# SOCIOECONOMIC AND FINANCIAL STUDY OF THE MUNICIPALITIES OF CACHOEIRA DO ARARI, SALVATERRA AND SOURE

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# SOCIOECONOMIC AND FINANCIAL STUDY OF THE MUNICIPALITIES OF CACHOEIRA DO ARARI, SALVATERRA AND SOURE

Elaboration


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SUMMARY

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AAFCAM - *Associação de Agricultores Familiares dos Campos do Marajó* (Campos do Marajó Family Farmers Association)
ABAYOMI - *Grupo de Juventude Negra Quilombola Abayomi* (Quilombola Abayomi Black Youth Group)
ADEPARÁ - *Agência de Defesa Agropecuária do Pará* (Agricultural Defense Agency of the State of Pará)
ASFARG - *Associação de Filhos e Amigos de Retiro Grande* (Retiro Grande Children and Friends Association)
BANPARÁ - *Banco do Estado do Pará* (Bank of the State of Pará)
CAFAS – *Cooperativa dos Agricultores e Agricultoras Familiares de Salvaterra* (Salvaterra Family Farmers Cooperative)
CONAQ - *Coordenação Nacional de Articulação de Comunidades Negras Rurais Quilombolas* (National Articulation Coordination of Black Rural Quilombola Communities)
CAPEX - Capital Expenditure
EETEPA - *Escola de Ensino Técnico do Estado do Pará* (Technical Education School of the State of Pará)
EMATER/PA - *Empresa de Assistência Técnica e Extensão Rural do Pará* (Technical Assistance and Rural Extension Institution of the State of Pará)
EMBRAPA – *Empresa Brasileira de Pesquisa Agropecuária* (Brazilian Agricultural Research Institution)
FAPESPA – *Fundação Amazônia de Amparo a Estudos e Pesquisas* (Amazônia Foundation for Studies and Research)
IBGE – *Instituto Brasileiro de Geografia e Estatística* (Brazilian Institute of Geography and Statistics)
IEB – *Instituto Internacional de Educação do Brasil* (Brazilian International Institute of Education)
ITERPA - *Instituto de Terras do Pará* (Land Institute of the State of Pará)
INCRA - *Instituto Nacional de Colonização e Reforma Agrária* (National Institute of Colonization and Agrarian Reform)
MiR – Microregion
OPEX - Operational Expenditure
PAA - *Programa de Aquisição de Alimentos* (Food Acquisition Program)
PNAE - *Programa Nacional de Alimentação Escolar* (National School Meals Program)
AFS – Agroforestry Sistems
SIDRA – *Sistema IBGE de Recuperação Automática* (IBGE Automatic Recovery System)
SPU – *Superintendência do Patrimônio da União* (Union Heritage Superintendence)
SEDAP –*Secretaria de Estado de Desenvolvimento Agropecuário e da Pesca* (State Secretariat for Agricultural and Fisheries Development)
SEBRAE –*Serviço Brasileiro de Apoio às Micro e Pequenas Empresas* (Brazilian Support Service for Micro and Small Enterprises)
SENAR – *Serviço Nacional de Aprendizagem Rural* (National Rural Apprenticeship Service)
SINPRUSAL - *Sindicato do Produtores e Produtoras Rurais de Salvaterra* (Salvaterra Rural Producers Union)
SINTEPP - *Sindicato dos Trabalhadores e das Trabalhadoras em Educação Pública do Pará* (Union of Public Education Workers of the State of Pará)
STTR - *Sindicato do Trabalhadores e Trabalhadoras Rurais*
UEPA - *Universidade do Estado do Pará* (Pará State University)
UFPA – *Universidade Federal do Pará* (Pará Federal University)
UFRA – *Universidade Federal da Amazônia* (Amazônia Federal University)

## KEY MESSAGES

The socioeconomic and financial study aims to present data on the economic dynamics of the communities that make up the municipalities of Cachoeira do Arari, Salvaterra and Soure as a subsidy for modeling arrangements of Agroforestry Systems that can be supported by the Green Climate Fund as an adaptation strategy to climate change, promoting resilience, maintenance and economic, social and environmental sustainability for the populations residing in these territories.

The main messages identified and that should be considered in the project are presented below:

1. The project focused on quilombola families, living in rural areas, with income composed of seasonal extractive activities, incipient commercialization of forest products and by-products, with an important component of public policies of income transfer. Women play a leading role, whether in community leadership, cooperative organization or agroforestry activities, especially in backyards.

2. Families, in addition to being exposed to food and climate security risks, live in collective areas not recognized by federal or state public bodies, therefore with their ways of life threatened and their succession vulnerable. Tenure rights, institutional coordination, financial incentives and monitoring systems are bottlenecks that need to be structured so that nature-based solutions to climate challenges are incorporated as primary actions in the territory, also guaranteeing community autonomy, gender equity in the distribution of benefits and food security.

3. The main arrangements of AFS that are resilient to climate change and that generate social and economic benefits are named in the study as AFS Quintal and AFS Diverse, composed of native species and which meet the premises of climate resilience, allow a diverse source of income, have good economic performance and are composed of species managed by women.

4. The economic-financial results of the proposed SAF models proved to be positive and with perspectives that can significantly impact the fight against climate and social vulnerability, considering projects with a discount rate of 4.36% (social discount rate in Brazil) and a 20-year horizon.

5. Implementation costs vary between US 400 and US 3000, with returns between 30 and 50%, capable of generating rents above the rents obtained by current systems (BAU reference values). However, the SAF does not imply the abandonment of seasonal activities and their derived income, activities that are also important for the maintenance of culture and social cohesion.

6. Two local family farmer organizations were mapped as institutional strengthening spaces to manage resources and access markets for AFS products.

7. Currently, the markets accessed directly by family farmers collectively are institutional food purchase programs, with demands for local products for school meals and the private market, especially açaí.

# INTRODUCTION

This document provides a detailed analysis of socioeconomic factors, including behavioral aspects of potential beneficiaries of agroforestry arrangements in the municipalities of Cachoeira do Arari, Salvaterra and Soure, located in the archipelago of Ilha de Marajó, state of Pará. It presents economic and financial analysis of possible Agroforestry Systems arrangements as part of nature-based solutions for mitigating climate challenges, promoting social, racial and gender equality, and promoting productive solutions that guarantee access to food and nutrition security, income generation and improved quality of life for the beneficiary families.

The primary data collection was divided into two stages: a) interviews with local actors, through a semi-structured script, where 28 social actors were interviewed, representing the local government, community leaders, technical assistance and extension technicians and farmers; and b) participatory workshops in the three municipalities with representatives of quilombola communities, family farmers and the local government.

Tools from the Restoration Opportunities Assessment Methodology (ROAM) (IUCN; WRI, 2014) were used in the collection of primary data, with emphasis on Social Landscape Mapping (BUCKINGHAM et al, 2018), The Diagnostic of Key Success Factors for Restoration (HANSON et al, 2015), proposition of AFS arrangements and financial analysis of the proposed models.

In the secondary data collection stage, information on the municipalities was gathered through public databases, such as IBGE (population and agricultural censuses, municipal agricultural research, municipal livestock production research), and PARÁ/FAPESPA (statistical yearbook of the state of Pará), in addition to data and overview of the region based on reports and research previously carried out in the region.

The document is organized into different sections, comprising (1) Analysis of Socioeconomic Factors; (2) Analysis of Beneficiaries' Behavioral Aspects; (3) Technical-Economic and Cost-Benefit Analysis; (4) Financial Analysis; (5) Analysis of Potential Transformation Techniques for Climate Resistant Agroforestry Products; (6) Market Research for Agroforestry-Based Solutions; (7) Access to Financing for Target Beneficiaries; (8) Current Government Regulations and Rules Affecting Market Access; (9) Main Specific Risks to be considered by the project and (10) General Recommendations.

SOCIOECONOMIC AND FINANCIAL STUDY

## 1. Analysis of Socioeconomic Factors

The income of families in the three municipalities is mainly composed of sources arising directly or indirectly from the use of natural resources, such as fishing and extractivism[1] associated with agricultural production, in addition to government income transfer policies. The main government income transfer programs accessed are Auxílio Brasil, unemployment insurance for fishing communities (Seguro Defeso) and retirement[2].

Table 01 – Per capita income (in R$) in the municipalities surveyed (continue)

| | Total households | % | ≤ 1/2 mw[1] | % | ≥ 1/2 ≤ 1 mw | % | ≥1 ≤ 2 mw | % |
|---|---|---|---|---|---|---|---|---|
| **Pará** | 1,858,732 | 100 | 146,404 | 7.88 | 282,932 | 15.22 | 474,271 | 25.52 |
| **Cachoeira do Arari** | 4,539 | 100 | 823 | 18.13 | 801 | 17.65 | 967 | 21.30 |
| **Salvaterra** | 5,083 | 100 | 721 | 14.18 | 1,071 | 21.07 | 1,311 | 25.78 |
| **Soure** | 5,525 | 100 | 565 | 10.23 | 1,164 | 21.07 | 1,464 | 26.45 |

Source: IBGE - Censo Demográfico 2010. Elaborated by: IEB, 2022.
Note: [1]mw – minimum wage

Table 01 – Per capita income (in R$) in the municipalities surveyed (end).

| Municipalities | ≥ 2 ≤ 5 mw | % | ≥ 5 mw | % | No income | % |
|---|---|---|---|---|---|---|
| **Pará** | 533,018 | 28.68 | 283,898 | 15.28 | 138,207 | 7.44 |
| **Cachoeira do Arari** | 1,053 | 23.12 | 256 | 5.64 | 640 | 14.10 |
| **Salvaterra** | 1,142 | 22.47 | 460 | 9.05 | 378 | 7.45 |
| **Soure** | 1,505 | 27.24 | 601 | 10.88 | 226 | 4.09 |

Source: IBGE - Censo Demográfico 2010. Elaborated by: IEB, 2022.

[1] In the context of this report, extractivism is considered to be the activities involving the collection and use of renewable natural resources in a non-predatory manner, performed by traditional peoples and communities.
[2] (i) Auxílio Brasil: monthly basic income benefit for families in extreme poverty (< R$ 105.00 per capita) and poverty (≤ R$ 105.01 and ≥ R$ 210.00); (ii) Seguro Defeso: income benefit paid to artisanal professional fishermen, during the closed period of the fishing activity; (iii) Retirement: monthly income social security benefit paid to workers based on contribution time, age, disability or physical disability. The criteria for accessing the benefit vary by sex and location of activity (urban or rural).

The 2010 Census[3] shows that the municipalities of Cachoeira do Arari and Soure have a higher proportion of households with per capita income between 2 and 5 minimum wages[4], 23.12% and 27.24%, respectively, following the reality in the State of Pará, with 28.68% of households in the same income bracket (Table 01). While Salvaterra presented most of the households in the income range between 01 and 02 minimum wages. When considering per capita income above 5 minimum wages, all three municipalities had households in this income range, with a lower amount for Cachoeira do Arari, with 5.64% of households. However, when we add the first two income statements, we can observe that the majority of the population, in the municipalities surveyed, live with an income of up to 01 minimum wage: 35.78% (Cachoeira do Arari), 35.25% (Salvaterra) and 31.30% (Soure). In addition to a significant portion that had no income during the census.

The consumption and income sources based on the use of natural resources are important for the food and nutrition security of local families when directed to their own consumption, in addition to guaranteeing income through commercialization (Table 02).

Table 02 - Main species cultivated in local gardens and plots, by purpose of use (consumption and/or commercialization)

| Species | Consumption | Commercialization |
|---|---|---|
| Pineapple | X | X |
| Pumpkin | X | X |
| Lettuce | X | X |
| Banana | X | X |
| Sweet potato | X | X |
| Beet | - | X |
| Waterleaf | X | X |
| Scallion | X | X |
| Carrot | - | X |
| Parsley | X | X |
| Chicory | X | X |
| Kale | X | X |
| Spinach | - | X |
| Squash | - | X |
| Sweet cassava | X | X |
| Bitter cassava | X | X |
| Maroon cucumber | X | X |
| Watermelon | X | X |
| Corn | - | X |
| Chili pepper | X | X |

[3] Last official census carried out by the Brazilian Institute of Geography and Statistics – IBGE.

[4] The official data available refer to the year 2010. During this period, the national minimum wage was equivalent to R$ 510.00. Taking into account that the exchange rate in 2010 was U$1.76 (IPEADATA, 2022), the dollar equivalent of the minimum wage, at the time of the census, was U$289.78

| | | |
|---|---|---|
| Okra | X | X |
| Radish | - | X |
| Cabbage | X | X |

Source: Field research. Elaborated by IEB 2022

Products for consumption and income generation are spatially distributed among family backyards, small plots, forests, rivers and lakes. Agricultural production is carried out in family backyards and plots, which are distinct areas, with different management. In family backyards, vegetable gardens are usually installed, where short-cycle species are produced, mainly vegetables such as jambu, parsley, cabbage and waterleaf. There are also fruit trees, small animals and medicinal plants.

The vegetable gardens are generally managed by women and the production is destined mainly for family consumption, which guarantees food and nutritional security for the family. When there are surpluses, the products are sold in the community or exchanged and donated between family members. The plots are implemented in more remote areas and are composed of medium-cycle species, such as pumpkin, and long-cycle species, such as pineapple and sweet cassava.

Products from extractivism, specifically non-timber forest products, derive from species found mainly in native forests, considered to be common access. However, local backyards also represent an important area for cultivation and management of these species, cultivated by families in intercropping systems with agricultural species. This planting system increases the diversity of crops close to the residence and production throughout the year (Frame 01).

Frame 01 - Important species for income generation reported in the municipality of Soure

| Vegetable gardens | Plots | Non-timber products (fruits and oils) |
|---|---|---|
| Lettuce | Pineapple | Native Açaí – Floodplain forest |
| Waterleaf | Pumpkin | Pará Açaí (BRS Pará variety) |
| Parsley | Banana | Acerola |
| Chicory | Sweet potato | Andiroba |
| Kale | Green bean | Bacuri |
| Jambu | Squash | Cashew |
| Maroon cucumber | Sweet cassava | Coconut |
| Chili pepper | Bitter cassava | Cupuaçu |
| Okra | Watermelon | Guava |
| Arugula | Corn | Soursop |
| | Cucumber | Soursop |
| | | Inga |
| | | Papaya |
| | | Mango |
| | | Muruci |
| | | Peach palm |
| | | Tangerine |
| | | Taperebá |

| | | |
|---|---|---|
| | | Urucum |

Source: Field research (2022). Elaboration: IEB (2022).

In both backyards and plots, the practice of intercropping occurs, in general, in agroforestry systems with greater or lesser diversity of agricultural and forestry species. The diversity of species found in agroforestry systems reduces the effects of adverse events, such as extreme climate changes (LIN, 2007), or seasonality (Frame 02) in the supply of food for consumption and for commercialization.

Frame 02 - Seasonal production calendar for the main products sold by local families

| Species | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pineapple | | | | | | | | | | | | |
| Native açaí | | | | | | | | | | | | |
| Acerola | | | | | | | | | | | | |
| Bacuri | | | | | | | | | | | | |
| Cupuaçú | | | | | | | | | | | | |
| Guava | | | | | | | | | | | | |
| Bitter cassava | | | | | | | | | | | | |
| Murici | | | | | | | | | | | | |
| Andiroba oil | | | | | | | | | | | | |
| Tucuma oil | | | | | | | | | | | | |
| Peach palm | | | | | | | | | | | | |
| Taperebá | | | | | | | | | | | | |

Source: Field research (2022).

Different production systems were found, from those based on fallow practices to agroforestry systems without and with irrigation, the latter found on a smaller scale and associated with the cultivation of the Pará açaí variety (BRS), adapted for dry land (Embrapa, 2004). In the fallow system, agricultural cultivation is carried out in recently cleared areas, that is, preceded by the cutting and burning of native vegetation. After one or two harvest cycles, this area is abandoned, and new areas are cleared. In this system, the production of bitter cassava and pineapple stands out.

There are various motivations for the practice of fallow agriculture, and they relate to factors such as absence of equipment for preparing the soil for new crops in the same area, and absence of technical assistance that supports the implementation of optimized techniques for the use and management of soil without the need for suppression of native vegetation.

Practices similar to those carried out in agroforestry systems, such as the intercropping of species, were identified in all rural communities of family farmers and quilombolas. However, intercropping or AFS practices takes place in small areas, such as backyards. In some communities, such as Maruacá in Salvaterra, these practices were disseminated by the Cooperativa dos Agricultores e Agricultoras Familiares de Salvaterra – CAFAS (Salvaterra's family farmers cooperative), in partnership with the Empresa de Assistência Técnica e Extensão Rural do Pará – Emater/PA (the state of Pará's technical assistance and rural extension company).

Predominantly carried out in a monoculture system, the cultivation of pineapple represents an important source of agricultural income in the municipalities. Virtually all pineapple production (98%) is sold at the state capital, Belém, and its metropolitan region. Pineapple production is continuous throughout the year, a feature that contributes to its relevance as a source of income in the localities.

Products derived from extractivism are commercialized *in natura* or processed into vegetable oils and regional fruit pulps. The processing of non-timber forest products is an important source of income, with low investment and high returns.

Açaí was identified as another important source of income, mainly in Cachoeira do Arari and Salvaterra. Called "black gold" by local actors, açaí has gained popularity and market value in the last 17 years, becoming an important source of income in the region over this period, especially during the harvest period (August to November/December). The popularity of the product increased demand, leading to investments by some local producers in production increase. The planting of the BRS-Pará species, developed by EMBRAPA (OLIVEIRA; NETO, 2004), is undergoing rapid expansion, mainly due to its high productivity and resistance. However, the supply of açaí is intermittent and complemented by other sources of consumption and income.

Box 01 – Açaí transportation chain

Difficulties involving the transportation and commercialization of products were identified as important barriers to the inclusion of agricultural and extractive products in local markets. In the case of açaí, the existence of a production chain is a key factor for investing in açaí cultivars. Currently, most of the production of açaí *in natura* is absorbed by factories that process the product in Belém. Açaí is transported mainly through the waterways in the communities of the archipelagos around the city.

According to local Emater technicians, agriculture was almost non-existent five years ago, but interest in information and training on the production, especially of vegetables, has increased in recent years and Emater has encouraged the diversification of this production, inserting different species into the local agricultural systems. During the interviews, it was possible to notice the diversity of agricultural species reported by local actors (Table 03).

Table 03 - Main products arising from family farming and sold in the municipalities of Cachoeira do Arari, Salvaterra and Soure[5]

| Species | Municipality | Value (BRL) | Value (USD) |
|---|---|---|---|
| Piquiá (kg) | Salvaterra | 5.00 | 0.92 |
| Açaí (basket) | Cachoeira. Soure and Salvaterra | 14.00 (harvest); | 2.60 |
| | | 80.00 (intercrop) | 14.84 |
| Bacuri (pulp Kg) | Cachoeira. Soure and Salvaterra | 20.00 | 3.71 |

[5] The products presented were the most cited by local families as the ones with the greatest potential for local commercialization.

| | | | |
|---|---|---|---|
| Cupuaçu (pulp kg) | Cachoeira. Soure and Salvaterra | 20.00 | 3.71 |
| Pineapple L (unit) | Salvaterra | 2.20 | 0.40 |
| Pineapple M (unit) | Salvaterra | 1.20 | 0.22 |
| Peach palm (kg) | Cachoeira and Salvaterra | 40.00 | 7.42 |
| Andiroba oil (liter) | Cachoeira and Salvaterra | 120.00 | 22.26 |
| Tucuma oil | Cachoeira and Salvaterra | 80.00 | 14.84 |
| Cassava flour (30-kg sack) | Cachoeira. Soure and Salvaterra | 120.00 | 22.26 |
| Tucupi (liter) | Cachoeira. Soure and Salvaterra | 3.00 | 0.56 |
| Tucupi with pepper (liter) | Cachoeira. Soure and Salvaterra | 10.00 | 1.85 |
| Tapioca flour (liter) | Cachoeira. Soure and Salvaterra | 5.00 | 0.93 |
| Jambu (bunch) | Cachoeira. Soure and Salvaterra | 1.50 | 0.27 |
| Parsley (bunch) | Soure and Salvaterra | 1.50 | 0.27 |

Source: Field research (2022).

The information outlined above, arising from field research, indicates that local families depend on a variety of products derived from agriculture and extractivism, both for their own consumption and for income generation. However, part of these sources of consumption and income have been negatively affected by barriers to market access and changes in weather patterns.

Furthermore, there is evidence that they carry out integrated planting involving agricultural and tree species, which indicates an accumulation of practical experiences with intercropping species in productive systems. These two groups of evidence can favor the implementation of development strategies based on agroforestry systems that guarantee the regular supply of food and income generation.

## 2. Analysis of the behavioral aspects of beneficiaries

In order to systematize the main problems identified that may impact the implementation of Agroforestry Systems as a nature-based solution for adapting to climate change, the diagnostic of the key success factors of restoration was applied, a complementary tool to the Restoration Opportunities Assessment Methodology - ROAM. ROAM facilitates the systematization, based on information obtained through interviews, workshops and/or meetings, of the main conditions for the restoration of landscapes and forests, whether for conservation or production purposes, to be established in a territory (HANSON et al., 2015). The analysis refers to the necessary conditions to Motivate, Facilitate and Implement AFS or other restoration models, assessing aspects such as generated benefits, ecological, market, political, institutional and social conditions, existence of leaders, technical knowledge, financial incentives, among others.

The systematization of information allows an assessment of which key factors are already present in the territory and which ones need to be strengthened, leading to the definition of action strategies. The tool provides information on the best strategies for a given project or action to find the best conditions to be implemented. For the territory in question, the diagnostic was adapted excluding the conditions that do not directly impact the implementation of AFS or in cases where it was not possible to collect information for their assessment. The systematization of the data encompasses the results for the three municipalities (Table 04).

Table 04 - Current status of the key success factors for the implementation of agroforestry system projects in the municipalities of Cachoeira do Arari, Salvaterra and Soure.

| Theme | Necessary conditions | Key factors | Status |
|---|---|---|---|
| Motivate | a. Benefits | AFS generates economic benefits | |
| | | AFS generates social benefits | |
| | | AFS generates environmental benefits | |
| | b. Awareness | The benefits of AFS are publicly disclosed | |
| | | AFS opportunities are identified | |
| | c. Crisis situation | Crisis situations generate opportunities for AFS implementation | |
| | d. Legal requirements | There are laws restricting deforestation | |
| | | Laws that restrict deforestation are widely understood and enforced | |
| Facilitate | | Conditions related to fires, climate, water and soil are favorable for restoration with AFS | |
| | | Seeds of native species, seedlings or origin populations are readily available | |
| | f. Market conditions | Competing demands (e.g. food, fuel) for degraded or converted forest areas are declining | |
| | | There are value chains for AFS producers and services | |
| | g. Political conditions | Land and natural resource tenure rights are guaranteed | |
| | | The local community will benefit from AFS | |
| | i. Institutional conditions | Roles and responsibilities related to AFS restoration are clearly defined | |
| | | There is effective institutional coordination | |
| | j. Leadership | There are local leaders for the implementation of AFS | |
| | | There is ongoing political commitment to AFS | |
| | k. Knowledge | There is relevant “knowledge” about AFS in the territory | |
| | | There is transmission of “knowledge” about AFS between specialists or rural extension | |
| Implement | l. Technical conception | The AFS project is technically sound and fights climate change | |
| | | AFS allow a positive carbon balance | |
| | m. Finances and incentives | The incentives and financial resources for implementing AFS outweigh the incentives for other competing activities | |
| | | Incentives and financial resources are readily available | |
| | n. Opinions and contributions | There are effective performance evaluation and monitoring systems | |
| | | The first achievements are communicated | |

Legend: Current situation (Green – in force; Yellow – partially in force; Red – inexistent)

- The **Motivate** axis, which corresponds to the motivations of local actors for the implementation of AFSs, shows the largest number of necessary conditions available in the localities. As for the motivation conditions, those regarding the economic, social and environmental benefits of AFSs are well understood by the participants, as well as the knowledge that crisis situations generate opportunities for the implementation of AFSs. However, the benefits of AFSs are not well communicated, which may be a result of the distance between the communities, observed mainly in Cachoeira do Arari, and/or the absence of a more efficient communication network. Communication about the benefits of AFSs occurs mostly through meetings of the Sindicato do Trabalhadores e Trabalhadoras Rurais – STTR (the rural workers' union), associations and cooperatives and is restricted to the families that participate in such spaces. The main bottleneck, i.e. inexistent condition, refers to (d) Legal requirements to implement AFSs. The laws are not widely understood, nor fully implemented, which makes it difficult to implement production arrangements in accordance with the rules provided for in current legal frameworks, such as the Native Vegetation Protection Law (Federal Law n. 12,651/12).
- The **Facilitate** axis, which corresponds to local conditions (ecological, market, political, social and institutional) that create a favorable context for facilitating the implementation of AFSs, has more unavailable conditions than available or partially available. The (h) social condition related to the awareness and perception of the benefits of AFSs where they are already implemented is the only condition available. The (e) ecological conditions are partially available in the municipalities such as control of degradation factors (for example, fires and droughts), water availability, soil quality and the presence of native species matrices for the production of seeds and seedlings, or that facilitate natural regeneration in degraded areas. The (f) market conditions associated with the existence of value chains for AFS producers and services are partially established, with the exception of the açaí and pineapple chains. There are still no signs of favorable conditions for changes regarding competing demands for land use involving degrading activities that exclude the most vulnerable communities, such as cattle ranching and large-scale rice cultivation (mainly observed in Cachoeira do Arari and Salvaterra). There are also bottlenecks in relation to (g) political conditions regarding the guarantee of land tenure rights and access to natural resources on which they depend, such as açaí palms and fish located within private areas; and mainly (i) Institutional conditions associated with roles and responsibilities related to AFS restoration and the existence of effective institutional coordination.
- The **Implement** axis, which corresponds to the capabilities and resources for the implementation of AFSs, has the largest number of unavailable conditions. Although there are local leaders in the municipalities engaged with AFS initiatives, there is no political commitment on the part of local actors, especially from government, to this production model (j. Leadership). The accumulation of experiences with AFSs in the territories is still at an early stage, as is the transmission of knowledge among local actors such as specialists and extensionists about these practices (k. Knowledge). Consequently, although there is technical-scientific knowledge (l. Technical conception) regarding the contribution of AFSs to carbon absorption and storage, existing projects are partially based on this knowledge. On the other hand, regarding (m) finances and incentives, capacities and resources to finance the implementation of AFSs are lacking. However, incentives and funding are available for activities that have promoted the degradation of local forests, with negative effects on the livelihoods of local populations that depend on these resources, especially in periods of scarcity of their own production. Finally, effective performance monitoring and evaluation systems are not established and, therefore, there is no communication of the first achievements and results of the implemented AFSs.

Box 02 - Role of women and youth

The role of women, based on observations made during visits to communities, is quite diverse. Women participate in the production process, from planting, to harvesting and sales, both in the fields and in their backyards. In addition to participating in production, women are responsible for organizing the family unit: preparing meals, caring for children, organizing the house.

In Salvaterra, at the family farmers' fair in the communities of Monsarás and Condeixas, which takes place three times a week, the women of these localities are responsible for selling the products.

In the collection of non-timber products, mainly andiroba and tucumã, production is carried out mainly by women. It is the women who collect the fruits and seeds, in addition to being responsible for the entire processing work.

The female role was more evident in quilombola communities. In these territories, it was possible to observe a very active participation of women in the development of local production, as shown by the speech:

> *"I'm going to pick açaí, automatically I'm going to fish; I'm going to pick açaí, automatically I'm going to hunt. So you do everything almost at the same time (Quilombola producer, Mangueiras, Salvaterra)."*

As for young people, their participation in local production is encouraged by families, especially in quilombola communities. Quilombola producer Cristina, from the Salvá community, reported that her children participate in the family unit's production process, collaborating in all stages of production, from planting to harvesting.

The participation of young people was also observed in the other quilombola communities visited (Providência, Deus Ajuda, Paixão, São Benedito and Mangueiras). In the rural communities of Monsarás, Condeixas and Maruacá, in Salvaterra, the participation of the local youth is also common and important in the development of local productive practices.

The participation of youth in leadership positions was also observed. The quilombola Jéssica Melo, from the Mangueiras community, is a young leader who is a reference in the community and among the communities. During the interview, we were able to observe that Jessica has a broad knowledge about the history of the community, the productive processes, as well as the local families, playing an important role in accessing families and facilitating the development of field work.

The presence of young people and training mechanisms aimed at women and young people, such as the informal training program developed by the Cooperativa de Agricultores Familiares de Salvaterra (Cafas) (Salvaterra's family farmers cooperative) is an experience that contributes to the maintenance of young people in the countryside and the dissemination of new, more sustainable agricultural practices.

## 3. Technical-Economic and Cost-Benefit Analysis

The economic analysis of Agroforestry Systems - AFS arrangements that contribute to the adaptation to climate change is an essential part of the assessment of possible investments that provide financial returns to beneficiary families. Based on the Cost-Benefit analysis, it is possible to adapt different arrangements, considering other complementary assumptions for the composition of species based on climate resilience, inserting in the analysis arrangements that consider criteria such as species already managed by the local community, agronomic compatibility between species, low cost of implementation and low labor requirement.

H2O Company (H2O Company, 2022) selected three main models of agroforestry systems based on the analysis of vulnerability, resilience and adaptability of species to climate change, ranging from five to nine species: the **Home Garden AFS** (Home Garden Agroforestry System); the **Diverse AFS I** (Diverse Agroforestry System); and the **Simplified AFS** (Simplified Management Agroforestry System). The Home Garden AFS is composed of nine species: murici, açaí, guava, banana, papaya, cassava, coffee, gliricidia and vegetables. The Diverse AFS I is also composed of nine species: açaí, guava, tucumã, bacuri, andiroba, banana, cassava, beans and pumpkin. The Simplified AFS is composed of five species: açaí, ingá, murici, buriti and andiroba.

Based on H2O Company's recommendations and inserting other complementary assumptions regarding (1) climate resilience for adaptation of production systems; (2) species diversification to expand income sources; (3) economic-financial performance that expresses economic viability; and (4) emphasis on at least one predominantly female-dominated system, three arrangements were defined for the cost-benefit analysis, among the various AFS composition possibilities (Frame 03). Other possible arrangements are presented in Annex 1.

In relation to the three main AFS models proposed by H2O, and based on the above criteria, the arrangement called "Simplified AFS" was excluded from the economic and financial analyzes because it did not meet the assumptions considered. The Home Garden and Diverse I AFSs were adapted, considering the species composition observed in the field by the team. In the Home Garden AFS, guava, coffee, murici and gliricidia were excluded. In the Diverse AFS I, guava, beans and pumpkin were excluded. Diverse AFS II has the same composition in both studies (H2O and WRI).

Frame 03 – Composition of AFSs considered for the financial analysis[6]

| Home Garden AFS | Diverse AFS I | Diverse AFS II |
|---|---|---|
| Açaí (*Euterpe oleracea*) | Açaí (*Euterpe oleracea*) | Açaí (*Euterpe oleracea*) |
| Banana (*Musa spp)* | Andiroba *(C. guianensis)* | Andiroba *(C. guianensis)* |
| Papaya *(Carica papaya)* | Bacuri *(P. insignis)* | Bacuri *(P. insignis)* |
| Cassava (*Manihot esculenta)* | Banana (*Musa spp)* | Banana (*Musa spp)* |
| | Cassava (*Manihot esculenta)* | Cassava *(Manihot esculenta)* |

| | | |
|---|---|---|
| | Tucumã *(Astrocaryum vulgare)* | Tucumã *(Astrocaryum vulgare)*<br>Cupuaçu *(Theobroma grandiflorum)*<br>Murici *(Byrsonima crassifolia)* |

It is important to point out that the Diverse AFS I and Diverse AFS II arrangements are very similar. Both include a basic food species that generates rapid income: cassava; two species that generate short-to-medium-term products with very well-established markets: bananas and açaí; and three long-term, highly resilient and high value-added native species: andiroba, bacuri and tucumã. The Diverse AFS II additionally includes murici and cupuaçu, which are native species highly appreciated by the local community and the foreign market. These two models can be part of the same implementation strategy, with the option of enriching species (murici and cupuaçu) depending on the farmer's preferences or knowledge. The two models represent convergent and non-competitive systems.

The Home Garden AFS has in its composition species normally found in areas close to homes, in backyards. The arrangement between species can be implemented in small areas, with management conducted by women. The species are used for daily food consumption, which guarantees food security for families.

In all models, a spacing of 3m x 3m between plants was considered, which guarantees the necessary luminosity for understory species in addition to facilitating the management of the area. It is considered that all the implementation work will be performed by the families benefiting from the project in return for the investments proposed in this project. Thus, this activity will be defined as "labor" in the economic analyses[7]. It is important to mention that maintenance costs include all those necessary to preserve the productive capacity of the SAF.

For each proposed model, the following assumptions and reference values were defined, based on field observation, or considered adequate to the observed characteristics of preference, technical knowledge, climatic suitability and market structure:

- For each species, reference values for the number of trees to be planted, need for replanting due to seedling death, seedling cost, growth and production curve, expected productivity, harvest cost and sale price of fruit *in natura*;
- Total investment, comprising the total area to be implemented, investment in seedlings, soil preparation, area fencing, inputs and labor for implementation. In cases with irrigation (models in Annex), the values necessary for the acquisition of irrigation equipment, including pipes, connectors, fasteners and engine room with solar energy generation module are included;
- Fixed Costs, understood as those that are independent of production, such as the opportunity cost of work, maintenance of systems with chemical and physical weeding, thinning and handling, and payment for Technical Assistance and Rural Extension (ATER) services;
- Variable Costs, such as costs of handling and crowning, harvesting, fruit cleaning and fruit packaging;

[7] Maintenance costs include all those necessary to preserve the productive capacity of the SAF.

- Cash Flow, considering structural options such as the Discount Rate applied, financial costs related to possible types of financing and scale gains curves.

The main parameters related to the economic analysis of the suggested AFS models are described in tables 05, 06 and 07.

Table 05 - Parameters for economic analysis – Home Garden AFS (0.1 ha)

| | N. of trees | Average Production (kg/tree/production year) | Average price (BRL/kg) | Total Production (Kg)*1 | Total Revenue (BRL) *2 |
|---|---|---|---|---|---|
| Açaí | 25 | 5.00 | 2.55 | 1,667 | 5,080 |
| Banana | 25 | 9.70 | 1.43 | 3,908 | 5,003 |
| Papaya | 20 | 10.00 | 1.20 | 1,950 | 2,923 |
| Cassava | 40 | 4.00 | 0.64 | 2,931 | 1,026 |
| Açaí heart of palm*3 | n.a. | n.a. | 3.31 | 25 | 42,139 |

Notes: (*1) Considering the average productivity over 20 years of the project; (*2) Considering the average total revenue over 20 years of the project; (*3) Final product of the açaí tree after 20 years of harvesting the açaí (fruit).

Table 06 - Parameters for economic analysis – Diverse AFS I (1 ha)

| | N. of trees | Average Production (kg/tree/production year) | Average price (BRL/kg) | Total Production (Kg)*1 | Total Revenue (BRL) *2 |
|---|---|---|---|---|---|
| Açaí | 500 | 5.00 | 2.55 | 33,346 | 126,787 |
| Andiroba | 60 | 18.50 | 1.96 | 2,184 | 7,514 |
| Bacuri | 60 | 29.30 | 2.20 | 6,298 | 32,864 |
| Banana | 300 | 9.70 | 1.43 | 46,902 | 74,759 |
| Cassava | 90 | 5.00 | 0.64 | 6,433 | 3,155 |
| Açaí heart of palm*3 | n.a | n.a. | 3.31 | 500* | 842,781 |
| Tucumã | 100 | 18.00 | 0.94 | 6,445 | 11,422 |

Notes: (*1) Considering the average productivity over 20 years of the project; (*2) Considering the average total revenue over 20 years of the project; (*3) Final product of the açaí tree after 20 years of harvesting the açaí (fruit).

Table 07 - Parameters for economic analysis – Diverse AFS II (1 ha)

| | N. of trees | Average Production (kg/tree/production year) | Average price (BRL/kg) | Total Production (Kg)*1 | Total Revenue (BRL) *2 |
|---|---|---|---|---|---|
| Açaí | 630 | 5.00 | 2.55 | 42,016 | 107,350 |
| Andiroba | 50 | 18.50 | 1.96 | 1,820 | 3,570 |
| Bacuri | 50 | 29.30 | 2.20 | 5,248 | 11,557 |
| Banana | 100 | 9.70 | 1.43 | 15,634 | 22,312 |
| Cupuaçu | 40 | 9.70 | 4.64 | 1,869 | 8,673 |

| | | | | | |
|---|---|---|---|---|---|
| Guava | 50 | 20.60 | 2.40 | 12,620 | 30,339 |
| Cassava | 100 | 5.00 | 0.64 | 7,148 | 4,555 |
| Murici | 50 | 39.00 | 2.67 | 6,935 | 18,531 |
| Açaí heart of palm *[3] | n.a. | n.a. | 3.31 | 630* | 2,083 |
| Tucumã | 40 | 18.00 | 0.94 | 2,578 | 2,421 |

Notes: (*1) Considering the average productivity over 20 years of the project; (*2) Considering the average total revenue over 20 years of the project; (*3) Final product of the açaí tree after 20 years of harvesting the açaí (fruit).

The economic-financial results of the proposed AFS models proved to be positive and with perspectives that can positively impact the fight against climate and social vulnerability, considering projects with a discount rate of 4.36% (social discount rate in Brazil) and a 20-year time horizon.

Depending on the differences in the compositions of the AFSs and maturation time of each of the species - which varies the amount produced and years with production, the expected revenues are illustrated in figures 01, 02 and 03.

Figure 01 - Expected Revenue Composition over 20 years for Home Garden AFS

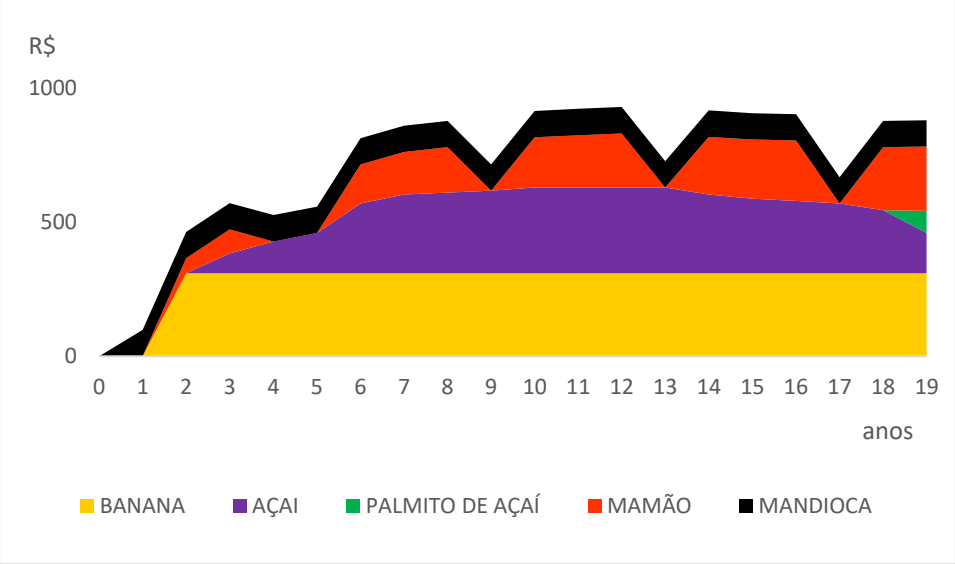



Figure 02 - Expected Revenue Composition over 20 years for Diverse AFS I

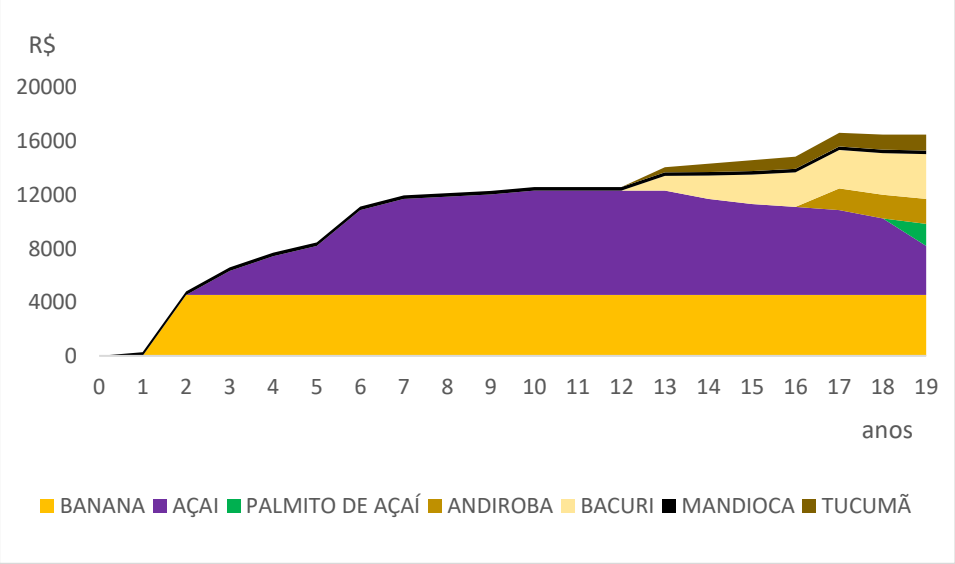
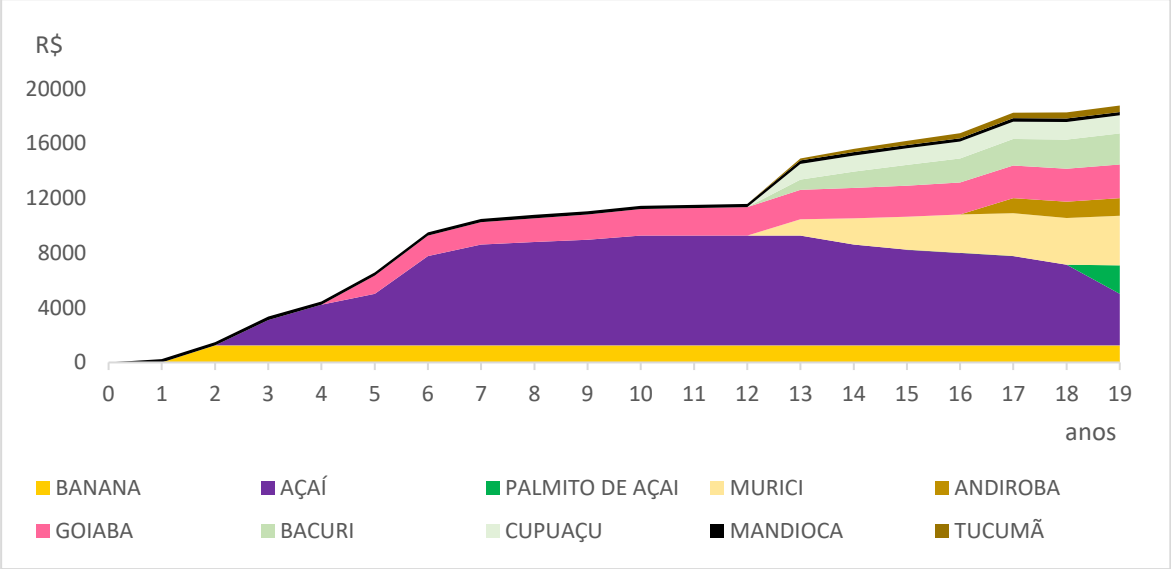


Figure 03 - Expected Revenue Composition over 20 years for Diverse AFS II




The activities and items for the implementation and maintenance of investment systems are described in table 08 as maintenance (Capital Expenditure - CAPEX) (Operational Expenditure - OPEX).

The investment need (Capital Expenditure - CAPEX) for the implementation of the systems as well as the annual maintenance costs (Operational Expenditure - OPEX) are detailed in Table 09. Investment costs (CAPEX) are composed of tree seedlings of the species defined in each model soil preparation activities, which include manual activities (labor), inputs and semi-mechanized activities, labor for planting, materials and labor for fencing and technical assistance throughout the implementation process. The operational costs (OPEX) are compose of weeding and others maintenance costs and technical assistance. The labor of farmers did not considerate, because is being considered as counterpart.

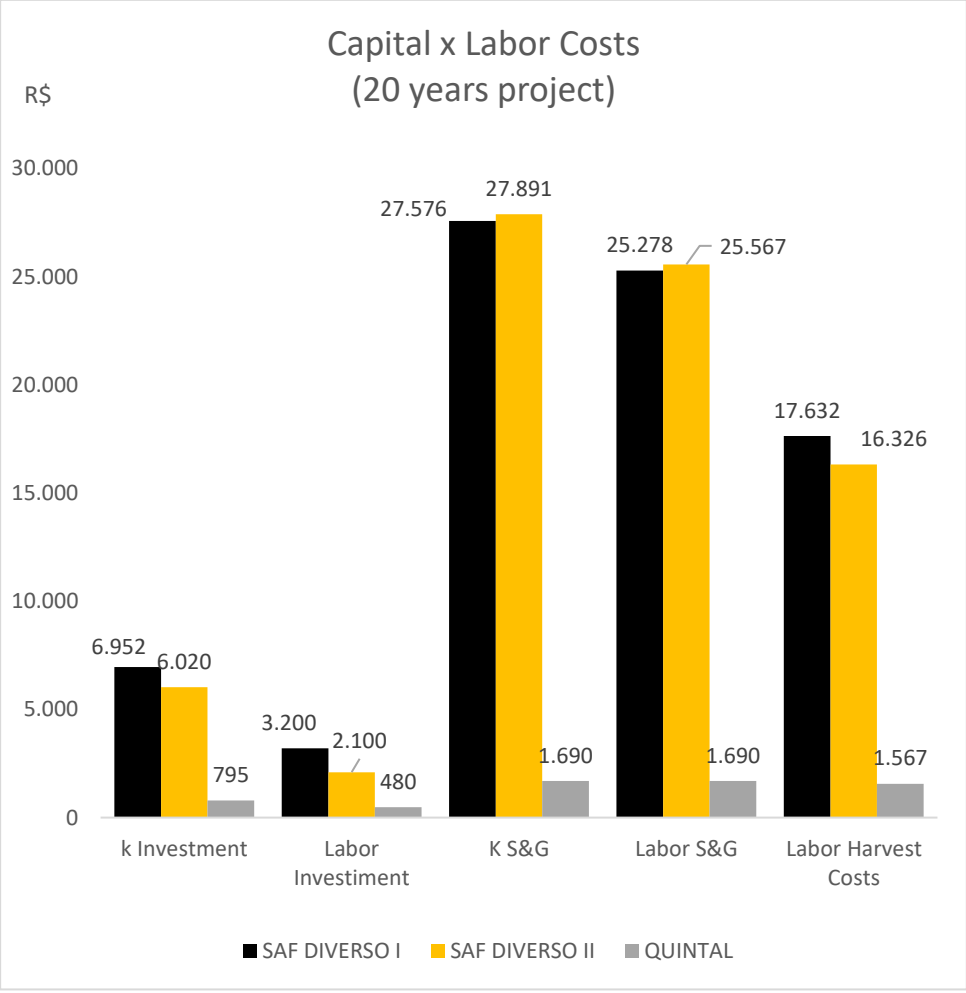
Table 08 - CAPEX and OPEX of the recommended AFSs (In BRL/hectare)

| | Diverse I (1 ha) | Diverse II (1 ha) | Home Garden (0,1 ha) |
|---|---|---|---|
| **CAPEX** | **10,145.30** | **8,119.80** | **388.39** |
| Seedlings | 3,452.00 | 2,925.00 | 28.50 |
| Soil Preparation | 1,898.10 | 999.00 | 10.99 |
| Labor | 599.40 | 299.70 | 5.00 |
| Inputs | 799.20 | 399.60 | 5.99 |
| Semi-mechanized operations | 499.50 | 299.70 | 0,00 |
| Planting | 1,198.80 | 599.40 | 11.99 |
| Labor | 1,198.80 | 599.40 | 11.99 |
| Fencing | 2,997.00 | 2,997.00 | 24.98 |

| | | | |
|---|---|---|---|
| Labor | 2,997.00 | 2,997.00 | 24.98 |
| Technical Assistance | 599.40 | 599.40 | 59.94 |
| **OPEX** | **2.297,00** | **2,297.70** | **119.88** |
| Salaries or Opportunity Cost of Work | 0.00 | 0.00 | 0.00 |
| Chemical weeding or pest control | 499.50 | 499.50 | 29.97 |
| Technical Assistance | 1,198.80 | 1,198.80 | 59.94 |
| Thinning and Handling | 599.40 | 599.40 | 29.97 |

Considering that these systems have an implementation time of 1 year and maintenance time of 19 years from the implementation, the division of the main production factors (capital=K and work=labor) would be as shown in Figure 04.

Figure 04 - Capital vs. Labor over 20 years (BRL)



It is considered that the work (labor) is the opportunity cost of all the activities that will be carried out by the beneficiary of the project, and that this amount will not be paid to him as a salary or any form of remuneration, but is his counterpart as equivalent working hours. Considering that the beneficiary will receive from project the inputs and ATER necessary to implement the project (investment) and another 3 years of inputs and ATER to maintain the systems, it can be concluded that, for Diverse AFS I, the total to be paid by project would be BRL 6,952 for implementation, plus BRL 4,355 (3/19 over BRL 27,576 for General and Administrative Costs - SGA) over 3 years for maintenance. The other costs must be covered in the form of work by the beneficiary, as well as disbursements that the latter must make from the fourth year onwards, using the proceeds obtained in the business to cover the costs of maintenance as well as harvesting.

According to the latest FOCUS inflation forecast report, a 7.11% National Consumer Price Index (IPCA) should be expected in 2022, decreasing in 2023 to 5.36% and to 3.41% in 2024. Considering that the project is submitted in mid-October 2022, it is recommended to consider an accumulated inflation of 10.2% between October 2022 and December 2024. It is also prudent to consider the long-term USD-BRL exchange rate, suggested at BRL 3.71 = 1 USD.

Based on these values, the following monetary parameters should be considered for each hectare of AFS, with a single disbursement for CAPEX and a 3-installment disbursement for OPEX, as shown in Table 09.

Table 09 - CAPEX and OPEX of the recommended AFSs (In USD/ha)

| USD | DIVERSE AFS I | DIVERSE AFS II | HOME GARDEN |
|---|---|---|---|
| **CAPEX** | **3,015.50** | **2,413.11** | **403.97** |
| Seedlings | 1,025.36 | 868.83 | 83.17 |
| Soil Preparation | 564.37 | 297.04 | 32.67 |
| Labor | 178.22 | 89.11 | 14.85 |
| Inputs | 237.63 | 118.81 | 17.82 |
| Semi-mechanized operations | 148.52 | 89.11 | 0.00 |
| Planting | 356.44 | 178.22 | 35.64 |
| Labor | 356.44 | 178.22 | 35.64 |
| Fencing | 891.11 | 891.11 | 74.26 |
| Labor | 891.11 | 891.11 | 74.26 |
| Technical Assistance | 178.22 | 178.22 | 178.22 |
| **OPEX** | **683.18** | **683.18** | **356.44** |
| Salaries or Opportunity Cost of Work | 0.00 | 0.00 | 0.00 |
| Chemical weeding or pest control | 148.52 | 148.52 | 89.11 |
| Technical Assistance | 356.44 | 356.44 | 178.22 |
| Thinning and handling | 178.22 | 178.22 | 89.11 |

In this case, the total amount to be invested in large-scale AFS projects, as well as the expected financial results, follow the pattern shown in table 10.

Table 10 – Performance of large-scale recommended AFSs (In USD)

| | AFS Diversy I 1000 ha | AFS Diversy II 1000 ha | Home Garden 1000 ha | Home Garden 100 ha |
|---|---|---|---|---|
| (1) TOTAL COSTS | 20,142,398 | 19,406,568 | 13,552,298 | 1,399,368 |
| *(2) Implementation* | 2,736,315 | 2,189,995 | 1,047,275 | 104,688 |
| *(3) Financial (Interests)* | 0 | 0 | 0 | 0 |
| *(4) Fixed Costs* | 10,785,983 | 10,785,983 | 5,627,470 | 607,478 |
| (5) Other Costs | 6,620,099 | 6,430,590 | 6,877,553 | 687,202 |
| *(6) Project Outgoings* | *4,354,213* | *3,807,892* | *1,891,396* | *195,810* |
| *(7) TOTAL BENEFITS* | 56,691,014 | 58,255,620 | 3,722,960 | 3,722,960 |
| *(8) NET BENEFITS* | 36,548,617 | 38,849,052 | 2,323,592 | 2,323,592 |
| *(9) NPV (DISCOUNTED)* | 14,203,505 | 16,760,005 | 1,065,066 | 1,065,066 |
| *(10) IRR (%)* | 19% | 28% | 36% | 36% |
| *(11) Payback (YEARS)* | 8.0 | 5.5 | 4.1 | 4.1 |
| *(12) NPV/ha eq* | 3,828 | 4,518 | 10,651 | 2,871 |
| (13) Equity Appreciation | 9,265,811 | 5,162,179 | 193,585 | 193,585 |
| | | | | |
| (1) TOTAL COSTS | 20,501,971 | 19,694,350 | 13,689,918 | 1,413,125 |
| *(2) Implementation* | 2,736,315 | 2,189,995 | 1,047,275 | 104,688 |
| *(3) Financial (Interests)* | 359,573 | 287,782 | 137,620 | 13,757 |
| *(4) Fixed Costs* | 10,785,983 | 10,785,983 | 5,627,470 | 607,478 |
| (5) Other Costs | 6,620,099 | 6,430,590 | 6,877,553 | 687,202 |
| *(6) Project Outgoings* | 4,354,213 | 3,807,892 | 1,891,396 | 195,810 |
| *(7) TOTAL BENEFITS* | 56,691,014 | 58,255,620 | 38,077,142 | 3,722,960 |
| *(8) NET BENEFITS* | 36,189,043 | 38,561,270 | 24,387,224 | 2,309,835 |
| *(9) NPV (DISCOUNTED)* | 14,159,085 | 16,724,454 | 11,246,901 | 1,063,366 |
| *(10) IRR (%)* | 22% | 36% | 53% | 50% |
| *(11) Payback (YEARS)* | 8.1 | 5.5 | 4.0 | 4.1 |
| *(12) NPV/ha eq* | 3,816 | 4,508 | 11,247 | 2,866 |
| (13) Equity Appreciation | 9,265,811 | 5,162,179 | 1,935,849 | 193,585 |
| | | | | |
| (1) TOTAL COSTS | 22,869,957 | 21,589,554 | 14,596,222 | 1,503,721 |
| *(2) Implementation* | 2,736,315 | 2,189,995 | 1,047,275 | 104,688 |
| *(3) Financial (Interests)* | 2,727,559 | 2,182,987 | 1,043,924 | 104,353 |
| *(4) Fixed Costs* | 10,785,983 | 10,785,983 | 5,627,470 | 607,478 |
| (5) Other Costs | 6,620,099 | 6,430,590 | 6,877,553 | 687,202 |
| *(6) Project Outgoings* | 4,354,213 | 3,807,892 | 1,891,396 | 195,810 |
| *(7) TOTAL BENEFITS* | 56,691,014 | 58,255,620 | 38,077,142 | 3,722,960 |
| *(8) NET BENEFITS* | 33,821,057 | 36,666,066 | 23,480,920 | 2,219,239 |
| *(9) NPV (DISCOUNTED)* | 11,834,922 | 14,864,324 | 10,357,370 | 974,447 |
| *(10) IRR (%)* | 15% | 24% | 34% | 32% |

| | | | | |
|---|---|---|---|---|
| *(11) Payback (YEARS)* | 10.2 | 6.9 | 5.3 | 5.4 |
| *(12) NPV/ha eq* | 3,190 | 14,864 | 10,357 | 2,627 |
| (13) Equity Appreciation | 9,265,811 | 5,162,179 | 1,935,849 | 193,585 |

Note: The rows of the table represent the following values: (1) Total Costs, equal to the sum of rows (1,2,3,4 and 5). (2) Implementation includes costs of seedlings, soil preparation, planting, fencing the area (labor and inputs for all items), and technical assistance for implementation, (3) Financial Costs are interest payments in the cases considered with credit loans, (4) Fixed Costs include labor for management and thinning, chemical and mechanical weeding, ant control, eventual implementation of organic fertilizers and technical assistance. (5) Other costs, especially costs with sales tax payments, harvesting, and production packaging. (5) Project Outgoings are the costs expected to be disbursed by the Project financier, considering the payment of line (2) and three twentieths of the costs of line (4), or 3 years of fixed cost payments. Row (7) represents the sum of expected revenues while row (8) represents the expected net profit resulting from the difference between rows (7) and (1). NPV or Net Present Value is the net present value under social discount rate 4.36% p.y. as suggested by See (https://journals.sagepub.com/doi/full/10.1177/1091142119890369). IRR in row (10) is the Internal Rate of Return, row (11) the payback time in years, NPV/ha eq is the net present value per hectare while Equity Appreciation (13) is the equity valuation estimated as the equivalent value of 3 revenues obtained from fruit trees as a residual value. All results reflect projects with a 20 year horizonBusiness as Usual Scenario (BAU)

In addition to comparing the systems' economic performance, it is essential to have a reference scenario against which to assess the AFSs' ability to overcome the current conditions, or Business as Usual (BAU), thus delivering the performances that are expected for impact investments.

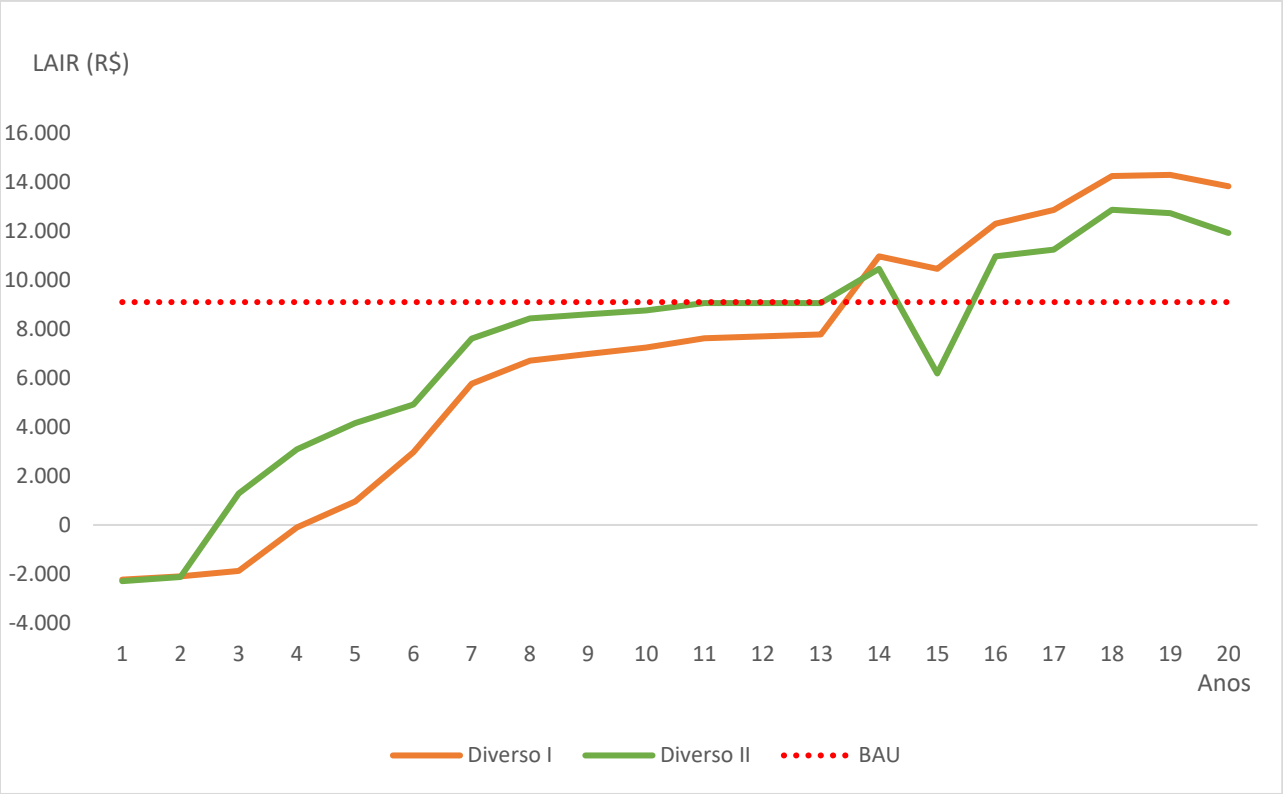
As discussed in other sections of this report, there is enormous cultural diversity in the municipalities covered by the study, which is reflected in material reproduction, labor employment, labor division and income sources. There was no interviewee or workshop participant, among those who fit the profile of potential project beneficiaries (farmers), who declared only one source of income, or even who claimed to dedicate themselves to only one activity.

The wealth of activities follows the climate seasonality and the opportunities offered by it, limited by the most varied restrictions, from access to land to the lack of financial resources that may prevent mobility within the territory. This diversity in income composition is a challenge for the establishment of a BAU reference.

Assuming that AFSs must be solutions that cannot be taken as substitutes for other culturally identifying activities of the communities (such as plant and animal extractivism), but as a solution amid agricultural activities, and considering that even in agriculture there are different production systems, the average income obtained from agricultural activities in the Marajó Mesoregion was considered as BAU, by property size class (IBGE, 2019).

For all revenues there are associated costs, so the same procedure was carried out for expenses. Finally, the Earnings Before Income Tax (EBIT), i.e. revenues minus costs, are compared for both the census-based BAU and the proposed AFSs. The results for systems with 1 ha are shown in figure 05.

Figure 05 - EBIT curves for different AFS models compared to the BAU model




It is possible to observe the positive trend of EBIT of both AFS – Diverse I and Diverse II – with the first surpassing the second from the 14th year of implementation onwards. Both models outperformed the BAU scenario in the long run. It is noteworthy that no seasonal activity is left out. Only agricultural activities are compared, so that SAF is an alternative to current systems but not to other non-agricultural sources of income.

This profit comparison analysis does not apply to the Home Garden AFS, given that the main intention of this AFS is not the sale of products, but the production of food for the family's own consumption, being generally managed by the women of the domestic unit.

In the end, the decision of which system to adopt is not trivial and will depend on a set of objectives that must be assessed against the scenario offered by the indicators. Without exhausting the possible analyses, but guiding some of the decisions to be made, it is possible to conclude and recommend:

(1) The disbursement necessary to adopt each of the systems is given by the total investment, plus 3/20 of the others if the project pays for the first three years of the AFS (Total Investment and Other Costs lines);

(2) If the project intends to leave a long-term legacy such as the reforestation of the rural space (and climate mitigation) made with native fruit trees that have currently established markets and are preferred and known by the farmers, the best system among the three analyzed is the Diverse AFS I.

Considering other arrangements presented in the Annex, there are other potential arrangements to be considered.

It is worth mentioning that the results shown in this report use conservative and static values, observed in the field or based on literature. However, the attached tool entitled "Cash Flows AFSs.xsls" allows the testing of hypotheses that may be relevant to the study. For example, the hypothetical condition in which climate change impacts the productivity of monoculture açaí and this raises the prices paid to producers by 10%, while açaí berries in agroforestry systems are resilient enough to absorb the changes without impact to productivity. Thus, the productivity of the proposed systems remains constant, but the revenues from açaí increase by 10%. The model allows us to assess that the Diverse AFS I would have a 17% higher NPV under such conditions.

## 4. Financial Analysis

The financial gap, which in this case represents the difference between the types of financing over the total cost of implementing the 1000 ha AFS models, indicates that this gap increases according to the type of financing and the corresponding financing rate.

The first gap goes from the scenario without financing (No Financial Credit), where the implementation cost is fully financed by the project, to the one with the cheapest financing (Cheapest Financial Credit). On average, there is an increase in the total cost of implementation of BRL 1,225 million (or BRL 1,225 thousand/ha). The second goes from the scenario with the cheapest financing to the scenario with the most expensive financing (Most Expensive Credit). In this case, on average, there is an increase in the total cost of implementation of BRL 8,067 million (or BRL 8,067 thousand/ha).

The investment ratio, that is, the ratio between the amount invested by the financier (Project Outgoings) and the difference between the total cost of the project and the amount invested, allows us to assess which AFS models demand greater investment from the partners, in particular, the beneficiary local families, whether in terms of work, reinvestment of revenues or other factors. With this information, it is possible to calculate how much the beneficiary will need to reinvest for every BRL 1 invested by the project so that the project achieves its expected financial results.

On a scale that goes from those AFS with greater demand for investment by beneficiaries to those with less demand, we observe: Home Garden AFS (BRL 6.15); Diverse AFS II (BRL 4.10); and Diverse AFS I (BRL 3.63). That is, while the Home Garden AFS is the system that requires the highest co-participation from the beneficiaries in terms of complementary investments, the Diverse AFS I is the one that demands the lowest co-participation from the beneficiaries.

## 5. Analysis of Potential Transformation Experiences for Climate Resistant Agroforestry Products

Agriculture and extractivism are important activities in the three municipalities surveyed and are sources of income generation, socialization and food and nutritional security. However, the practices locally developed employ, in most cases, management and planting techniques based on traditional itinerant agriculture (FLOHRSCHÜTZ; DUTRA, 1986). This agricultural system consists of cutting and burning native or secondary forests (clearing the area) for the implementation of the species to be cultivated.

During the field research, a number of initiatives and research projects were identified that seek to implement new production techniques in order to improve the use of agricultural and forestry crops and to protect and improve the chemical, biological and physical properties of the soil. These experiences can be summarized in strategies for processing and selling products originating from AFS, mainly in Soure and Salvaterra, with potential for replication in the municipalities (Frame 04).

Frame 04 - AFS initiatives or similar actions that can be leveraged in the municipalities of Salvaterra, Soure and Cachoeira do Arari.

| Initiative | Municipality/Community | Characteristics |
|---|---|---|
| Experiences with AFS | Cachoeira do Arari/ Comunidade de Sant'ana | With the help of training and workshops, some farmers implemented other forms of cultivation without the routine use of burnings, adopting soil cover with biomass from the production system itself. As a result, farmers report an improvement in soil fertility and an increase in production and, mainly, a reduction in the need to use chemical fertilizers in the area. |
| AFSs supported by Cafas | Salvaterra | AFS initiatives on family properties linked to CAFAS and initiated with species intercropping (usually açaí and cupuaçu). Production processed in a processing micro-industry and sold mainly to the PNAE (the national school meals program) |
| Aldeia Lunar | Soure | Food production without the use of chemical inputs. Soil, water and biodiversity conservation and preservation practices. Production of seedlings, fertilizer (composting) and intercropped production of native species between fruit trees and timber (the latter with the objective of producing biomass), and the production of short and annual cycle species (small plots). In this system, species are divided into main rows and between rows. Long-cycle species are cultivated in the main rows and short-cycle species between the rows. The production goes to school meals, through the PNAE, and the consumer market in Soure, through baskets delivered directly to consumers. |
| "Mulheres que plantam" (Women who plant) | Soure | Research and extension project coordinated by Prof. Cinthya Arruda from UFPA in Soure, with the objective of recording the productive practices of women in situations of social vulnerability in the municipality, and implementing seedbeds, agroecological gardens, edible gardens and AFSs using agroecology tools as basis, taking advantage of the spaces available in the participants' homes. The goals of these spaces are the production of food for self-consumption, income generation from the sale of surpluses (if any), the production of seedlings and the organic compounds generated, always aiming at reducing the socioeconomic vulnerability of the participating women. |

The medicinal plants identified in home gardens are used as important sources of homeopathic medicines. These plants constitute sources of medicines intended for different uses, from "spiritual" problems (such as "evil eye") to physical conditions (diarrhea, anti-inflammatory medicines, etc.). For example, the cultivation of

species such as kale, carirú and pariri: the first two species are rich in iron and, according to a producer from Soure, her daughter, who has anemia, eats "with gusto". Pariri (*Arrabidaea chica*) is rich in flavonoids (antioxidants) and is used for its anti-inflammatory, healing and antianemic properties.

Most of the fruits are consumed and/or sold *in natura*. However, there are some species that go through some type of processing before commercialization. The fruits are transformed into pulps, although for some fruits the preference is for commercialization *in natura*, as the economic return is higher and "the work is less painful". For example, in the quilombola community of Mangueiras, a producer reported that 50 fruits are needed to produce 1 kg of bacuri pulp, and the pulp is sold for BRL 20.00, while a bag of 100 fresh bacuri fruits is sold for BRL 60.00. In this situation, the decision on whether or not to process the fruit is driven by demand, given that the pulps are easier to preserve for future sales.

The açaí berry is sold *in natura*, in 14-kilogram baskets, mostly to intermediaries who go to the communities to purchase the product. The intermediaries resell the açaí fruit in the municipalities, where it is processed and transformed into the açaí "wine". In Soure, açaí wine is processed into ice cream. The ice cream is sold for BRL 5.00 a cup. The açaí processing in Soure has been promoted by a partnership between the açaí processors' association and local industries.

Cassava is the species with the greatest diversity of processed products and can be transformed into several by-products such as flour, tapioca flour, maniva and tucupi. Among these by-products, flour is the main one, being sold in 30-kilogram bags at a price of BRL 120.00 per bag. The other products are sold in small quantities, usually within the communities[8].

Cocoa production is still incipient in the three municipalities. However, there is an important movement encouraging the cultivation, production and commercialization of cocoa in the region[9]. Pará is currently the largest national producer of cocoa and its cultivation is carried out mainly by family farmers by means of agroforestry systems. Cocoa production in the state of Pará has contributed to the reduction of fires, soil protection, reduction of greenhouse gas emissions, in addition to contributing to the creation of jobs (direct and indirect) and income (Venturieri et al., 2022).

During the field research, we were able to observe some family units with cocoa trees in their backyards. However, this production is mainly destined for the families' self-consumption. Little or nothing is commercialized, due to the small quantity produced and difficulties of transporting the production to the city centers. The part of cocoa that is commercialized is the frozen fruit pulp. During the field research, the production or commercialization of cocoa beans and/or chocolates was not identified.

[8] In the quilombola community of Mangueiras, tapioca flour is sold for BRL 5.00 a liter; tucupi for BRL 3.00 (liters); tucupi with pepper for BRL 10.00 (liters).
[9] Incentive demonstrated through regulations that encourage the production of the fruit (cocoa) and recognize its importance in the preservation and conservation of native areas and in income generation for small producers (item 7, page 26)

Box 03 - Cocoa processing, the case of Dona Nena

To exemplify the potential of this production, the case of Dona Izete Costa, known as Dona Nena, a producer of 100% natural and artisan cocoa and chocolate in the metropolitan region of Belém, is presented. Dona Nena's family has always worked with the production and commercialization of cocoa beans, but in 2006, after going through financial difficulties, they decided to dig up an old family recipe. After the cocoa beans are dried, Dona Nena uses a type of grinder to produce a dense cocoa mass that is wrapped in the leaf of the cocoa tree and sold right there, in her family unit's shop on the island of Combu, in Belém. In addition to the 100% chocolate bar, there are other products: cocoa powder, nibs and brigadeiro (a typical Brazilian sweet) in a jar.

## 5.1 Analysis of the Maturity Level of Local Entities

The analysis of the level of maturity of an entity assumes the existence of a development process, through which the entities are evaluated in a certain time scale (KURIAKOSE et al, 2011). Therefore, over time, entities develop within a predictable, structured and decomposable path into sequential stages – maturity levels – ascertainable through the presence of certain characteristics and requirements (BECKER et al, 2009). Thus, in theory, the higher the maturity level of a given organization, the more developed it would be in the evaluated domain. For the development of this work and analysis of the level of maturity of the two entities that we propose to observe, the characteristics evaluated are the following: organizational governance, people management, financial management, commercial management, management of production processes and socio-environmental management (annexes), according to the methodology proposed by IEB (2018).

The two institutions assessed for their institutional maturity, CAFAS, in Salvaterra, and AAFCAM, in Soure, stood out during the field research as aggregating entities, acting as intermediary actors between the local producers, government bodies and the local market. In this sense, these two entities are focused on organizing the associated producers, accessing public policies and acting as a channel for processing and/or transporting part of the production to the local and institutional market (PNAE, mainly).

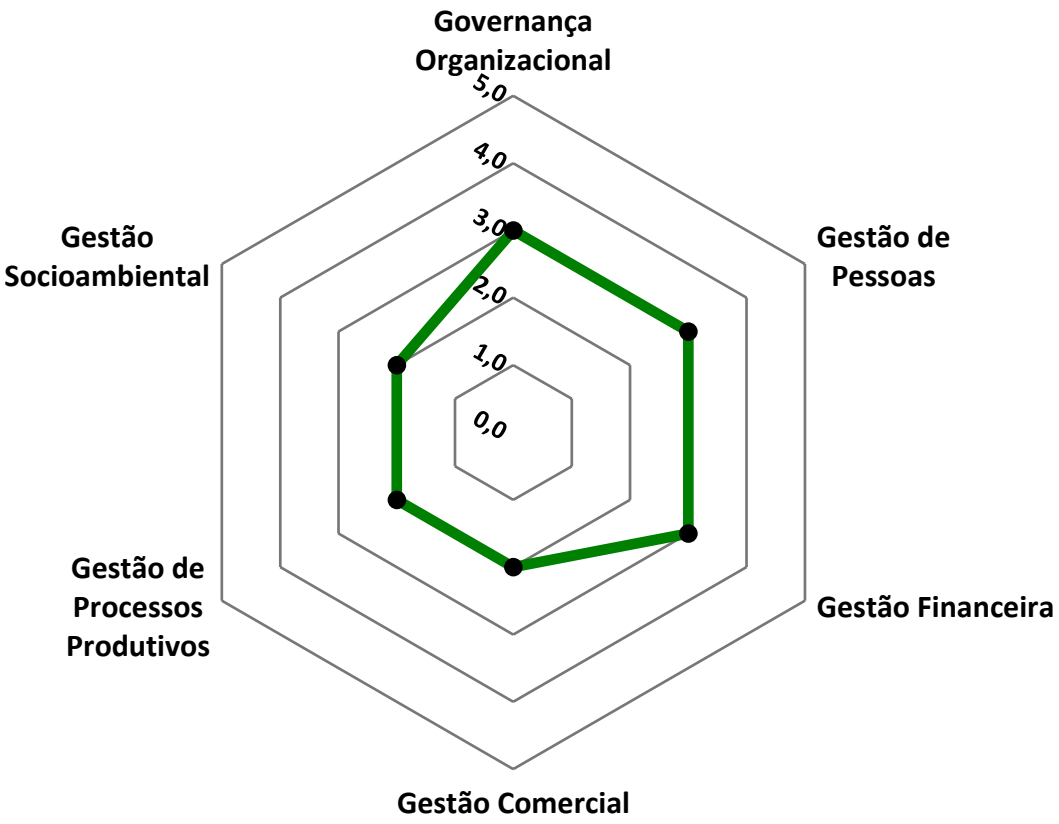
### *5.1.1 Cooperativa dos Agricultores e Agricultoras Familiares de Salvaterra – CAFAS (Salvaterra Family Farmers Cooperative)*

CAFAS is a singular cooperative and follows the Law nº 5.764/71, or law of cooperativism, being currently formed by 60 (sixty) members, all individuals, between men and women, family producers in the municipality of Salvaterra. Producers has as the main production fruit pulp, and some vegetables, however they work with several parallel cultures, for own consumption. For more than 10 years in the market, CAFAS has consolidated itself as an alternative for the disposal of agricultural products through the state markets, PAA and PNAE, making Salvaterra's production arrive in the cities of Soure and Cachoeira do Arari. In this sense, the cooperative's main business is to seek a market for such productions, as well as improve the production system itself, and especially the quality of life of its members, related producers and the local population.

The overall score obtained by the CAFAS cooperative, indicating its level of maturity, based on a scale of 0-5, was 2.5, (Figure 06), which indicates an "Intermediate organizational level where management is in

development, the processes are disciplined and systemic, but there are still many improvements to be made". The cooperative has a good control of processes such as financial, people and commercial management, accessing important public policies for the commercialization of the cooperative's production. There is a concern in relation to socio-environmental governance processes, with projects for the implementation of agricultural condominiums for the cooperative's members. The documentation for its operation is up to date, ensuring a positive situation in relation to its fiscal and financial obligations with the control bodies.

Figure 06 - CAFAS Organizational Maturity Level




Elaborated by: IEB, 2022.

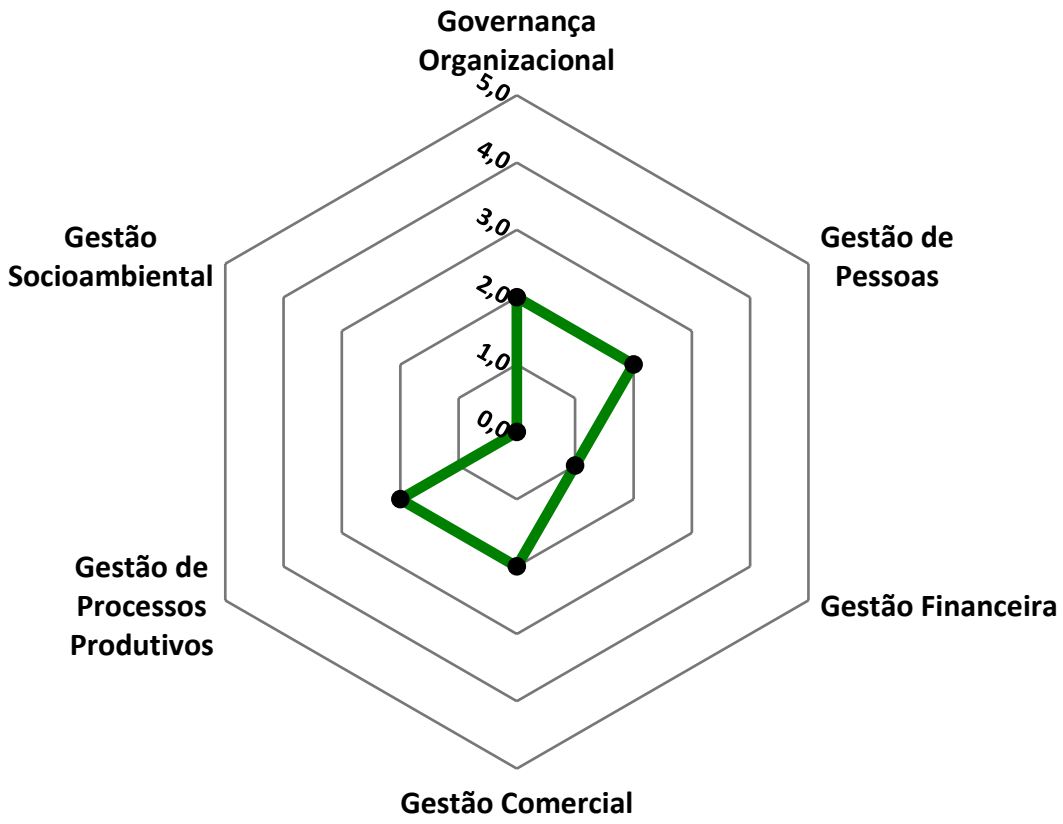
Among all the points observed in the field, we highlight that the processes that involve organizational, people and finance management were the most developed, with the highest score among all the questions raised (note 3), showing that, despite the intermediate level of maturity reached, in general, the management developed by CAFAS's representatives and members has been focused on financial control and participation in decision-making, with such themes internally debated and organized with naturality.

### *5.1.2 Associação de Agricultores Familiares dos Campos do Marajó (AAFCAM) (Campos do Marajó Family Farmers Association)*

The Associação de Agricultores Familiares dos Campos do Marajó (AAFCAM) was created in 2019, with the help of Emater de Soure. Currently, it brings together 55 families of rural producers who sell their agricultural products mainly in institutional markets such as the PAA and PNAE.

The overall score obtained by AAFCAM, indicating its level of maturity and using the 0-5 scale as a reference, was 1.7 (Figure 07), which, according to the diagnostic instruments, indicates a “fragile organizational level, where management reacts to problems, but processes occur in an unpredictable and uncontrolled manner”. The association was founded in 2019, and despite its short history and the hiatus created by the pandemic, the entity has a good control of processes such as commercial and productive management, accessing important public policies for the commercialization of the associates' production and the local market. However, it was not possible to assess actions in relation to socio-environmental, people and financial management. The association, however, complies with its legal obligations, ensuring a positive situation regarding its fiscal and financial obligations with the control bodies.

Figure 07 - AAFCAM Organizational Maturity Level




Elaborated by: IEB, 2022.

Among all the points observed in the field, we highlight that the processes that involve the management and commercialization of production were the most developed, presenting the highest score among all the questions raised (note 2), showing that despite the initial maturity level reached, in general the management developed by AAFCAM's representatives and members regarding sales to institutional and local markets is a major concern of the entity, thus ensuring an important sales channel for the association's production. Ensuring this flow was one of the main reasons for the creation of the association in 2019, given the difficulty faced by producers in selling their production and the need for organization to resolve this issue. However, the level of participation in decision-making is still fragile and needs to be improved.

The strengthening of these entities, and of others in initial stages (for example, see Annex 2, Exhibit 07 and 08, in mapped social actors of Organized Civil Society), is an important factor to be taken into account, as they are participatory spaces of governance, with horizontal decision-making, that work to facilitate access to public policies, expand market access and, above all, increase the ability to negotiate fair prices for local products with large buyer companies that usually determine the prices paid for products in the localities and communities, leaving local producers in the hands of middlemen.

# 6. Market Research for Agroforestry-Based Solutions in Marajó

## 6.1 Institutional Markets

Institutional markets are important tools for income generation, encouraging the diversification of production and associates/members' work. The main institutional market identified was the National School Meals Program – PNAE.

The PNAE constitutes a public policy for the provision of school meals and food and nutrition education for basic education students (kindergarten, basic education and youth and adult education) in the public school network. Resources for purchasing food and other activities are transferred by the federal government to states and municipalities, according to the number of students enrolled in the respective education networks. Since the approval of Law No. 11,947, of 6/16/2009, 30% of the financial resources allocated to the PNAE must be spent on the acquisition of family farming products present in the municipalities of schools registered in the program (FNDE, 2022).

Access to public procurement takes place mainly through associations, unions and cooperatives of local producers (CAFAS in Salvaterra, STTR in Cachoeira do Arari and AAFCAM in Soure) and açaí processors (ABAS, Soure), but can also be accessed directly by individual farmers, with a sales limit of up to BRL 40,000.00 per DAP (Pronaf's Declaration of Aptitude) on average.

Box 04 - Family farmers in the PNAE

The importance of agricultural production was observed in the speech of the president of Associação de Agricultores Familiares dos Campos do Marajó - AAFCAM, Alessandro Marinho, who reported that AAFCAM participated in the public procurement program for PNAE (2022) of the municipality of Soure. Of the 43 included in the public procurement program (SOURE, 2022), the association will provide 38 items, demonstrating the existence of continuous and significant agricultural production in the municipality.

The institutions have the role of collecting the products and commercializing them collectively, guaranteeing access to the market in the amount stipulated by the procurement program, establishing the bridge between institutional markets and local farmers, participating in the PNAE purchases, receiving, processing, packaging and providing products for school meals.

The amounts paid for the products are defined for each purchase and are normally based on prices in the local markets. According to the interviewees, as they are fixed values (Table 11) and are not influenced by production cycles, they contribute to generating income that is important for the socioeconomic development of local families and encouraging local production.

Table 11 - Amounts paid for PNAE purchases in Salvaterra and Soure in 2022, with emphasis on products from AFSs and derivatives

| Products | Price (in BRL) | |
|---|---|---|
| | Salvaterra | Soure |
| Banana ("prata" variety) (Kg) | 10.00 | 5.42 |
| Cassava flour | 180.00 (bundle) | 5.91 (kg) |
| Tapioca flour (liter) | 6.00 | 3.87 |
| Sweet cassava (kg) | 6.00 | 2.39 |
| Papaya (kg) | 8.00 | 5.38 |
| Pre-cooked maniva (Kg) | - | 7.17 |
| Maroon cucumber (kg) | 8.00 | 5.16 |
| Açaí pulp (liter) | 20.00 | 14.95 |
| Guava pulp | 14.50 | 12.00 |
| Cupuaçu pulp (Kg) | 18.00 | 17.54 |
| Muruci pulp (kg) | 15.00 | 12.36 |
| Tucupi (liter) | - | 7.06 |

Source: PNAE Public Procurement – Soure/Salvaterra (2022). Elaboration: IEB, 2022.

## 6.2 Local Commerce

Restaurants, the municipal market and direct consumers constitute a sales channel, mainly in Soure and Salvaterra, for products such as parsley, jambu, cassava flour, watermelon, sweet cassava, fish and part of the native fruits collected such as açaí. There is also commercialization within the communities, considering the distances from the communities to the city centers for access to urban markets.

Greengrocers are also an important commercialization channel for family farming products in Soure and Salvaterra. According to the owners of the establishments visited, the main products sold from local agriculture are leafy greens (jambu, kale, parsley and chicory)[10].

However, some of these establishments said they found it difficult to acquire certain items from local producers. Among the barriers mentioned are products destined for sale outside the municipalities (especially pineapple), seasonality in the offer of native fruit species and, mainly, high prices. Faced with these obstacles to the acquisition of local products, most products purchased locally come from the state of Pará's food supply center (CEASA – Belém).

[10] On the day of the visit, the prices informed were as follows: Jambu (purchase for BRL 1.5 a bunch and resale for BRL 3.00); Kale (purchase for BRL 0.5 and resale for BRL 2.00) and Parsley (purchase for BRL 1.5 and resale for BRL 3.00).

# 7. Access to Financing for Target Beneficiaries

## 7.1 *Programa Nacional de Fortalecimento da Agricultura Familiar* (Pronaf) (National program for family agriculture)

The *Programa Nacional de Fortalecimento da Agricultura Familiar* (PRONAF) (National program for family agriculture) is the main source of credit for small farmers and their families. This line of credit is intended to finance projects and investments in the implementation, expansion or modernization of production, processing, industrialization and service structure in rural establishments or in nearby rural community areas.

Pronaf offers the following financing lines: agroindustry, Pronaf woman, Agroecology, Bioeconomy, Pronaf food, Pronaf youth, Pronaf microcredit and Pronaf quotas (BNDES, 2022a). According to local information, the PRONAF lines most accessed by producers in the three municipalities of interest to the project are PRONAF B and PRONAF food.

Pronaf can be accessed individually or collectively, and borrowers need to obtain a Declaration of Aptitude for Pronaf (DAP) issued by EMATER (BASA, 2022), Rural Unions, or the Incra certificate in case of agrarian reform settlements. Additionally, it is necessary to prepare a technical financing project by an ATER technician or engage a financial agent (usually a bank agent).

According to information obtained through the Federal Government's information channel, in the last 9 years, 3,555 PRONAF contracts were signed, representing a total of BRL 12,811,896.20 in rural loans granted to the three municipalities. The municipality of Cachoeira do Arari has the highest number of contracts concluded (1,935), followed by Soure (1,050) and Salvaterra (570) (Table 12). When we look at the financed amounts, Cachoeira do Arari accounted for BRL 6,339,604.11, Salvaterra comes second with BRL 3,362,623.74, followed by Soure with BRL 3,109,668.35 (Tables 13).

Table 12 - Number of PRONAF contracts in the three cities surveyed

| Municipality | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022* |
|---|---|---|---|---|---|---|---|---|---|---|
| Cachoeira do Arari | 391 | 486 | 335 | 197 | 38 | 48 | 68 | 57 | 241 | 74 |
| Salvaterra | 76 | 87 | 86 | 73 | 32 | 5 | 3 | 5 | 105 | 98 |
| Soure | 112 | 129 | 141 | 117 | 53 | 20 | 51 | 18 | 282 | 127 |

Source: BCB/DEROP/SICOR Elaboration: IEB, 2022.

Table 13 – Total amount financed (in BRL) by PRONAF in the three municipalities surveyed (continue)

| Municipality | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|
| Cachoeira do Arari | 1,083,291.83 | 1,357.774.25 | 1,308,172.15 | 736,648.50 | 95,000.00 |
| Salvaterra | 312,246.46 | 300,943.60 | 296,669.50 | 278,688.77 | 87,740.00 |
| Soure | 505,824.51 | 330,443.78 | 356,503.59 | 304,376.19 | 132,500.00 |

Source: BCB/DEROP/SICOR Elaboration: IEB, 2022.

Table 13 – Total amount financed (in BRL) by PRONAF in the three municipalities surveyed (end)

| Municipality | 2018 | 2019 | 2020 | 2021 | 2022* | Total financed |
|---|---|---|---|---|---|---|
| Cachoeira do Arari | 120.000,00 | 224,604.80 | 318,706.73 | 808,794.49 | 286,611.36 | 6,339,604.11 |
| Salvaterra | 12.500,00 | 37,220.80 | 167,079.21 | 617,200.03 | 1,252,335.37 | 3,362,623.74 |
| Soure | 50.000,00 | 127,500.00 | 109,667.00 | 772,834.93 | 420,018.35 | 3,109,668.35 |

Source: BCB/DEROP/SICOR Elaboration: IEB, 2022.

The information obtained does not clarify the type of Pronaf loan accessed. However, according to information from technical assistance agencies, associations and some local producers, Pronaf B is the type of credit with the highest volume of contracts carried out in the three municipalities. PRONAF B invests in family farmers with a gross annual income of up to BRL 23 thousand (USD 4,267.00), with up to BRL 3 thousand (USD 556.00) released per beneficiary.

Pronaf Food was also mentioned during the field work. This line of credit is focused on investment in improvements in infrastructure, equipment, storage, transport and inputs. According to the investment objective, the amounts can vary between BRL 60 thousand (USD 11,131.00) to BRL 400,000 (USD 74,211.00).

In terms of financial institutions, Banco da Amazônia – Basa is the entity with the greatest reach and regional capillarity when it comes to accessing credit via Pronaf. The relationship with other institutions such as Banco do Brasil (federal-owned) and Banpará (state-owned), according to information from Emater's technicians, is somewhat conflicting, due to borrowers' default rates at these institutions.

Based on interviews with EMATER technicians, it was identified that events of default are a problem in the region, mainly due to the lack of information on how the credit lines work. As a result, access has become more limited. According to local Emater technicians, there is an effort to encourage small local farmers to control production, with the offer of training programs in financial education (production control, costs, gross income, where the money is invested, etc.), thus improving property management and consequently improving access to credit and financing.

## 7.2 ABC+ Program

ABC+ offers credit lines for agricultural activities that contribute to the reduction of greenhouse gas emissions and other environmental impacts. Among other activities, ABC+ provides financing for the implementation of integrated systems such as agroforestry systems, including technical assistance for project preparation and maintenance of activities, acquisition of seeds and seedlings and implementation of nurseries in rural properties.

The ABC+ credit lines can be applied for directly by rural producers (individuals or legal entities) and through producer cooperatives. Credit is contracted through financial institutions accredited by Banco Nacional de

Desenvolvimento Econômico e Social – BNDES, such as Basa. Payment terms range from up to 12 years, with an 8-year grace period, for cases of implantation and maintenance of forests such as açaí and cocoa, to up to 10 years, with a 5-year grace period, for other projects (BNDES, 2022b).

## 8. Current Government Regulations and Rules Affecting Market Access

This item presents a summary of the main regulations currently in force at the state and federal levels (Frame 05) that address the implementation of Agroforestry Systems as an alternative for the recovery of degraded areas, reconstitution of Legal Reserve areas, aiming at the socioeconomic, cultural and social development of beneficiary regions and families.

Frame 05 - Main legislation addressing the implementation of AFS

| Legislation | Objective | Level |
|---|---|---|
| LAW NO. 12.854, AS OF AUGUST 26, 2013. | Fosters and encourages actions that promote forest restoration and the implementation of agroforestry systems in expropriated rural areas and in degraded areas, in the cases specified | Federal |
| LAW NO. 6.462, AS OF JULY 04, 2002 | The State Policy on Forests and other Vegetation Forms is the set of principles, objectives and instruments of action established in this Law with the aim of preserving, conserving and recovering the natural flora heritage and contributing to the socioeconomic development of the State of Pará, in accordance with the State Environmental Policy and in accordance with the applicable Federal Legislation. | State |
| NORMATIVE INSTRUCTION NO. 1, AS OF JANUARY 10, 2018 | Establishes the Forest Restoration Project through Agroforestry Systems - PROSAF under the responsibility of Ideflor-bio, for implementation in small rural properties or rural households, for the purposes of production and environmental regularization and approves the requirements and procedures for interested parties to join the project. | State |
| JOINT NORMATIVE INSTRUCTION SEMAS/IDEFLOR-BIO NO. 07 AS OF SEPTEMBER 20, 2019 | Provides for the criteria and procedures for reconstituting the Legal Reserve by landowners and land holders, through the planting of cocoa – *Theobroma cacao L*. in Agroforestry Systems - AFS, within the scope of the Secretaria Estadual de Meio Ambiente e Sustentabilidade - SEMAS (State Secretariat for the Environment and Sustainability) and the Instituto de Desenvolvimento Florestal e da Biodiversidade do Estado do Pará - IDEFLOR-Bio (Institute for Forestry and Biodiversity Development of the State of Pará). | State |

The regulations above demonstrate a favorable inclination of the government of the State of Pará, as well as of the Federal Government, to support projects for the preservation, conservation and recovery of the state's natural heritage, fauna and flora. Support for the implementation of AFS is the main line of action to achieve these goals, as we can see in IN No. 01/2008 and in joint IN SEMAS/IDEFLOR-BIO No. 07/2019, a favorable trend with regards to the object of this project. The existence of an environmental monitoring agency is another important sign to be observed through these regulations.

The Secretaria Estadual de Meio Ambiente e Sustentabilidade - SEMAS (State Secretariat for the Environment and Sustainability) and the Instituto de Desenvolvimento Florestal e da Biodiversidade do Estado do Pará - IDEFLOR-Bio (Institute for Forestry and Biodiversity Development of the State of Pará) are the main governmental entities related to this theme in the State of Pará, willing to support and encourage projects whose main scope is sustainable production, combined with the preservation and conservation of local fauna and flora, promoting sustainable income generation and ensuring improvements in quality of life and food and nutritional security in the territories reached.

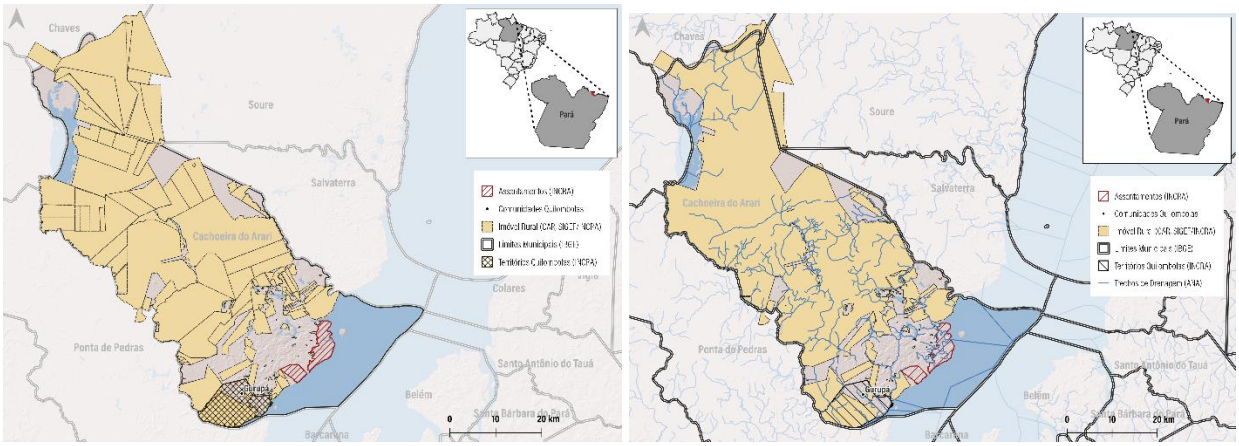
## 9. Main Specific Risks

### 9.1 Implementation Areas

For each municipality, spatial data referring to land tenure structure was overlapped, estimating the overlaps of areas occupied by different categories of land tenure and management.

In Cachoeira do Arari, the only quilombola community, Gurupá, has its recognized territory totaling 10,200 ha, but about 62% of it overlaps an area declared as private (CAR), which certainly raises concerns over potential conflicts. The 2 INCRA rural settlements total 4,400 ha with no apparent conflict caused by overlapping areas (Figure 08).

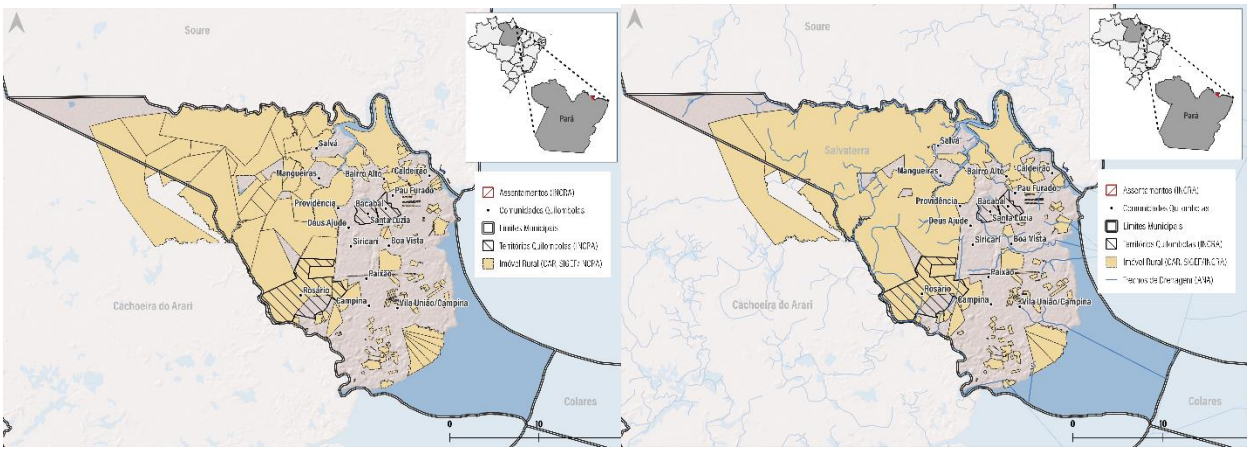
Figure 08 - Overlapping layers of land tenure information in the municipality of Cachoeira do Arari/PA.




From the point of view of access to fishing and floodplain resources, such as açaí for extractivism, the crossing of hydrological maps with the layers of land tenure structure shows that about 94% of the linear extension of watercourses are within private property areas (CAR), evidencing the exhaustively reported problem of restricted access to vital resources for the economy and culture of quilombola peoples, reinforcing the need for alternative income projects, such as the AFS proposal.

The general situation is less serious in Salvaterra, where 66% of watercourses are privately-owned, although there are communities that are especially vulnerable to access restriction, such as Salvá, Magueiras, Barro Alto, Pau Furado, Providência and Deus Ajude. A more comfortable situation is seen in Santa Luzia and Bacabal, where quilombola territories are recognized, there are streams and there is no record of private properties, as shown in the figure below (Figure 09).

Figure 09 - Overlapping layers of land tenure information in the municipality of Salvaterra/PA.

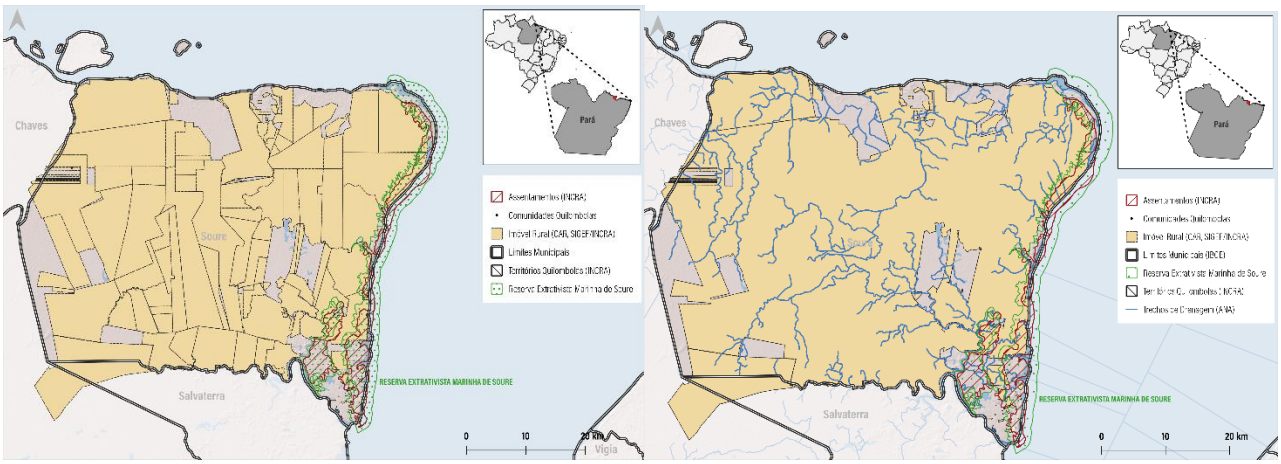



Most communities' territories are not officially recognized, which represents a risk to the maintenance of traditional production systems, but, on the other hand, these territories are non-earmarked public areas, most of them belonging to the State of Pará, with no overlapping with privately-owned areas. An important exception is the territory of Rosario, whose recognized quilombola area encompasses 4,000 ha, of which 3,000 have been declared as privately-owned.

Soure, on the other hand, presents a peculiar situation (Figure 7). The only two quilombola communities[11] live in the fishing zone to the south of the municipality, in an area belonging to the Soure Extractive Reserve, which has 7 of its 30 thousand hectares in a situation of conflict, in areas declared private. In terms of the "privatization" of watercourses, similarly to Cachoeira do Arari, more than 90% of the linear extension is within privately-owned areas (Figure 10).

[11] Identified in the field, but without official title.

Figure 10 - Overlapping layers of land tenure information in the municipality of Soure.




## 9.2 Lack of Seedlings

According to a survey by IPEA (2015), Pará is the third state with the highest number of nurseries of native species, with 106 registered in 2015. Of this total, 18 are located in the metropolitan area of Belém, in the municipalities of Belém, Marituba and Ananindeua, and others 30 in the Castanhal and Northeast of Pará Mesoregions.

The implantation of 1000 ha of AFS would require between 550 thousand and 1.05 million seedlings, which is equivalent to 10% of the annual production capacity installed in the State of Pará. If the project is carried out in 3 years, and considering only the nurseries in the Belém metropolitan region, it would require something around 5% of the installed capacity and 10% of the actual annual sales of the 18 nurseries in the region (IPEA, 2015).

The production of local seedlings, on the other hand, requires investments of around BRL 20 thousand for the installation, another BRL 20 thousand for training and fixed costs of around BRL 12 thousand/month for the establishment of centers in at least 4 communities aiming at a production of 100 thousand seedlings per year, with an average loss rate of 15%.

Considering the initial seedlings target, the nurseries would need to be ready and in full operation by the end of year 1 and operating at maximum capacity to meet the demand of the AFS implementation project in 3 years.

We estimated an average cost for the seedlings at around BRL 4.5 compared to the average price used in the models of BRL 9.9, except for Açaí, which has a local price of BRL 0.9.

But competitiveness depends on ability and experience. CAFAS is developing a nursery, but on a small scale, with a current capacity of 1,000 seedlings (Figure 11).

Figure 11 - Photos of the nursery of seedlings of native forest species at Cafas, Soure/PA

## 10. General Recommendations

- **Prioritize AFS models according to adaptation and ecological resilience criteria, also considering economic, sociocultural and equity factors.** AFS models present trade-offs regarding implementation costs according to scale, financing options, need for investments on the part of beneficiaries, among other factors. The option for AFS models in units of 1 ha or less, such as those analyzed (Diverse AFS I, Diverse AFS II and Home Garden AFS), can contribute to the achievement of positive economic, social and environmental results, with a fair distribution of benefits and the expected provision and maintenance of ecosystem services according to the maturity level of these systems. Furthermore, it contributes to greater inclusion of women in the promoted models, based on their role in the local economy.
- **Concentrate the implementation of initiatives in territories that favor their continuity**. The land tenure issue in the municipalities brings a series of barriers to access to resources for consumption and income generation, in addition to constraining the use of land in small areas by families of small rural producers, limiting the scaling of their productions. However, some communities, such as the quilombola communities in the municipality of Salvaterra, are inserted into a context of lower risk associated with land conflicts and, therefore, have a lower opportunity cost of land use. Furthermore, these communities have a rich cultural repertoire and agricultural vocation historically experienced in their territories. Concentrating the initial actions in these contexts may imply lower risks to project implementation.
- **Facilitate access to infrastructure and equipment to improve the production process.** As diagnosed, infrastructure conditions and access to equipment can leverage production and access to markets for local family farming products. Facilitating access conditions, as well as including the acquisition of these structures in the project budget can contribute to gains in scale and efficiency in the production of beneficiary families.

- Expand the inclusion of products derived from AFSs in institutional and local markets. Due to geographic proximity, demand predictability and price stability, these market options can favor the strengthening of a local economy based on the AFS products. In the case of institutional markets, the design of such programs encourages productive diversification which, in turn, can reduce the risks associated with supply shocks (for example, caused by extreme weather events) in the production of certain products, negatively impacting food and nutrition security, in addition to generating income for local families.
- Collaborate with technical assistance and rural extension bodies in the dissemination of information and training. The absence of technical assistance focused on family farmers impairs access to credit programs such as PRONAF. Emater, in Soure, has invested in training on financial control and education, with the aim of improving information on local production and, consequently, enabling local farmers/producers to have greater control over production, accessibility to credit programs and greater visibility of the municipal production. However, considering the current decrease in the supply of ATER in the municipalities, collaborative arrangements between institutions may enable the resumption of training opportunities and dissemination of knowledge. The involvement of teaching and research institutions, such as Universidade Federal do Pará, present in Soure, should be considered in this type of arrangement.
- Ongoing training to adapt production systems to the effects of climate change, considering the experiences of AFSs accumulated in the territory. Approaches that rescue, value and strengthen community and local knowledge are essential for the implementation of agricultural models that reconcile income generation and the strengthening of local communities in the face of current climate and economic challenges. The current ATER model has been criticized for holding workshops and specific events that do not guarantee the permanence and continuity of disseminated practices. Strategies for continuous monitoring, training of local leaders, training of youth and women and establishment of impact indicators are essential for continuous monitoring and adaptation of strategies to achieve the expected results.

- Facilitate spaces for dialogue between different social actors in the territory. The co-participation of different segments of social actors (public, private, community representatives and individuals) in spaces for dialogue and decision-making can favor mutual learning and the recognition of experiences and knowledge that are developed in local daily life, resulting in projects with greater legitimacy and adherence to the sociocultural, economic and environmental conditions of the locality. In this sense, the mapped network of social actors may suggest paths of interaction between the actors present in the territory.
- Strengthen local representation institutions such as associations and cooperatives. With the exception of some occasional experiences, local institutions exist by right, but not in practice. In this sense, strengthening and turning these spaces into intermediary centers between the local market, the government and farmers is fundamental. These are governance spaces that can also become centers for training, acquisition, processing and commercialization.
- Align project proposals with the interests of rural youth and women. The participation of young people is encouraged by families, especially women, who transmit knowledge through practice, in their daily productive tasks, encouraging the permanence of young people in the community. However, the hard work and lack of support is one of the main obstacles to the maintenance of young people in the communities. Facilitating youth and women's participation processes, from the formulation of project

objectives and public policies, to the monitoring of activities and evaluation of results, is essential to promote equal opportunities for inclusion and reduce inequalities.

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## ANNEX 1 – ECONOMIC ANALYSIS OF POSSIBLE AFS ARRANGEMENTS ASSESSED

In addition to the three AFS arrangements described in the report, financial assessments were carried out for another five possible AFS arrangements considering the assumptions mentioned in chapter 3, based on observations and data collected in the field. Frame 06 presents the assessed arrangements.

Frame 06 - Other proposed AFS arrangements for financial analysis.

| Simplified AFS | Cambeua AFS (Irrigated) * | Fruit AFS (Irrigated) | Worker* AFS | Cocoa AFS |
|---|---|---|---|---|
| Açai (*Euterpe oleracea*)<br>Cassava (*Manihot esculenta)* | Açai (*Euterpe oleracea*)<br>Murici *(Byrsonima Crassifolia)*<br>Bacuri *(P. insignis)*<br>Cupuaçu *(Theobroma grandiflorum)*<br>Cassava (*Manihot esculenta* | Banana (*Musa spp)*<br>Açai (*Euterpe oleracea*)<br>Murici *(Byrsonima Crassifolia)*<br>Guava (*Psidium guajava)*<br>Bacuri *(P. insignis)*<br>Cupuaçu *(Theobroma grandiflorum)*<br>Tucumã *(Astrocaryum vulgare)* | Banana (*Musa spp)*<br>Açai (*Euterpe oleracea*)<br>Murici *(Byrsonima Crassifolia)*<br>Bacuri *(P. insignis)*<br>Cupuaçu *(Theobroma grandiflorum)*<br>Cassava (*Manihot esculenta)* | Banana (*Musa spp)*<br>Cocoa (*Theobroma cacao*)<br>Cupuaçu *(Theobroma grandiflorum)* |

In addition to the AFS arrangements presented in the report, other arrangements proved to be economically viable, especially those models that have irrigation systems. Despite the need for higher upfront investments and maintenance, the expected productivity of irrigated models is higher (Table 18 and 19).

Table 14 - Performance of alternative AFS models. 1000 Ha (in USD)

| In USD | Simplified AFS 1000 ha | Cambeua AFS (Irrigated) | Fruit AFS (Irrigated) | Worker AFS 500 ha | Cocoa AFS H20 |
|---|---|---|---|---|---|
| | | | Outputs - No Financial CREDIT | | |
| TOTAL COSTS (CURRENT) | 76.212.378 | 87.921.427 | 87.980.060 | 34.457.899 | 72.101.728 |
| *Implementation* | 5.653.980 | 18.818.680 | 19.218.800 | 1.746.832 | 10.474.480 |
| *Financial (Interest)* | 0 | 0 | 0 | 0 | 0 |

| | | | | | |
|---|---|---|---|---|---|
| *Fixed* | 40.015.998 | 41.755.824 | 41.718.240 | 20.896.704 | 40.015.998 |
| Other Costs | 30.542.400 | 27.346.923 | 27.043.020 | 11.814.363 | 21.611.250 |
| *Project Outgoings* | 11.656.380 | 25.082.054 | 25.476.536 | 4.881.338 | 16.476.880 |
| *TOTAL BENEFITS (CURRENT)* | 218.913.714 | 238.380.844 | 301.681.106 | 81.723.275 | 114.814.143 |
| *NET BENEFITS* | 142.701.336 | 150.459.417 | 213.701.046 | 47.265.376 | 42.712.415 |
| *NPV (DISCOUNTED)* | 62.372.377 | 54.619.741 | 83.794.070 | 18.507.617 | 9.257.478 |
| *IRR (%)* | 27% | 16% | 19% | 21% | 8% |
| *Payback (YEARS)* | 6,3 | 9,4 | 7,9 | 7,9 | 15,8 |
| *NPV/ha eq* | 62.372 | 54.620 | 83.794 | 37.015 | 9.257 |
| Equity Appreciation (DISCOUNTED) | 0 | 28.861.623 | 42.015.553 | 13.614.341 | 26.964.648 |
| | | **Outputs - Cheapest Financial CREDIT** | | | |
| TOTAL COSTS (CURRENT) | 76.955.355 | 90.394.349 | 90.505.560 | 34.687.446 | 73.478.157 |
| *Implementation* | 5.653.980 | 18.818.680 | 19.218.800 | 1.746.832 | 10.474.480 |
| *Financial (Interest)* | 742.977 | 2.472.922 | 2.525.500 | 229.547 | 1.376.429 |
| *Fixed* | 40.015.998 | 41.755.824 | 41.718.240 | 20.896.704 | 40.015.998 |
| Other Costs | 30.542.400 | 27.346.923 | 27.043.020 | 11.814.363 | 21.611.250 |
| *Project Outgoings* | 11.656.380 | 25.082.054 | 25.476.536 | 4.881.338 | 16.476.880 |
| *TOTAL BENEFITS (CURRENT)* | 218.913.714 | 238.380.844 | 301.681.106 | 81.723.275 | 114.814.143 |
| *NET BENEFITS* | 141.958.359 | 147.986.496 | 211.175.545 | 47.035.829 | 41.335.987 |
| *NPV (DISCOUNTED)* | 62.280.593 | 54.314.249 | 83.482.083 | 18.479.260 | 9.087.441 |
| *IRR (%)* | 31% | 18% | 23% | 23% | 8% |
| *Payback (YEARS)* | 6,4 | 9,5 | 7,9 | 7,9 | 15,8 |
| *NPV/ha eq* | 62.281 | 54.314 | 83.482 | 36.959 | 9.087 |
| Equity Appreciation (DISCOUNTED) | 0 | 28.861.623 | 42.015.553 | 13.614.341 | 26.964.648 |
| | | **Outputs - Most Expensive Financial CREDIT** | | | |
| TOTAL COSTS (CURRENT) | 81.848.265 | 106.679.887 | 107.137.360 | 36.199.141 | 82.542.690 |
| *Implementation* | 5.653.980 | 18.818.680 | 19.218.800 | 1.746.832 | 10.474.480 |

| | | | | | |
|---|---|---|---|---|---|
| *Financial (Interest)* | 5.635.887 | 18.758.460 | 19.157.300 | 1.741.242 | 10.440.962 |
| *Fixed* | 40.015.998 | 41.755.824 | 41.718.240 | 20.896.704 | 40.015.998 |
| Other Costs | 30.542.400 | 27.346.923 | 27.043.020 | 11.814.363 | 21.611.250 |
| *Project Outgoings* | 11.656.380 | 25.082.054 | 25.476.536 | 4.881.338 | 16.476.880 |
| *TOTAL BENEFITS (CURRENT)* | 218.913.714 | 238.380.844 | 301.681.106 | 81.723.275 | 114.814.143 |
| *NET BENEFITS* | 137.065.449 | 131.700.957 | 194.543.746 | 45.524.134 | 32.271.454 |
| *NPV (DISCOUNTED)* | 57.478.234 | 38.330.101 | 67.158.082 | 16.995.541 | 190.662 |
| *IRR (%)* | 24% | 11% | 15% | 19% | 4% |
| *Payback (YEARS)* | 7,1 | 12,6 | 10,3 | 9,2 | 18,9 |
| *NPV/ha eq* | 57.478 | 38.330 | 67.158 | 33.991 | 191 |
| Equity Appreciation (DISCOUNTED) | 0 | 28.861.623 | 42.015.553 | 13.614.341 | 26.964.648 |

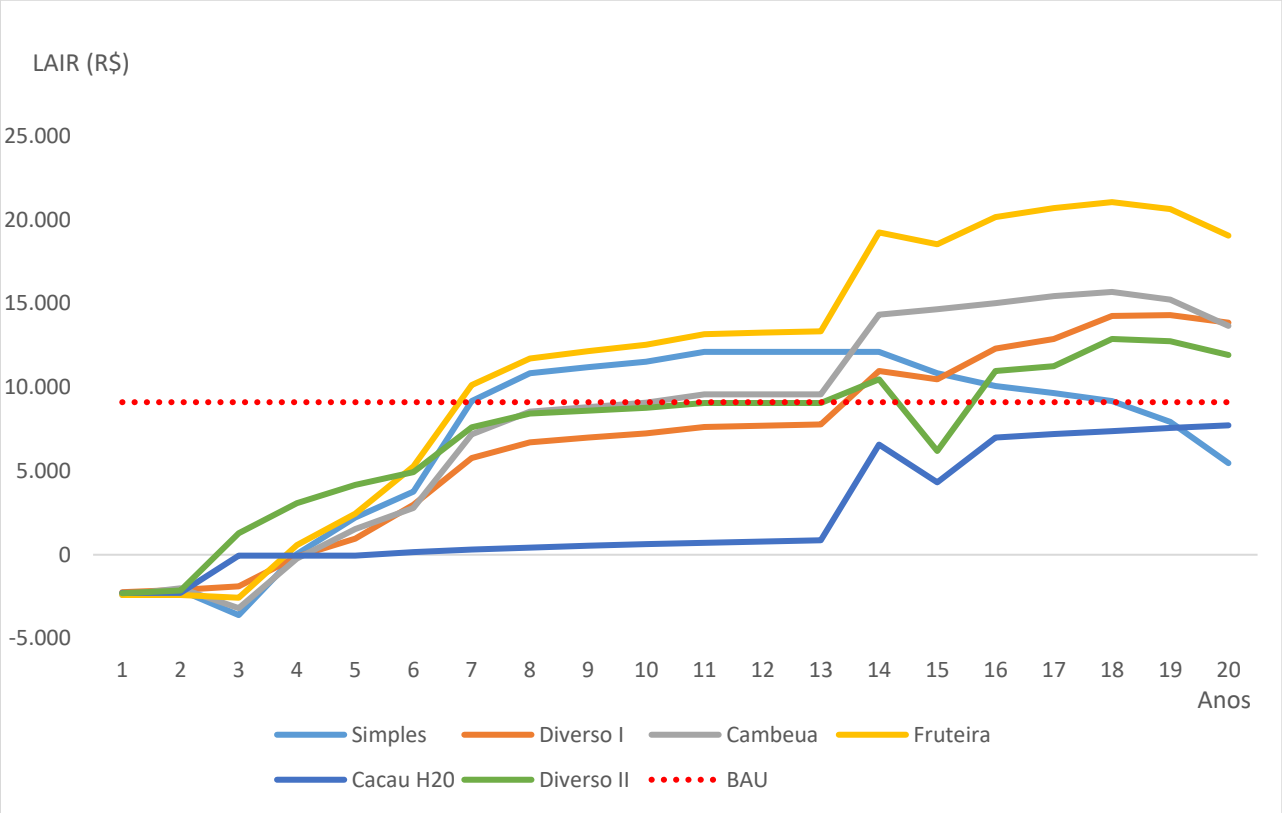
Table 15 - Performance of alternative AFS models. 1 Ha (in USD)

| | Simplified AFS | Cambeua AFS (Irrigated) | Fruit AFS (Irrigated) | Worker AFS 0.5 ha | Cocoa AFS H20 |
|---|---|---|---|---|---|
| | | | Outputs - No Financial CREDIT | | |
| TOTAL COSTS (CURRENT) | 82.192 | 94.074 | 94.214 | 72.832 | 77.267 |
| *Implementation* | 5.654 | 18.803 | 19.219 | 3.450 | 10.368 |
| *Financial (Interests)* | 0 | 0 | 0 | 0 | 0 |
| *Fixed* | 45.995 | 47.952 | 47.952 | 46.656 | 45.540 |
| Other Costs | 30.542 | 27.319 | 27.043 | 22.727 | 21.359 |
| *Project Outgoings* | 12.553 | 25.996 | 26.412 | 10.448 | 17.199 |
| *TOTAL BENEFITS (CURRENT)* | 218.914 | 238.165 | 301.681 | 157.888 | 114.361 |
| *NET BENEFITS* | 136.722 | 144.091 | 207.467 | 85.056 | 37.094 |
| *NPV (DISCOUNTED)* | 58.970 | 50.976 | 80.247 | 32.042 | 6.157 |
| *IRR (%)* | 25% | 15% | 19% | 19% | 7% |
| *Payback (YEARS)* | 6,6 | 9,9 | 8,2 | 9,0 | 16,7 |
| *NPV/ha eq* | 58.970 | 50.976 | 80.247 | 64.085 | 6.157 |
| Equity Appreciation (DISCOUNTED) | 0 | 28.862 | 42.016 | 27.229 | 26.854 |

From the investor's perspective, it is worth noting the significant difference in the need for investment when it comes to irrigated systems. The Cambeua AFS irrigated system was observed in the field (name “Cambeua” because it was observed in the homonymous community) and it is a system whose implementation is based on a run-of-river suction pump. Therefore, it is dependent on the existence of water courses, such as a motor pump powered by a solar system with low electricity consumption and water conduction through pipes with sprinkler distribution. Irrigation requires ATER, which can provide guidance on optimal levels and seasonality of sprinkler dosages.

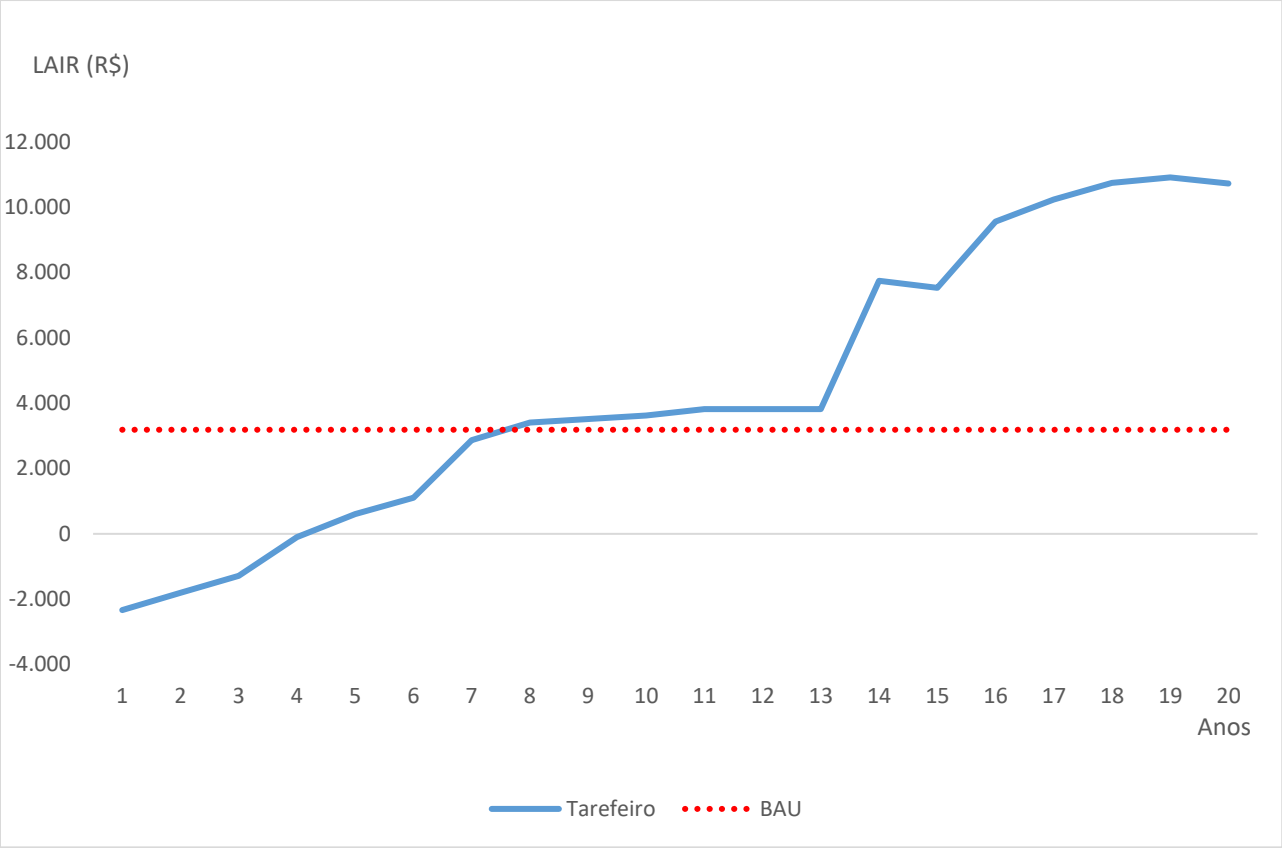
The productivity levels reported by the farmer differ significantly from the other non-irrigated AFS models - productivity above 25% on average – thus this is a model that can be encouraged for producers located on dry land on the banks of streams. However, it cannot be considered as the main model to be encouraged given its implementation cost. The total operating cost is very similar across all projects because they were designed as labor intensive. The workforce was calculated considering the need to employ 3 days per week for all maintenance and production surveillance services, based on the Opportunity Cost of Labor (OCL) of a monthly minimum wage. That is, even if the producer works for himself without discriminating his remuneration, it is the value he would receive if he worked for third parties or that he would pay if he had to hire someone else to do his work. In this sense, the OCL is identical for all systems with the exception of the 0.5 ha worker system, estimated as equivalent to a half-minimum-wage work load, and the home garden, which considers 1 day per week of labor with a daily value of BRL 60.00. Other significant costs are fixed costs, the largest portion of which is spent on ATER (Figure 15).

Figure 12 - EBIT curves according to different AFS models compared to the BAU model



The assessments show that only the Cocoa AFS would not surpass the BAU in the long term, while the Simplified AFS would lose competitiveness with the depreciation of the system due to the decrease in productivity of the açaí groves, a phenomenon that is offset by the long-term fruit species in the other systems. Comparing the Worker AFS with its BAU of 0.5 ha, the competitiveness of the proposal is also verified, as shown in the figure below (Figure 16):

Figure 13 - EBIT curve between the Worker AFS model and the BAU scenario.




In addition, the assessments conducted so far assume the perspective of the investor, in this case, the project's financiers, but who could be any other financing agent. If observed from the perspective of the beneficiary, that is, the producer who will receive the investments for the project, as well as the maintenance costs referring to 1/3 of the other costs outlined for the systems, the Worker AFS would generate an NPV (Net Present Value) 11.1% higher.

If, in the execution of the project, a partnership is established with an impact investor, in which the current discount rate of 5.3% (the rate used by the World Bank for social projects in Brazil) could be diluted to 3% per year, the NPV of the Worker AFS would increase by 44%, that is, the revenues of the worker-producer would increase by almost 40%. Therefore, many of the instruments depend on the objectives and arrangements that are achieved along the project's development.

## ANNEX 2 – SOCIAL LANDSCAPE MAPPING

In any agroforestry arrangement to be defined by the project, it is essential to ensure the organization of a governance structure composed of the different social actors that make up what we call the "social landscape" of the territory. The social landscape mapping, one of the tools of the Restoration Opportunities Assessment Methodology (ROAM), can be applied to support the planning and structuring of governance by identifying the different actors involved with the theme, their scales of performance and how they relate to each other in general or when it comes to specific subjects.

The social landscape mapping is represented here by social networks as a strategy to identify and visualize the social actors involved with AFS and related topics and how they relate to each other and act in the municipalities. Through the networks, it is possible to identify, for example, who are the most central actors, who exercise leadership roles and who, therefore, are important for structuring local governance or establishing partnerships. The analysis of the structure of the networks also allows the identification of possible bottlenecks or potentialities for governance; for example, an excess of centralization may suggest that the network is too dependent on a single actor (BUCKINGHAM et al., 2018). When it comes to a new project, carried out in a territory with which the research group is not very familiar, the application of this method is essential to guide the group's initial interactions with the local reality.

In the context of this analysis, the networks and actors that compose them were identified in the workshops developed in the municipalities of Salvaterra and Cachoeira do Arari, with the participation of different local actors. The networks representing the flow of technical information and inputs (materials and financial resources) in the municipality of Salvaterra and the general network in the municipality of Cachoeira do Arari were mapped. In Soure the tool was not applied, and it was not possible to identify how the different actors are connected. In general, we seek to understand how these networks can become better connected to ensure the strengthening of effective governance, based on a vision of the future that considers not only the implementation of productive and institutional arrangements, but also social diversity.

- Social Landscape Mapping in Salvaterra

In Salvaterra, 42 actors were mapped that are directly or indirectly involved with environmental issues, agriculture and/or agrarian conflicts and related topics relevant to the assessments proposed in the study, totaling 21 civil society organizations, 12 federal, state or municipal government organizations, 2 financial institutions and two entities classified as "others" (Frame 07).

Frame 07 - Institutions that make up the social landscape of the municipality of Salvaterra, by type of local actors.

| SECTOR | INSTITUTION |
|---|---|
| GOVERNMENTAL ORGANIZATIONS | Secretaria Municipal de Meio Ambiente |
| | Secretaria Municipal de Agricultura |
| | Adepará |
| | Escola Quilombola |

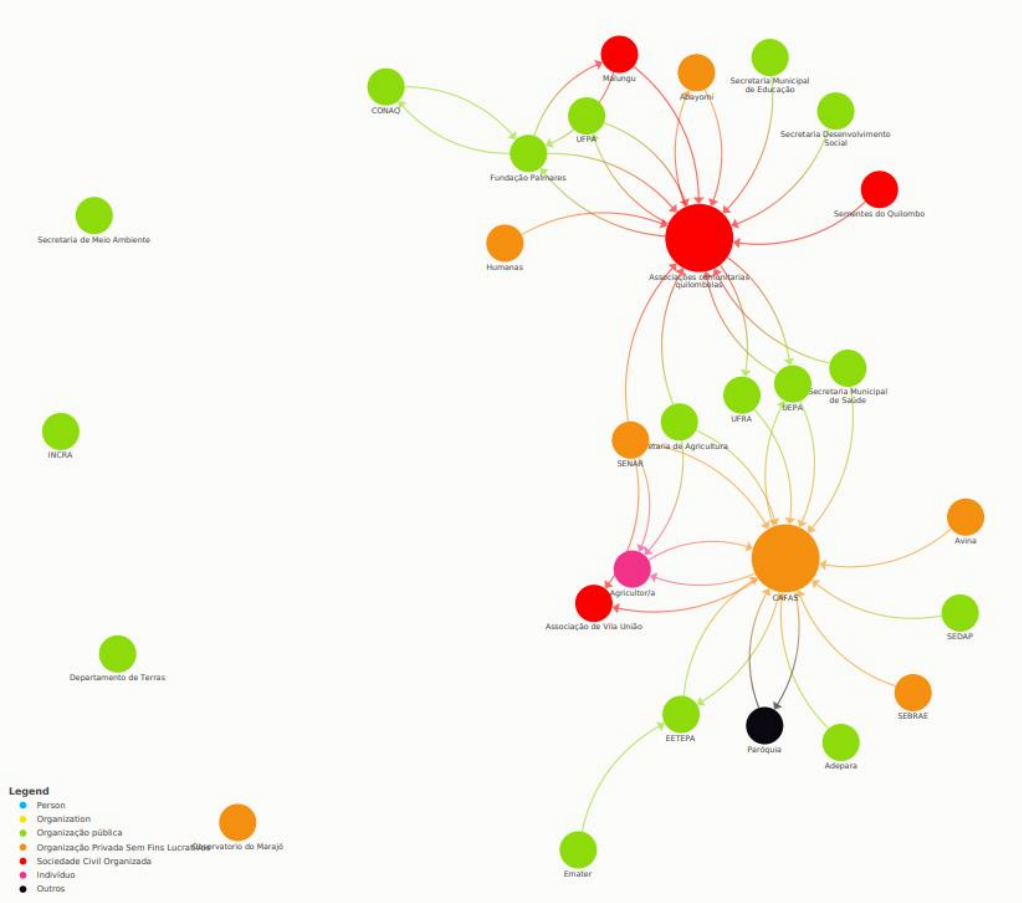
| | |
|---|---|
| | Secretaria Municipal de Assistência Social |
| | EMATER |
| | Secretaria Municipal de Obras e Transportes |
| | Secretaria Municipal de Educação |
| | Embrapa |
| | INCRA |
| | ITERPA |
| | SEDAP |
| | Polícia Militar |
| | UFPA Soure |
| | UEPA Campus XIX |
| | EETEPA |
| PRIVATE NON-PROFIT ORGANIZATIONS | SEBRAE |
| | Fundo DEMA |
| | Fund. Ford |
| | Observatório do Marajó |
| CIVIL SOCIETY ORGANIZATIONS | Associação Quilombola de Boa Vista |
| | Associação de Rabeteiros De Mangueiras |
| | Malungu |
| | Coordenação Nacional de Articulação de Comunidades Negras Rurais Quilombolas - CONAQ |
| | Colônia de Pescadores |
| | CAFAS |
| | Pastoral da Criança |
| | Abayomi |
| | Associação Quilombola de Paixão |
| | Associação Quilombola de Mangueiras |
| | Associação de Pescadores |
| | Sementes do Quilombo |
| | Associação Quilombola de Siricari |
| | Sindicato dos Produtores Rurais de Salvaterra - Simprusal |
| | Grupo de Mulheres Quilombolas |
| | Associação Quilombola de Salvar |
| | Associação Quilombola de São Benedito |
| | Associação Quilombola de Providência |
| FINANCIAL INSTITUTIONS | Banco da Amazônia |
| | Banpará |
| | Paróquia |

- Technical information flow network

The technical information flow network seeks to identify which actors exchange information related to AFS or related topics among the actors present and active in the municipality and how these actors connect when it comes to accessing, sharing and disseminating data, studies, results and general information. The network helps to identify the best strategies for engagement and dissemination of information on AFS that allow the optimization of resources and efforts and are able to reach a greater number of people.

Of the 42 actors mapped in Salvaterra, 29 make up the technical information network, of which 16 are governmental organizations. Quilombola community associations and Cafas are organizations with greater centrality, that is, they have a greater number of connections. They are also key institutions for community mobilization and dissemination of AFS, playing a strategic role in projects focused on benefiting local communities and reducing the vulnerability of marginalized populations. These organizations form different clusters with different institutions, but with have bridge institutions in common, such as UEPA, UFRA, the municipal health and agriculture secretariats, which connect with the two institutions and can be strategic in the exchange of technical information between different actors. Some institutions such as INCRA, Departamento de Terras, Observatório do Marajó are identified as important actors in the network, but they are not connected, and it is necessary to evaluate their contributions in the exchange of technical information supporting the implementation of AFS in the municipality (Figure 17).

Figure 14 - Technical information flow network in the municipality of Salvaterra.




Elaborated by: WRI 2022.

- Input flow network

The elaboration of the input network (Figure 18) considered actors who exchange, receive or supply materials for the implementation of AFS, seedlings, seeds, inputs, machinery, including agricultural production and financial resources.

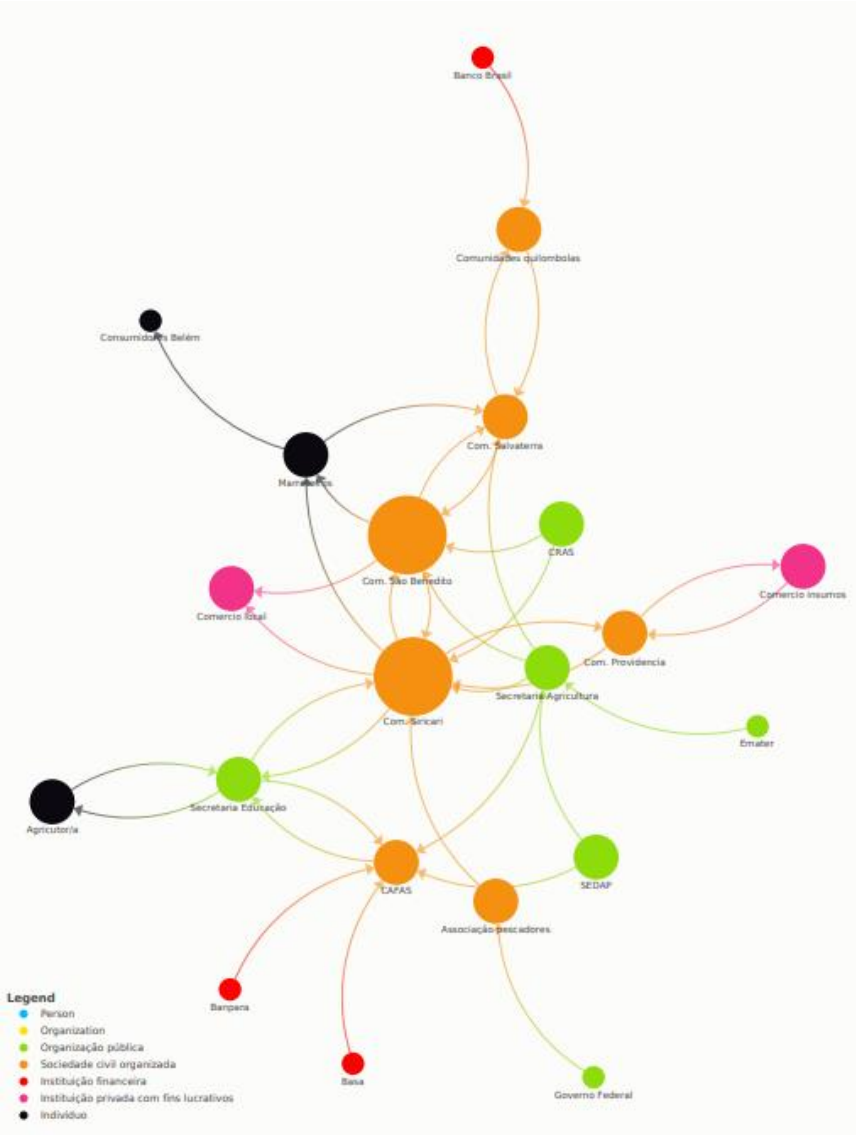
Of the 42 actors mapped in the municipality, 21 make up the inputs network, of which 07 are civil society organizations, 06 from the public sphere and 03 are financial institutions.

The São Benedito and Siricari communities are central to the network, with the greatest number of connections with the other actors, which shows that they are the communities that establish more exchanges of inputs and/or financial resources, whether providing or receiving. Exchanges are established with other communities in the municipality, and mainly refer to their production (sale of flour, tapioca, fruit, etc.).

The local government, represented by the education, agriculture and agricultural and fisheries development secretariats are recognized as actors that provide inputs, although their presence in the network is occasional, establishing exchanges with few actors. It is worth mentioning that the communities' agricultural production circulates within the municipality. The external market, represented in the network as "Belém Consumers" does not access production directly from producers, but from intermediaries, with açaí as the main product sold.

There is low access to financial institutions, as shown in the network, which can be strengthened by improving the network of financial resources so that investments are shared.

Figure 15 - Input flow network in the municipality of Salvaterra.




Elaborated by: WRI 2022.

- Social landscape mapping in Cachoeira do Arari

In Cachoeira do Arari, due to the number of workshop participants and the fragility of the exchange networks in the municipality, only a general network was created, identifying the actors present in the territory and that connect directly or indirectly with agriculture and AFS. In all, 29 institutions were identified, of which 11 are governmental organizations and 11 are civil society institutions. There are also private non-profit institutions and actors linked to the church and rural producers (Frame 08).

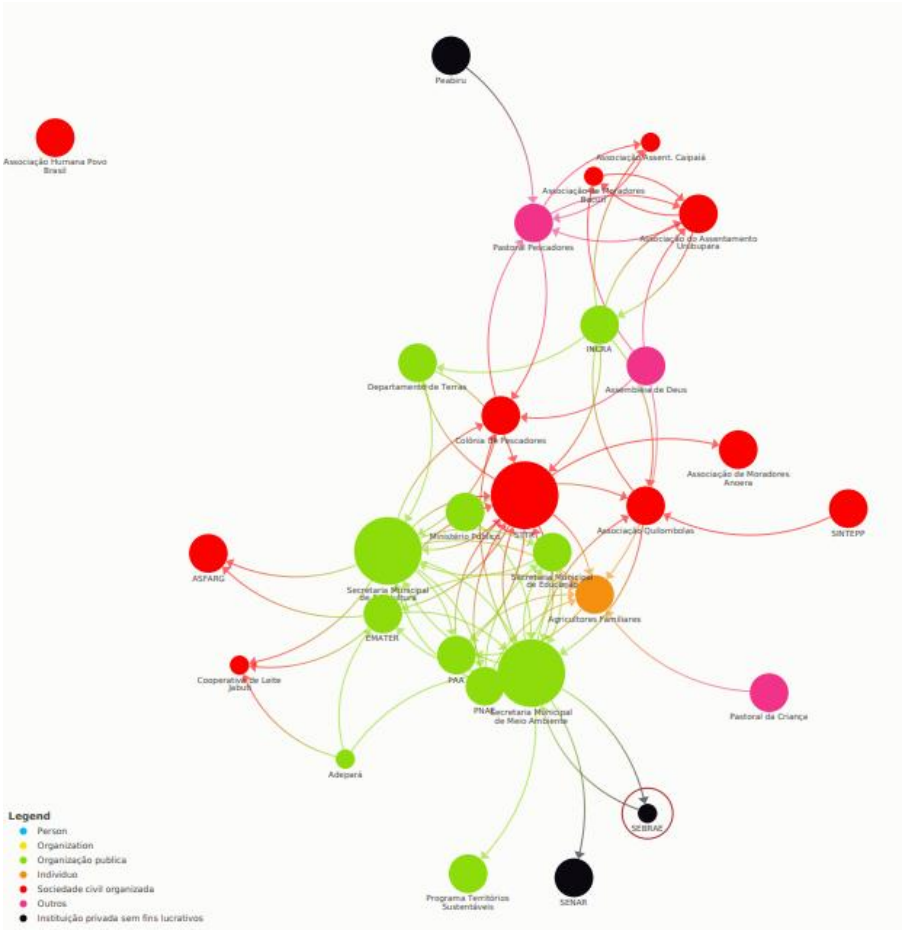
Frame 08 - Institutions that make up the social landscape of the municipality of Cachoeira do Arari, by type of local actors.

| SECTOR | INSTITUTION |
|---|---|
| Individuals | Family Farmers |
| Private non-profit institutions | Peabiru |
| | SEBRAE |
| | SENAR |
| Governmental organizations | Adepará |
| | Departamento de Terras |
| | EMATER |
| | INCRA |
| | Ministério Público |
| | PAA |
| | PNAE |
| | Programa Territórios Sustentáveis |
| | Secretaria Municipal de Agricultura |
| | Secretaria Municipal de Educação |
| | Secretaria Municipal de Meio Ambiente |
| Civil society organizations | ASFARG |
| | Associação Assent. Caipaiá |
| | Associação de Moradores Anoera |
| | Associação de Moradores Bacuri |
| | Associação do Assentamento Urubupara |
| | Associação Humana Povo Brasil |
| | Colônia de Pescadores |
| | Cooperativa de Leite Jabuti |
| | Sindicato dos Trabalhadores e das Trabalhadoras em Educação Pública do Pará - SINTEPP |
| | Sindicato de Trabalhadores e Trabalhadoras Rurais - STTR |
| | Associação Quilombolas |
| Others | Assembleia de Deus |
| | Pastoral da Criança |
| | Pastoral Pescadores |

The general network provides an overview of the individuals, groups, organizations and social movements that influence and are influenced by agriculture in general. The network also provides information for governance arrangements and implementation of projects and initiatives based on the knowledge and positioning of various actors and/or groups.

In Cachoeira do Arari, the STTR and the secretariats of agriculture and the environment are central to the network, with a greater number of connections with the other actors in the network. Thus, the three institutions are key because they have a greater number of connections, less distance between the actors to which they are connected, being able to quickly reach all actors in the network and share information, being also able to exert influence on key actors (Figure 19).

Figure 16 - General network of actors in the municipality of Cachoeira do Arari



## ANNEX 3 – INSTITUTIONAL MATURITY LEVEL DIAGNOSTIC PROTOCOL

| Diagnostic: Maturity Level Form - CAFAS | | | | |
|---|---|---|---|---|
| AREA | MATURITY LEVEL | NOTE | Average of PRACTICES | Mark the Best PERCEPTION (X) |
| ORGANIZATIONAL GOVERNANCE | Inexistent | 0 | | |
| | There are no institutional governance processes in place and management is carried out through unstructured initiatives. | 1 | | |
| | Governance processes are still fragile, and people's participation is limited. Some management areas already have established routines. | 2 | | |
| | Formal processes of participation, conflict management and decision-making already work well. Management works to accomplish what was collectively planned. | 3 | | x |
| | Governance is consolidated, and activities reflect what was defined in the strategic planning. Internal controls and mechanisms for participation and decision-making work very well, as does conflict management. | 4 | | |
| | Governance has reached a level of excellence, with strong integration between functional areas and continuous improvement of spaces for participation and decision-making. The enterprise operates according to a long-term strategic plan. | 5 | | |
| PEOPLE MANAGEMENT | Inexistent | 0 | | |
| | People’s contribution is not sought beyond the simple fulfillment of their tasks. | 1 | | |
| | The importance of developing the potential of each person in the enterprise is recognized. | 2 | | |
| | People get involved in continuous improvement activities at all levels. The implementation of policies, practices and resources aimed at people's well-being and quality of life at work has begun. | 3 | | x |
| | The enterprise has qualified people who work as a team and apply their knowledge to innovation and continuous | 4 | | |

| | | | | |
|---|---|---|---|---|
| | improvement projects. In their daily lives, people are well aligned with the strategic objectives of the enterprise. | | | |
| | People work in the enterprise with a sense of passion and enjoy a good quality of life at work. There are shared values between the enterprise and its allies and customers. People development and inclusion practices are regularly analyzed, seeking greater efficiency and equity. | 5 | | |
| FINANCIAL MANAGEMENT | Inexistent | 0 | | |
| | There are no control or methods in place for evaluating the financial health of the enterprise or the economic viability of the business. | 1 | | |
| | Beginning of the implementation of internal controls and methods of financial management and evaluation of economic viability. | 2 | | |
| | There are controls or methods for financial management and assessment of economic viability in place, as well as processes related to suppliers and balance sheet. But there are still many improvements to be made to increase efficiency in the use of enterprise resources. | 3 | | x |
| | There are financial management and control systems in place. Business plans, feasibility studies and market assessments are prepared to guide decision making. | 4 | | |
| | The financial management system has reached a level of excellence and encompasses the balance sheet, income statements, inventory control and accounts payable and receivable and tax and legal obligations. | 5 | | |
| COMMERCIAL MANAGEMENT | Inexistent | 0 | | |
| | Weak commercial management. The business model has not yet been defined and its economic viability has not yet been analyzed. | 1 | | |
| | The business model and commercial strategy are under development. There is already a feasibility analysis, but there are still many improvements to be made. | 2 | | x |

| | | | | |
|---|---|---|---|---|
| | Commercial management works well. There is standardization of products and services and the relationship with customers is predictable. But there is still a discrepancy between what is planned and what is accomplished. | 3 | | |
| | Commercial management works very well. Results are in line with what was planned, and business operations are under control. | 4 | | |
| | Excellent level of commercial management, with consolidated results. The relationship with customers undergoes continuous improvement. | 5 | | |
| MANAGEMENT OF PRODUCTIVE PROCESSES | Inexistent | 0 | | |
| | Production processes are conducted without control or planning. | 1 | | |
| | Good management of production processes is under development. Planning is carried out but partially implemented. There are flows and quality control, but there are still many improvements to be made. | 2 | | x |
| | Production processes already occur in a systemic way. Activities are aligned with production planning. Production and processing routines occur consistently and meet quality standards. | 3 | | |
| | Production processes are predictable and controlled. The results are in line with what was planned. The internal routines work very well. | 4 | | |
| | The production processes have reached an excellent level and are consolidated and in continuous improvement. There is strong integration between the different areas and the internal routines enable high production performance. | 5 | | |
| SOCIOENVIRONMENTAL MANAGEMENT | Inexistent | 0 | | |
| | There is no environmental awareness and no action is taken considering the environmental criteria. There is no environmental policy in the enterprise. | 1 | | |
| | The importance of the environment is recognized. Actions are initiated to adapt the activities of the enterprise to the environmental legislation. | 2 | | x |

| | | | | |
|---|---|---|---|---|
| | Environmental issues are valued in the enterprise. There is a commitment to put into practice actions aimed at environmental adequacy and impact reduction. But there are still many improvements to be made. | 3 | | |
| | The enterprise implements the necessary measures to guarantee its environmental regularity. People's behavior and practices follow a plan that takes into account environmental aspects. | 4 | | |
| | There is a consolidated environmental policy that is applied on a daily basis at the enterprise. There is continuous improvement in practices aimed at environmental sustainability. Environmental impacts are reduced. | 5 | | |

| MANAGEMENT AREA | Average of PRACTICES | PERCEPTION | Development State |
|---|---|---|---|
| Organizational Governance | NA | 3,0 | INTERMEDIÁRIO |
| People Management | NA | 3,0 | INTERMEDIÁRIO |
| Financial Management | NA | 3,0 | INTERMEDIÁRIO |
| Commercial Management | NA | 2,0 | INICIAL |
| Management of Productive Processes | NA | 2,0 | INICIAL |
| Socioenvironmental Management | NA | 2,0 | INICIAL |
| **GENERAL (total)** | **NA** | **2,5** | **INTERMEDIARY** |

| Diagnostic: Maturity Level Form - AAFCAM | | | | |
|---|---|---|---|---|
| AREA | MATURITY LEVEL | NOTE | Average of PRACTICES | Mark the Best PERCEPTION (X) |
| ORGANIZATIONAL GOVERNANCE | Inexistent | 0 | | |
| | There are no institutional governance processes in place and management is carried out through unstructured initiatives. | 1 | | |
| | Governance processes are still fragile, and people's participation is limited. Some management areas already have established routines. | 2 | | X |
| | Formal processes of participation, conflict management and decision-making already work well. Management works to accomplish what was collectively planned. | 3 | | |

| | | | | |
|---|---|---|---|---|
| PEOPLE MANAGEMENT | Governance is consolidated, and activities reflect what was defined in the strategic planning. Internal controls and mechanisms for participation and decision-making work very well, as does conflict management. | 4 | | |
| | Governance has reached a level of excellence, with strong integration between functional areas and continuous improvement of spaces for participation and decision-making. The enterprise operates according to a long-term strategic plan. | 5 | | |
| | Inexistent | 0 | | |
| | People's contribution is not sought beyond the simple fulfillment of their tasks. | 1 | | |
| | The importance of developing the potential of each person in the enterprise is recognized. | 2 | | X |
| | People get involved in continuous improvement activities at all levels. The implementation of policies, practices and resources aimed at people's well-being and quality of life at work has begun. | 3 | | |
| | The enterprise has qualified people who work as a team and apply their knowledge to innovation and continuous improvement projects. In their daily lives, people are well aligned with the strategic objectives of the enterprise. | 4 | | |
| | People work in the enterprise with a sense of passion and enjoy a good quality of life at work. There are shared values between the enterprise and its allies and customers. People development and inclusion practices are regularly analyzed, seeking greater efficiency and equity. | 5 | | |
| FINANCIAL MANAGEMENT | Inexistent | 0 | | |
| | There are no control or methods in place for evaluating the financial health of the enterprise or the economic viability of the business. | 1 | | x |

| | | | | |
|---|---|---|---|---|
| | Beginning of the implementation of internal controls and methods of financial management and evaluation of economic viability. | 2 | | |
| | There are controls or methods in place for financial management and assessment of economic viability, as well as processes related to suppliers and balance sheet. But there are still many improvements to be made to increase efficiency in the use of enterprise resources. | 3 | | |
| | There is financial management and control systems in place. Business plans, feasibility studies and market assessments are prepared to guide decision making. | 4 | | |
| | The financial management system has reached a level of excellence and encompasses the balance sheet, income statements, inventory control and accounts payable and receivable and tax and legal obligations. | 5 | | |
| COMMERCIAL MANAGEMENT | Inexistent | 0 | | |
| | Weak commercial management. The business model has not yet been defined and its economic viability has not yet been analyzed. | 1 | | |
| | The business model and commercial strategy are under development. There is already a feasibility analysis, but there are still many improvements to be made. | 2 | | x |
| | Commercial management works well. There is standardization of products and services and the relationship with customers is predictable. But there is still a discrepancy between what is planned and what is accomplished. | 3 | | |
| | Commercial management works very well. Results are in line with what was planned, and business operations are under control. | 4 | | |
| | Excellent level of commercial management, with consolidated results. The relationship with customers undergoes continuous improvement. | 5 | | |
| MANAGEMENT OF PRODCTIVE | Inexistent | 0 | | |
| | Production processes are conducted without control or planning. | 1 | | |

| | | | | |
|---|---|---|---|---|
| SOCIOENVIRONMENTAL MANAGEMENT | Good management of production processes is under development. Planning is carried out but partially implemented. There are flows and quality control, but there are still many improvements to be made. | 2 | | x |
| | Production processes already occur in a systemic way. Activities are aligned with production planning. Production and processing routines occur consistently and meet quality standards. | 3 | | |
| | Production processes are predictable and controlled. The results are in line with what was planned. The internal routines work very well. | 4 | | |
| | The production processes have reached an excellent level and are consolidated and in continuous improvement. There is strong integration between the different areas and the internal routines enable high production performance. | 5 | | |
| | Inexistent | 0 | | x |
| | There is no environmental awareness and no action is taken considering the environmental criteria. There is no environmental policy in the enterprise. | 1 | | |
| | The importance of the environment is recognized. Actions are initiated to adapt the activities of the enterprise to the environmental legislation. | 2 | | |
| | Environmental issues are valued in the enterprise. There is a commitment to put into practice actions aimed at environmental adequacy and impact reduction. But there are still many improvements to be made. | 3 | | |
| | The enterprise implements the necessary measures to guarantee its environmental regularity. People's behavior and practices follow a plan that takes into account environmental aspects. | 4 | | |
| | There is a consolidated environmental policy that is applied on a daily basis at the enterprise. There is continuous improvement in practices aimed at environmental sustainability. Environmental impacts are reduced. | 5 | | |

| MANAGEMENT AREA | Average of PRACTICES | PERCEPTION | Development Stage |
|---|---|---|---|
| Organizational Governance | NA | 2.0 | INITIAL |
| People Management | NA | 2.0 | INITIAL |
| Financial Management | NA | 1.0 | INITIAL |
| Commercial Management | NA | 2.0 | INITIAL |
| Management of Productive Processes | NA | 2.0 | INITIAL |
| Socioenvironmental Management | NA | 0.0 | INEXISTENT |
| **GENERAL (total)** | **NA** | **1.5** | **INITIAL** |

| AREA | MATURITY LEVEL | NOTE |
|---|---|---|
| GENERAL (total) | Inexistent | 0 |
| | Fragile organizational level. Management reacts to problems, but processes occur unpredictably and without control. | 1 |
| | Management is under development. Processes are disciplined and systemic, but there are still many improvements to be made. | 2 |
| | Management works well, and the organization operates in a systemic way, with a good relationship between the parts and the whole. There is planning and alignment of activities. Processes are consistent and standardized. | 3 |
| | Management works very well and in line with what was planned. Processes are predictable and controlled. | 4 |
| | Excellent level of management, with strong integration between the different areas. Processes are consolidated and are continually improved. | 5 |