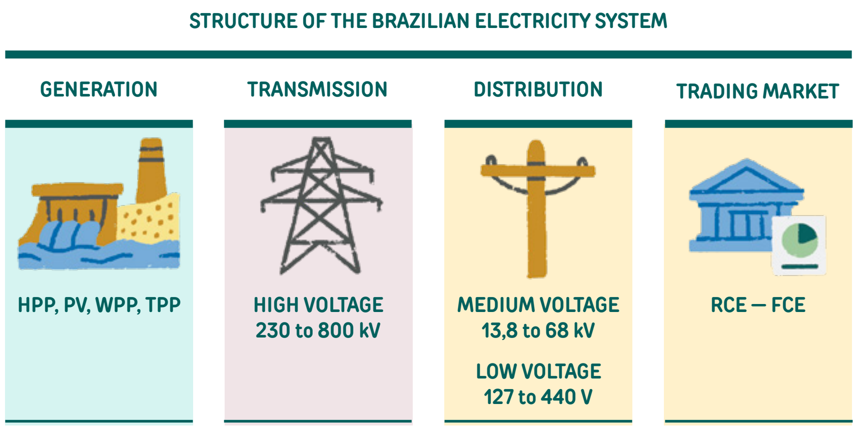
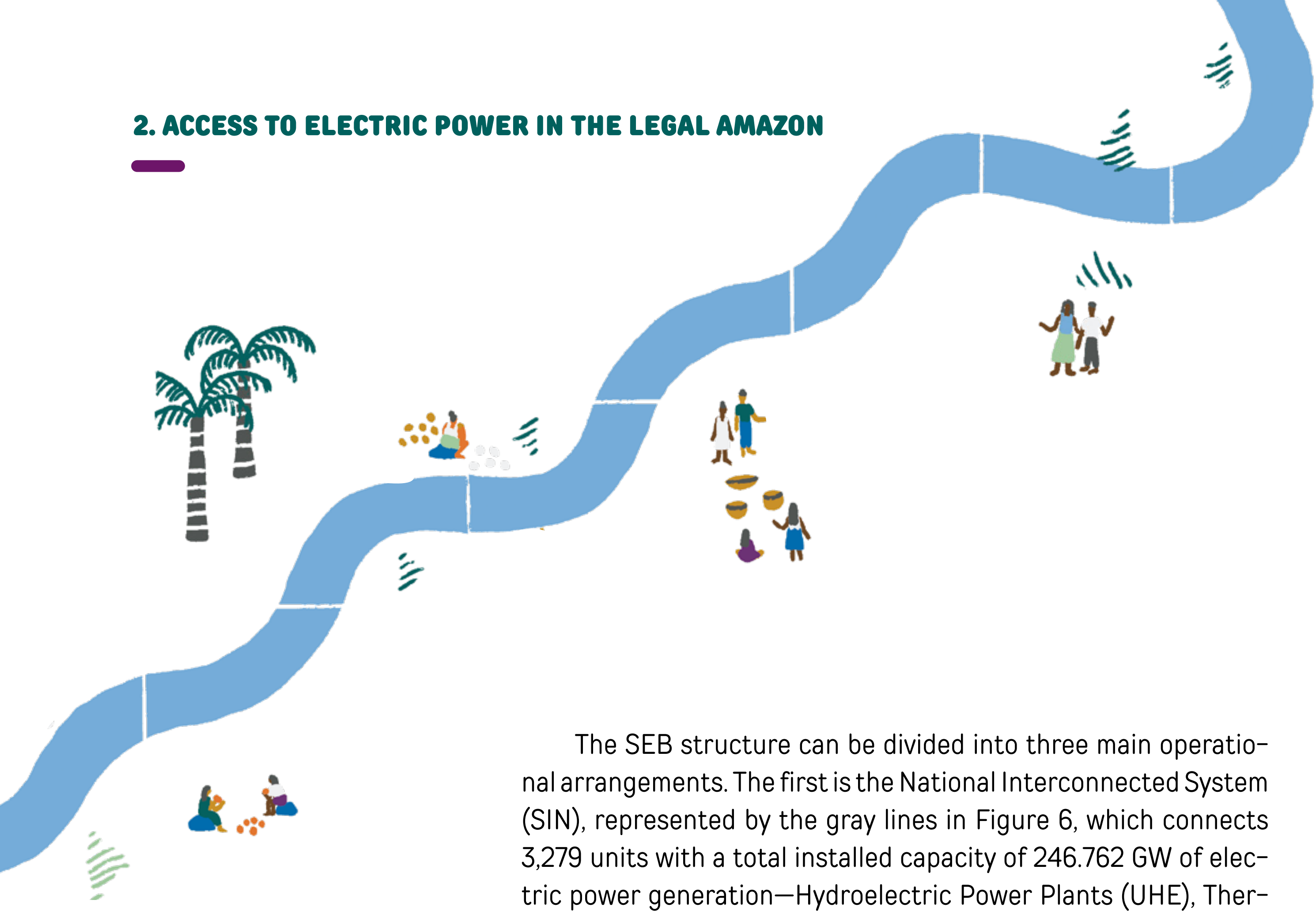


Figure 5. General structure of the SEB.



The SEB structure can be divided into three main operational arrangements. The first is the National Interconnected System (SIN), represented by the gray lines in Figure 6, which connects 3,279 units with a total installed capacity of 246.762 GW of electric power generation—Hydroelectric Power Plants (UHE), Thermal Power Plants (UTE) using oil, diesel, natural gas, biomass, nuclear and coal, Solar Photovoltaic Power Plants (UFV), Wind Power Plants (EOL), and micro and mini distributed generation (MMGD)—and 176.16 thousand km of basic transmission grid (gray lines highlighted in Figure 6) distributed across the national and border territory (Electric Energy Commercialization Chamber (Câmara de Comercialização de Energia Elétrica - CCEE) 2025; National Electric System Operator (ONS) 2025). The SIN serves most consumer units in the country, reaching approximately 98% of the population.

The second arrangement corresponds to the 175 Isolated Systems (SISOL), composed of generation units—mostly using fossil fuels, such as diesel, natural gas, and fuel oil[2]—and local electric power distribution networks that operate independently of the SIN (Godoy et al. 2024). These systems mainly supply municipal seats in the states of the Legal Amazon that are not yet connected to the SIN, serving around 2.5 million people (Energy Research Office (EPE) 2025). The SISOL are represented by the red dots in Figure 6.

2. Of the total 175 SISOL power plants: 19 use biomass (vegetable oil, elephant grass, and forest residues), two are hydroelectric (UHE and PCH), and one is photovoltaic – solar (EPE 2025).

There is still a third component, commonly disregarded in the national technical debate, corresponding to consumer units located outside the SIN and the SISOL. These units, situated beyond the coverage areas of distribution networks, when served by the public electric power service, receive supply through decentralized and autonomous, or off-grid, systems (Martinez-Bolaños et al. 2020), aimed at communities in remote regions[3] without public access to conventional electric power (distribution networks, highlighted in yellow in Figure 6), where the expansion of these networks is unfeasible from both environmental and economic standpoints.

In such cases, local renewable generation is used, through Individual Generation Systems with Intermittent Source (SIGFI) or Isolated Micro-Systems for Power Generation and Distribution (MIGDI), implemented notably by the Light for All Program (LPT) and operated by public electricity service concessionaires (Ministry of Mines and Energy (MME) 2024). In the absence of this public

3. Small settlements distant from municipal seats and lacking economies of scale or population density (Brasil 2010).

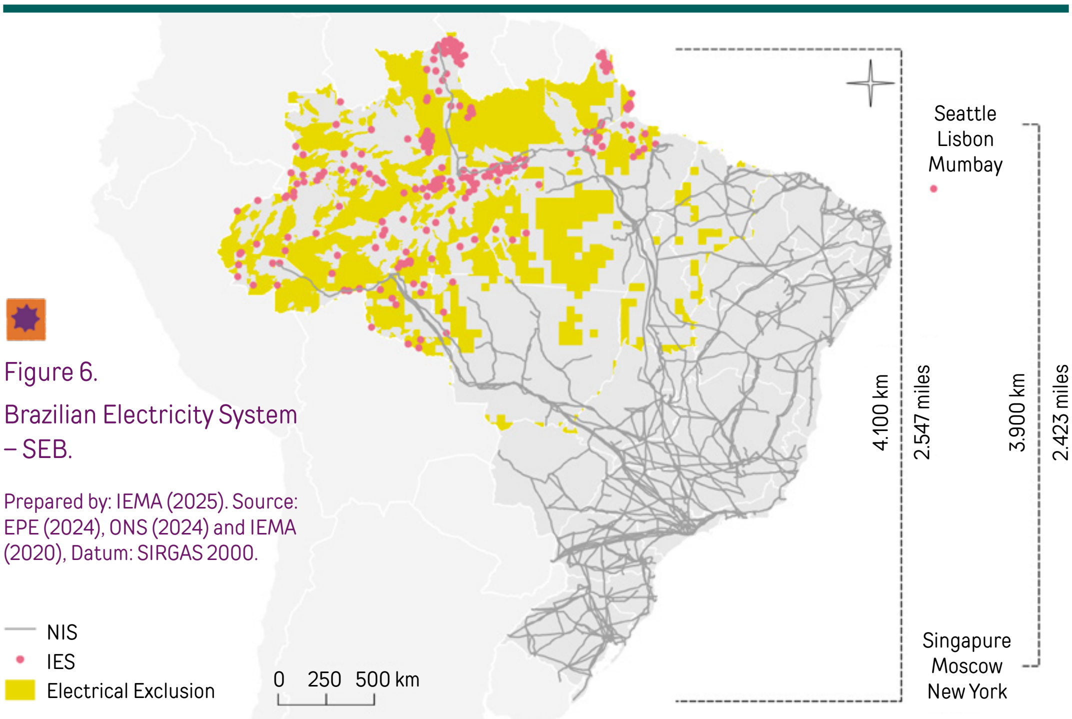


Figure 6.
Brazilian Electricity System – SEB.

Prepared by: IEMA (2025). Source: EPE (2024), ONS (2024) and IEMA (2020), Datum: SIRGAS 2000.

infrastructure, consumers are forced to generate their own electricity, usually from fossil sources such as diesel and gasoline, with high costs and low quality of supply.

Created in 2003, the LPT has supplied electricity to about 3.7 million consumer units across the country, benefiting approximately 17.5 million people. Of these, 89% live in rural areas, 10% in urban areas, and 1% in remote areas (Agência Gov 2024). In the states of the Legal Amazon, the LPT has served more than 1.4 million households since 2003; in remote areas, service is estimated to exceed 60 thousand consumer units since 2020 (MME 2025). Figure 7 shows the distribution of consumer units and type of LPT service nationwide.

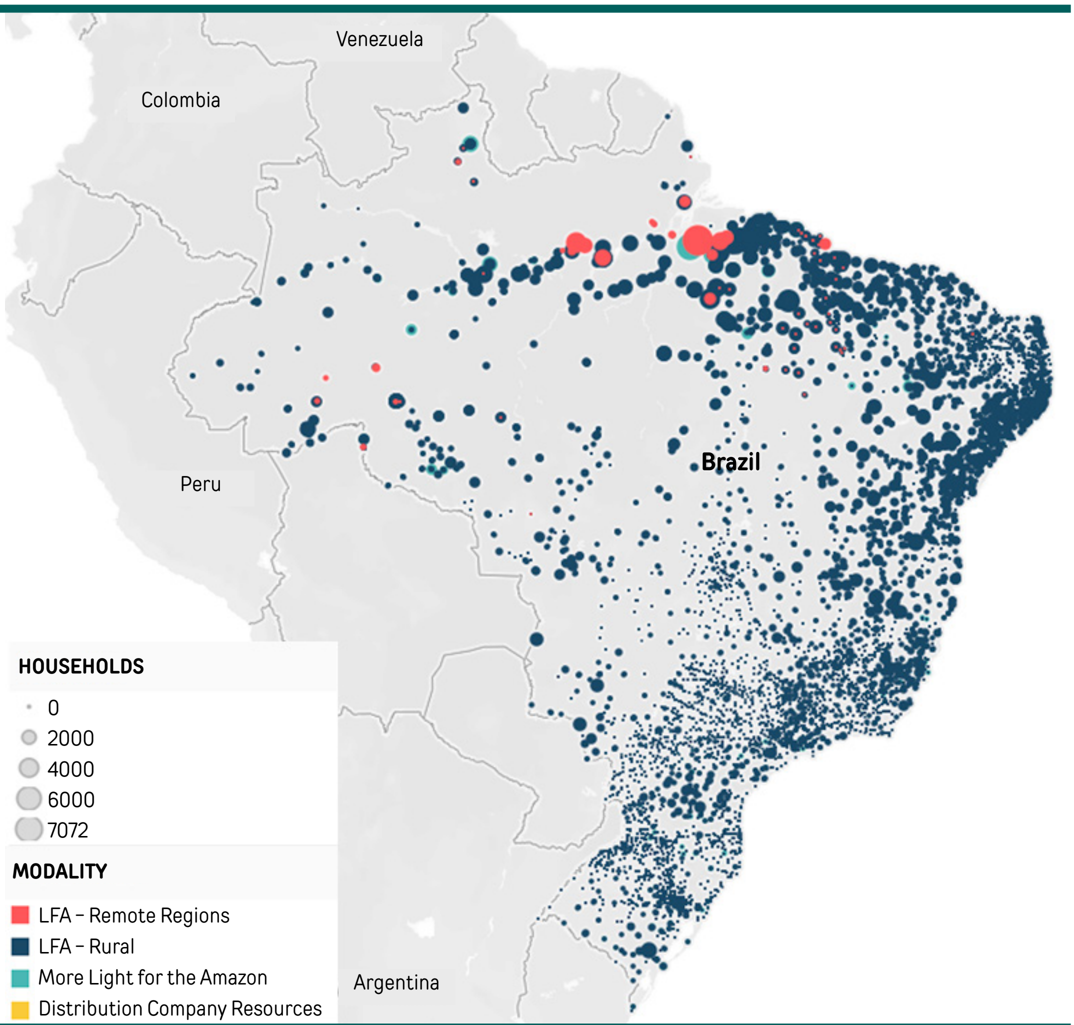


Figure 7. Map of the concentration and distribution of consumer units served by the LPT.

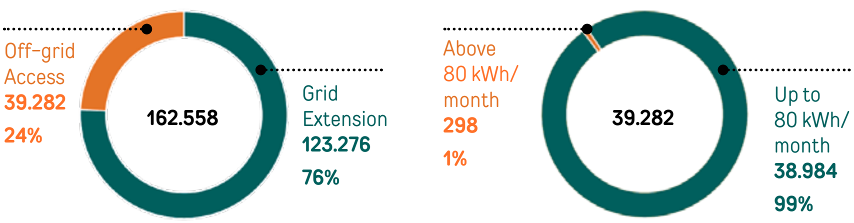
Source: Prepared by the authors based on data provided by the MME.

Based on contracts signed between the Ministry of Mines and Energy (MME) and electric power distribution utilities under the LPT, service is planned for 162,558 new consumer units (CUs), according to information made available by the MME [2024] [4]. Of this total, 123,276 CUs will be connected through extensions of the conventional grid and 39,232 through remote systems, as shown in Figure 8.a.

4. Official Letter No. 75-2024-DUPS-SNEE-MME.

Figure 8.Planned LPT service in the Legal Amazon: (a) type of access, (b) capacity of individual systems.

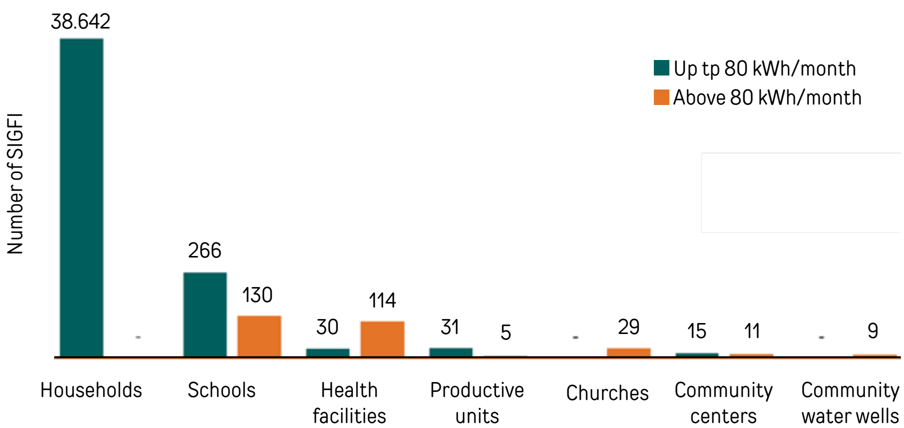
Source: Prepared by the authors based on MME [2024] data.



Of the remote systems, approximately 99% will be Individual Generation Systems with Intermittent Source (SIGFI). Of these, 99.2% correspond to systems with a supply capacity of up to 80 kWh/month, totaling 38,985 units (Figure 8.b). There is no plan to serve households with systems above that consumption range. Only 0.8% of remote installations (298 units) will be equipped with higher-capacity SIGFIs (160 and 180 kWh/month). In these cases, service is intended for collective-use consumer units such as schools, churches, productive units, and health units, as indicated in Figure 9.

Figure 9. Planned individual LPT service in the Legal Amazon by type of consumer unit.

Source: Prepared by the authors based on MME [2024] data.



2.2 ELECTRICAL EXCLUSION IN THE LEGAL AMAZON

Despite the progress made in recent years, a significant portion of the population of the Legal Amazon, which predominantly lives in remote communities, is outside the SEB and remains excluded from the public electric power service.

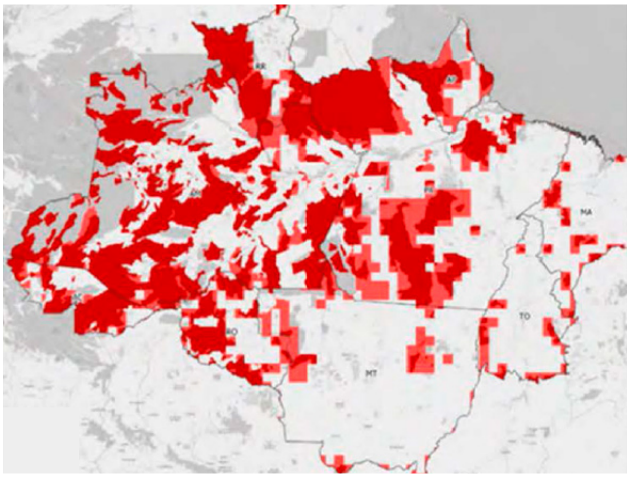
According to a study by the Institute for Energy and the Environment (IEMA), approximately 990 thousand people live without public access to this essential service (IEMA 2020).

It is estimated that 19% of the Indigenous population and 22% of the population living in Conservation Units in the Amazon live without access to the public electric power service. In addition, more than 650 thousand people excluded from the public electric power service are located outside officially demarcated areas in the region, as indicated in Figure 10 (IEMA 2020).

Figure 10. People living in areas without access to the public electric power service.

Territorial Demarcation	Population without Access to Electricity	Percentage of Total Group Population
Indigenous Territories	78.388	19%
Quilombola Territories	2.555	4%
Conservation Units	59.106	22%
Rural Settlements	212.791	10%
Outside Designated Areas	679.470	3%
TOTAL	990.103	4%

Remote Regions
Non-Remote Regions



By way of comparison, the total area of electrical exclusion—highlighted in yellow in Figure 6 and in red in Figure 10—is approximately 1.7 million km², making it larger than any Brazilian state individually. Figure 11 compares the exclusion area with the three largest Brazilian states: Amazonas (1.559 million km²), Pará (1.245 million km²), and Mato Grosso (0.903 million km²).

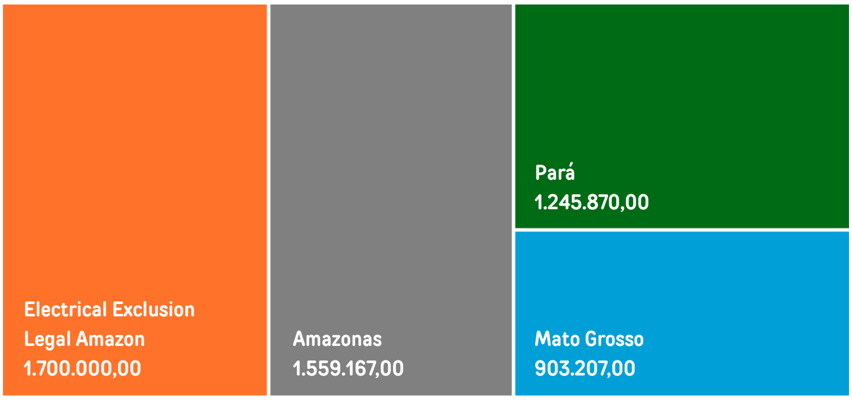


Figure 11. Comparison between the area of electrical exclusion in the Legal Amazon and the area of the largest Brazilian states (km²).

The absence of adequate energy infrastructure, especially the lack of a public electric power supply, compromises the operation of essential basic services—connectivity (internet), education, sanitation, and health—and prevents the development of productive activities (Godoy et al. 2024), constituting one of the main structural challenges to the region's sustainable socioeconomic development.

As an alternative solution, many of these communities use individual or community generators running on fossil fuels, which operate for few hours per day and have significantly high operating costs. This scenario is aggravated by the high prices of fossil fuels formally marketed in the region, which are among the highest in the country (Brazilian National Agency for Petroleum, Natural Gas and Biofuels (ANP) 2025).

Additionally, in remote and isolated areas, access to fuel often occurs through informal channels, with intermediaries who charge prices higher than those in the formal market, which makes continuous and adequate supply for productive, community, and residential energy demands unfeasible.

2.3 AGRICULTURAL ESTABLISHMENTS WITHOUT ACCESS TO ELECTRIC POWER IN THE LEGAL AMAZON

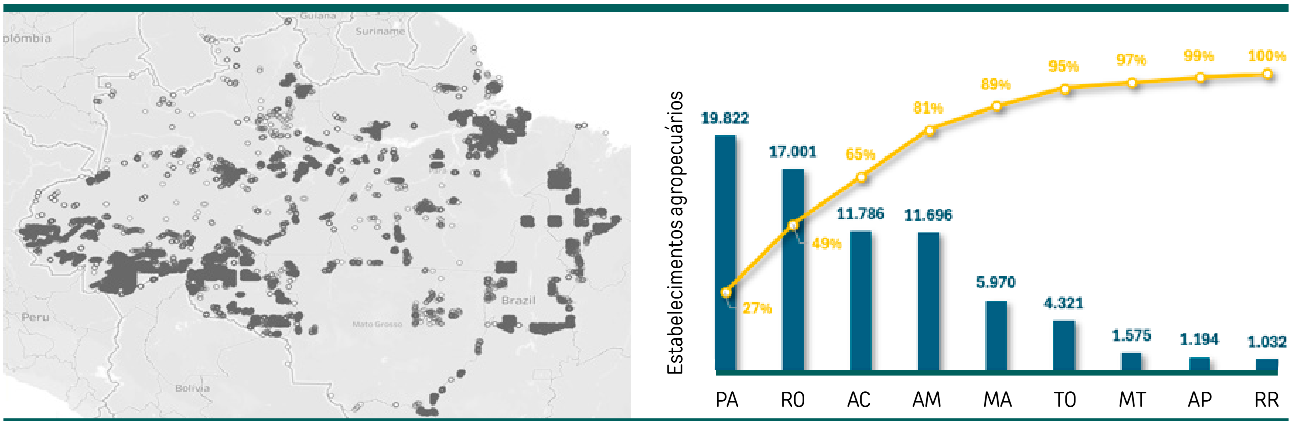
According to IBGE (2017a), the states of the Legal Amazon concentrate approximately 865 thousand agricultural establishments, covering diverse activities, including crops, animal husbandry, and plant extractivism. Also, according to IBGE, 221,702 households still lack access to electricity, and based on the intersection between the addresses of agricultural establishments and the exclusion areas estimated by IEMA (2020), 74,393 of these agricultural establishments are located in areas without access to the public electric power service, which limits the adoption of productive technologies, product processing, preservation of perishable inputs, and local value addition.

The states of Pará (PA), Rondônia (RO), and Acre (AC) together concentrate 65% of agricultural establishments not served by the public electric power service, as indicated in Figure 12.

In general, all types of socio-bioeconomy productive chains—such as fish farming, silviculture, grain drying, pulp production, processing of fruits and nuts, cassava flour production, among others (Di Lascio and Barreto 2009)—depend on electric power at multiple stages of the production process, including extraction, transport, pre-processing, processing, and storage.

Figure 12. Agricultural establishments in areas excluded from public access to electric power.

Source: Prepared by the authors based on IEMA (2020) and IBGE (2024e) data.



THE LPT'S PROPOSED SERVICE FOR REMOTE AREAS PROVES TECHNICALLY LIMITED IN THE FACE OF PRODUCTIVE ENERGY DEMANDS.

Box II illustrates the main energy services associated with Amazonian Value Chains, highlighting their relevance for promoting value addition, increasing productivity, and generating income.

However, the LPT's proposed service for remote areas—based predominantly on installing SIGFI systems with capacities of up to 160 kWh/month—proves technically limited in the face of productive energy demands. These systems are insufficient, especially for driving higher-power equipment, such as electric motors and refrigeration systems, restricting possibilities for economic development and the autonomy of the communities served.

This reality reinforces that the energy made available by the program is inadequate to ensure the productive inclusion of establishments and enterprises linked to socio-bioeconomy chains, particularly plant extractivism. It is therefore urgent to review strategies for universalizing energy in the Legal Amazon, with a territorial and productive focus, considering not only household access but also full service to community and productive infrastructure essential to the territories' socioeconomic sustainability and resilience.

Given this scenario, producing and using territorialized and disaggregated information that makes it possible to more precisely identify productive establishments excluded from the public electric power service, their locations, characteristics, and respective energy demands becomes essential. Detailed mapping of these units, articulated with productive typologies and socio-bioeconomy territories, is a key step to guiding effective strategies for universalizing access to energy in the Legal Amazon. The next chapter presents the methodological approach adopted in this study for systematizing, cross-referencing, and analyzing these data, with the aim of supporting more equitable, productive, and territorially sensitive public policies.

Box II. Demand for electric power in the Amazonian socio-bioeconomy.

DEMAND FOR REFRIGERATION AND HEAT

The demand for refrigeration in extractivist regions and in areas of permanent and temporary crops of the Legal Amazon is essential for various applications, such as fish refrigeration; storage of medicines and vaccines; processing in the production chain of cupuaçu butter and extraction of oils and pulps; storage of fruit pulp; pasteurization processes; and ice production, the latter being indispensable for fishing activities and the preservation of perishable goods (Homma 2014; Mathyas, Souza, and Cassares 2018).

In contrast, the use of heat in production chains is less frequent than refrigeration. Its application is mainly associated with drying and dehydration processes for food and grains, meeting the specific demands of certain socio-bioeconomy chains. This contrast underscores the importance of energy solutions tailored to the distinct demands for cooling and heating, optimizing the efficiency of productive activities in the region.

The lack of electric power compels extractivist collectors and small producers of permanent and temporary crops to sell the fruit in natura, without separating those destined for direct consumption from those suitable for processing (pulp extraction). This practice hinders the use of smaller fruits that lack commercial value but could otherwise be processed into pulp, which has strong market demand. This step would add value to the product and increase producers' income through the diversification of marketed items. In some cases, extractivists and small producers resort to buying ice during pulp extraction or hiring third-party freezer storage services (Homma 2014).

The implementation of refrigeration systems for cold-storage activities has boosted productive systems in the Amazon, enabling the storage of perishable products such as fruit pulp (açaí, cupuaçu, buriti) and fish from seasonal fishing. This advancement has made it possible to export these products to other regions of Brazil and international markets. In addition to the commercial benefits, refrigeration has generated significant social impacts — such as enabling the preservation of fresh food in public schools, reducing dependence on processed and canned foods in school meals (IEI 2022) — by facilitating the purchase and storage of food from family farming and local extractivism through public programs such as the National School Feeding Program (PNAE) and the Food Procurement Program (PAA).

Therefore, the availability of electric power also creates opportunities to expand business models and improve the efficiency of extractivist and small rural producers' activities. It enables the mechanization of productive processes and the refrigerated storage of pulp for future sale, complementing the traditionally adopted in natura trade. These advancements can strengthen local value chains and contribute to the sustainable development of the Amazon.

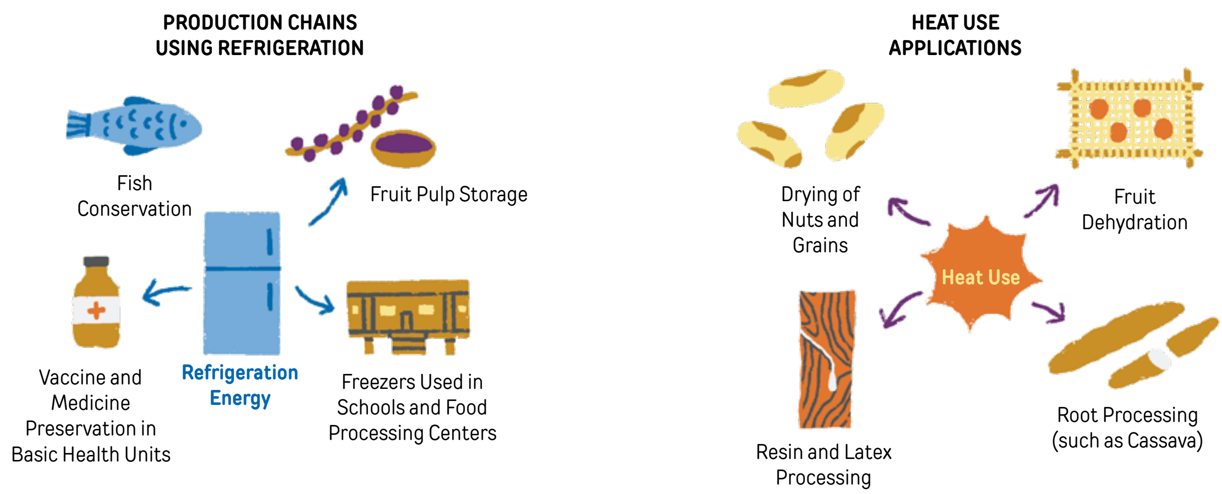


Figure 13. Use of cooling and heating in the socio-bioeconomy chains of plant extraction.

Source: Prepared by the authors.

DEMAND FOR MOTIVE POWER – ELECTRIC MOTORS

The commercialization of fruit pulps depends directly on the availability of electric power, essential both for the depulping process (Mathyas et al. 2018) and for refrigerated storage (Homma 2014). Induction motors are widely used in processes requiring continuous operation throughout the production chain. Their applications include fruit depulpers, cassava and nut grinders, machines used in mechanical workshops, and electrical equipment for silviculture, as well as motor pumps for water pumping (Homma 2014; Di Lascio and Barreto 2009).

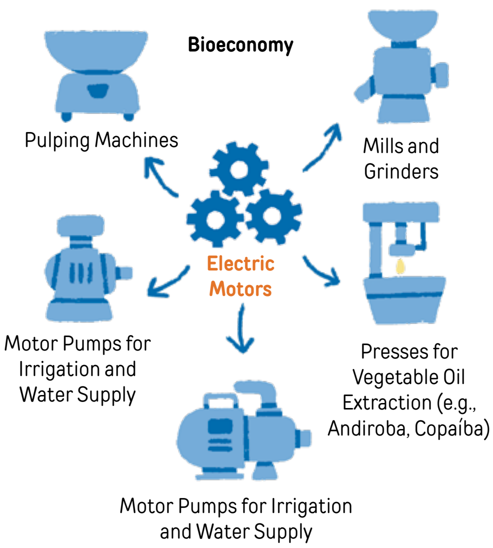
Their use in equipment for processing and refining socio-bioeconomy products — such as presses for extracting vegetable oils (e.g., andiroba, copaíba, and buriti) and shredders for biomass preparation — is essential. These machines increase productive efficiency and ensure product standardization, adding value and improving market competitiveness (Homma 2014; Di Lascio and Barreto 2009).

Electric motors also play a key role in drying and grinding systems, used for drying grains and dehydrating fruits. Equipment such as industrial fans and mills for grinding seeds and fibers rely on motors for continuous and efficient operation. These systems are particularly important in regions where high humidity can compromise the quality of stored products.

In the context of water pumping, electric motors are fundamental for crop irrigation, water supply for human and animal consumption, and productive processes such as fruit cleaning and sorting. The latter two have a major social impact, as they improve the quality of water consumed by communities (PSA 2025) and eliminate the need for manual water collection — a task that consumes around six hours of labor per week and is often carried out by women and children (Mathyas et al. 2018).

Electric motors are also used in the transport and handling of materials, such as conveyor belts and freight elevators, facilitating internal product movement within production units. This application is crucial in activities like nut storage, fruit sorting, and internal logistics in cooperatives, optimizing production flows and reducing workers' physical effort (Mathyas et al. 2018).

DEMAND FOR ELECTRIC MOTORS IN THE SOCIO-BIOECONOMY SUPPLY CHAIN



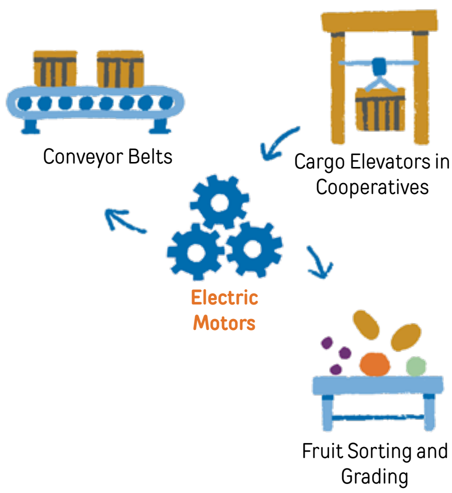


Figure 14. Application of electric motors in the socio-bioeconomy processing chain.

Figure 15. Application of electric motors in the socio-bioeconomy processing chain.

3. SOURCES OF TERRITORIALIZED DATA AND INFORMATION ON PLANT EXTRACTIVIST PRODUCTION IN THE LEGAL AMAZON

3.1 DATA SURVEY AND SYSTEMATIZATION STRATEGY

The search for territorialized data sources and information on plant extractivist production in the Legal Amazon was guided by six guiding questions:

- **What are the types of socio-bioeconomy products in the region?**
- **Where are these products produced?**
- **What is the quantity produced?**
- **What is the number of productive establishments?**
- **What is the size (area) of these establishments?**
- **Is there access to the public electric power service in these establishments?**

To answer these questions, the research methodology was structured in six sequential stages, as illustrated in Figure 16:

STAGES 1 AND 2:

> **Survey** of public, private, associative, and third-sector organizations working in socio-bioeconomy productive chains;

> **Systematization** of activities carried out by these organizations, identification of territories of operation, and formulation of general and specific questions for interviews.

STAGES 3 AND 4:

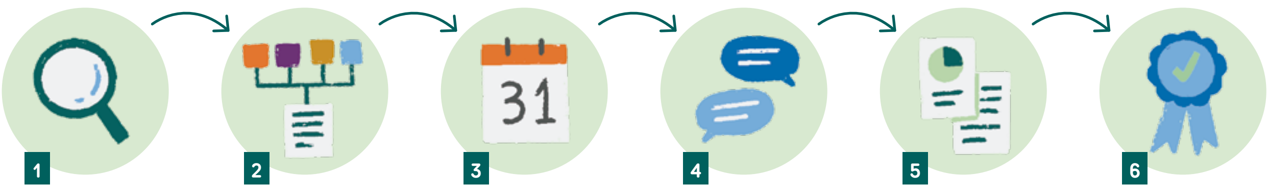
> **Scheduling** interviews with the identified organizations;
> **Conducting** interviews based on the defined questions, with the goal of understanding institutional actions and collecting primary and secondary data.

STAGES 5 AND 6:

> **Analysis** of the data obtained to consolidate information on productive chains;
> **Mapping** socio-bioeconomy production and the existing infrastructure;
> **Validation** with key agents and institutional representatives.

Figure 16. Methodology for compiling and systematizing data and information.

METHODOLOGY FOR DATA AND INFORMATION COLLECTION AND SYSTEMATIZATION



IDENTIFICATION

- Identify agents from public organizations, private sector, civil society, associations, universities, etc.
- Identify documentation, information and data (portals: government and agencies (federal and state); scientific; companies; associations; and civil society).

SYSTEMATIZATION

- Consolidate information about agents and organizations – contacts.
- Consolidate documents, data and information – quantitative and qualitative.
- Structure general and specific questions for interviewed agents.

SCHEDULING

- Send invitation requesting meetings (virtual or in-person) with mapped agents and organizations.
- Schedule and conduct meetings.

INTERVIEWS

- Interview agents from identified organizations.
- Identify data and information for mapping.
- Interview IBGE agents and assess the feasibility of estimating productive activities.

CONSOLIDATION

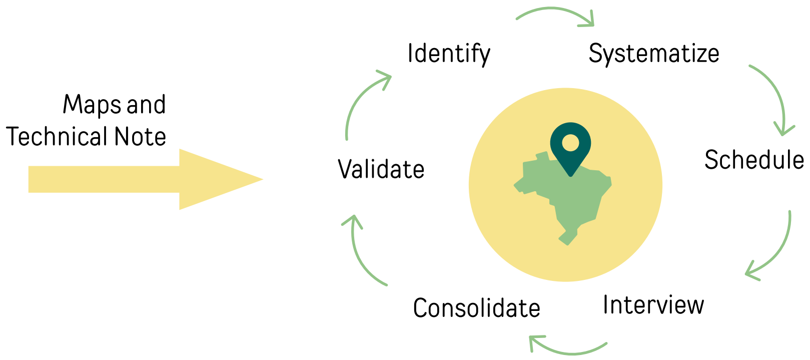
- Analyze and systematize data and information received or directed by interviewed agents.
- Build database and develop georeferenced maps of sociobiodiversity activities.

VALIDATION

- Validate consolidated data and information with interviewed agents adhering to the research.
- Hold meetings, present mapping results and exchange information with mapped agents.

3. SOURCES OF TERRITORIALIZED DATA AND INFORMATION

DESCRIPTION OF METHODOLOGY STAGES AND ACTIONS



3.2 MAPPING PUBLIC POLICIES AND INSTITUTIONS INVOLVED IN THE SOCIO-BIOECONOMY

Eighty-eight institutions—public, private, associative, social movements, and third sector—were identified as involved with socio-productive and energy activities in the Legal Amazon. Figure 17 consolidates general information on the institutions that operate and demand socio-bioeconomy data.

Figure 17. Institutions and actors that demand data on socio-bioeconomy activities.

	• 57 governmental initiatives (national, state and interstate) to promote sociobiodiversity-based productive activities in the Legal Amazon.
	• +80 entities work in the areas of bioeconomy, livestock, family farming, regional development, and census surveying at the federal and state levels.
	• 11 federal government ministries work with bioeconomy, agriculture and regional development activities, some with more than one secretariat. • The nine states in the region have secretariats that work with extractive activities, agriculture and livestock, family farming and environment. • The Brazilian Institute of Geography and Statistics (IBGE) is the main source of official data and information on productive activities in Brazil and the Legal Amazon.
	• The two main development institutions, with programs focused on sociobiodiversity activities, are BNDES and SUDAM.
	• The nine states of the Legal Amazon have universities and institutes (federal and state), which conduct research related to sociobiodiversity activities. • +90 researchers working with bioeconomy and sociobiodiversity activities.

The mapped institutions are, directly or indirectly, involved in 57 active public policy initiatives[1] aimed at promoting socioeconomic development, productive efficiency, provision of environmental services, and conservation of rural areas, distributed among:

- **21** federal;
- **34** state (with emphasis on Pará, with **14** initiatives); and
- **2** interstate.

These initiatives encompass different instruments of action—programs (21), plans (9), policies (8), tools (5), and others (19). Their objectives range from structuring databases, consolidating productive chains, logistical support, credit, land regularization, and energy inclusion, to fostering activities aimed at environmental conservation, promoting productive inclusion, and territorial resilience.

Of the initiatives developed, 28 are geared to serving productive chains, that is, to providing infrastructure and services that directly support different stages of the production process—such as extraction, planting, management, processing, beneficiation,

1. In Brazil, the main public policy for the agricultural sector is the Plano Safra (Harvest Plan), which aims to finance the planting and commercialization of grains with subsidized interest rates between 5% and 12.5% per year (depending on the subprogram). For the 2025/2026 harvest, R$ 516.2 billion were made available, representing a 1.6% increase over the previous harvest. Of this amount, R$ 89 billion (15.5% of the total) were allocated to policies for rural credit, public procurement, agricultural insurance, technical assistance, minimum price guarantees, among others. From this portion, R$ 78.2 billion (15.1% of the total) were directed to the National Program for Strengthening Family Farming (Pronaf), with interest rates between 2.0% and 6% per year (MDA 2025). The National Supply Company (CONAB), a public company responsible for providing technical information for the formulation of agricultural public policies, acts in the execution of storage and regularization of food and agricultural product supplies throughout the country (Conab 2022a). The company maintains a historical series since 2014, which includes average monthly and weekly wholesale and retail prices for more than 130 agricultural products in all Federative Units (Conab 2022c). Additionally, CONAB publishes the Sociobiodiversity Bulletin, which details the characteristics of various Amazonian productions, including açaí, extractive rubber, cocoa, and nuts, among others (Conab 2022b). It also systematizes information on subsidies granted by the Policy for Guaranteeing Minimum Prices for Sociobiodiversity Products (PGPM-Bio), which establishes minimum prices for 17 extractive products (Conab 2017). This policy plays a strategic role in coordinating regional development programs, distributing income, and preserving local extractive and agricultural chains, contributing to keeping the population in rural areas and promoting the economic sustainability of the socio-bioeconomy.

preservation, commercialization, among others—of activities linked to the socio-bioeconomy. These initiatives encompass 52 types of products such as Açaí (Euterpe oleracea), cupuaçu (Theobroma grandiflorum), cassava (Manihot esculenta), oils, tree planting and extraction, fishing, among others. In addition, two federal initiatives focus on fostering energy infrastructure for production units. Three initiatives focus on implementing renewable power plants, while one aims to deploy photovoltaic systems to support the production chains of small rural producers and Indigenous peoples (Ministry of Agriculture and Livestock (MAPA) 2019). A final one seeks to promote sanitation and renewable energy infrastructure for small rural producers (Brazilian Development Bank (BNDES) 2022).

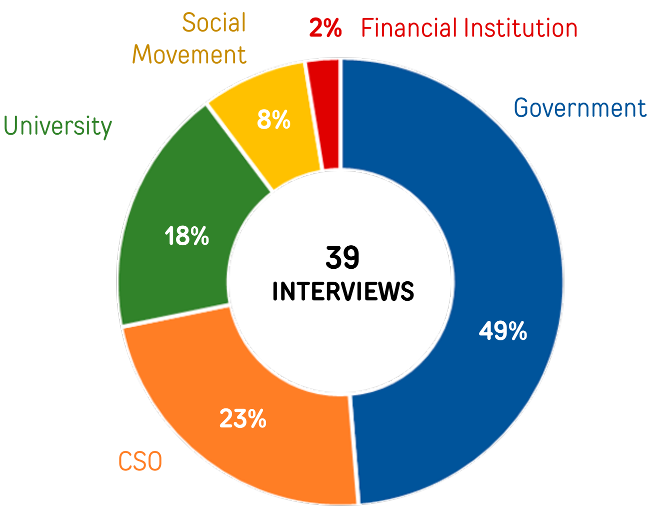
3.3 INSTITUTIONAL PARTICIPATION AND QUALIFIED INTERVIEWS

Between March 2023 and November 2024, 39 virtual and in-person interviews were conducted with the participation of more than 100 people, including decision-makers, specialists, members of social movements, and civil society representatives. In addition, there were direct interactions with specialists in four workshops[2] focused on developing productive activities of the socio-bioeconomy, in the context of developing the National Socio-Bioeconomy Plan (MMA 2025). Figure 18[3] illustrates general information on these interviews.

2. One workshop for the development of the new ARPA (Amazon Region Protected Areas) program, organized by WWF Brazil (WWF-Brasil 2025); and three meetings—two regional in Manaus-AM and Belém-PA, and one sectoral in Brasília-DF—for the Dialogues of the National Socio-Bioeconomy Plan (MMA 2024), organized by the Ministry of Environment (MMA), the Ministry of Agrarian Development (MDA), and the Ministry of Social Development (MDS).

3. Table 9 in APPENDIX II presents the systematization of these interviews.

Figure 18. Agents and organizations interviewed (Full names and general descriptions of the organizations are in APPENDIX II).



- +60 interview requests
- +100 interviewees
- Some organizations interviewed more than once
- Participation in regional and national workshops with dozens of organizations
- MMA, MME, MDA, MDICS
- SEMA-AP, SEAF-MT, SEMA-AM, CIAMA-AM, IDAM-AM
- BNDES, SUDAM, IBGE
- UFAM, UFPA, UENO, UFAC, UFRA, UFOP, UNIFESSPA, USP
- CPI, WWF, Greenpeace, ISA, Uma Concertação pela Amazônia, Amazônia 2030
- COIAB, CONAQ, CNS
- Experts

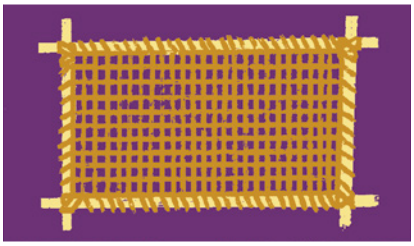
3.4 RESULTS OF THE DIAGNOSTIC OF AVAILABLE DATA SOURCES AND INFORMATION

Although several databases are under development, it was found that IBGE holds the only effective and open databases on socio-bioeconomy activities, covering the entire Legal Amazon and Brazilian territory.

These data, partially anonymized by pre-established criteria in their methodology and by Law No. 5,533/1968[4], are the only sources available on productive establishments related to socio-bioeconomy production in the region.

4. Law No. 5,534 of November 14, 1968, mandates that any natural or legal person must provide information requested by the IBGE Foundation. This information is confidential and will be used exclusively for statistical purposes (Brasil 1968).

4. DATABASE ON AGRO-EXTRACTIVE PRODUCTION IN THE LEGAL AMAZON



IBGE information can be accessed and extracted through its information portal, known as SIDRA, IBGE Automatic Recovery System (IBGE 2024g).

IBGE conducts data collection and systematizes time series using statistical and geographic information from conjunctural and structural surveys. These surveys are complementary in that they allow both continuous multisectoral monitoring and provide inputs for the formulation of public policies and strategic planning in different economic sectors and strata of society.

Conjunctural surveys are carried out periodically (monthly, quarterly, semiannually, and annually) to monitor short-term variations and trends in specific sectors of the economy, demography, or society, supporting public policies and business decisions by providing updated data on the economic and social context. Among the conjunctural surveys, the Municipal Agricultural Production Survey (PAM) and the Survey of Plant Extraction and Forestry Production (PEVS) stand out; both are conducted continuously (annually) in sectoral consensus meetings, at municipal and state levels, to estimate and monitor short-term trends (IBGE 2018).

Structural surveys occur at longer intervals (quinquennial and decennial) and aim to capture long-term characteristics and trends of economic sectors and the population, serving as a basis for strategic planning and the formulation of public policies aimed at long-term sustainable development. Among these surveys, the Agricultural Census stands out; it adopts a census approach, with door-to-door data collection directly at the productive establishment, allowing a detailed analysis of long-term trends in the sector.

Table 2 systematizes the main characteristics of these surveys and cites some examples.

CHARACTERISTIC	CONJUNCTURAL SURVEYS (PAM AND PEVS)	STRUCTURAL SURVEY (AGRICULTURAL CENSUS)
Objective	To monitor short-term trends and fluctuations in economic and social indicators.	To analyze structural transformations and the long-term evolution of sectors.
Periodicity	Short term (quarterly, semiannual, and annual) – up to one year.	Long term (every 5, 10, or more years).
Scope	Specific and sectoral indicators, based on sampling and without direct contact with respondents.	General and comprehensive characteristics, conducted door-to-door (direct contact with respondents).
Surveys	Municipal Agricultural Production Survey (PAM), Survey of Plant Extraction and Forestry Production (PEVS), Systematic Survey of Agricultural Production (LSPA), Continuous National Household Sample Survey (Continuous PNAD), Broad National Consumer Price Index (IPCA).	Agricultural Census and Demographic Census.

Table 2. Characteristics of the types of surveys.

Source: Prepared by the authors based on (IBGE 2025b).

Agricultural production based on permanent and temporary crops requires, as an initial stage, land-use change, with deforestation of the native biome for subsequent planting. On large properties, this practice is generally associated with dense monoculture systems such as banana, coffee, orange, rubber tree, in the case of permanent crops; and soy, cotton (Gossypium spp.), corn, rice, cassava (Manihot esculenta), in the case of temporary crops, among others (IBGE 2018). Inputs such as fertilizers and irrigation are invariably used (Homma 2014; Amazon Environmental Research Institute (IPAM) 2018), generating environmental impacts and high operating costs.

Plant extractivism, in turn, refers to exploitation of native plant resources through the collection or extraction of products such as timber, latex, waxes, seeds, fibers, fruits, and roots (IBGE 2018). This activity can be conducted sustainably, ensuring continuous production over time, or in a predatory and itinerant manner, generally allowing only a single extraction.

Silviculture is configured as an activity primarily oriented to timber extraction, especially for the production of firewood, logs destined for the paper and pulp industry, and other uses. Measured in thousand cubic meters (m^3) of timber extracted (IBGE 2018), this practice involves permanent tree felling for direct extraction and for opening access and transport routes for logs.

In contrast to large agro-livestock production systems, family farming can be developed under all three models—crops, extractivism, and silviculture—distinguishing itself by its multifunctionality[1] and pluriactivit[2]. This production model integrates agricultural activities with non-agricultural activities, generally carried out by family members, on small properties with strong territorial ties. Family farming plays a strategic role in sustainable rural development, contributing to food security, environmental preservation, and social cohesion (CEAM 2005).

Table 3 consolidates the main technical characteristics of the agricultural and extractivist production models analyzed.

1. It refers to the integration of the productive, social, cultural, and environmental dimensions in the rural context. It emphasizes the farmer's role as a social actor with multiple functions within the territory, not limited to an economic rationale, but involved in practices that ensure food security, environmental conservation, the maintenance of ways of life, and the promotion of social cohesion (CEAM 2005).

2. It is characterized by the combination of agricultural activities with other non-agricultural occupations carried out by members of the same family. This phenomenon results from the interaction between family strategies and the socioeconomic context in which they are embedded, serving as a form of income diversification, economic stability, and integration into the labor market, even in rural regions with limited infrastructure (CEAM 2005).

Table 3. Characteristics of agricultural and extractivist production models.

Source: Prepared by the authors based on (IBGE 2025b).

CHARACTERISTIC	PERMANENT AND TEMPORARY CROPS	PLANT EXTRACTIVISM
Cultivation area	Systematic planting in deforested areas.	Spontaneous growth in native forests.
Management	Phytosanitary control, crop densification, and use of agricultural inputs.	Traditional management, without the use of inputs.
Productivity	High, due to controlled cultivation.	Low, dependent on natural conditions.
Predictability	Regular.	Variable.
Impact	Deforestation and contamination due to input use.	Conserves biodiversity.
Production cost	High, requiring inputs and management.	Low, with no need for inputs.
Sustainability	Can be integrated into agroforestry systems.	Maintains ecosystems and environmental services.
Workforce	Mechanized in some stages.	Labor-intensive manual work.

4.1 CONTINUOUS MONITORING OF AGRICULTURAL AND EXTRACTIVIST ACTIVITIES

4.1.1 Municipal Agricultural Production Survey (PAM)

The PAM, initiated in 1938[3] with a data history systematized since 1974 (IBGE 2023d), provides statistical information on planted area, harvested area, quantity produced, average yield, and average price paid to the producer in the base year (year of data and information collection), as summarized in Figure 19.

It includes information on species commercially cultivated in areas of spontaneous vegetation, such as Açaí (Euterpe oleracea), cashew nut, rubber trees, among others. It excludes information on products whose planted or harvest area is less than one hectare or whose annual production does not reach one tonne (IBGE 2018, 2023a).

3. "This survey began at the Ministry of Agriculture in 1938. The information was gathered by IBGE's Collection Agents, with the Ministry of Agriculture being responsible for preparing the questionnaires, and for the tabulation, review, and dissemination of the results. On 01/17/74, by Decree No. 73,482, IBGE became responsible for all phases of the survey. Information for the years 1971 and 1972 is not available as it was not released by the Ministry of Agriculture" (IBGE 2023b).

Figure 19. General characteristics of the PAM.

- Municipal Agricultural Production (PAM) releases data annually.
- Data collection via questionnaire occurs from January to March, with publication in September of each year.

- Investigates products from temporary and permanent crops in Brazilian municipalities.
- Covers 64 agricultural products: 31 from temporary crops and 33 from permanent crops.

- Estimates are made by Municipal Collection Agents – individuals with knowledge of local producers and associations – together with agricultural technicians and large producers.

- Planted area; area intended for harvest; harvested area; quantity produced; average yield; and average price paid to producers in the reference year.

- Data are published at disaggregation levels: Brazil, Major Regions, Federation Units, Mesoregions and Geographic Microregions, and Municipalities.
- Tables and historical series are available in the IBGE Automatic Retrieval System - Sidra.

- Does not investigate energy use.

The PAM monitors the evolution of the agro-livestock production system (IBGE 2014), being used mainly to:

- **Monitor agricultural and territorial development** by evaluating agricultural activity and analyzing land distribution and use, considering expansion into frontier areas;
- **Support the formulation of policies** aimed at developing the productive sector and rural communities, in addition to supporting research to improve agro-livestock management;
- **Define economic and fiscal parameters**[4] by contributing to calculation of the municipal Gross Domestic Product (GDP) and to defining municipalities' shares in the distribution of state tax revenues; and
- **Support planning and investments in the private sector** by providing information for sales planning, investments, and financing in the agricultural sector, strengthening the long-term economic sustainability of productive activities.

The survey covers 41 agricultural products of temporary crops and 35 products of permanent crops, always considering the municipality of origin of production[5]. In addition, it collects data on the evolution of the agro-livestock production system and land use.

PAM data collection is conducted by IBGE technicians responsible for structuring the information system, based on the sources available in the municipalities under their jurisdiction, following the guidance of the State Supervision of Agricultural Surveys and involving technical representatives from public and private entities that participate in agricultural statistics technical councils, organized at three levels[6]—state, regional, and municipal (IBGE 2023d).

4. Municipal governments use the data for the transfer of rural ICMS (a state-level value-added tax), based on the officially declared planted area, and financial institutions use official statistics for the calculation and approval of rural credit and agricultural insurance.

5. The products surveyed by IBGE can be seen in Table 8 of APPENDIX I.

The survey is classified by the institute itself as subjective, since its estimates are built on the consensus of information obtained by collection agents (IBGE 2014), through periodic consultations with specialized sources, such as public and private entities, producers, and technicians linked to production, commercialization, industrialization, and oversight of agricultural products, and from the knowledge acquired by the agent in the municipalities where they operate, enabling systematic monitoring of agricultural production and identification of factors that may have influenced production over the year (IBGE 2018).

4.1.2 Survey of Plant Extraction and Forestry Production (PEVS)

THE PEVS, AVAILABLE IN THE IBGE STATISTICAL TABLES DATABASE (SIDRA), PROVIDES STATISTICAL INFORMATION ON QUANTITY PRODUCED, PRODUCTION VALUE, AND AVERAGE UNIT PRICE OF EACH PRODUCT ORIGINATING FROM PLANT EXTRACTIVISM AND SILVICULTURE

The PEVS, initiated in 1938[7], has a systematized data history since 1974 and is available in the IBGE Statistical Tables Database (SIDRA) from 1986 (IBGE 2023c). It provides statistical information on quantity produced, production value, and average unit price of each product originating from plant extractivism and silviculture[8] by Brazilian municipality during the survey's reference year, as summarized in Figure 20. In the case of silviculture, the survey also collects data on total existing area and harvested area (IBGE 2018).

PEVS data collection, as in PAM, is conducted by technicians responsible for structuring the information system based on the sources available in the municipalities under their jurisdiction. This system should involve public and private entities, producers, technicians, and agencies linked to the production, commercia-

6. The organizations that participate in the construction of the PAM, by federative unit, can be seen in Table 10 of APPENDIX III.

7. "Information collection began in 1938, and the Ministry of Agriculture was responsible not only for preparing the questionnaire but also for the review, tabulation, and dissemination of the results. As for the forestry (silviculture) survey, IBGE created and launched it in 1974, due to the importance the sector assumed as a result of industrial projects in the paper, pulp, and steel industries, which received tax incentives for reforestation. In 1986, the two surveys, Plant Extractive Production and Forestry, were combined into a single investigation, under the name Production of Plant Extraction and Forestry. Basically, the survey on forestry was incorporated into the survey on the plant extractive sector" (IBGE 2023c).

8. Products originating from planted forest stands.

Figure 20. General characteristics of the PEVS.

- Plant Extraction and Silviculture Production (PEVS) releases data annually.
- Data collection via questionnaire occurs from January to March, with publication in September of each year.

- Investigates production obtained from the exploitation of natural forest resources.
- Covers 40 products from plant extraction (plus others) and 15 from silviculture.

- Estimates are made with regional technicians from IBAMA (Brazilian Institute of Environment and Renewable Natural Resources), state forestry institutes, state secretariats, agricultural and industrial establishments, and sector agencies.

- Plant extraction and silviculture production; average unit price paid to producers; and existing and harvested areas of forest crops.

- Data are published at disaggregation levels: Brazil, Major Regions, Federation Units, Mesoregions and Geographic Microregions, and Municipalities.
- Tables and historical series are available on the IBGE website and in Sidra.

- Does not investigate energy use.

lization, industrialization, and oversight of forest products, both native and from planted forests (IBGE 2018).

The survey covers dozens of plant extraction[9] and silviculture products, considering the municipality of origin of production.

Information is obtained through periodic consultations with institutional and productive sources, enabling systematic monitoring of forest resource exploitation and identification of factors that may have influenced production over the year.

The main data and information sources for products from native forests include State Forest Institutes, State Secretariats of Environment, and regional units of the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA)[10]. In the case of silviculture, due to the sector's greater organization, much of the information is obtained directly from reforestation companies and their suppliers (IBGE 2023e).

9. The products surveyed by IBGE can be seen in Table 8 of APPENDIX I.

10. The organizations that participate in the construction of the PEVS, by federative unit, are listed in Table 11 of APPENDIX III.

In regions where it is difficult to obtain information, due to scarcity of informants or dispersion of activity, collection technicians may adopt alternative estimation methods, such as: (i) surveys at the main points of commercialization, identifying production by municipality of origin; and (ii) using technical knowledge of industry and commerce sectors that use forest raw materials, making estimates based on average consumption of these products.

4.1.3 Assessment of the PAM and PEVS

Analysis of PAM and PEVS data reveals a significant disparity between agricultural and extractive production modes.

Figure 21 shows that agricultural production can be up to ten times greater than production from extractivism.

In 2020, for example, extractive production of rubber (all types) was 897 tonnes (IBGE 2023c), while agricultural production reached 18,500 thousand tonnes (IBGE 2023a), representing a difference of almost 2,000%. Additionally, extractive rubber production has shown a declining trend over time, losing market share to production in permanent crops.

As for production distribution, limiting data disaggregation to the municipal level, as shown in Figure 22, hampers precise identification of productive areas due to municipalities' large territorial extent.

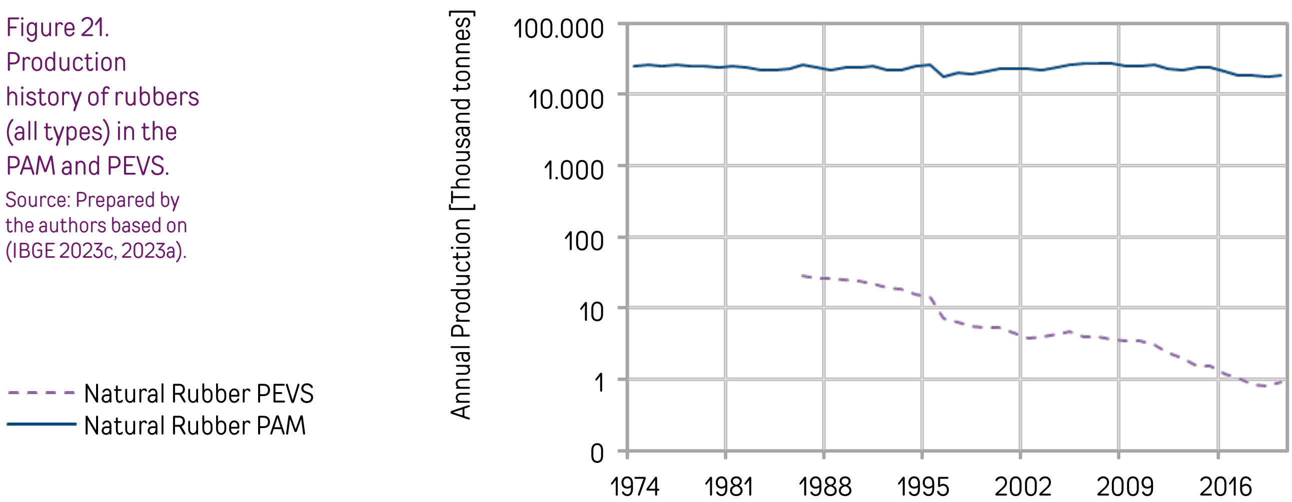


Figure 21. Production history of rubbers (all types) in the PAM and PEVS.
Source: Prepared by the authors based on (IBGE 2023c, 2023a).

This characteristic undermines the effectiveness of implementing targeted policies (focalization) and the strategic allocation of infrastructure and physical, logistical, and financial resources, such as transport, equipment, and investments aimed at productive establishments and the communities involved.

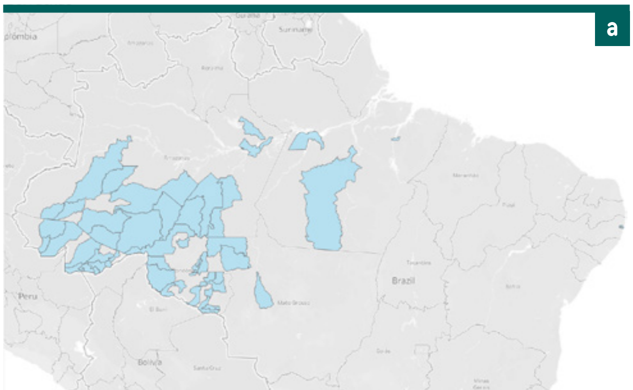
The lack of greater spatial granularity in the data hampers delimitation of production regions and viable routes for distribution, limiting the effectiveness of territorial planning and structuring actions to support productive activities, especially in regions of great territorial extension.

An example that highlights the limitation of spatial disaggregation of data is the municipality of Lábrea, in the state of Amazonas (Figure 23), which, according to the PEVS, recorded production of 4,580 tonnes of Açaí (Euterpe oleracea) in 2020. With a territorial area of 68.3 thousand km²—equivalent to twice the size of the municipality of Porto Velho, the largest capital of the Legal Amazon, with 34.1 thousand km²—Lábrea exemplifies the challenges posed by the absence of data disaggregated at sub-municipal or census-tract levels.

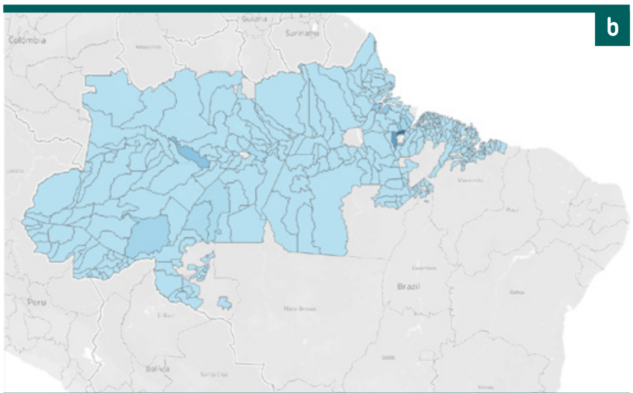
This scenario recurs in several municipalities of the Legal Amazon, where vast territorial extension and limited granularity of available data hinder precise identification of the origin of production.

Figure 22. Municipalities with production of (a) rubber and (b) Açaí (Euterpe oleracea).
Source: Prepared by the authors based on (IBGE 2025b).

RUBBER



AÇAÍ



Aggregating data from the PAM and PEVS only at the municipal level hampers detailed mapping of productive chains linked to the socio-bioeconomy, whose complexity and diversity demand more comprehensive and disaggregated information in order to:

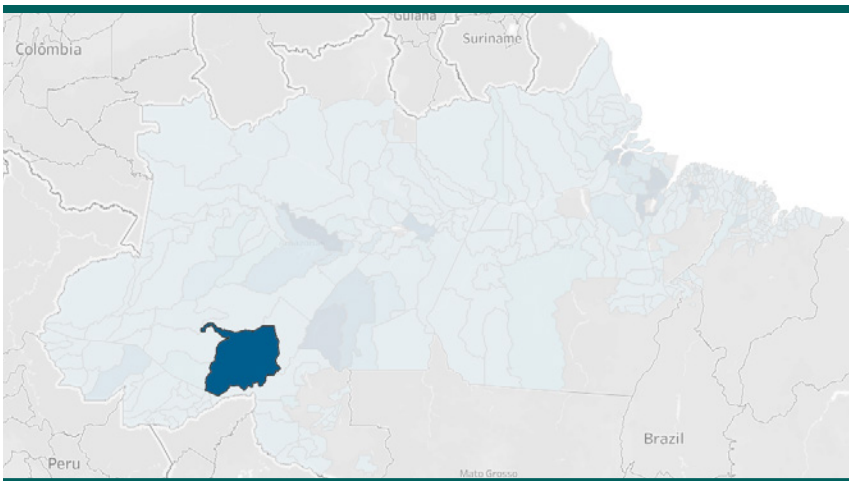


Figure 23. Highlight on the municipality of Lábrea in the State of Amazonas.

Source: Prepared by the authors based on (IBGE 2025b).

- Understand who produces, how they produce, with what resources, at what scale, and in which territory;
- Identify infrastructure bottlenecks, such as the absence of energy or transport;
- Observe market relations, income distribution, forms of social organization, and governance; and, above all,
- Map interconnections among the different links in the chain, from collection/production to processing, commercialization, and consumption—determining origin and possible destinations.

4.2 CENSUS-BASED MONITORING: IBGE AND THE AGRICULTURAL CENSUS

The Agricultural Census is the main census survey aimed at collecting detailed information on the agro-livestock sector in Brazil, investigating structural aspects of productive units, ranging from characteristics of the producer to available infrastructure, including land use, technologies employed, production systems, and commercialization. It also gathers information on the legal status of the producer and the land, the use of electric power, access to the internet, irrigation, fertilization, pesticides, and agricultural machinery, covering segments such as livestock, temporary and permanent crops, silviculture, and plant extractivism (IBGE 2025a).

The planned periodicity for the survey is quinquennial (IBGE 2025a). However, this regularity has often been compromised, resulting in the survey being conducted, in practice, every ten years[11].

The survey is conducted by field agents who know local producers and associations, following prior planning based on territorial stratification by census tracts. During data collection, these agents verify whether establishments are productive units eligible to be interviewed[12] (IBGE 2017b).

11. The first edition of the Agricultural Census occurred in 1920, integrating the General Census of Brazil. Since then, its periodicity has changed according to government demands and budgetary conditions. Until 1970, the survey was conducted every ten years, later being reformulated to a quinquennial (five-year) frequency. However, this regularity was compromised on several occasions, such as in 1990, when the census was not carried out. The following survey occurred only in 1995–1996, with a methodology based on the crop year, while the 2006 Census returned to the civil year model. The surveys for the years 1990, 1995, 2000, 2005, 2010, and 2015 could not be conducted due to budgetary constraints. The 1990 Agricultural Census did not occur, while the 1995 survey was carried out in 1996, coinciding with the Population Count. The 2000 census was not carried out, the 2005 one went to the field in 2007 along with the Population Count, the 2010 one did not materialize, and the 2015 one was carried out in 2017 (IBGE 2025a)..

12. The identification of establishments follows the guidelines of the Enumerator's Manual, which instructs agents to observe the property, question residents about the existence of agricultural activities, and only then determine if the property is a unit to be surveyed. Small domestic vegetable gardens and residential backyards are not considered agricultural establishments and, therefore, are not included in the survey. Only after this characterization are the animal stocks, temporary and permanent crops, and all production of the unit recorded (IBGE 2017b).

ALTHOUGH PAM AND PEVS ARE RELEVANT INSTRUMENTS FOR ANNUAL MONITORING OF PRODUCTION, THEIR SPATIAL LIMITATIONS RESTRICT THE LEVEL OF DETAIL NECESSARY FOR FORMULATING SPECIFIC PUBLIC POLICIES, ESPECIALLY FOR ACCESS TO ELECTRIC POWER.

Agents carry out door-to-door visits to measure and map productive establishments of all sizes and legal categories, including production units for subsistence, producers without their own land[13] such as extractivists, farmers on leased land, in partnership or occupied land, as well as beneficiaries of family farming and the National Program for Strengthening Family Farming (PRONAF). This identification is important for formulating public policies to support small and medium rural producers.

Figure 24 presents a summary of the main methodological, informational, spatial, and structural characteristics of the Agricultural Census, highlighting survey frequency and territorial scope; the categories of production analyzed; the method of data collection, validation, and processing; and the strategy for disseminating information and its application in public policy formulation.

Although PAM and PEVS are relevant instruments for annual monitoring of production, their spatial limitations restrict the level of detail necessary for formulating specific public policies, especially for access to electric power, the focus of this work.

While the PEVS and PAM provide data at the municipal level, the Agricultural Census is conducted by census tract, allowing more detailed spatial disaggregation. This granularity makes it possible to map more precisely where and how agro-livestock and extractive activities occur within a municipality and to correlate them with existing and planned infrastructure for the territory. This is particularly important for the Legal Amazon, where many municipalities have large territorial extensions, in some cases larger than those of certain Brazilian states.

In addition, data collection down to the census-tract level[14],

13. In this characteristic, IBGE includes: honey producers; extractivists; animal breeders on roadsides; producers in river floodplains (vazantes); itinerant farms (roças itinerantes); those who produced on leased land, in partnership, or on occupied land, but who were not using it on the survey's reference date; and other situations (IBGE 2017c)..

14. Disaggregation criteria:

Disaggregation by establishment characteristics: total establishment area (size brackets), legal land status (owned, leased, tenure, occupation, etc.), land use (pasture, crops, forests, natural vegetation, etc.), labor origin (family, hired, salaried, etc.), production purpose (self-consumption, commercialization), and access to services and infrastructure (electricity, internet, rural credit, technical assistance);

	• The Agricultural Census publishes structural data on the sector every five years. • It informs public policies for small and medium-scale rural producers, including Pronaf (National Program for Strengthening Family Farming) and the Climate Fund.
	• The census covers the following segments: agriculture, livestock, aquaculture, poultry farming, frog farming, beekeeping, sericulture, plant extraction and silviculture.
	• The survey is conducted by Field Agents at establishments door-to-door.
	• Number and total area of establishments; land use; use of electricity, internet and irrigation; gender, age, race or color of producers; among others.
	• Data are published at disaggregation levels: Brazil, Major Regions, Federation Units, Municipalities, Funai Regional Coordination, Indigenous Land, Sustainable Development Reserve (RDS), Extractive Reserve (Resex). • Tables and historical series are available on the IBGE website in Sidra.
	• (1) "Does the establishment use electricity?" • (2) "What was the total amount spent by the establishment? Electricity." • The answer to (1): Yes or No. Is it for residential use, productive processes or both?

Figure 24. Characteristics of the Agricultural Census.

identifies not only production but also fundamental aspects such as the legal status of the producer and the land, productive practices, land structure, and access to essential services such as electric power, irrigation, storage, mechanization, and transport. This integrated approach enables comprehensive diagnostics of the territories' socioeconomic reality.

Unlike conjunctural surveys, which capture short-term trends and are limited to a predefined list of products, the Agricultural

Disaggregation by productive typology: types of crops planted (permanent and temporary crops), livestock (cattle, swine, poultry, etc.); Plant extractivism (Brazil nuts, rubber, açaí, etc.), silviculture (planted forest production), irrigation systems used, and use of agricultural machinery and implements;

Disaggregation by producer profile: sex, age, and education level of the producer, number of producers per establishment, and housing conditions on the establishment;

Disaggregation by access to public policies: participation in social programs, access to rural credit, and receipt of technical assistance; and

Territorial disaggregation (geographic levels): Brazil (national), Major Regions (North, Northeast, Center-West, Southeast, South), Federative Units (states), Intermediate and Immediate Regions (Mesoregions and Microregions), Municipalities (standard level for public release), Districts and Subdistricts (when available), and Census Tracts (most granular level; used in specific studies and generally accessed upon technical request, respecting confidentiality rules).

UNLIKE CONJUNCTURAL SURVEYS, WHICH CAPTURE SHORT-TERM TRENDS AND ARE LIMITED TO A PREDEFINED LIST OF PRODUCTS, THE AGRICULTURAL CENSUS MAKES IT POSSIBLE TO UNDERSTAND TRANSFORMATION DYNAMICS OVER TIME.

Census makes it possible to understand transformation dynamics over time, such as: the expansion of agriculture over areas of extractivism; changes in land-use patterns; and conditions of access to markets, inputs, and basic infrastructure. This perspective is essential for formulating long-term public policies, with a focus on strengthening the socio-bioeconomy and family farming, balancing environmental conservation with economic development.

Another relevant differentiator is the detailed collection of information on energy use in establishments. The Census collects data on the direct use of electric power through objective questions such as "Does the establishment use electric power?" and "What was the total amount of expenses incurred in the establishment with electricity?", in addition to addressing indirect use by observing the presence and power of machinery and irrigation systems. Although the questions do not specify the source or purpose of the energy, these data are crucial to attempt to understand availability and energy bottlenecks in productive units (IBGE 2017c).

Additionally, information is captured on the existence of storage structures, such as silos, grain bins, and conventional warehouses, which are essential for the distribution and preservation of agricultural and extractive production, making it possible to identify which structural barriers limit productivity and the inclusion of small producers and extractive communities in the market.

5. MAPPING PLANT EXTRACTIVISM PRODUCTION IN THE LEGAL AMAZON: IBGE AGRICULTURAL CENSUS[1]

5.1 TERRITORIAL PREDOMINANCE OF PLANT EXTRACTIVISM IN THE LEGAL AMAZON: PARTICIPATION, VOLUMES, AND COMPARISONS WITH OTHER PRODUCTIVE MODELS

Agro-livestock production in the Legal Amazon consists predominantly of four major productive models: permanent and temporary crops, plant extractivism, and silviculture. The region's share in national production shows significant variations among these models.

Figure 25 shows the share of total production, in tonnes (t) and thousand cubic meters (thousand m³), of these three production models in Brazil and in the Legal Amazon, indicating the number of product types identified in the 2017 Agricultural Census[2].

Permanent and temporary crops account for 3% and 11% of national production, respectively, with 1.8 million tonnes for permanent crops and 98.2 million tonnes for temporary crops. Plant Extraction, in turn, stands out for the region's significant importance: 73% of national production occurs in the Legal Amazon, totaling approximately 600 thousand tonnes. Production related to forestry (legal) accounts for 34% of national production, with 8.73 million m³ of wood extracted in the region (IBGE 2024g).

1. Access to this information was made possible through a request for Special Tabulation, made via Brazil's Services and Information Portal, available on GOV.BR, as per guidance from IBGE technicians. Interviews and direct interactions were held with IBGE technicians responsible for PAM, PEVS, and the Agricultural Census, aiming to understand the structure of the databases and the formal procedures for requesting information not directly available on SIDRA. These interactions allowed for a deeper understanding of the confidentiality criteria, the available levels of disaggregation, and the processes for accessing complementary data, which are essential for specific analyses and for supporting public policies aimed at the agro-extractive sector.

2.The complete list of products considered by IBGE in each category can be consulted in Table 8 of APPENDIX I.

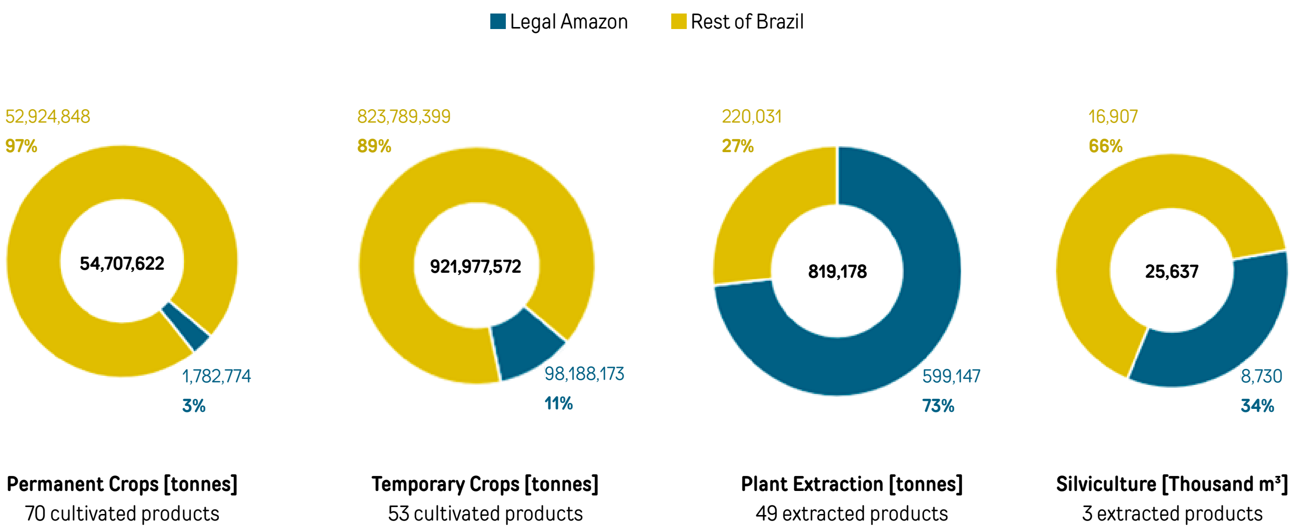


Figure 25. Composition of agro-extractive production in Brazil and in the Legal Amazon34*.

(*) Of the 53 temporary crop products, 40 are produced in the states of the Legal Amazon. For Plant Extraction, of the 52 products, 49 are produced in the states of the Legal Amazon.

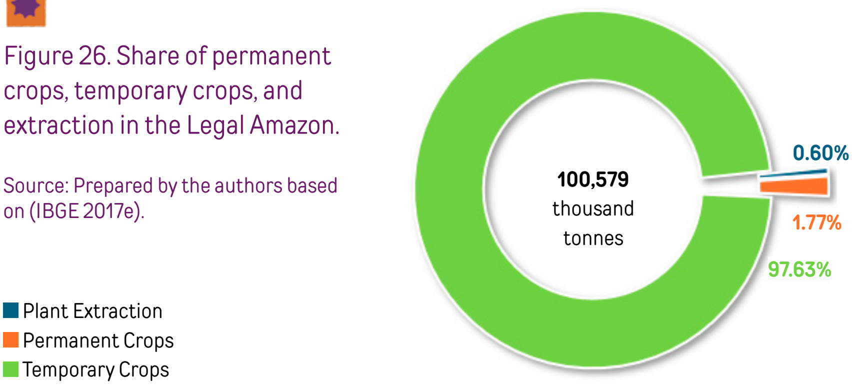
Source: Prepared by the authors based on (IBGE 2017d).

In total volume, the region produced approximately 100.579 million tonnes considering only permanent and temporary crops and Plant Extraction. Despite the relevance of Plant Extraction in the national context, its contribution to the region's total plant production is relatively modest: it represents only 33% of the output of permanent crops and about 0.61% of the output of temporary crops. Considering these three production models together, Plant Extraction accounts for only 0.60% of the total, while permanent crops contribute 1.77%. These data reveal a marked asymmetry among the region's productive models, with a predominance of temporary crops, characterized in many cases by intensive production practices and high pressure on ecosystems, reinforcing the concentration of an exploratory and predatory model in the Amazonian territory, as shown in Figure 26.

Six products were identified whose production occurs both in Plant Extraction and in permanent crops: Açaí (Euterpe oleracea), Cocoa (almond) (Theobroma cacao), Cupuaçu (Theobroma grandiflorum), rubber (coagulated latex), rubber (liquid latex), and Camu-camu (Myrciaria dubia) (IBGE 2017d). Figure 27 presents these outputs, in tonnes. Açaí, rubber (liquid latex), and Camu-camu recorded higher production quantities in Plant Extraction compared to per-

Figure 26. Share of permanent crops, temporary crops, and extraction in the Legal Amazon.

Source: Prepared by the authors based on (IBGE 2017e).



manent crops. By contrast, Cocoa (almond), Cupuaçu, and rubber (coagulated latex) are predominantly produced in permanent crops[3].

Plant Extraction plays a strategic role in sustaining value chains linked to non-timber forest products, such as Açaí and liquid latex, reinforcing its sociocultural and economic importance for traditional communities of the Legal Amazon. Conversely, permanent crops demonstrate greater efficiency in terms of production volume, especially for crops aimed at large-scale commercialization and higher market value, such as Cocoa (almond) and coagulated latex, reflecting more intensive investment in productive infrastructure.

5.2 OVERVIEW OF SOCIOBIOECONOMY PRODUCTION

The 2017 Agricultural Census reveals data on the production of 49 Plant Extraction products in Legal Amazon[4]. The total output

3. Açaí production from extractivism is 64% higher than in permanent crops, reinforcing the economic and cultural relevance of this activity for local communities. The production of coagulated latex is ten times greater than that of liquid latex, due to the value added by the coagulation process, making it more commercially competitive and hindering the participation of extractivist producers in this market. On the other hand, camu-camu production from extractivism is 500% higher than in permanent crops, although its absolute volume is small. In permanent crops, the production of cocoa (almond) and cupuaçu is higher than in plant extractivism, being 10,343% and 1,781% greater, respectively, in terms of volume produced (tonnes). Likewise, rubber (coagulated latex) shows 387% higher production in permanent crops compared to plant extractivism (IBGE 2017d).

4. The complete list of plant extractivism products is consolidated in Table 8 of APPENDIX I.

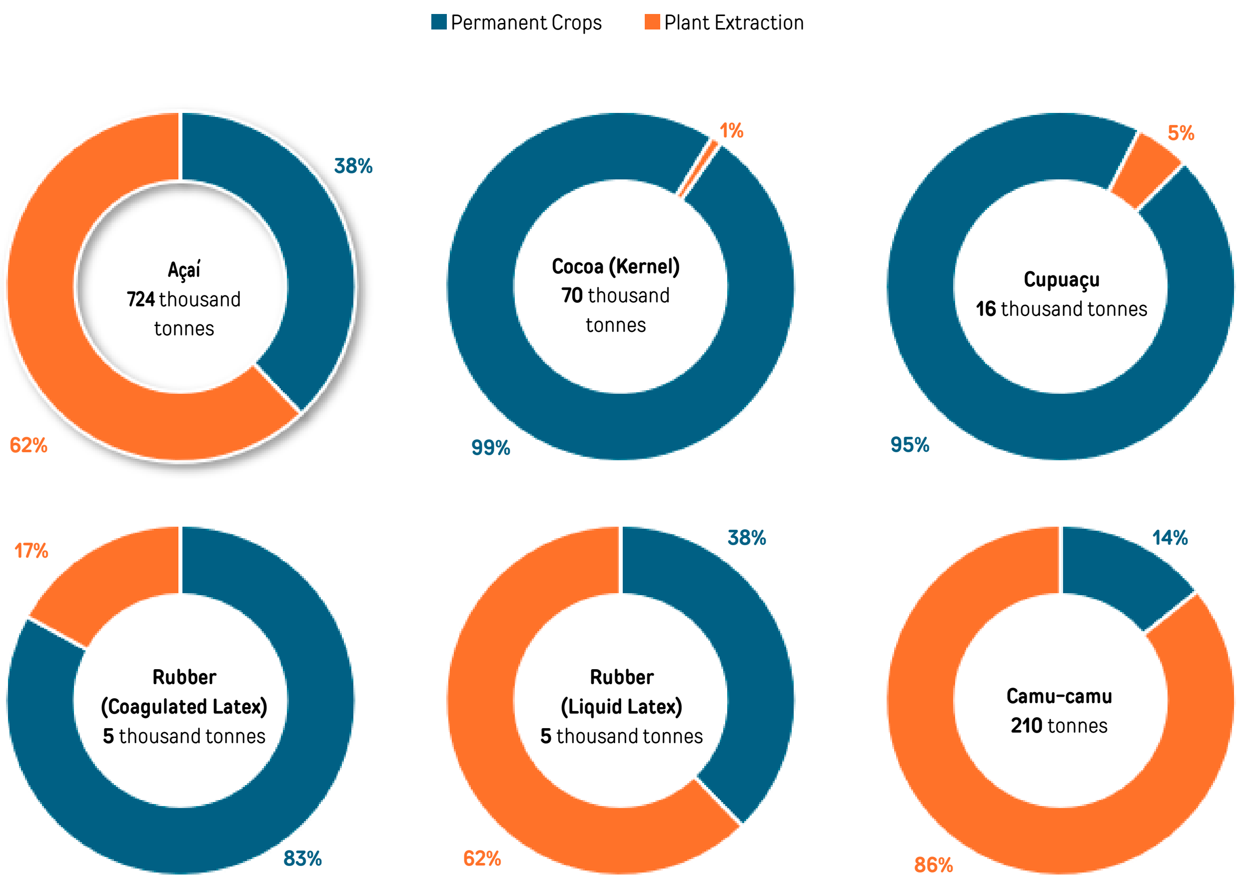


Figure 27. Production common to permanent crops and Plant Extraction.

Source: Prepared by the authors based on (IBGE 2017d)(IBGE 2024b).

identified in the region was approximately 600 thousand tonnes, moving more than R$ 1.2 billion in 2017 (IBGE 2017e).

Açaí established itself as the main product of the sociobio-economy with an annual output of about 450 thousand tonnes, representing 75% of total extractive production in the region, as illustrated in Figure 28. Other significant products are Babassu (nut and kernel) (Attalea speciosa), with 77 thousand tonnes per year or 13% of the total; and Brazil Nut (Bertholletia excelsa), with an annual output of 27 thousand tonnes or 4% of the total. The other 46 extractive products together totaled approximately 45 thousand tonnes per year, or 8% of the total.

5.3 TERRITORIAL DISTRIBUTION OF EXTRACTIVE PRODUCTION IN THE LEGAL AMAZON

5.3.1 Levels of Territorial Disaggregation of Agricultural Census Production Data

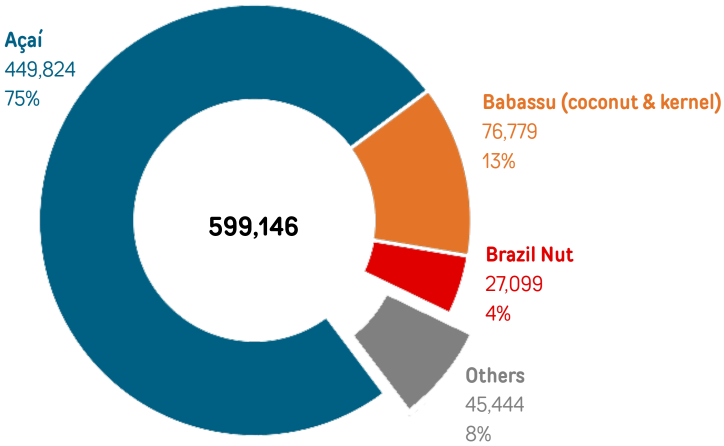
Agricultural Census data are made available according to different disaggregation criteria: characteristics of the establishment, productive typology, producer profile, access to public policies, and territorial distribution. In terms of territorial distribution, in addition to the national level, data are disaggregated by state, municipalities, and census tract.

Although data are collected by census tract, in many cases, to preserve the statistical confidentiality of respondents, public release takes place up to the municipal level. In the case of data at more disaggregated levels—district[5] and census tract—access

5. Data at more disaggregated levels refer to information collected and organized below the municipal level, such as district (or subdistrict) data and census tracts. According to the Brazilian territorial division, "subdistricts are geographic units that fully divide the territory of the district or municipality," allowing for a more detailed visualization of the spatial distribution of economic, social, and demographic activities. Census tracts correspond to the smallest territorial unit used by IBGE for census collection purposes, generally composed of groups of contiguous and homogeneous households. These breakdowns allow for more precise analyses of local production and infrastructure patterns, but their disclosure is conditioned on preserving statistical confidentiality (IBGE 2025a).

Figure 28. Total production in the Legal Amazon's Federative Units (UF) (thousand tonnes, 2017).

Source: Prepared by the authors based on (IBGE 2024b).



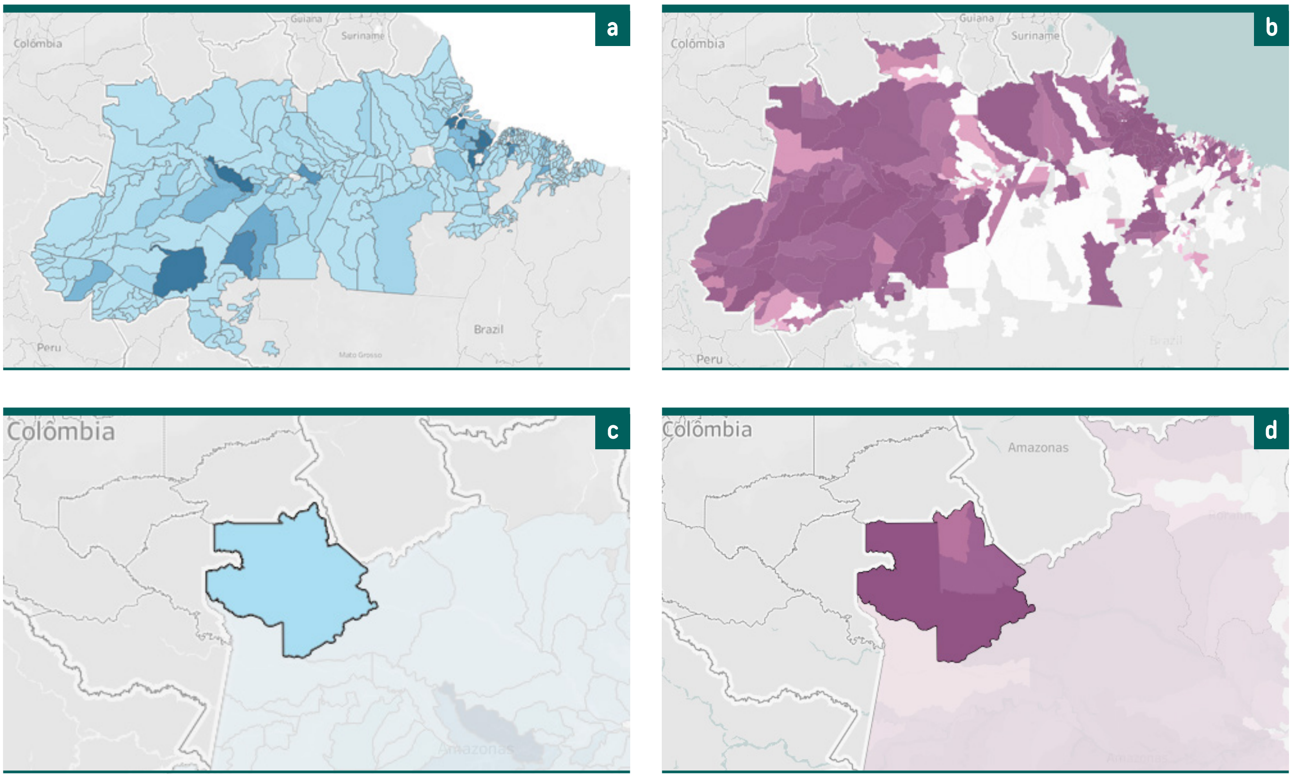


Figure 29.
Disaggregation of Açaí production in the Legal Amazon (a) municipality, (b) subdistricts, (c) municipality of São Gabriel da Cachoeira and its (d) four subdistricts.

Source: Prepared by the authors based on (IBGE 2017d).

may occasionally be granted upon technical request, in compliance with international confidentiality and anonymization standards.

Even so, to ensure statistical confidentiality and comply with the data anonymization guidelines adopted by the Brazilian Institute of Geography and Statistics (IBGE), information on subdistricts with fewer than ten productive establishments is not disclosed to the public. Likewise, at the municipal level, data are suppressed for municipalities with fewer than three establishments, so as to protect the identity of producers.

In Figure 29, by way of illustration, the distribution of Açaí production in the Legal Amazon is presented, considering different levels of spatial disaggregation: (a) municipal and (b) subdistricts. In addition, the figure details production in the municipality of São Gabriel da Cachoeira, with the total distribution shown in (c) and the subdivision of production among its four subdistricts—São Gabriel da Cachoeira, Içana, São Felipe, and Cucui—in (d).

5.3.2 Distribution of Plant Extraction Production by State in the Legal Amazon

Figure 30 presents Plant Extraction production by state in the Legal Amazon, expressed in tonnes, and the respective regional shares. The lighter-shaded states have lower shares, such as Roraima (RR), with 0.4% of the total, while the darker-shaded states have higher shares, such as Pará (PA), which concentrates 69.3% of extractive production, followed by Maranhão, with nearly 14%, and Amazonas with approximately 7%. Together, these three states account for more than 90% of the region's extractive production.

Figure 31 and Table 4 show the concentration of production of the main Plant Extraction products in the Legal Amazon, highlighting Açaí (fruit), Babassu (nut and kernel), and Brazil Nut (Bertholletia excelsa). Pará accounts for 88% of regional Açaí production, with 397,076 tonnes, followed by Amazonas (5%), Amapá (4%), Acre (1%), and Rondônia (0.4%). Babassu shows an even more pronounced concentration: Maranhão is responsible for 96% of the region's total production, with 56,858 tonnes. Brazil Nut production, although also concentrated, is more diversified among the states: Amazonas leads with 40.3%, followed by Pará (17.6%), Mato Grosso (17.1%), Acre (13%), and Roraima (1%). Other regional

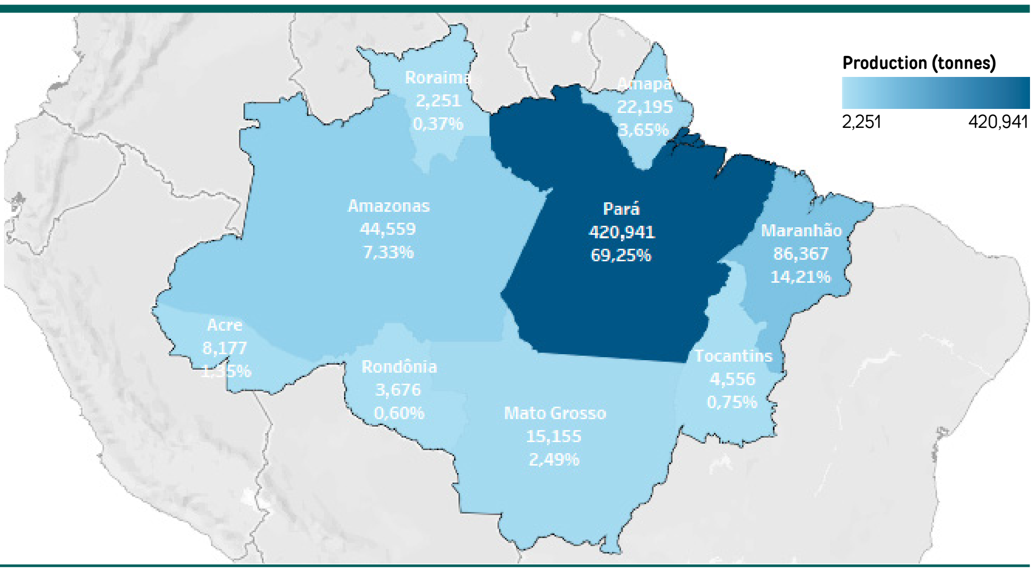


Figure 30. Extractive production by UF in the Legal Amazon (in tonnes, 2017).

Source: Prepared by the authors based on (IBGE 2017e).

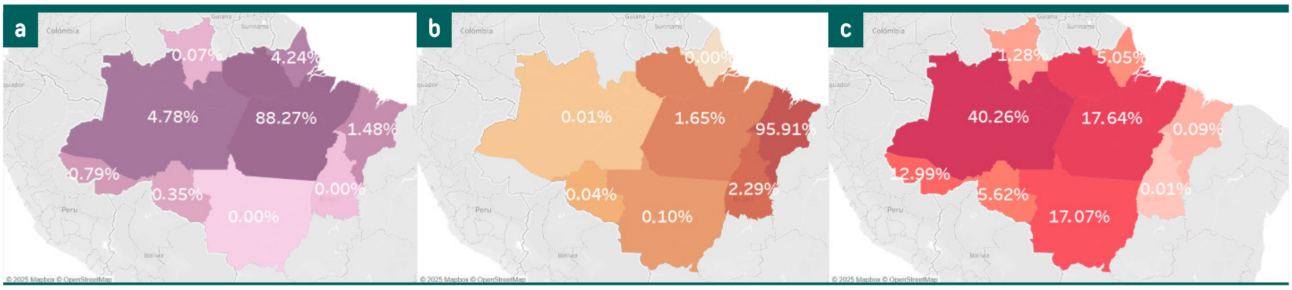


Figure 31. State-level concentration of the three largest extractive productions (a) Açaí, (b) Babassu, and (c) Brazil Nut (in tonnes, 2017).

Source: Prepared by the authors based on (IBGE 2017e).

Table 4. Main Plant Extraction outputs in each state of the Legal Amazon.

Source: Prepared by the authors based on (IBGE 2017e).

STATE	PRODUCT	PRODUCTION (tonnes)	%
Acre	Açaí (fruit)	3,564	1%
Amapá	Açaí (fruit)	19,062	4%
Amazonas	Açaí (fruit)	21,515	5%
Maranhão	Babassu (Coconut)	56,858	96%
Mato Grosso	Other products	7,419	66%
Pará	Açaí (fruit)	397,076	88%
Rondônia	Açaí (fruit)	1,596	0%
Roraima	Brazil Nut	347.49	1%
Tocantins	Pequi (fruit)	1,540	39%

products also stand out: Tocantins concentrates 39% of the region's Pequi (Caryocar brasiliense) production, and Mato Grosso accounts for 66% of "other products," demonstrating high extractive diversity in the state.

5.3.3 Distribution of Plant Extraction Production by Municipality in the Legal Amazon

Municipal distribution of Plant Extraction production in the Amazon, as shown at the state level, is concentrated in the state of Pará, where the municipalities with the largest production volumes are located. In the states of Amazonas, Acre, and Amapá, a more balanced distribution is observed among different municipalities, with less concentration in specific municipalities or regions, as shown in Figure 32.

The spatial analysis illustrated by Figure 32, with a color gradient from light blue to dark blue, shows that the largest volumes of Plant Extraction production are concentrated in municipalities along the northeastern strip of Pará, in municipalities near Belém

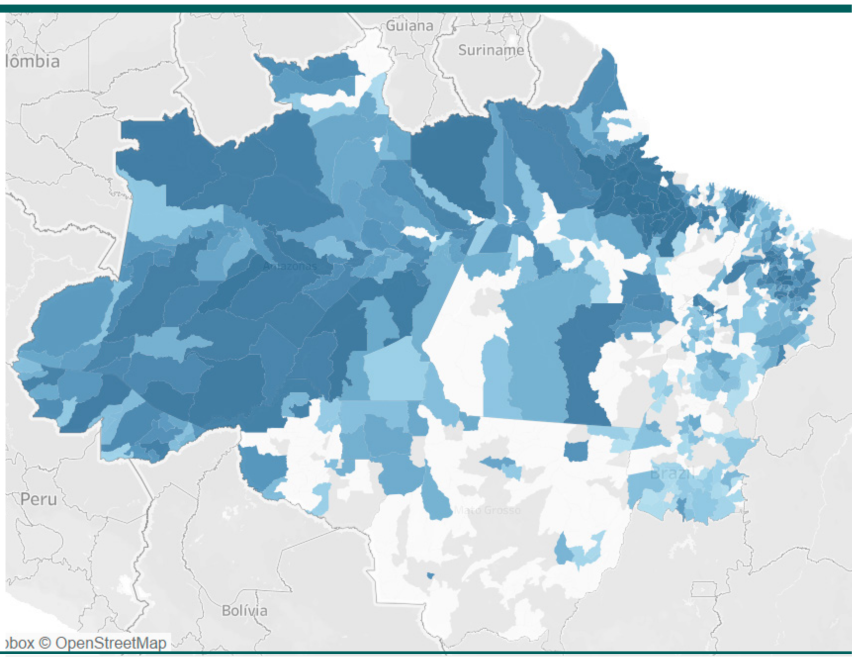


Figure 32. Plant Extraction production in the municipalities of the Legal Amazon.

Source: Prepared by the authors based on (IBGE 2017e).

and the Marajó Region, especially along the main stem of the Amazon River and its tributaries. Municipalities shaded in lighter blue, representing lower production volumes, are dispersed mainly along the southern and southeastern edges of the Amazon region, indicating areas with lower extractive intensity or reduced access to productive and logistics infrastructure.

Figure 33 complements the analysis by presenting the concentration of production of the three most-produced sociobioeconomy products in the states of the Legal Amazon—Açaí, Babassu, and Brazil Nut—demonstrating the concentrating nature of Babassu production in the state of Maranhão; for Açaí, although present throughout the region, the highest concentration is near the municipalities of Belém and the Marajó Region, in the state of Pará. As for Brazil Nut, production has concentration clusters dispersed across several municipalities in the region.

The ten largest producers are the Pará municipalities of Curralinho, Cametá, Afuá, Limoeiro do Ajuru, Breves, Muaná, Barcarena, Abaetetuba, Ponta de Pedras, and São Sebastião da Boa Vista, which together account for 56% of total municipal production, driven mainly by Açaí. Outside the state of Pará are Bacabal and São Luiz do

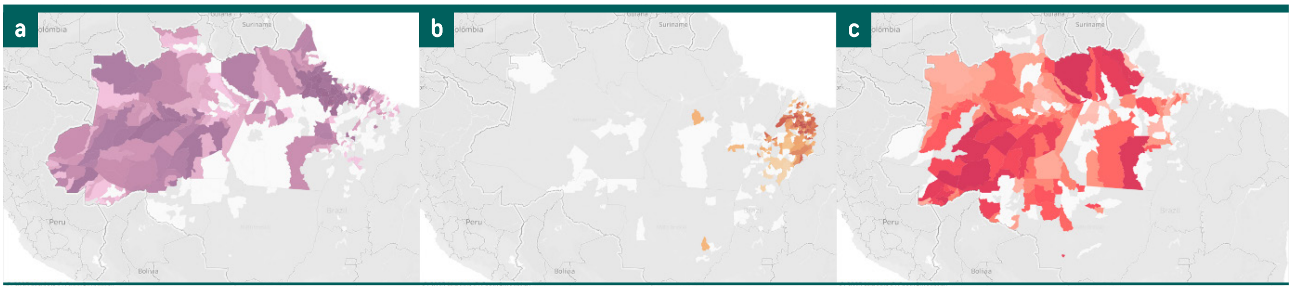


Figure 33. Concentration of the three largest extractive productions by municipality (a) Açaí, (b) Babassu, and (c) Brazil Nut (in tonnes, 2017).

Source: Prepared by the authors based on (IBGE 2017e).

Gonzaga, in Maranhão, in twelfth and thirteenth place; Mazagão and Macapá, in Amapá, in eighteenth and twentieth; and Tefé, in Amazonas, in twenty-second on the list of top-producing municipalities.

Figure 34 reinforces the previous analyses by highlighting the territorial concentration, by subdistrict, of three central products for the sociobioeconomy in the Legal Amazon: Açaí, Babassu, and Brazil Nut. While Açaí and Brazil Nut production is distributed across the entire Legal Amazon, Figure 34 (a) and (c), Babassu production is concentrated in the state of Maranhão, as detailed in Figure 34 (b).

These data reveal asymmetries in the territorial distribution of extractive production, with states highly specialized in certain products. This inequality underscores the importance of place-based strategies to strengthen the sociobioeconomy, considering local productive vocations and the structural conditions of each territory.

5.3.4 Extractive Production Nuclei and River Dependence

There are more than one thousand extractive production nuclei in the Amazon, defined as municipalities with a concentration of productive establishments characterized by high diversity and relevant production volume, with different levels of diversification. However, only 23 municipalities concentrate the production

Figure 34. Concentration of the three largest extractive productions by subdistrict (b) Açaí, (c) Babassu, and (d) Brazil Nut (in tonnes, 2017).

Source: Prepared by the authors based on (IBGE 2017e).

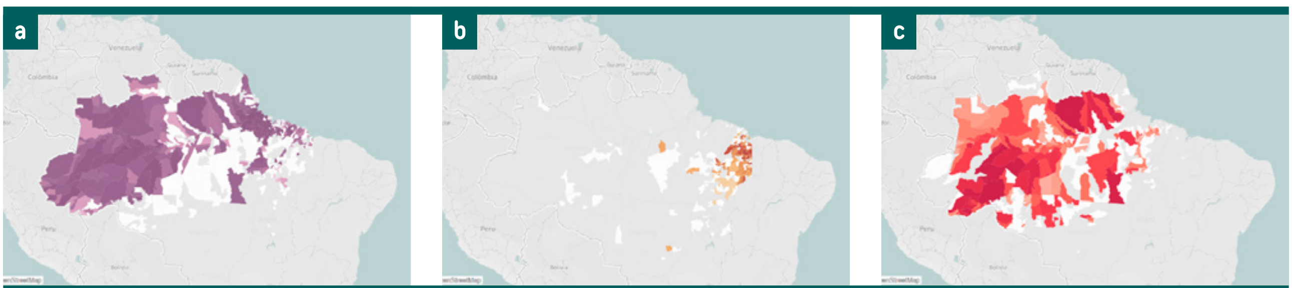


Table 5. Nuclei with the greatest diversification of Plant Extraction products.

Source: Prepared by the authors based on (IBGE 2017e).

Nº	STATE	MUNICIPALITY	PRODUCTION (tonnes)	PRODUCTS
1	Amapá	Santana	3,822	19
2	Amazonas	Borba	1,662	19
3	Pará	Cametá	46,345	18
4	Amazonas	Jutaí	1,359	17
5	Amazonas	Tabatinga	428	16
6	Pará	Mocajuba	427	16
7	Amazonas	Lábrea	1,991	15
8	Amazonas	São Gabriel da Cachoeira	1,644	15
9	Amapá	Pedra Branca do Amapari	376	15
10	Pará	Abaetetuba	16,148	14
11	Tocantins	Babaçulândia	115	14
12	Pará	Viseu	8,441	13
13	Pará	Igarapé-Mirim	6,807	13
14	Amazonas	Santa Isabel do Rio Negro	1,293	13
15	Amazonas	Tapauá	1,251	13
16	Amazonas	São Paulo de Olivença	606	13
17	Pará	Barcarena	16,608	12
18	Pará	Oriximiná	2,887	12
19	Amazonas	Nhamundá	907	12
20	Amazonas	Parintins	712	12

of 11 or more extractive products, as detailed in Table 5. Among them, the municipalities of Santana (AP) and Borba (AM) stand out, with 19 distinct products totaling 3.8 thousand tonnes and 1.7 thousand tonnes per year, respectively. Cametá (PA) and Jutaí (AM) also stand out, with 18 and 17 different products and outputs of 46.3 thousand tonnes and 1.3 thousand tonnes, respectively. The municipality of Babaçulândia (TO) is the only one outside the western and eastern regions of the Amazon to rank among the most diversified, with 15 products and 115 tonnes per year.

Despite the presence of municipalities with broad productive diversification, most nuclei are specialized in the extraction of one or two products. There are 113 nuclei with exclusive production of a single product, with the highest concentrations in Maranhão (27%), Mato Grosso (25%), and Pará (20%). By contrast, states such as Acre, Amazonas, Amapá, and Roraima have low participation in

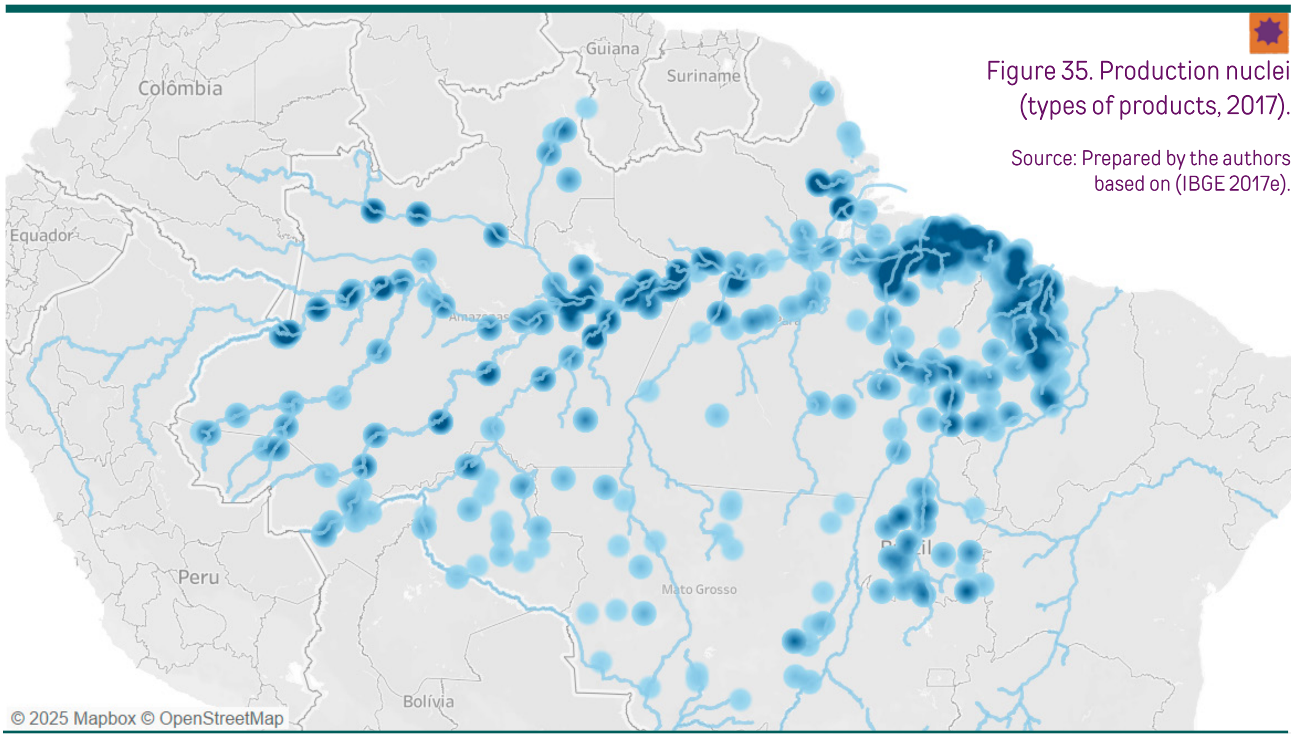


Figure 35. Production nuclei (types of products, 2017).

Source: Prepared by the authors based on (IBGE 2017e).

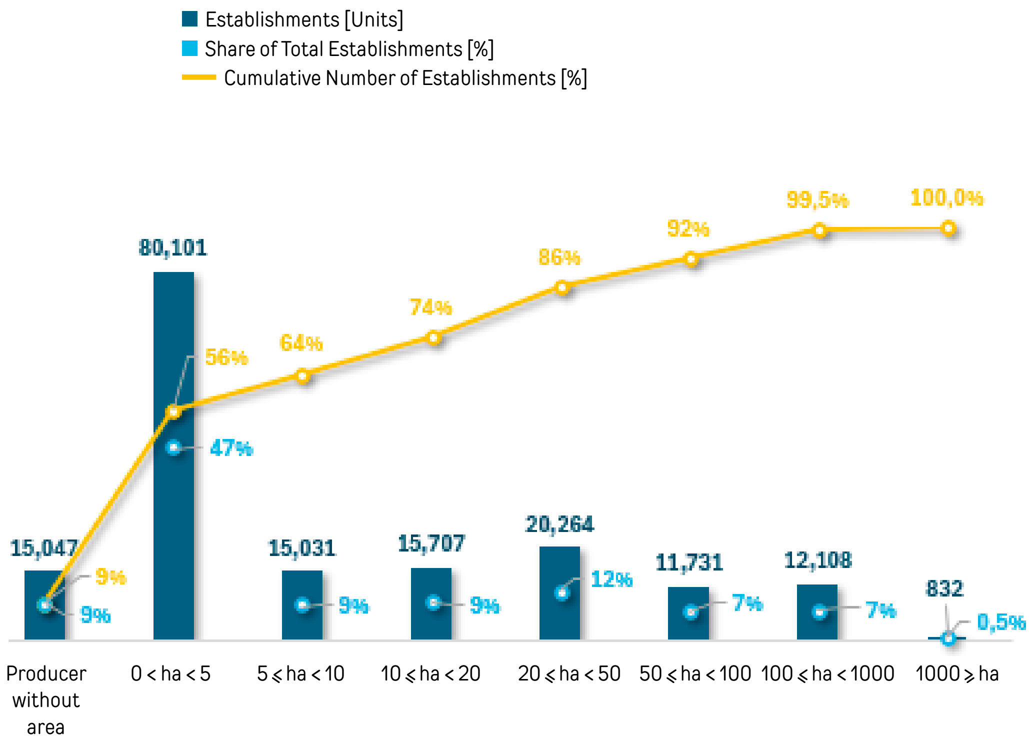
this category (1%, 2%, 3%, and 4%, respectively). Nuclei with two products total 118 units, with predominance in Maranhão (57%), Pará (16%), and Tocantins (12%), while Amazonas and Roraima account for 1% each.

The spatial analysis of Plant Extraction production in the Legal Amazon shows a strong correlation between production concentration and proximity to the main Amazon rivers, especially in the region of the mouth of the Amazon River and areas adjacent to the Atlantic Ocean. In Figure 35, it is observed that productive nuclei tend to cluster along riverbanks, represented by blue lines, while blue circles indicate areas of greater density of total production; that is, the more intense the shading, the higher the concentration of production.

This spatial distribution reflects the region's settlement and production pattern over the centuries. The Amazonian rivers have always played a central role as axes of territorial integration, enabling the movement of people, the transport of goods, and the exchange of information, especially for the outflow of extractive production and the supply of communities. In addition, access to

Figure 36. Number of productive establishments by property size in 2017.

Source: Prepared by the authors based on (IBGE 2017e).



public services is typically more present in municipal seats, which are generally located near rivers. These factors contribute to the extractive economy developing predominantly in riverside zones.

The spatial distribution of the productive nuclei presented in Figure 35 shows the tendency to concentrate along navigable waterways of the Amazon River basin and near its mouth, suggesting a strong influence of river logistics on the economic viability of transporting inputs and outflowing the production of extractive activities, especially in the states of Pará and Amapá.

5.4 DISTRIBUTION OF PRODUCTION BY PROPERTY SIZE AND ITS COMMERCIALIZATION

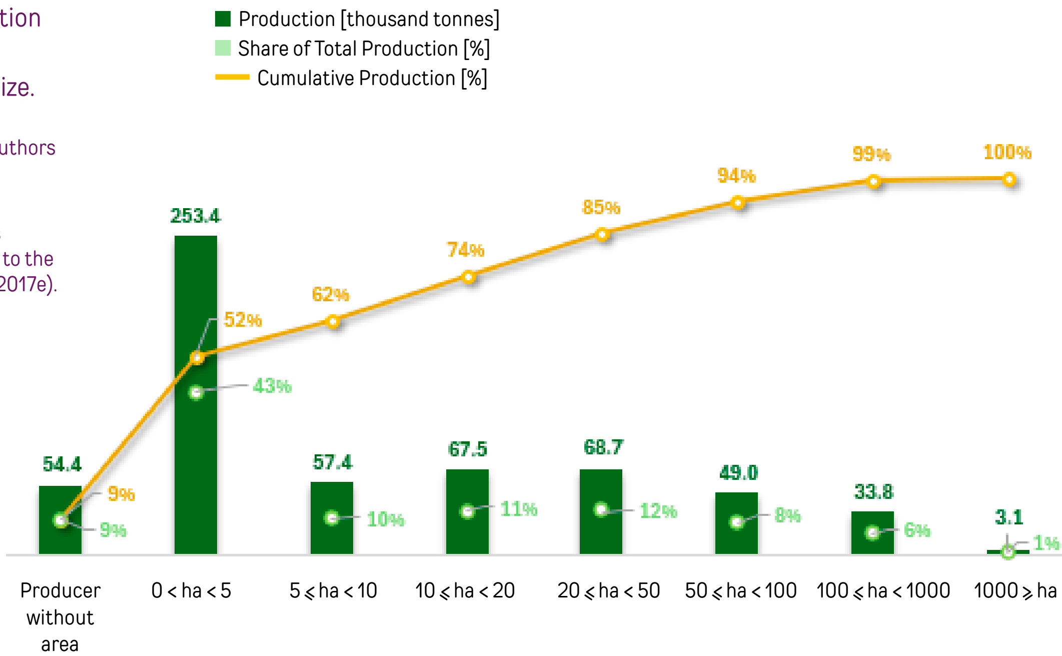
In 2017, the Legal Amazon had approximately 170 thousand productive establishments dedicated to Plant Extraction, characterized predominantly by small properties, as shown in Figure 36. The blue bars represent the absolute number of establishments by area range (property size); the light blue circles indicate each range's percentage share of the regional total; and the yellow line shows the cumulative number of establishments as area increases. It is observed that 74% of establishments have less than 20 hectares, while approximately 50% have up to 5 hectares. Establishments above 100 hectares represent only 0.5% of the total. It is also noteworthy that 9% of extractivist producers do not own land.

Figure 37 presents the distribution of production according to the size of the establishments' area, showing that most production is concentrated in small properties. Productive establishments with up to 5 hectares account for 43% of total output, totaling more than 253 thousand tonnes, representing a significant share of the total extracted in the region. Establishments with more than 1,000 hectares have a reduced participation, contributing 1% of total production, which indicates the low representativeness of large properties in the extractive sector. It stands out that 54 thousand tonnes (9%) of the total were produced by extractivists without formal land tenure, who operate in public areas, environmental reserves, and other protected areas.

Figure 37. Concentration of production by establishment area size.

Source: Prepared by the authors based on (IBGE 2017e)*.

(*) The IBGE database has 11,500 tonnes with no link to the subdivisions above (IBGE 2017e).



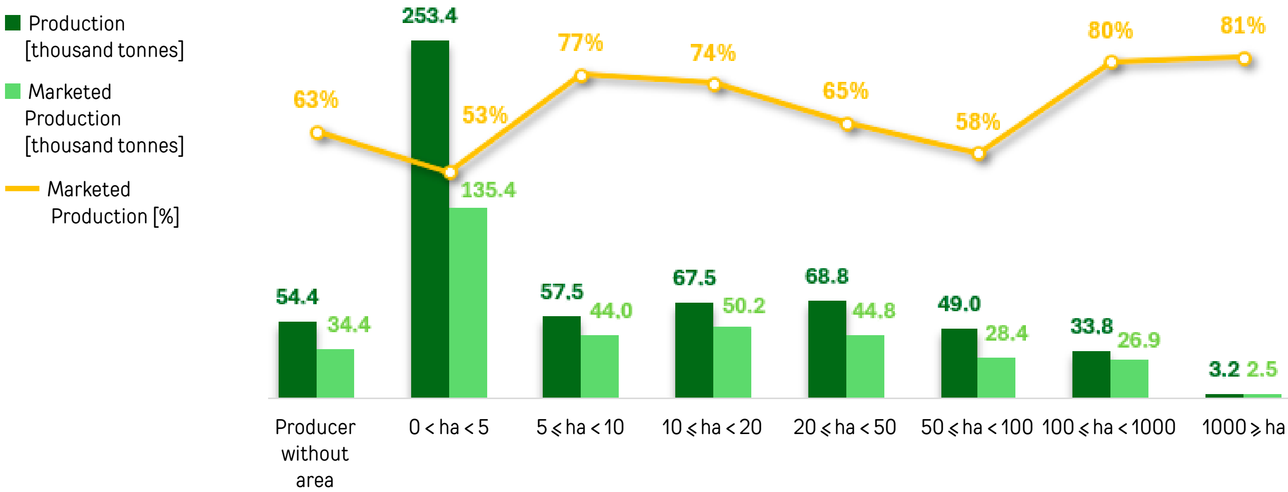


Figure 38. Concentration of production and commercialization by establishment area size (in tonnes, 2017).

Source: Prepared by the authors based on (IBGE 2017e).*

(*) The IBGE database has 11,500 tonnes with no link to the subdivisions above (IBGE 2017e).

Regarding commercialization of production, Figure 38 indicates that establishments smaller than 5 hectares market 53% of their output, retaining almost half for internal consumption, which indicates a profile geared toward subsistence and the importance of these properties for the food security of local communities. In the case of establishments with more than 100 hectares, more than 80% of production is destined for the market, suggesting a profile of greater integration into commercial and industrial chains.

These data demonstrate the predominance of small properties and Subsistence Extraction, reinforcing its importance for local income generation and for maintaining traditional production systems, which are fundamental to the region's socioeconomic development. In addition, they show the prevalence of extraction in small family units and under precarious land access conditions.

5.5 TERRITORIAL DISTRIBUTION OF EXTRACTIVIST ESTABLISHMENTS

The formulation of effective public policies to ensure access to electricity in the Legal Amazon requires, as an essential condition, detailed knowledge of the location of the region's productive establishments, especially those linked to the sociobioeconomy.

5. MAPPING PLANT EXTRACTIVISM PRODUCTION

Accurately identifying the territorial distribution of these productive units makes it possible to target investments, plan energy solutions suited to local characteristics, and guide service strategies that consider territorial realities. In this regard, the data provided by the Brazilian Institute of Geography and Statistics (IBGE), from the 2017 Agricultural Census, represent a valuable basis, as they provide information on productive establishments with different levels of geographic disaggregation—from state and municipal levels to subdistricts and census tracts.

However, to ensure the confidentiality of respondents and to respect international statistical anonymization protocols, IBGE imposes restrictions on the public release of information in territories with low establishment density. For this reason, data for subdistricts with fewer than ten establishments and municipalities with fewer than three are suppressed.

Even so, the degree of granularity available, especially in cases where technical access is possible upon justified request, enables important territorial analyses such as the identification of productive nuclei, areas with low coverage of energy infrastructure, and regions with a high concentration of extractive activities.

Incorporating this information into energy planning is essential to address territorial asymmetries and promote productive inclusion, ensuring that electricity also reaches establishments currently excluded from the Public Service, many of which are located in remote and hard-to-reach areas.

Of the roughly 170 thousand productive establishments dedicated to Plant Extraction in the Legal Amazon, the state of Pará concentrates most of these units, totaling approximately 64 thousand establishments, which represents 38% of the regional total, as illustrated in Figure 39. Next is the state of Amazonas, with about 40 thousand establishments (24%), and Maranhão, with 20%. Tocantins accounts for 8% of the total. In contrast, the lowest numbers are recorded in Mato Grosso (1.4 thousand establishments) and Rondônia (917), both with approximately 1% participation.

This distribution reveals the predominance of extractive activities in the states of Pará, Amazonas, and Maranhão, which together concentrate 82% of establishments linked to Plant Extraction in the region, reinforcing their importance for the local and regional economy and the need for specific infrastructure and access-to-energy policies.

On the other hand, the low totals observed in Mato Grosso and Rondônia may indicate a lesser extractive tradition or vocation, greater land concentration, or even underreporting of extractive activity in hard-to-reach areas or with lower census coverage. In addition, the data reinforce that the states with the highest density of establishments are also those where product diversity and the presence of traditional communities are more significant, which calls for special attention in territorial planning and energy service strategies.

Figure 39. Establishments by UF in 2017.

Source: Prepared by the authors based on (IBGE 2017e).

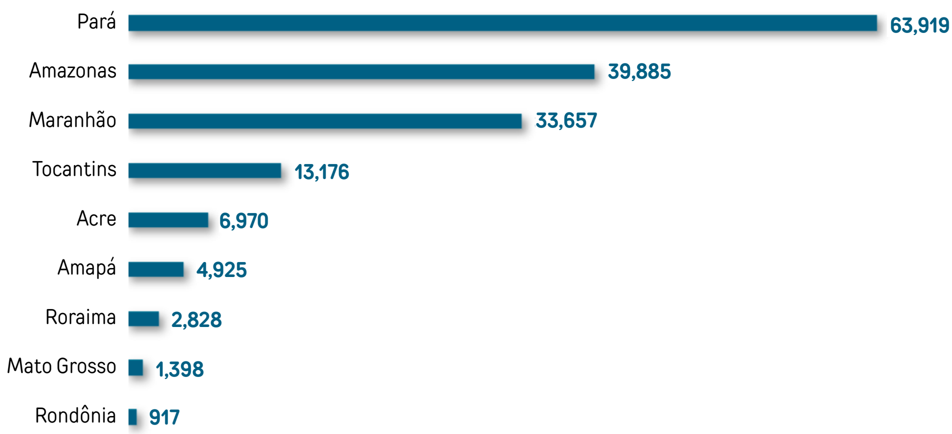


Figure 40 presents the number of subdistricts with fewer than ten establishments by state and their respective shares in total state production. Although Pará has the largest number of subdistricts with fewer than ten establishments, it has the second-lowest share of production in these locations (552 subdistricts, 1.5%), ahead only of Acre (51 subdistricts, 1.2%). Conversely, Mato Grosso concentrates more than 70% (340 subdistricts) of production in subdistricts with fewer than ten establishments, followed by Tocantins (367 subdistricts, 19.2%) and Rondônia (106 subdistricts, 11.9%).

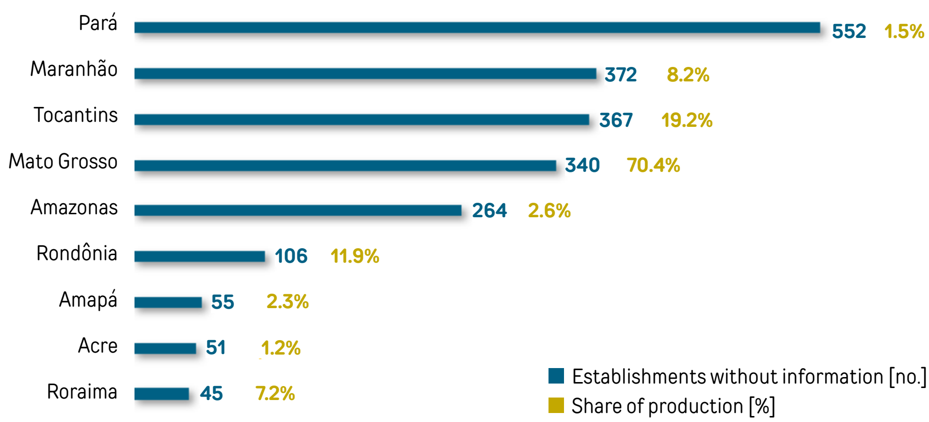
These data indicate a critical aspect for designing public policies aimed at universalizing access to electricity for productive use. In some states, such as Mato Grosso, extractive production is dispersed in areas with very low establishment density, which represents a major logistical and cost challenge for implementing conventional energy infrastructure.

In these contexts, most production is concentrated in municipalities with fewer than ten productive establishments per subdistrict, which may limit the attractiveness of deploying conventional grids, reinforcing the need for alternative technical solutions, such as decentralized and off-grid systems.

The situation observed in Mato Grosso, where 70% of extractive production occurs in contexts of low productive density, exemplifies the degree of territorial fragmentation and the im-

Figure 40. Number of municipalities with fewer than 10 establishments and percentage of productive concentration by UF in 2017.

Source: Prepared by the authors based on (IBGE 2017e).



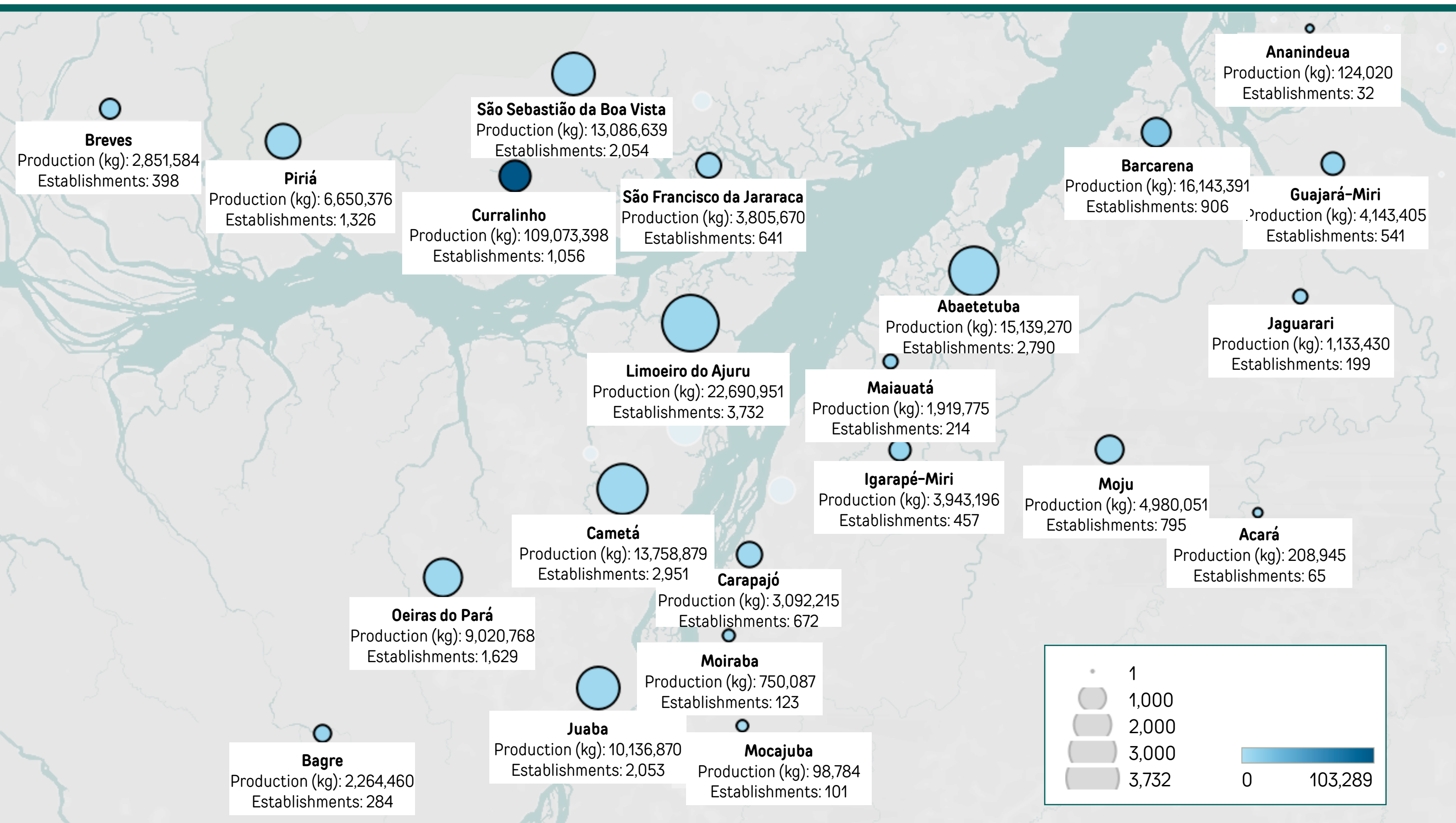
portance of electrification strategies adapted to the local reality, reinforcing that the granularity of territorial information provided by IBGE is fundamental to guide access-to-energy policies that are efficient, equitable, and territorially sensitive.

On the other hand, regarding the large number of establishments per subdistrict, Limoeiro do Ajuru (PA) stands out, with more than three thousand Açaí extractive establishments, which account for an annual production of 22.7 thousand tonnes. Despite this, the subdistrict of Curralinho (PA), with about one thousand fewer establishments, has a production almost five times higher, showing greater concentration of production per productive unit. These contrasts are illustrated in Figure 41.

Figure 41. Açaí—production and number of establishments in Pará municipalities in 2017.

Source: Prepared by the authors based on (IBGE 2017e).

KG/ESTABLISHMENTS (2)



5.6 ELECTRICAL EXCLUSION IN THE AMAZON: WHAT IBGE DATA SHOW

The use of electricity in agricultural establishments surveyed in the 2017 Agricultural Census is addressed through two questions (IBGE 2017c):

> **Seção 5, pergunta 02: Section 5, question 02:** *"Is electricity used in the establishment?"*

> **Section 30, question 01.10:** *"What was the total amount of expenses incurred in the establishment with electricity?"*

The first question allows only Yes or No answers, without detailing the source of electricity (Public Service or self-generation), its purposes (residential, productive processes, or both), or other useful information, such as intermittency; user-perceived quality; whether it meets day-to-day needs; amount used; among others. Table 6 presents the characterization of the user's perception of electricity in relation to the electricity supply service.

SOURCE OF ELECTRICITY	• Public service: electricity supplied through the official distribution grid by utilities (such as Equatorial, Energisa, Amazonas Energia, Roraima Energia, etc.). • Self-generation: electricity generated by the consumer, for example through solar panels, batteries, light engines (diesel or gasoline generators), or hybrid systems (solar + battery + generator).
PURPOSE OF ELECTRICITY USE	• Residential: used for domestic purposes (lighting, refrigerator, freezer, TV, fan, computer, mobile phone, etc.). • Productive: used for work and income generation, such as in açaí pulp machines, commercial freezers, irrigation motors, ice makers, depulpers, grinders, etc. • Both: when electricity is used both for household and productive purposes.
INTERMITTENCY	When the power supply is not continuous — that is, when it frequently fails, weakens, or turns off periodically.
QUALITY AS PERCEIVED BY THE USER	How people assess the electricity they receive: • Frequency of power outages (blackouts); • Voltage fluctuations (e.g., flickering lights); • Damage to electrical appliances; • Whether the amount of power is sufficient for daily needs (e.g., refrigeration, lighting, or production).
AMOUNT USED	The volume of electricity consumed per month. Example: 160 kWh/month (as in SIGFI systems under the Light for All Program – LPT), which may be insufficient for productive uses.

Table 6. Technical characteristics of the electricity service.

Source: Prepared by the authors based on (Ferreira et al. 2023; Silva et al. 2024).

According to the surveyed data on electricity use[6], more than 84 thousand establishments dedicated to extractive production in the region do not have access to electricity. It is not possible to identify whether the establishments with access are linked to the Public Service of electricity or whether the available electricity is used in productive processes or for residential use.

6. The database requested from IBGE on access to electricity in productive establishments consists of: identifying extractive production, production value, and electricity expenses only in establishments with electricity. The database received contains information filtered for agricultural establishments with electricity. Therefore, the comparison between the first database (focused on extractive production) and the second database (focused on electricity use) shows quantitative differences, with the first always having larger values than the second. Furthermore, another difference noted within the databases is the presence of two additional subdistricts in the database of establishments with electricity compared to the first database. The subdistricts of the homonymous municipalities Nova Monte Verde – MT and Zé Doca – MA appear in the second database but not in the first. This results in a difference in the number of rows in both bases, but it does not affect the sum of quantitative data.

Figure 42 shows the spatial distribution of these Plant Extraction-linked establishments without electricity: (a) by municipality and (b) by subdistrict.

This panorama reveals structural inequalities in access to energy, affecting not only the capacity for production, conservation, and local processing, but also opportunities for income generation, value addition, and strengthening of sociobioeconomy value chains. The high incidence of energy exclusion directly undermines the productive autonomy of extractive communities, perpetuating cycles of economic vulnerability and technological limitation.

Figure 43 shows that the state of Pará concentrates the largest number of establishments without electricity (45% of the state total), followed by Amazonas, with 26,285 non-electrified establishments (66%), and Maranhão with 17,123 (51%). Roraima, despite having an absolute number lower than several states, has 74% of establishments without access to electricity. Conversely, Tocantins has the lowest percentage of energy exclusion (19%). Mato Grosso and Rondônia, with 492 (35%) and 359 (39%), respectively, round out the list of states with the fewest establishments without electricity in the states of the Legal Amazon.

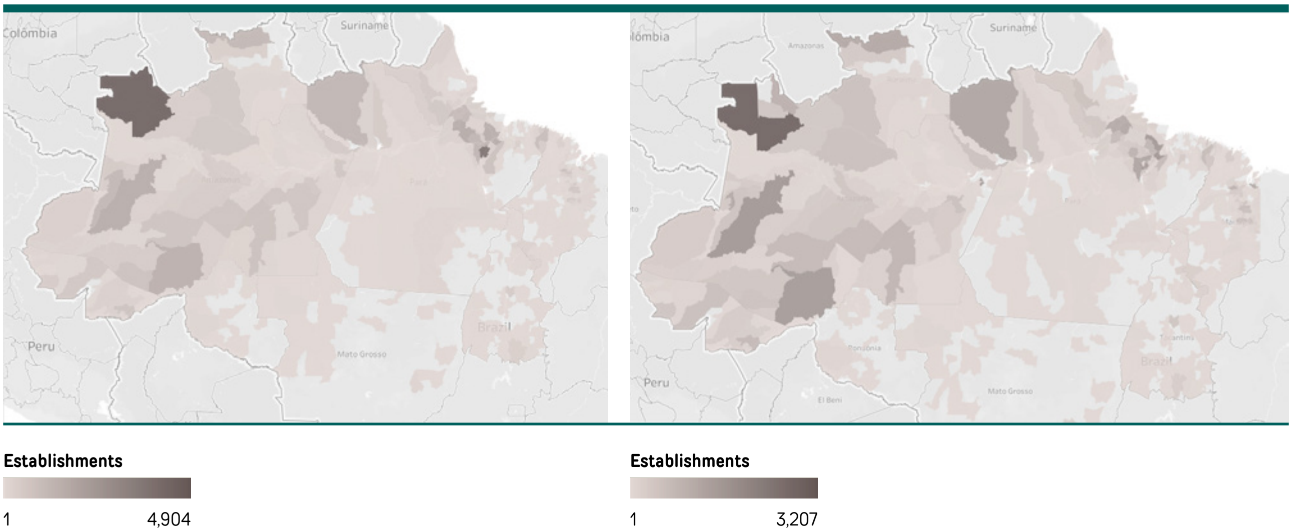


Figure 42. Concentration of productive establishments dedicated to Plant Extraction without access to electricity (a) municipal and (b) subdistrict. Source: Prepared by the authors based on (IBGE 2017e).

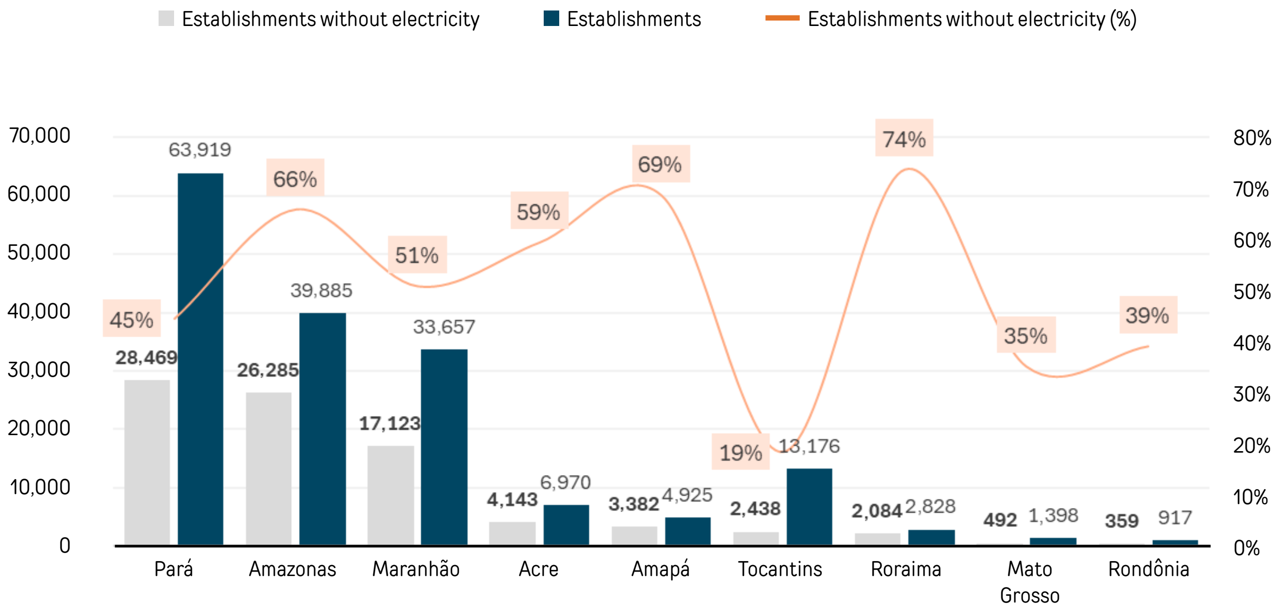


Figure 43. Number of establishments dedicated to extractive production with and without electricity by UF.
Source: Prepared by the authors based on (IBGE 2017e).

The survey makes it possible to identify the municipalities with the highest incidence of electrical exclusion, with emphasis on the municipality of São Gabriel da Cachoeira (AM), which has the largest number of extractive establishments without access to electricity: 4,904 establishments without electricity. Next is the Pará municipality of Cametá, with 4,267 unserved establishments, followed by other important productive nuclei of the Marajó Mesoregion such as Breves (1,833), Muaná (1,752), Ponta de Pedras (1,688), Limoeiro do Ajuru (1,406), and Curralinho (1,383), see Table 7.

The municipality of Abaetetuba (PA), with 1,852 non-electrified establishments, also merits attention, as it is recognized as one of the main centers for marketing sociobiodiversity products in the state. In Amazonas, in addition to São Gabriel da Cachoeira, Jutaí (1,741) and Lábrea (1,637) stand out, both located in areas with vast territorial extensions and low population density.

Figure 44 presents the quantity produced in establishments with and without access to electricity. Pará stands out with the largest absolute difference, with 284 thousand tonnes produced

Table 7. Municipalities with the highest occurrence of establishments without electricity.

Source: Prepared by the authors based on (IBGE 2017e).

STATE (UF)	MUNICIPALITY	ESTABLISHMENTS WITHOUT ELECTRIC POWER
AM	São Gabriel da Cachoeira	4,904
PA	Cametá	4,267
PA	Abaetetuba	1,852
PA	Breves	1,833
PA	Muaná	1,752
AM	Jutaí	1,741
PA	Ponta de Pedras	1,688
AM	Lábrea	1,637
PA	Limoeiro do Ajuru	1,406
PA	Curralinho	1,383

in electrified units, compared to 137 thousand tonnes in units without access to electricity, representing 67% of the state's total production in electrified units.

Maranhão, Amazonas, and Amapá also show relevant volumes in non-electrified establishments—45 thousand, 27 thousand, and 16 thousand tonnes, respectively—indicating that, despite energy limitations, these territories sustain active productive chains.

By contrast, states such as Mato Grosso, Rondônia, Roraima, and Tocantins have low production volumes in non-electrified units, which may reflect the concentration of extractive activities in areas with access to energy infrastructure.

Figure 45, in turn, shows the predominance of Açaí (fruit) among extractive products with the largest number of establishments without electricity: 33,663 establishments are in this condition, which poses a barrier to conservation and commercialization, given its high perishability and need for refrigeration. Brazil Nut (10,087 establishments) and Babassu (almond and nut, with 7,339 and 4,094 establishments, respectively) also stand out. This pattern was expected, as these products generally concentrate the largest number of productive establishments, which naturally raises the number of units in a situation of electrical exclusion.

Figure 44. Production, in tonnes, in establishments with and without electricity.

Source: Prepared by the authors based on (IBGE 2017e).

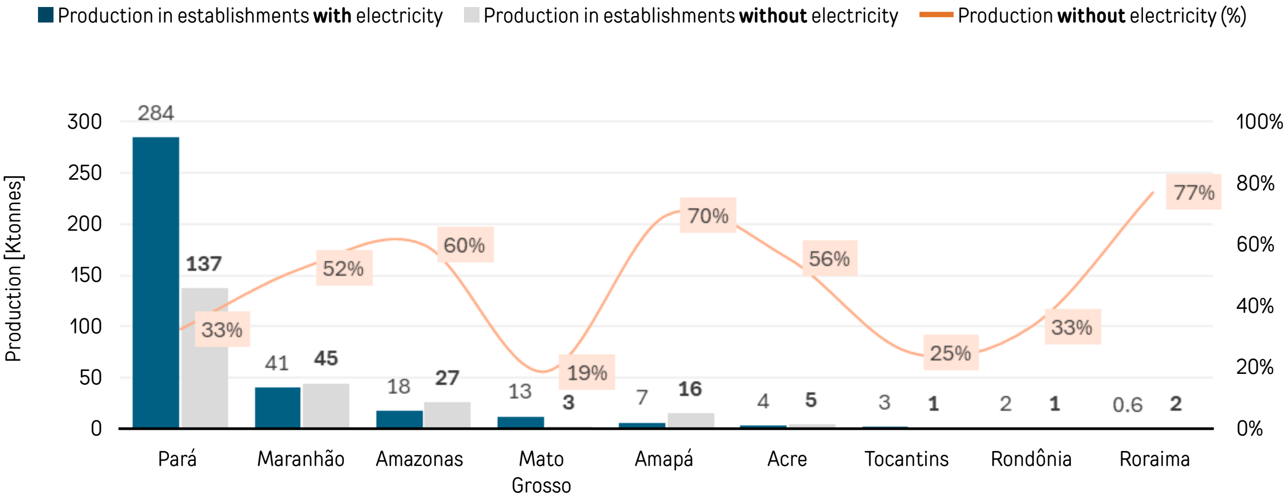
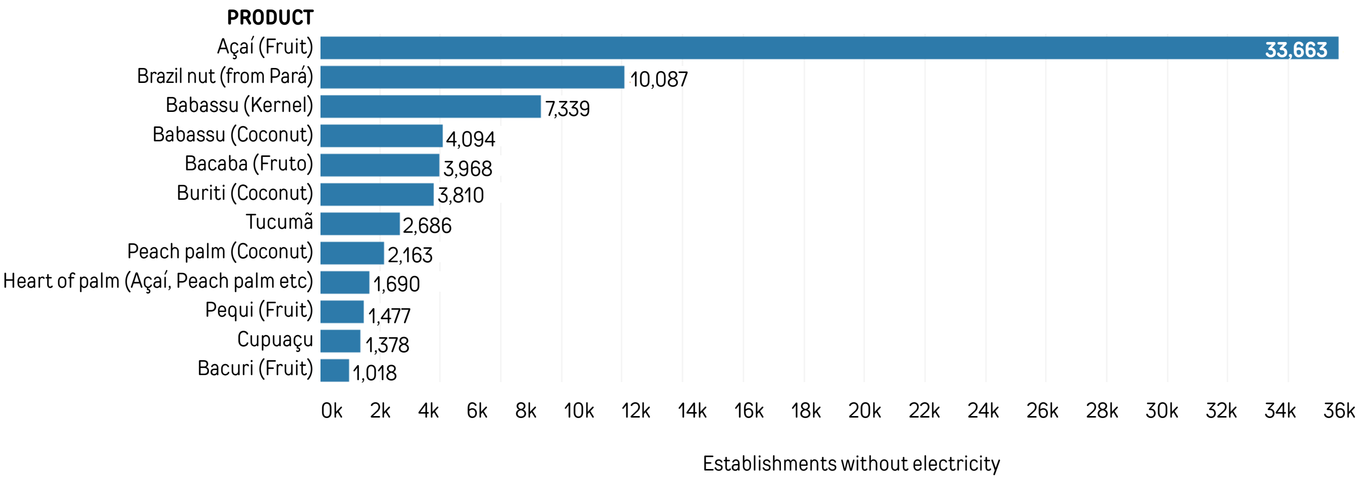


Figure 46 reveals asymmetries in access to electricity among different products. In some cases, almost all production occurs in establishments without electricity, such as Sorva (non-elastic gum) (Couma spp.), whose production rate in locations without access to the Public Service of electricity reaches 93%. Products such as Maçaranduba (non-elastic gum) (Manilkara spp.), Copaiba (oil or balsam) (Copaifera spp.), Piassava (fiber) (Attalea funifera), and Carnauba (straw powder) (Copernicia prunifera) also show high rates, with more than 80% of production occurring under conditions of energy exclusion. Other products with high percentages, between 60% and 80%, include Umbu (fruit) (Spondias tuberosa), Camu-camu (fruit) (Myrciaria dubia), jaborandi (leaf), Bacaba (fruit) (Oenocarpus bacaba), Cagaita (fruit) (Eugenia dysenterica), Babassu (almond), and Brazil Nut, reinforcing that a significant part of extractive production of almonds, fruits, and leaves occurs in contexts of precarious infrastructure.

Figure 45. Number of establishments without electricity by type of production.

Source: Prepared by the authors based on (IBGE 2017e).

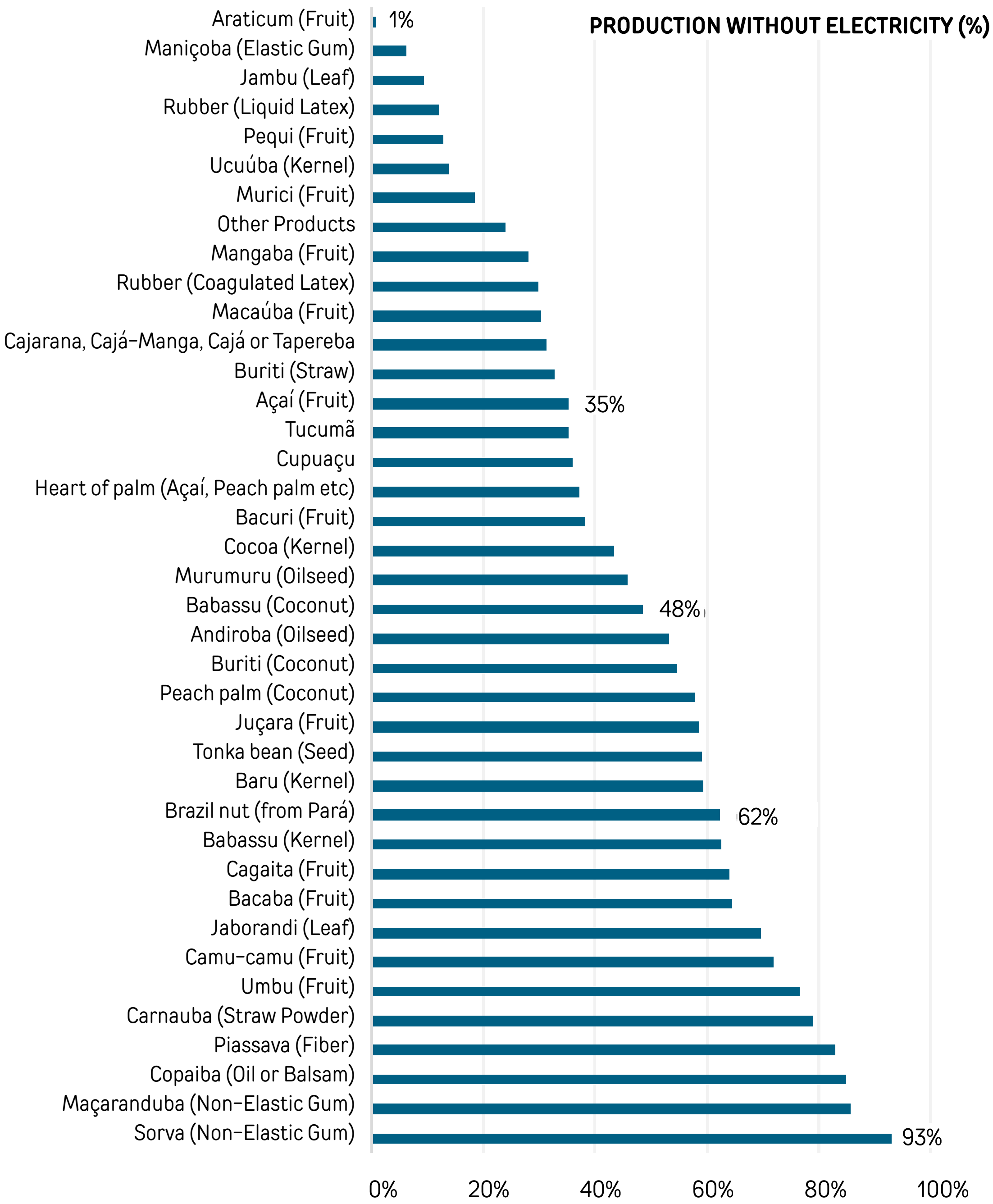


At the other extreme, products with a lower proportion of production in establishments without electricity—therefore more integrated into basic infrastructure—include Araticum (Annona crassiflora) (1%), Maniçoba (elastic gum) (Manihot glaziovii), Jambu (Acmella oleracea), rubber (liquid latex), and Pequi (Caryocar brasiliense), all with values below 10%, indicating closer proximity to grid-served centers or better insertion in areas with electrification. Overall, a trend is observed: the more specialized or traditionally artisanal the value chain (such as resins, gums, and oils extracted directly from the forest), the greater the associated electrical exclusion. This inequality shows that the very products with the greatest potential for value addition and linkage to traditional knowledge face the greatest barriers to access to electrical infrastructure, which compromises local processing, production conservation, and the productive inclusion of extractive communities.

Insufficient access to electricity in Plant Extraction in the Amazon undermines local value addition, limits productive diversification, and reinforces dependence on intermediaries, weakening the economic autonomy of extractive communities.

Figure 46. Percentage of production carried out in establishments without electricity.

Source: Prepared by the authors based on (IBGE 2017e).



6. CONCLUSIONS AND RECOMMENDATIONS

The sustainable development of the Legal Amazon requires in-depth knowledge of local realities by public policy makers at federal, state, and municipal levels. Understanding the potentials and demands of traditional, riverside, and Indigenous populations, and of small producers, is essential for the formulation of effective public policies.

Access to electricity must be understood as one of the structuring conditions for enabling this development, contributing to strengthening the sociobioeconomy and family farming, which are pillars of the region's sustainability.

Formulating public policies to guarantee this access depends, among other factors, on identifying the producers, where the productive establishments are located, what they produce, and what technical and structural limitations they face in their productive activities.

Thus, this work sought to relate the territorial distribution of Plant Extraction production in the Legal Amazon with access to Public Service electricity. It sought to verify whether the available official information makes it possible to understand electrical exclusion and guide the formulation of more effective public policies to overcome it.

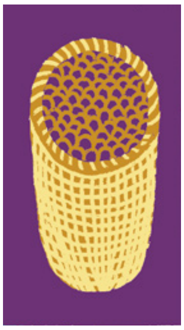
The mapping carried out revealed important gaps in the availability of data for formulating public policies for access to electricity, aimed at meeting the demands of Plant Extraction value chains in the Amazon.

IBGE data are particularly valuable because they are the only comprehensive databases available on value chains, enabling the design of specific strategies for regional development and the socioeconomic inclusion of local communities. However, although the Agricultural Census is the most comprehensive database with the widest territorial capillarity available in the country, it does not have as its central objective to support public policies for access to electricity. The mere identification of the presence or absence of electricity in establishments does not allow assessment of whether this access is adequate, continuous, sufficient, and capable of meeting productive demands.

Even so, the mapping performed made it possible to conclude that the territorial distribution of extractive production reveals high heterogeneity. In various localities of the Legal Amazon where Plant Extraction is significant, there is no adequate electricity supply. The absence of reliable electricity limits local processing and value addition to products, hindering access to more demanding markets.

Rural electrification policies still do not fully meet the needs of extractive communities, requiring specific strategies to expand access to energy in the region's isolated areas.

The current federal government program for access to electricity, the Light for All Program (LPT), focuses mainly on first access, with technical limitations in terms of power and availability of energy for productive use. This disconnect between production and infrastructure reveals the urgency of an integrated, data-driven approach, enabling the Ministry of Mines and Energy (MME), in coordination with other ministries and public institutions, to design and monitor effective electricity access policies aimed at strengthening sociobioeconomy value chains in the Amazon.



These conclusions underpin a set of recommendations structured along strategic axes, shown in Figure 47, with the objective of strengthening sociobioeconomy governance, optimizing public resources, and promoting the socioproductive inclusion of traditional populations and the sustainable development of the Legal Amazon.

Without a clear directive requiring the electricity utility (local electricity distributor) to serve these specific demands, remote and extractive regions remain on the margins of development processes.

Figure 47. Lines of Action of the recommendations.

Recognition of electricity as a structural driver of the sociobioeconomy.
Inter-institutional coordination for energy planning oriented towards the sociobioeconomy.
Redefinition of census instruments to qualify access to electricity.
Overcoming information gaps on energy infrastructure in Amazonian territories.
Revision of service parameters of the Light for All Program.
Constructive use of existing data for formulating targeted public policies.
Integration between territorial data and formulation of rural electrification public policies.
Territorial focus on identifying underserved extractive production and family farming hubs.

6.1 RECOMMENDATIONS FOR UNIVERSALIZING ACCESS TO ELECTRICITY FOR PRODUCTIVE USE IN THE SOCIOBIOECONOMY

- **Coordinating and implementing agents of sectoral development plans and programs should identify sociobioeconomy productive nuclei,** developing place-based strategies to expand access to electricity, based on evidence and precise mapping of extractive and family farming productive nuclei, prioritizing regions with high production, low electrification, and strong dependence on sociobioeconomy value chains;

- **Recognize access to electricity as a structuring vector of the sociobioeconomy's development,** formulating specific public policies for the sector, with coordinated action among sectoral ministries, federative entities, and permanent and robust financing instruments, focused on productive inclusion, combating regional inequalities, and strengthening sustainable value chains in the Legal Amazon;

- **Strengthen interinstitutional coordination for energy planning oriented to the sociobioeconomy among the Ministry of Mines and Energy (MME),** the Ministry of Planning, the Brazilian Institute of Geography and Statistics (IBGE), the Ministry of Agrarian Development and Family Farming (MDA), and the Ministry of Environment and Climate Change (MMA), promoting alignment between rural electrification public policies and the sociobioeconomy's productive demands, with integration of data systems, information exchange, and inclusion of qualified variables, considering the specificities of extractive territories in the Legal Amazon, in census and administrative instruments;

PROMOTE ALIGNMENT BETWEEN RURAL ELECTRIFICATION PUBLIC POLICIES AND THE PRODUCTIVE DEMANDS OF THE SOCIO-BIOECONOMY, WITH INTEGRATED DATA SYSTEMS, INFORMATION EXCHANGE, AND THE INCLUSION OF QUALIFIED VARIABLES.

- **Overcome information gaps on energy infrastructure in extractive and family farming territories,** using the Agricultural Census as the main tool for mapping electrical exclusion in the productive areas of the sociobioeconomy, acknowledging its current limitations and promoting its improvement with a focus on the collection and availability of georeferenced and disaggregated data, suitable for supporting territorial public policies;

- **Integrate territorial data on extractive and family farming production into energy planning,** ensuring that access-to-energy and rural electrification policies consider territories with high production density and low electrical coverage, so as to overcome structural barriers to the sustainable development of the sociobioeconomy, enabling the MME to more precisely target policies to universalize access to electricity;

- **Expand integration between IBGE databases and the processes of planning and implementing public policies,** especially through greater use of information produced by the Agricultural Census, which remains underused by various government institutions;

- **Review the technical and operational service parameters of the Light for All Program (LPT),** expanding its scope to meet energy demands linked to extractive, agroforestry, and family farming production, with sufficient, reliable electricity compatible with the requirements of productive activities. The current approach, focused on minimal residential service, is insufficient to sustain energy-intensive value chains such as Açaí, Babassu, Brazil Nut, and other high-value and perishable products; and

- **Promote a constructive approach to existing data, rather than dismissing the limitations of official data,** interpreting IBGE databases as strategic inputs for formulating intersectoral policies that integrate energy and logistics infrastructure, territorial planning, environmental conservation, and the socioproductive inclusion of traditional communities.

6.2 RECOMMENDATIONS FOR IMPROVING THE AGRICULTURAL CENSUS

STRENGTHEN IBGE'S INSTITUTIONAL CAPACITY, WITH ADEQUATE ALLOCATION OF HUMAN AND FINANCIAL RESOURCES,

- **Strengthen IBGE's institutional capacity, with adequate allocation of human and financial resources,** ensuring the continuity of censuses and annual surveys and the updating of methodologies to support socioeconomic and environmental public policies based on reliable primary data;

- **Redesign official census instruments to qualify access to energy, such as the Agricultural Census,** incorporating more detailed information with variables that qualify access to electricity in productive establishments, differentiating between formal access (Public Service provided by the local electricity utility) and functional access (Self-production), considering criteria such as installed power, regularity and quality of supply, and end use (residential, community, or productive). This redesign should take place between 2025 and 2026, the preparation period for the next Agricultural Census, which will be conducted throughout the national territory in 2027;

- **Overcome spatial limitations of annual surveys by increasing territorial granularity,** adopting methodological strategies that enable spatial disaggregation to submunicipal and census-tract levels. The restriction of annual surveys to the municipal level does not adequately capture infrastructure and production realities in remote areas or in low-density populations with vast territorial dimensions;

- **Periodically recalibrate Agricultural Census data, with an annual sampling update cycle,** similar to the methodology applied in the Continuous National Household Sample Survey (PNAD Continuous) for the Population Census, in order to capture recent dynamics of rural infrastructure and production. This strategy should be accompanied by increased territorial granularity of agricultural surveys, with disaggregation at submunicipal and census-tract levels, especially in remote areas or with low population density, in order to improve the identification of infrastructure deficits;

- **Expand active search—door-to-door collection—of producers and extractivists, both in the planning phase and in fieldwork,** with support from associations, cooperatives, and local entities, to ensure data collection and guarantee the representativeness of territories and traditional populations; and

- **Review and improve the questionnaire applied in the Agricultural Census to broaden the level of territorial disaggregation,** especially in regions with large territorial dimensions, and to include new variables related to production infrastructure, access to electricity, water, and transport, with details on the availability of electricity in establishments, distinguishing the source of supply (Public Service or self-production) and the types of end use (productive, residential, community lighting, among others). This level of detail is essential to support public policies such as the Light for All Program and initiatives to foster rural and extractive production focused on the sociobioeconomy.

REFERENCES

Abramovay, R., J. Ferreira, F. A. Costa, M. Ehrlich, A. M. C. Euler, C. E. F. Young, D. Kaimowitz, P. Moutinho, I. Nobre, H. Rogez, E. Roxo, T. Schor, and L. Villanova. 2021. "The New Bioeconomy in the Amazon: Opportunities and Challenges for a Healthy Standing Forest and Flowing Rivers." in *Amazon Assessment Report 2021*, edited by J. SACHS. New York: United Nations Sustainable Development Solutions Network.

Agência Gov. 2024. "Luz Para Todos Atinge 17,5 Milhões de Pessoas Nos 21 Anos Do Programa." *Social e Políticas Públicas*. Retrieved March 20, 2025 (https://agenciagov.ebc.com.br/noticias/202412/luz-para-todos-atinge-17-5-milhoes-de-pessoas-nos-21-anos-do-programa#:~:text=De janeiro de 2023 a,a esse serviço público essencial.).

ANP. 2025. "Levantamento de Preços de Combustíveis (Últimas Semanas Pesquisadas)." *Preços*. Retrieved August 29, 2025 (Levantamento de Preços de Combustíveis (últimas semanas pesquisadas)).

Aracaty e Silva, Michele Lins. 2023. "Bioeconomia: Uma Alternativa Para o Desenvolvimento Da Amazônia." *Cadernos Adenauer* XXIV:95–110.

BNDES. 2022. *Pronaf ABC+ Bioeconomia*. Rio de Janeiro.

Brasil. 1968. *Lei Nº 5.534 de 14 de Novembro de 1968*. Brasília.

Brasil. 2010. "Decreto Nº 7.246, de 28 de Julho de 2010."

CCEE. 2025. "Geração de Energia Elétrica." *Geração*. Retrieved August 29, 2025 (https://www.ccee.org.br/web/guest/dados-e-analises/dados-geracao).

CEAM. 2005. *Agricultura Familiar e Desenvolvimento Territorial – Contribuições Ao Debate*. edited by F. B. B. Filho. Brasília: Universidade de Brasília – UnB.

Conab. 2017. "Política de Garantia de Preços Mínimos Para Os Produtos Da Sociobiodiversidade (PGPM-Bio)." *Atuação*. Retrieved July 13, 2022 (https://www.conab.gov.br/precos-minimos/pgpm-bio).

Conab. 2022a. *Boletim Da Sociobiodiversidade*. Brasília.

Conab. 2022b. *Boletim Da Sociobiodiversidade – Junho – 2022*. Vol. 6. Brasília.

Conab. 2022c. "Preços Agropecuários." *Informações Agropecuárias*. Retrieved July 20, 2022 (https://www.conab.gov.br/info-agro/precos).

Cotag. 2024. "Agricultura Familiar e Meio Ambiente: O Papel Fundamental Para a Diminuição Do Aquecimento Global." *Dia Mundial Do Meio Ambiente*. Retrieved July 30, 2024 (https://ww2.contag.org.br/agricultura-familiar-e-meio-ambiente--o-papel-fundamental-para-a-diminuicao-do-aquecimento-global-20240605#:~:text=A agricultura familiar brasileira tem,de uma economia de carbono.).

EPE. 2025. "PASI." *Portal de Acompanhamento e Informações Dos Sistemas Isolados*. Retrieved August 20, 2025 (https://pasi.epe.gov.br/PainelInterativo).

Ferreira, André Luis, Fabio Galdino, Isis Nóbile Diniz, Ricardo Lacerda Baitelo, and Vinícius Oliveira da Silva. 2023. *Fotovoltaicos Na Amazônia Legal: Avaliação e Proposição de Políticas Públicas de Universalização de Energia Elétrica e Logística Reversa*. Maio de 2023. São Paulo. doi: 10.13140/RG.2.2.17064.65287.

Godoy, Clayton Peron Franco de, Rodolfo Dourado Maia Gomes, Vinícius Oliveira da Silva, and Alessandra Mathyas. 2024. "Energia." Pp. 66–79 in *Propostas para as Amazônias: um olhar integrado para a agenda de desenvolvimento*, edited by Uma Concertação pela Amazônia. São Paulo: Arapyaú.

Homma, Alfredo Kingo Oyama. 2014. *Extrativismo Vegetal Na Amazônia*. Brasília: Embrapa.

Hornborg, Alf. 2019. "The Money-Energy-Technology Complex and Ecological Marxism: Rethinking the Concept of 'Use-Value' to Extend Our Understanding of Unequal Exchange, Part 1." *Capitalism Nature Socialism* 30(3):27–39. doi: 10.1080/10455752.2018.1440614.

IBGE. 2010. "Resultados Do Universo – Características Da População e Dos Domicílios." *Censo Demográfico 2010*. Retrieved August 23, 2022 (https://sidra.ibge.gov.br/pesquisa/censo-demografico/demografico-2010/universo-caracteristicas-da-populacao-e-dos-domicilios).

IBGE. 2014. *Manual Técnico Pesquisas Agropecuárias Municipais Manual Técnico Pesquisas Agropecuárias Municipais*. edited by C. de Agropecuária. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística.

IBGE. 2017a. "Censo Agropecuário." *Estatísticas*. Retrieved (https://www.ibge.gov.br/estatisticas/economicas/agricultura-e-pecuaria/21814-2017-censo-agropecuario.html?=&t=sobre).

REFERENCES

IBGE. 2017b. *Manual Do Recenseador: Censo Agro 2017*. CA-1.09. Rio de Janeiro.

IBGE. 2017c. *Questionário: Censo Agropecuário 2017*. Rio de Janeiro.

IBGE. 2017d. "Tabela 6778 – Número de Estabelecimento Agropecuários, Por Tipologia, Existência de Energia Elétrica, Condição Do Produtor Em Relação Às Terras, Residência Da Pessoa Que Dirige o Estabelecimento, Grupos de Atividade Econômica e Grupos de Área Total." *Censo Agropecuário 2017*. Retrieved April 25, 2024 (https://sidra.ibge.gov.br/Tabela/6778#resultado).

IBGE. 2017e. "Tabelas." *Censo Agropecuário*. Retrieved July 20, 2022 (https://www.ibge.gov.br/estatisticas/economicas/agricultura-e-pecuaria/21814-2017-censo-agropecuario.html?=&t=resultados).

IBGE. 2018. *Pesquisas Agropecuárias*. 3rd ed. Rio de Janeiro.

IBGE. 2022. "Municipios Da Amazônia Legal." *Organização Do Território*. Retrieved July 10, 2024 (https://geoftp.ibge.gov.br/organizacao_do_territorio/estrutura_territorial/Amazônia_legal/2022/Municipios_da_Amazônia_Legal_2022.xlsx).

IBGE. 2023a. *PAM – 2023*. Rio de Janeiro.

IBGE. 2023b. "PAM – Produção Agrícola Municipal." *Agricultura, Pecuária e Outros*. Retrieved April 20, 2024 (https://www.ibge.gov.br/estatisticas/economicas/agricultura-e-pecuaria/9117-producao-agricola-municipal-culturas-temporarias-e-permanentes.html?=&t=conceitos-e-metodos).

IBGE. 2023c. "PEVS – Produção Da Extração Vegetal e Da Silvicultura." *Agricultura, Pecuária e Outros*. Retrieved April 20, 2025 (https://biblioteca.ibge.gov.br/index.php/biblioteca-catalogo#).

IBGE. 2023d. *Produção Agrícola Municipal: Culturas Temporárias e Permanentes*. Brasília.

IBGE. 2023e. *Produção Da Extração Vegetal e Da Silvicultura*. Brasília.

IBGE. 2024a. *Biomas e Sistema Costeiro-Marinho Do Brasil: Compatível Com a Escala 1:250 000*. Notas metodológicas n. 01/2024. Brasília.

IBGE. 2024b. "Censo Agropecuário 2017." *Sistema IBGE de Recuperação Automática – SIDRA*. Retrieved March 5, 2024 (https://sidra.ibge.gov.br/acervo#/S/CA/A/Q).

IBGE. 2024c. "Em 2023, Pobreza No País Cai Ao Menor Nível Desde 2012." *Síntese de Indicadores Sociais*. Retrieved January 10, 2025 (https://agenciadenoticias.ibge.gov.br/agencia-noticias/2012-agencia-de-noticias/noticias/42043-em-2023-pobreza-no-pais-cai-ao-menor-nivel-desde-2012).

IBGE. 2024d. *Padrão de Vida e Distribuição de Rendimentos*. Rio de Janeiro.

IBGE. 2024e. "Plataforma Geográfica Interativa (PGI)." *Censo Demográfico 2022*. Retrieved March 18, 2024 (https://censo2022.ibge.gov.br/apps/pgi/#/home/).

IBGE. 2024f. "PNAD Contínua – Pesquisa Nacional Por Amostra de Domicílios Contínua." *Estatísticas*. Retrieved October 20, 2024 (https://1drv.ms/x/s!AuwEBHxVU0YSnME09wEMrIEgYqG6SQ?e=34RHp9).

IBGE. 2024g. "SIDRA." *Banco de Tabelas Estatíticas*. Retrieved August 23, 2022 (https://sidra.ibge.gov.br/home/ipp/brasil).

IBGE. 2025a. "Censo Agropecuário." *Estatísticas*. Retrieved March 20, 2024 (https://www.ibge.gov.br/estatisticas/economicas/agricultura-e-pecuaria/21814-2017-censo-agropecuario.html?=&t=conceitos-e-metodos).

IBGE. 2025b. "Todas as Pesquisas e Estudos." *Estatísticas*. Retrieved March 20, 2024 (https://www.ibge.gov.br/estatisticas/todos-os-produtos-estatisticas.html).

IEI. 2022. *Universalização Do Acesso à Eletricidade No Brasil: Avaliação Dos SIGFIs e MIGDIs*. International Energy Initiative Brasil.

IEMA. 2020. *Exclusão Elétrica Na Amazônia Legal: Quem Ainda Está Sem Acesso à Energia Elétrica?* São Paulo: Instituto de Energia e Meio Ambiente (IEMA).

IPAM. 2018. *Desafios Para a Sustentabilidade Na Cadeia Do Açaí: Subsídios Para a Iniciativa Açaí Austentável*. Brasília.

Di Lascio, Marco Alfredo, and Eduardo José Fagundes Barreto. 2009. *Energia e Desenvolvimento Sustentável Para a Amazônia Rural Brasileira: Eletrificação de Comunidades Isoladas*. 1º. Brasília: Kaco Gráfica e Editora Ltda.

MAPA. 2019. *Portaria Nº 121, de 18 de Junho de 2019*. Brasília.

Mariosa, Pedro Henrique, Henrique dos Santos Pereira, Duarcides Ferreira Mariosa, Orandi Mina Falsarella, Diego de Melo Conti, and Samuel Carvalho De Benedicto. 2022. "Family Farming and Social and Solidarity Economy Enterprises in the Amazon: Opportunities for Sustainable Development." *Sustainability* 14(17):10855. doi: 10.3390/su141710855.

Martinez-Bolaños, Julio, Vinícius Silva, Mariana Zucchi, Raphael Heideier, Stefania Relva, Marco Saidel, and Eliane Fadigas. 2020. "Performance Analysis of Topologies for Autonomous Hybrid Microgrids in Remote Non-Interconnected Communities in the Amazon Region." *Sustainability* 13(1):44. doi: 10.3390/su13010044.

REFERENCES

Mathyas, Mota, Aurélio Andrade Souza, and Mauricio Andrés Rodrigues Cassares. 2018. “Energia Solar Potencializa Produção Extrativista Na Amazônia.” Pp. 1–9 in *VII Congresso Brasiliero de Energia Solar*. Gramado.

MDA. 2025. “Plano Safra 2025/2026.” *Ministério Do Desenvolvimento Agrário e Agricultura Familiar*. Retrieved August 29, 2025 (https://www.gov.br/mda/pt-br/noticias/2025/06/plano-safra-2025-2026).

Mello, Roxane, and Nelson Wellausen Dias. 2003. “Agricultura Familiar Sustentabilidade Social e Ambiental.” Pp. 1–4 in *XII Encontro Latino Americano de Iniciação Científica e VIII Encontro Latino Americano de Pós-Graduação – Universidade do Vale do Paraíba*. São José dos Campos.

MMA. 2024. “Diálogos Do Plano Nacional Da Sociobioeconomia.” *Plano Nacional Da Sociobioeconomia*. Retrieved November 30, 2024 (https://www.gov.br/mma/pt-br/composicao/sbc/dpeb/plano-nacional-da-sociobioeconomia/dialogos-do-plano-nacional-da-sociobioeconomia).

MMA. 2025. *Plano Nacional Da Sociobioeconomia*. Brasília.

MME. 2024. “Programa Nacional de Universalização Do Acesso e Uso Da Energia Elétrica: Manual de Operacionalização Do Programa Luz Para Todos.” 45.

MME. 2025. “Luz Para Todos.” *Cojunto de Dados*. Retrieved March 20, 2025 (https://dadosabertos.mme.gov.br/dataset/luz-para-todos).

OCDE. 2009. *The Bioeconomy to 2030: Designing a Policy Agenda*. Paris: OECD.

Ollinaho, Ossi I., and Markus Kröger. 2023. “Separating the Two Faces of ‘Bioeconomy’: Plantation Economy and Sociobiodiverse Economy in Brazil.” *Forest Policy and Economics* 149:102932. doi: 10.1016/j.forpol.2023.102932.

ONS. 2025. “Evolução Da Capacidade Instalada No SIN - Agosto 2025/Dezembro 2029.” *O Sistema Em Números*. Retrieved August 29, 2025 (https://www.ons.org.br/paginas/sobre-o-sin/o-sistema-em-numeros).

PNUD. 2024. “Índice de Desenvolvimento Humano Municipal.” *Painel IDHM: Base de Dados (Csv)*. Retrieved March 19, 2024 (https://www.undp.org/sites/g/files/zskgke326/files/2023-07/base_de_dados.xlsx).

PSA. 2025. “Água e Saneamento.” *Saúde Comunitária*. Retrieved April 19, 2025 (https://saudeealegria.org.br/saude-comunitaria/agua-e-saneamento/).

Da Silva Júnior, Daniel Melo, Fernanda Cristina Wiebusch Sindelar, Liana Johann, and Elisete Maria De Freitas. 2023. “Avaliação Das Condições Socioeconômicas Da Reserva Extrativista Do Rio Cajari/AP.” *Revista de Gestão Social e Ambiental* 17(2):e03199. doi: 10.24857/rgsa.v17n2-017.

Silva, Lindomar de Jesus de Souza, Gilmar Antônio Meneguetti, José Pinheiro, Elizângela Carneiro, and Bruna Pereira. 2018. *Extrativismo: Reflexões a Partir Da Realidade Socioeconômica Das Comunidades Coletoras de Castanha-Do-Brasil de Tefé, AM*. Mamaus.

Silva, Vinícius Oliveira da. 2022. “Como Inserir Recursos Energéticos Importados No Planejamento Energético Nacional? Modelo de Determinação de Recursos Energéticos Para a Integração Energética Transnacional.” Universidade de São Paulo, São Paulo.

Silva, Vinicius Oliveira da, Stefania Gomes Relva, Miguel Edgar Molares Udaeta, André Luiz Veiga Gimenes, and Drielli Peyerl. 2021. “Challenges and Uncertainties of Sustainable Development in Electrical Planning: A Brazilian Approach.” *ENERLAC. Revista de Energía de Latinoamérica y El Caribe* 5(1):50–75.

Silva, Vinícius Oliveira da, Fabio Galdino dos Santos, Isis Nóbile Diniz, Ricardo Lacerda Baitelo, and André Luis Ferreira. 2024. “Photovoltaic Systems, Costs, and Electrical and Electronic Waste in the Legal Amazon: An Evaluation of the Luz Para Todos Program.” *Renewable and Sustainable Energy Reviews* 203(November 2023):114721. doi: 10.1016/j.rser.2024.114721.

Torres, Juliana Martins. 2020. “Avaliação Do Resultado Da Política de Garantia de Preços Mínimos Para Os Produtos Da Sociobiodiversidade (PGPM-Bio) No Combate à Pobreza.” Escola Nacional de Administração Pública - Enap.

Uma Concertação pela Amazônia. 2024. *Propostas Para as Amazônias: Um Olhar Integrado Para a Agenda de Desenvolvimento*. edited by Arapyaú. São Paulo: Uma Concertação pela Amazônia.

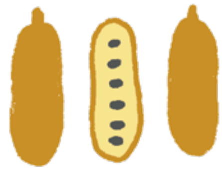
WWF-Brasil. 2025. “Conheça o Arpa.” *Program Arpa*. Retrieved May 15, 2025 (https://www.wwf.org.br/natureza_brasileira/areas_prioritarias/Amazônia1/nossas_solucoes_na_Amazônia/areas_protegidas_na_Amazônia/arpa/).

WWF. 2024. “Inside the Amazon.” *About the Amazon*. Retrieved March 13, 2024 (https://wwf.panda.org/discover/knowledge_hub/where_we_work/amazon/about_the_amazon/).

APPENDIX I

Table 8. Permanent and temporary crops, Plant Extraction, and forestry products monitored by the Agricultural Census, PAM, and PEVS in the Legal Amazon.

Source: Prepared by the authors based on (IBGE 2024g).



PERMANENT CROPS

1. Orange
2. Banana
3. Arabica coffee (green bean)
4. Apple
5. Coconut
6. Oil palm (dendê)
7. Grape (for wine or juice)
8. Papaya
9. Lemon
10. Mango
11. Canephora coffee (robusta/conilon) (green bean)
12. Tangerine, bergamot, mandarin
13. Table grape
14. Açaí (fruit)
15. Passion fruit
16. Yerba mate
17. Cocoa (kernel)
18. Avocado
19. Guava
20. Peach
21. Mulberry (leaf)
22. Heart of palm
23. Rubber (coagulated latex)
24. Persimmon
25. Other products
26. Acerola (Barbados cherry)
27. Cashew nut
28. Black pepper
29. Plum
30. Cashew fruit
31. Agave, sisal (fiber)
32. Cupuaçu
33. Pear
34. Agave, sisal (leaf)
35. Peach palm (pupunha, fruit bunch)
36. Sugar apple
37. Annatto (seed)
38. Soursop
39. Fig
40. Rubber (liquid latex)
41. Kiwi
42. Lychee
43. Atemoya
44. Lime
45. Nectarine
46. Jackfruit
47. Jabuticaba
48. Mulberry (fruit)
49. Starfruit
50. Walnut (European, pecan)
51. Tea (Camellia sinensis)
52. Guaraná
53. Clove (Syzygium aromaticum)
54. Pitaya (dragon fruit)
55. Olive
56. Bay leaf (Laurus nobilis)
57. Loquat
58. Pomegranate
59. Surinam cherry
60. Rose apple
61. Camu-camu (fruit)
62. Tree cotton
63. Grape seedling
64. Other permanent crop seedling
65. Papaya seedling
66. Citrus seedling (orange, lemon, tangerine, etc.)
67. Coconut seedling
68. Cashew seedling
69. Coffee seedling
70. Cocoa seedling

PLANT EXTRACTION

1. Açaí (fruit)
2. Andiroba (seed)
3. Araticum (fruit)
4. Babassu (coconut)
5. Babassu (kernel)
6. Bacaba (fruit)
7. Bacuri
8. Baru (kernel)
9. Rubber (liquid latex)
10. Rubber (coagulated latex)
11. Buriti (coconut)
12. Buriti (straw)
13. Butiá (fiber)
14. Cocoa (kernel)
15. Cagaita (fruit)
16. Cajarana
17. Camu-camu (fruit)
18. Carnauba (wax)
19. Carnauba (powdered straw)
20. Angico bark
21. Brazil nut
22. Caucho (natural rubber gum)
23. Copaíba (oil)
24. Cumaru (seed)
25. Cupuaçu
26. Yerba mate
27. Ipecac (root)
28. Jaborandi (leaf)
29. Jambu (leaf)
30. Juçara (fruit)
31. Licuri (kernel)
32. Licuri (wax)
33. Maçaranduba (non-elastic gum)
34. Macaúba (fruit)
35. Mangaba (fruit)
36. Maniçoba (elastic gum)
37. Murici
38. Murumuru (seed)
39. Heart of palm
40. Oiticica (seed)
41. Pequi (fruit)
42. Piassava (fiber)
43. Araucaria seed (pinhão)
44. Peach palm (coconut)
45. Sorva (non-elastic gum)
46. Ucuuba (kernel)
47. Umbu
48. Other products
49. Tucumã

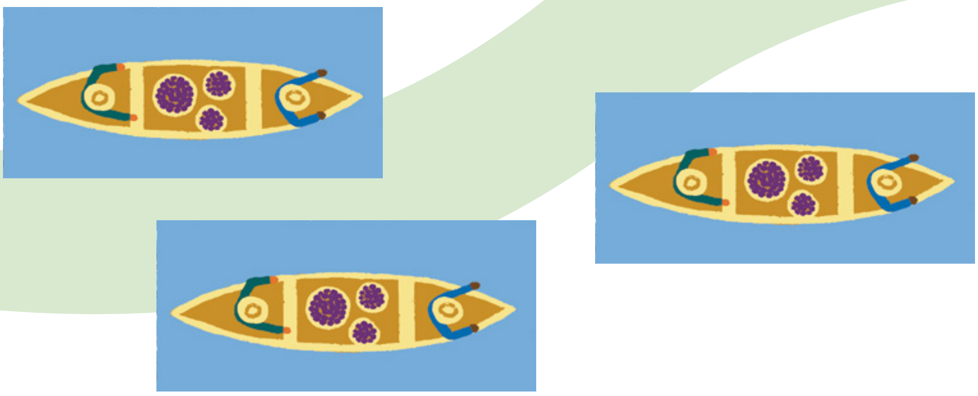
APPENDIX I

TEMPORARY CROPS

1. Pumpkin, winter squash
2. Upland cotton
3. Garlic
4. Peanut (in shell)
5. Rice (paddy)
6. White oats (grain)
7. Potato
8. Sugarcane
9. Onion
10. Rye (grain)
11. Barley (grain)
12. Rapeseed (colza)
13. Pea (grain)
14. Fava bean (grain)
15. Black bean (grain)
16. Colored bean (grain)
17. Cowpea (grain)
18. Green bean
19. Tobacco (dried leaf)
20. Sesame
21. Sunflower
22. Jute
23. Flax
24. Mallow
25. Castor bean
26. Cassava (manioc)
27. Watermelon
28. Melon
29. Maize (grain)
30. Ramie
31. Soybean (grain)
32. Sorghum (grain)
33. Broom sorghum
34. Processing tomato
35. Wheat (grain)
36. Black wheat (grain)
37. Triticale (grain)
38. Forage crops for cutting
39. Forage sugarcane
40. Forage maize
41. Forage cactus
42. Forage sorghum
43. Other products
44. Cotton seed
45. Rice seed
46. Bean seed
47. Maize seed
48. Soybean seed
49. Wheat seed
50. Forage seed
51. Potato seed tuber
52. Sugarcane cutting
53. Seed and other propagation material for other products

SILVICULTURE

1. Firewood
2. Logs for paper production
3. Logs for other purposes



APPENDIX II

Table 9. Organizations that participated in the interviews and workshops.

The list includes only the names of the key organizations whose members participated in the interviews, without mentioning the names of specialists, directorates, or secretariats. Some organizations contributed representatives from different secretariats and directorates, either in the same interview or in separate interviews. Others informed that they did not have data available but still participated in the discussions with the IEMA team.

Nº	ACRONYM	NAME
1	---	Amazônia 2030
2	BNDES	Brazilian Development Bank (BNDES)
3	CIAMA	Development Company of Amazonas State (CIAMA)
4	CNS	National Council of Extractivist Populations (CNS)
5	COIAB	Coordination of Indigenous Organizations of the Brazilian Amazon (COIAB)
6	CONAQ	National Coordination for the Articulation of Black Rural Quilombola Communities (CONAQ)
7	CPI	Climate Policy Initiative (CPI)
8	---	eAmazônia – Sustainable Energy and Innovation
9	EMBRAPA	Brazilian Agricultural Research Corporation (EMBRAPA)
10	ENBPar	Brazilian Company of Nuclear and Binational Energy (ENBPar)
11	EPE	Energy Research Office (EPE)
12	---	Greenpeace Brazil
13	IBGE	Brazilian Institute of Geography and Statistics (IBGE)
14	ICMBio	Chico Mendes Institute for Biodiversity Conservation (ICMBio)
15	IDAM	Institute for Sustainable Agricultural, Livestock and Forestry Development of Amazonas State (IDAM)
16	INCRA	National Institute of Colonization and Agrarian Reform (INCRA)
17	ISA	Socioenvironmental Institute (ISA)
18	---	Mamirauá Institute for Sustainable Development
19	MDA	Ministry of Agrarian Development and Family Farming (MDA)
20	MDICS	Ministry of Development, Industry, Trade and Services (MDIC)
21	MMA	Ministry of Environment and Climate Change (MMA)
22	MME	Ministry of Mines and Energy (MME)
23	SEAF-MT	State Secretariat of Family Farming of Mato Grosso (SEAF-MT)
24	SEMA-AM	State Secretariat of Environment of Amazonas (SEMA-AM)
25	SEMA-AP	State Secretariat of Environment of Amapá (SEMA-AP)
26	SEPROR	State Secretariat of Rural Production of Amazonas (SEPROR)
27	SUDAM	Superintendency of Development for the Amazon (SUDAM)
28	UENP	State University of Northern Paraná (UENP)
29	UFAC	Federal University of Acre (UFAC)
30	UFAM	Federal University of Amazonas (UFAM)
31	UFOPA	Federal University of Western Pará (UFOPA)
32	UFPA	Federal University of Pará (UFPA)
33	UFRA	Federal Rural University of the Amazon (UFRA)
34	---	Amazon Concertation
35	UNIFESSPA	Federal University of the South and Southeast of Pará (UNIFESSPA)
36	UNIR	Federal University of Rondônia (UNIR)
37	USP	University of São Paulo (USP)
38	WWF-Brasil	WWF-Brazil (WWF-Brasil)

APPENDIX III

Table 10. Organizations that participate in the PAM.

Source: Prepared by the authors based on (IBGE 2023d).

Nº	REGION	ACRONYM	NAME
1	Federal	IBGE	Research Directorate, Information Technology Directorate and State Supervisors of the Brazilian Institute of Geography and Statistics
2	Acre	BASA/AC	Bank of Amazon
3	Acre	BB/AC	Bank of Brazil
4	Acre	CONAB/AC	National Supply Company
5	Acre	EMBRAPA/AC	Brazilian Agricultural Research Corporation
6	Acre	EMATER/AC	Company for Technical Assistance and Rural Extension of Acre State
7	Acre	FAEAC	Federation of Agriculture and Livestock of Acre State
8	Acre	IDAF/AC	Institute for Agricultural and Forestry Defense of Acre
9	Acre	INCRA/AC	National Institute of Colonization and Agrarian Reform
10	Acre	Sefaz/AC	State Secretariat of Finance
11	Acre	Seplan/AC	State Secretariat of Planning and Management
12	Acre	SFA/AC	State Secretariat of Production and Agribusiness
13	Acre	SEMPRO/AC	Municipal Secretariats of Production
14	Acre	STTR/AC	Rural Workers Union
15	Acre	SFA/AC	Federal Superintendency of Agriculture
16	Amapá	DIAGRO	Agency for Agricultural and Livestock Defense and Inspection of Amapá State
17	Amapá	Agência Amapá	Agency for Economic Development of Amapá
18	Amapá	BASA/AP	Bank of Amazon
19	Amapá	BB/AP	Bank of Brazil
20	Amapá	CPAF/AP	Agroforestry Research Center of Amapá
21	Amapá	CONAB/AP	National Supply Company
22	Amapá	FAEAP	Federation of Agriculture and Livestock of Amapá State
23	Amapá	RURAP	Institute for Rural Development of Amapá
24	Amapá	IEPA	Institute of Studies and Research of Amapá State
25	Amapá	Amapá Terras	Institute of Land of Amapá State
26	Amapá	INCRA/AP	National Institute of Colonization and Agrarian Reform
27	Amapá	SDR/AP	State Secretariat of Rural Development
28	Amapá	SEMA/AP	State Secretariat of Environment
29	Amapá	SEPLAN/AP	State Secretariat of Planning
30	Amapá	SEMTRADI/AP	Municipal Secretariat of Labor, Economic Development and Innovation
31	Amapá	SENAR/AP	National Rural Learning Service
32	Amapá	SFA/AP	Federal Superintendency of Agriculture
33	Amazonas	ADS	Agency for Sustainable Development of Amazonas

34	Amazonas	ADAF	Agency for Agricultural, Livestock and Forestry Defense of Amazonas State
35	Amazonas	AFEAM	Agency for Development of Amazonas State
36	Amazonas	BASA/AM	Bank of Amazon
37	Amazonas	CEPLAC	Executive Commission of the Cocoa Farming Plan
38	Amazonas	CONAB/AM	National Supply Company
39	Amazonas	EMBRAPA/AM	Brazilian Agricultural Research Corporation
40	Amazonas	FAEA/AM	Federation of Agriculture and Livestock of Amazonas State
41	Amazonas	IDAM	Institute for Sustainable Agricultural, Livestock and Forestry Development of Amazonas State
42	Amazonas	MAPA/AP	Ministry of Agriculture and Livestock
43	Amazonas	SEPROR/AM	State Secretariat of Rural Production
44	Amazonas	SEDECTI/AMV	State Secretariat of Planning, Development, Science, Technology and Innovation
45	Amazonas	SEMA/AM	State Secretariat of Environment
46	Amazonas	OCB/AM	Union and Organization of Cooperatives of Amazonas State
47	Amazonas	SUFRAMA	Superintendency of the Manaus Free Trade Zone
48	Amazonas	UFAM	Federal University of Amazonas
49	Maranhão	AGED	State Agency for Agricultural and Livestock Defense of Maranhão
50	Maranhão	AGERP	State Agency for Agricultural Research and Rural Extension of Maranhão
51	Maranhão	BB/MA	Bank of Brazil
52	Maranhão	BNB/MA	Bank of Northeast Brazil
53	Maranhão	CONAB/MA	National Supply Company
54	Maranhão	EMBRAPA Cocais	Brazilian Agricultural Research Corporation
55	Maranhão	FAEMA	Federation of Agriculture and Livestock of Maranhão State
56	Maranhão	IMESC	Maranhão Institute of Socioeconomic and Cartographic Studies
57	Maranhão	SAGRIMA/MA	State Secretariat of Agriculture and Supply
58	Maranhão	SAF/MA	State Secretariat of Family Farming
59	Maranhão	SFA/MA	Federal Superintendency of Agriculture
60	Mato Grosso	AMPA	Mato Grosso Association of Cotton Producers
61	Mato Grosso	CONAB/MT	National Supply Company
62	Mato Grosso	EMPAER/MT	Mato Grosso Company for Research, Assistance and Rural Extension
63	Mato Grosso	INDEA-MT	Institute for Agricultural and Livestock Defense of Mato Grosso State
64	Mato Grosso	IMEA	Mato Grosso Institute of Agricultural Economics
65	Pará	ADEPARÁ	Agency for Agricultural and Livestock Defense of Pará State
66	Pará	APROSOJA Pará	Association of Soy, Corn and Rice Producers of Pará State
67	Pará	CEPLAC	Executive Commission of the Cocoa Farming Plan
68	Pará	EMATER/PA	Company for Technical Assistance and Rural Extension of Pará State
69	Rondônia	IDARON	Agency for Agrosilvopastoral Health Defense of Rondônia State
70	Rondônia	CONAB	National Supply Company

71	Rondônia	EMBRAPA/RO	Brazilian Agricultural Research Corporation
72	Rondônia	EMATER-RO	Autonomous Entity for Technical Assistance and Rural Extension of Rondônia State
73	Rondônia	Kanindé	Kanindé Ethno-environmental Defense Association
74	Rondônia	OSR	Organization of Rubber Tappers of Rondônia State
75	Rondônia	SEAGRI/RO	State Secretariat of Agriculture
76	Roraima	ADERR	Agency for Agricultural and Livestock Defense of Roraima
77	Roraima	CONAB	National Supply Company
78	Roraima	EMBRAPA/RR	Brazilian Agricultural Research Corporation
79	Roraima	FAERR	Federation of Agriculture and Livestock of Roraima
80	Roraima	SEAPA/RR	State Secretariat of Agriculture, Livestock and Supply
81	Roraima	SEPLAN/RR	State Secretariat of Planning and Development
82	Roraima	STTR	Rural Workers Union of Boa Vista
83	Roraima	SFA/RR	Federal Superintendency of Agriculture
84	Tocantins	ADAPEC	Agency for Agricultural and Livestock Defense of Tocantins State
85	Tocantins	UniCatólica	Catholic University Center of Tocantins
86	Tocantins	CONAB	National Supply Company
87	Tocantins	EMBRAPA/TO	Brazilian Agricultural Research Corporation
88	Tocantins	FAET/SENAR	Federation of Agriculture and Livestock of Tocantins State
89	Tocantins	RURALTINS	Institute for Rural Development of Tocantins State
90	Tocantins	NATURATINS	Tocantins Nature Institute
91	Tocantins	SEAGRO/TO	State Secretariat of Agriculture, Livestock and Aquaculture
92	Tocantins	Seplan/TO	State Secretariat of Planning and Budget

Table 11. Organizations that participate in the PEVS.

Source: Prepared by the authors based on (IBGE 2023d).

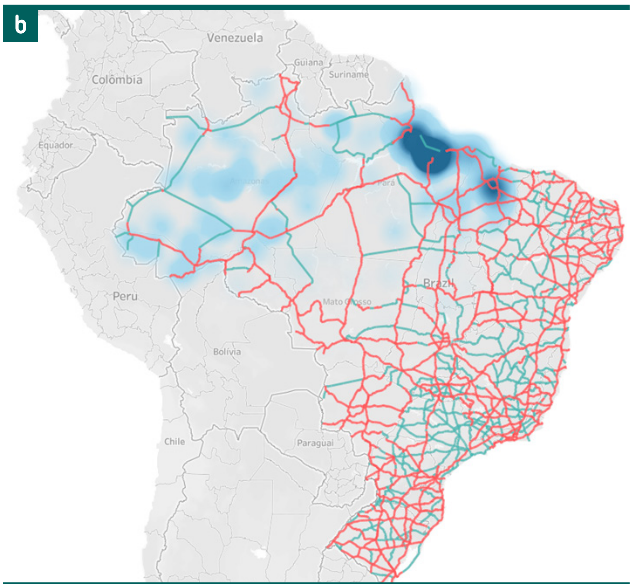
Nº	REGION	ACRONYM	NAME
1	Federal	IBGE	Research Directorate, Information Technology Directorate and State Supervisors of the Brazilian Institute of Geography and Statistics
2	Federal	BCB	Central Bank of Brazil
3	Federal	BB	Bank of Brazil
4	Federal	CONAB	National Supply Company
5	Federal	EMBRAPA	Brazilian Agricultural Research Corporation
6	Federal	IBAMA	Brazilian Institute of Environment and Renewable Natural Resources
7	Federal	ICMBio	Chico Mendes Institute for Biodiversity Conservation
8	Federal	INCRA	National Institute of Colonization and Agrarian Reform
9	Federal	MAPA	Ministry of Agriculture and Livestock
10	Federal	MDA	Ministry of Agrarian Development and Family Farming
11	Federal	MDIC	Ministry of Development, Industry, Trade and Services
12	Federal	MPO	Ministry of Planning and Budget
13	Federal	MDH	Ministry of Human Rights and Citizenship
14	Federal	SEBRAE	Brazilian Service for Support to Micro and Small Enterprises
15	Federal	SFA	Federal Superintendency of Agriculture
16	Acre	COOPERACRE	Central Cooperative for Extractive Commercialization of Acre
17	Acre	IMAC	Institute of Environment of Acre
18	Acre	SFA/AC	State Secretariat of Agriculture
19	Acre	Sefaz/AC	State Secretariat of Finance
20	Amapá	DIAGRO/AP	Agency for Agricultural and Livestock Defense and Inspection of Amapá State
21	Amapá	Agência Amapá	Agency for Economic Development of Amapá
22	Amapá	BASA/AC	Bank of Amazon
23	Amapá	BB/AP	Bank of Brazil
24	Amapá	CPAF/AP	Agroforestry Research Center of Amapá
25	Amapá	CONAB	National Supply Company
26	Amapá	FAEAP	Federation of Agriculture and Livestock of Amapá State
27	Amapá	RURAP	Institute for Rural Development of Amapá
28	Amapá	IEPA	Institute of Studies and Research of Amapá State
29	Amapá	Amapá Terras	Institute of Land of Amapá State
30	Amapá	INCRA/AC	National Institute of Colonization and Agrarian Reform
31	Amapá	SDR/AP	State Secretariat of Rural Development
32	Amapá	SEMA/AP	State Secretariat of Environment
33	Amapá	SEPLAN/APV	State Secretariat of Planning

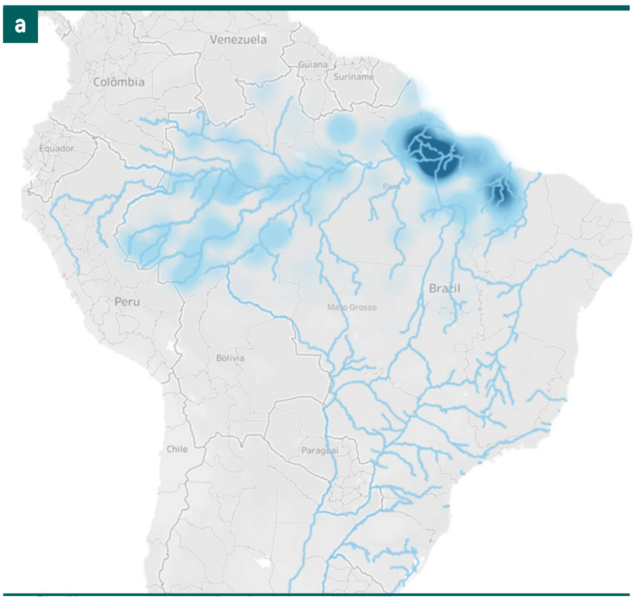
34	Amapá	SEMTRADI/AP	Municipal Secretariats for Labor, Economic Development and Innovation
35	Amapá	SENAR/AP	National Rural Learning Service
36	Amapá	SFA/AP	Federal Superintendency of Agriculture
37	Amazonas	ADAF	Agency for Agricultural, Livestock and Forestry Defense of Amazonas State
38	Amazonas	ADS	Agency for Sustainable Development of Amazonas
39	Amazonas	FVA	Vitória Amazônica Foundation
40	Amazonas	IDAM	Institute for Sustainable Agricultural, Livestock and Forestry Development of Amazonas State
41	Amazonas	IPAAM	Institute for Environmental Protection of Amazonas
42	Amazonas	SEPROR	State Secretariat of Rural Production
43	Amazonas	SEDECTI	State Secretariat of Planning, Development, Science, Technology and Innovation
44	Amazonas	UFAM	Federal University of Amazonas
45	Maranhão	AGERP	State Agency for Agricultural Research and Rural Extension of Maranhão
46	Maranhão	FAEMA	Federation of Agriculture and Livestock of Maranhão State
47	Mato Grosso	AREFLORESTA	Association of Reforesters of Mato Grosso
48	Mato Grosso	EMPAER/MT	Mato Grosso Company for Research, Technical Assistance and Rural Extension
49	Mato Grosso	INDEA/MT	Institute for Agricultural and Livestock Defense of Mato Grosso State
50	Mato Grosso	IMEA	Mato Grosso Institute of Agricultural Economics
51	Mato Grosso	Sema/MT	State Secretariat of Environment
52	Pará	Sedam/PA	State Secretariat of Environment and Sustainability
53	Rondônia	IDARON	Agency for Agrosilvopastoral Health Defense of Rondônia State
54	Rondônia	IBAMA/RO	Brazilian Institute of Environment and Renewable Natural Resources
55	Rondônia	ICMBio/RO	Chico Mendes Institute for Biodiversity Conservation
56	Rondônia	OSR	Organization of Rubber Tappers of Rondônia
57	Rondônia	RECA	Project for Intercropped and Densified Economic Reforestation
58	Rondônia	Resex do Lago do Cuniã	Extractive Reserve of Cuniã Lake
59	Rondônia	Resex Rio Cautário	Extractive Reserve of Cautário River
60	Rondônia	Sedam/RO	State Secretariat of Environmental Development
61	Roraima	ADERR	Agency for Agricultural and Livestock Defense of Roraima
62	Roraima	CODESAIMA	Development Company of Roraima
63	Roraima	FEMARHv	State Foundation for Environment and Water Resources
64	Roraima	Ibama/RR	Brazilian Institute of Environment and Renewable Natural Resources
65	Tocantins	RURALTINS	Institute for Rural Development of Tocantins State
66	Tocantins	NATURATINS	Tocantins Nature Institute
67	Tocantins	Seplan/TO	State Secretariat of Planning and Budget

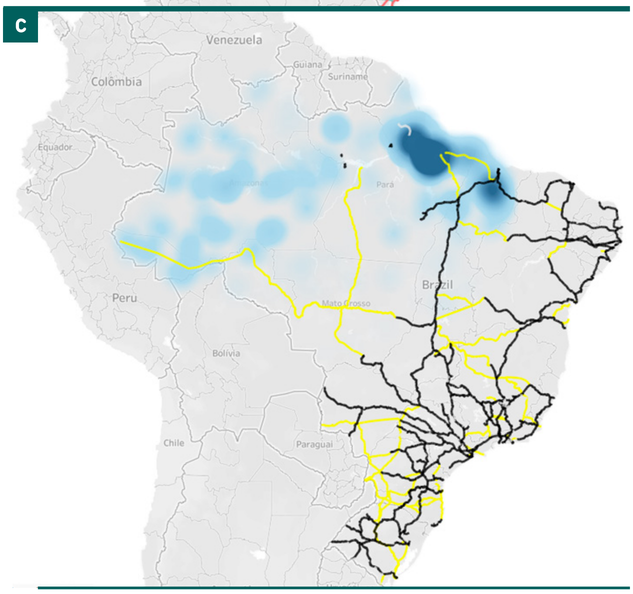
APPENDIX IV

Figure 48 presents the distribution of annual extractive production concentration hotspots in the Legal Amazon in relation to the region's transport infrastructure. The modes considered include railways (in operation, under construction, planned, under study, and deactivated), highways (limited to the federal network), and waterways (representing the main rivers of the national hydrographic basin). Unlike the previous maps, which focus exclusively on the Legal Amazon, this representation aims to highlight the logic of the federal transport network, primarily geared toward the outflow of commodities, both toward ports in the North and to those in the South of the country.

Figure 48. Plant Extraction production associated with (a) waterways, (b) federal highways (current in red and planned in green), and (c) federal railways (current in black and planned in yellow).







LOGISTICS INFRASTRUCTURE MUST BE RECONFIGURED FROM AN INTEGRATED TERRITORIAL PERSPECTIVE, WHICH CONSIDERS NAVIGABILITY AS A FUNDAMENTAL PREMISE FOR STRENGTHENING THE SOCIOBIOECONOMY.

This logistical configuration reveals the concentration of sociobioeconomy activities in specific areas of the Amazon and the resulting disconnect with existing and planned transport infrastructure. The layout of the federal network privileges major export corridors for grains and minerals, leaving the main sociobioeconomy production hubs on the sidelines. Railway infrastructure, in particular, is concentrated on routes oriented to agribusiness and mining, while highway planning lacks integration with riverside and extractive territories. By contrast, river navigation stands out as the main structuring axis of regional logistics, given its suitability to the Amazon's geographic and socioproductive characteristics.

Spatial analysis highlights the centrality of rivers in the Amazonian socio-economic organization, with a strong correlation between extractive productive nuclei and proximity to watercourses, especially in regions near the mouth of the Amazon River and the Atlantic coast. This territorial configuration results from historical, ecological, and logistical factors that have shaped land use, underscoring the role of rivers as vectors for transporting inputs, goods, and services, and as reference points for locating municipal seats, schools, health posts, and local markets.

However, the navigability of these rivers has become increasingly challenging. Climate change is intensifying periods of drought, making river transport unfeasible in various areas and affecting the outflow of extractive production and the supply of communities. This reality underscores the urgency of long-term strategic planning, with continuous investments in port infrastructure, signaling, dredging, and hydrological monitoring, to ensure the functionality of river transport year-round.

Therefore, logistics infrastructure must be reconfigured from an integrated territorial perspective, which considers navigability as a fundamental premise for strengthening the sociobioeconomy. The adoption of public policies oriented to Amazonian specificities, focusing on river logistics and support for extractive production, is essential to overcome structural bottlenecks and promote sustainable and inclusive development in the region.

APPENDIX V

Figure 49 depicts production, in tonnes, of all sociobioeconomy products in each state of the Legal Amazon, showing where production is allocated by quartile; that is, dividing the scale into four parts with equal intervals of production, in tonnes, as follows:

Q1	lower quartile or first quartile represents the interval that separates the product with the lowest production from the product representing the 25% lowest productions;
Q2	median or second quartile represents the central point of production, where 50% of values are below and 50% of values are above production, in tonnes;
Q3	upper quartile or third quartile represents the value that separates the 75% lowest values from the 25% highest production values, in tonnes;
IQR	interquartile range represents the difference between the third quartile (Q3) and the first quartile (Q1); values above 1.5 times the IQR are generally considered outliers in the sample.

Production outliers in the chart are visible in most states and are almost always represented by Açaí production, which stands out as the largest production in six of the nine states of the Legal Amazon.

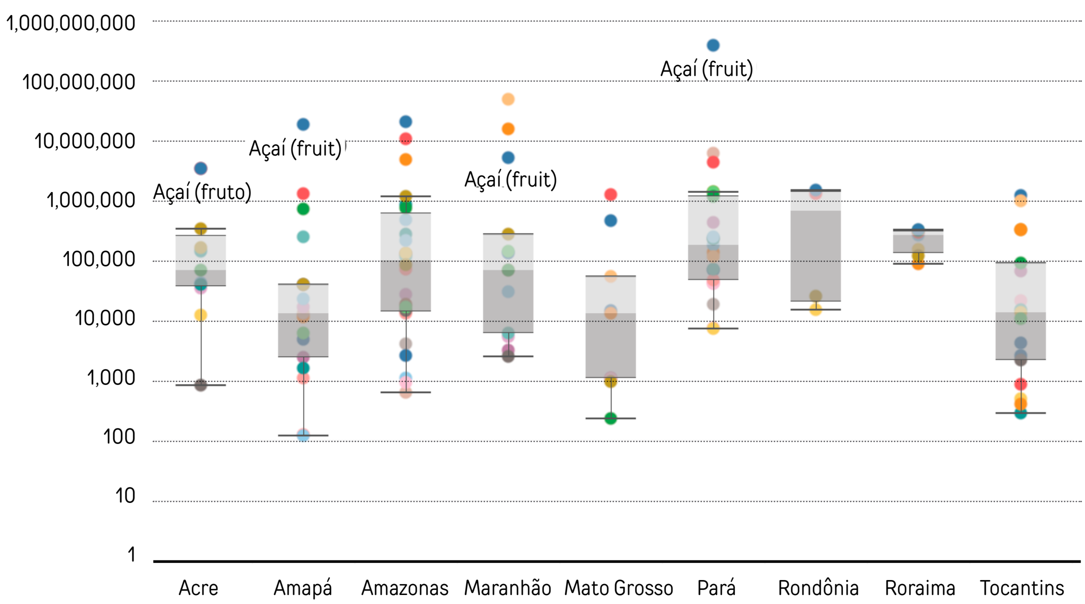
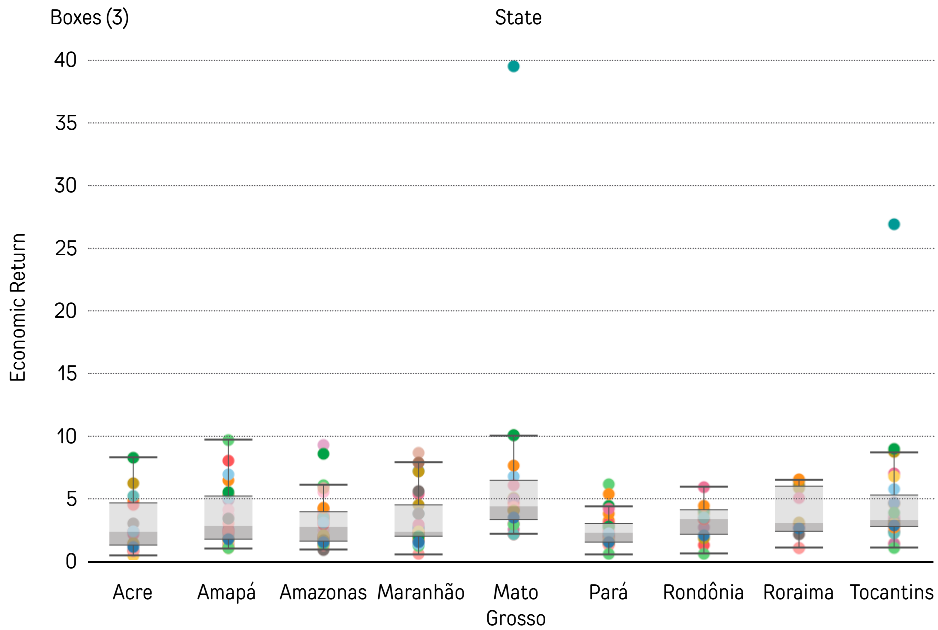


Figure 49. Production of all products by UF (logarithmic scale in tonnes, 2017).
Source: Prepared by the authors based on (IBGE 2017a).

Following the same interpretive logic exemplified in Figure 49, Figure 50 presents the economic yield obtained per kilogram produced (R$/kg) for all sociobioeconomy Plant Extraction products in each state of the Legal Amazon. This analysis makes it possible to identify differences in product valuation among states, highlighting regional pricing patterns and possible structural factors that influence the profitability of extractive production.

Figure 50. Production yield in R$ per kilogram produced by type of product and by UF (in R$/kg, 2017).

Source: Prepared by the authors based on (IBGE 2017a).



PRODUCT (STATE)

- Açaí (Fruit)
- Andiroba (Oilseed)
- Araticum (Fruit)
- Babassu (Kernel)
- Babassu (Coconut)
- Bacaba (Fruit)
- Bacuri (Fruit)
- Baru (Kernel)
- Rubber (Coagulated Latex)
- Rubber (Liquid Latex)
- Buriti (Coconut)
- Buriti (Straw)
- Cocoa (Kernel)
- Cagaita (Fruit)
- Cajá, Cajá-Manga, Cajá or Tapereba
- Camu-Camu (Fruit)
- Carnaúba (Wax)
- Carnaúba (Straw Powder)
- Angico Bark
- Brazil nut (from Pará)
- Copaiba (Oil or Balsam)
- Tonka bean (Seed)
- Cupuaçu
- Jaborandi (Leaf)
- Jambu (Leaf)
- Juçara (Fruit)
- Licuri, Auriicuri or Uricuri (Wax)
- Licuri, Auriicuri or Uricuri (Shell)
- Maçaranduba (Non-Elastic Gum)
- Macaúba (Fruit)
- Mangaba (Fruit)
- Maniçoba (Elastic Gum)
- Murici (Fruit)
- Murumuru (Oilseed)
- Oiticica (Oilseed)
- Heart of palm (Açaí, Peach palm etc)
- Pequi (Fruit)
- Piassava (Fiber)
- Peach palm (Coconut)
- Sorva (Non-Elastic Gum)
- Tucumã
- Ucuúba (Kernel)
- Umbu (Fruit)

Instituto de Energia e Meio Ambiente (IEMA)
11 3476 2850 • energiaeambiente.org.br
energiaeambiente@energiaeambiente.org.br
Rua Artur de Azevedo, 1212, 9º andar,
São Paulo-SP • CEP 05404-003

twitter.com/iema_instituto
linkedin.com/company/instituto-de-energia-e-meio-ambiente
facebook.com/institutoenergiaeambiente
instagram.com/energiaeambiente

iema
Instituto de Energia
e Meio Ambiente