

## **Appendix**

### **Support the Big Impact of Amazonian Community-Based Bioeconomy Businesses**

#### **Fulbright Amazônia Bioeconomy and Sustainable Development Working Group**

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### **Introduction**

This Appendix provides additional insights, evidence and contextualization to the Fulbright Amazonia Policy Brief, based on work by Fulbright Scholars and community organizations across Brazil, Colombia, Peru, and Suriname. It highlights the successful community-based management of pirarucu (*Arapaima gigas*) in Brazil, which has boosted fish populations and local incomes, and the female-led açai sector in Suriname, which faces land tenure challenges. The Amazon Triple Frontier, a biodiverse and culturally rich region, is emphasized for its vital bioeconomic value chains in fishing, agriculture, and ecotourism. These efforts align with G20 Bioeconomy principles, promoting inclusive, sustainable, and resilient bioeconomies.

### **Community-based fisheries management and environmental protection in the Amazon: The Pirarucu story**

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Managing wild fisheries presents a promising alternative to commercial beef production, offering benefits such as supporting local livelihoods, improving diet diversity and health, reducing inequality, and easing pressure on ecosystems threatened by agricultural expansion<sup>1</sup>. This approach also leads to significant reductions in CO<sub>2</sub> and CH<sub>4</sub> emissions from deforestation and livestock farming. This is particularly important in lowland Amazonia, home to the world's largest freshwater fishery, where 23 million people rely on fish as their primary source of animal protein.

Rural Amazonians have the highest per-capita fish protein intake globally. However, Amazonian fisheries are largely unmanaged, and overfishing has led to stock collapse, reducing protein supply for local communities and urban populations. Weak enforcement

of government policies on overfishing forces rural communities into market economies, increasing dependence on beef, which drives Amazonian deforestation, accounting for 80% of forest loss.

The community-based management of pirarucu (Arapaima in English) is an alternative model exists in Brazilian Amazonia, representing a positive bottom up example of sociobioeconomy built from the integration of traditional knowledge and science<sup>2</sup>. Overfished in the past, pirarucu is now recovering in community-led protected lakes. In this model, communities are empowered to protect their fishing grounds with a “Fishing Agreement,” which designates three categories of lake management: open access, subsistence-use, and strictly protected lakes. These protected lakes ensure species reproduction, with sustainable harvest quotas set based on direct population counts<sup>3,4,5,6,7,8,9</sup>.



**Figure 1.** Arapaima fisher harvesting an adult arapaima with 170 kg. Photo by: Carlos Peres.

Our research shows that pirarucu populations have increased by over 600% in managed areas, with protected lakes hosting 50 times more pirarucu than unprotected ones<sup>3</sup>. This model covers 15 million hectares and has contributed approximately 4 million dollars to local incomes annually. It also provides opportunities for women’s participation in decision-making and income generation, strengthening social organization and

contributing to gender equality<sup>4,5</sup>. This approach has proven effective in addressing conservation, food security, and poverty in Amazonia<sup>10</sup>.

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## Case Study: The Surinamese female-led Açai sector in Moengo

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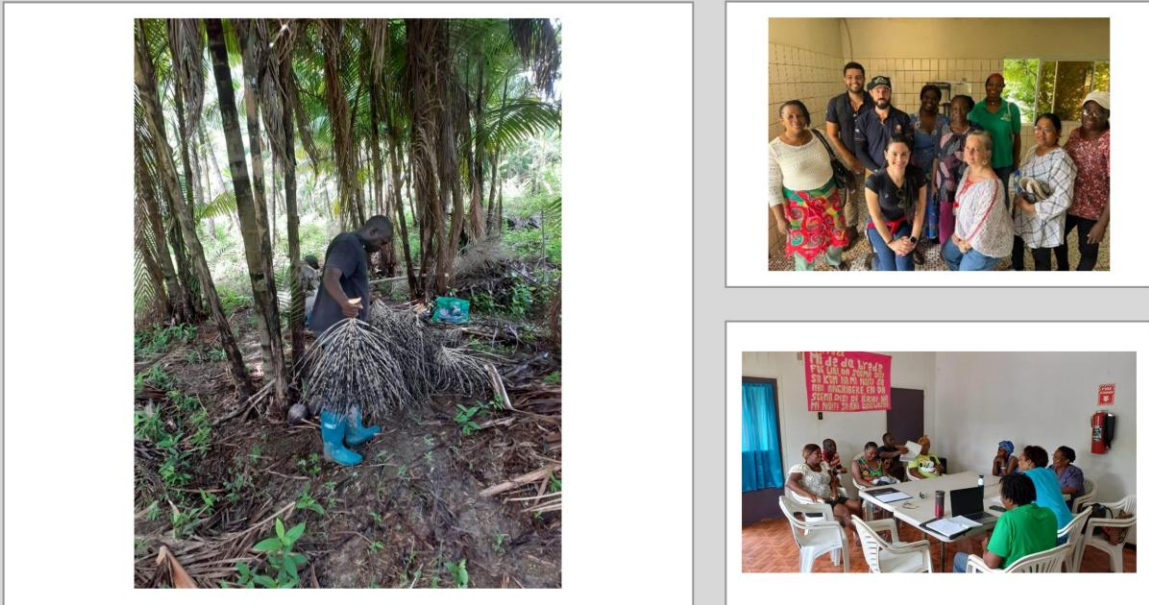
In Suriname, the maroon community of Moengo, comprising approximately 6,000 residents<sup>1</sup>, has cultivated a rich tradition of producing açai—a key Non-Timber Forest Product (NTFP)—primarily through a matriarchal business model. Utilizing their traditional ecological knowledge (TEK), the men, often sons or husbands, harvest açai berries from the pina palm (*Euterpe oleracea*), while the women manage the processing, marketing, and sales, often collaborating with their daughters or sisters.

Despite being informal, rural family businesses in Moengo export around 50% of their açai production, particularly along the road and across the French Guiana border<sup>2,3</sup>. However, the rising demand for fresh açai berries, coupled with issues surrounding land tenure and rights, has led to an influx of non-traditional harvesters into the forests. This has resulted in forest degradation and biodiversity loss.

A value chain analysis reveals significant shifts in the market dynamics. The emergence of açai plantations, not only established by the male maroon population in Moengo but also by external investors in other districts, has been a response to the scarcity of wild-harvested berries. As a result, more male-led artisanal producers and non-traditional companies—some operating their own plantations—have entered the açai market with a focus on export opportunities<sup>4,5,6</sup>.

This change poses challenges for these unique female-led businesses that rely on sustainable traditional practices and their unique açai forests for their livelihoods. Maintaining these traditional enterprises is critical as they face increasing competition. The findings suggest that artisanal entrepreneurs still hold a competitive edge in the market, particularly among traditional ethnic consumers, due to the superior sensory attributes of their products, such as the distinct taste of berries harvested from natural forests and the quality of their processed açai drinks<sup>5</sup>.

To protect and enhance their traditional knowledge and practices, these communities need to secure land tenure. This will allow them to safeguard their forests and improve the sustainability of their harvesting methods. Moreover, a shift towards a more externally oriented approach is necessary to meet the export market's requirements for standardization and certification, ultimately ensuring the survival of their unique female-led açai enterprises<sup>5,6</sup>.



**Figure 2.** Açai (*Euterpe* spp) harvesting, a male activity, while Maroon women collectively work to enhance their açai production in workshops. Photos by CELOS.

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# **Territorial Perspectives: Exploring Transboundary Sociobioeconomies in the Upper Solimões Region, Triple Amazonian Frontier**

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The Bioeconomy overview of the Upper Solimões region is an ongoing initiative supported by the Fulbright Amazonia Program in collaboration with the Upper Solimões Scientific and Technological Park (PACTAS) and other organizations in the Amazon Triple Frontier between Brazil, Colombia, and Peru<sup>1</sup>. It aims to support and promote inclusive, fair, and sustainable sociobioeconomic initiatives in the Triple Frontier region. This study amplifies the voices and perspectives of local territories, providing an overview of prominent sociobioeconomy initiatives, identifying obstacles and opportunities, and contributing to the implementation of socio-bioeconomic strategies connected to public policies and transnational agreements.

Our approach aligns with the G20 Declaration of Bioeconomy, which emphasizes principles such as inclusivity, equity, and sustainability. The G20 principles advocate for the integration of traditional knowledge with advanced science, promoting gender equality, and addressing climate change through sustainable practices<sup>2</sup>. By focusing on the unique challenges and opportunities in the Amazon Triple Frontier, this study supports the G20's vision of a bioeconomy that fosters economic growth while conserving biodiversity and ensuring the equitable sharing of benefits<sup>3</sup>. The collaboration between local and international stakeholders exemplifies the G20's call for global cooperation and the development of sustainable, innovative bioeconomic models<sup>4</sup>.

The Amazon triple frontier, where Brazil, Colombia, and Peru converge, is a unique transboundary region characterized by its rich biodiversity and cultural diversity. The main interconnected cities are Tabatinga (Brazil), Leticia (Colombia), and Santa Rosa de Yavari (Peru), which form a vibrant hub of cross-border interaction. This region is home to diverse cultures and languages, including Portuguese, Spanish, and numerous indigenous languages. The area is known for its intricate bioeconomic value chains, such as fishing, agriculture, and ecotourism, which are vital for local livelihoods<sup>5</sup>. Environmental protection is a critical concern, with significant efforts directed towards preserving the Amazon rainforest and its ecosystems. The region faces challenges like illegal logging, mining, and drug trafficking, which threaten both the environment and local communities<sup>3</sup>.

The study employed a rapid qualitative diagnostic approach, including literature review, stakeholder mapping, technical visits, and in-person interviews. Key actors and voices from the territories included government representatives, educational and research institutions, producer associations, indigenous communities, and private sector initiatives. Promising initiatives were selected based on their potential for bioeconomic development within the PACTAS framework<sup>1</sup>.

## **Challenges and Opportunities for Transboundary Sociobioeconomies**

**Fishing and Fisheries Management:** The fishing sector in the Upper Solimões region faces several challenges and opportunities. The Sindicato dos Pescadores Artesanais de Tabatinga, representing 500-700 members, struggles with limited education access, migration, lack of municipal support, and increased crime. Similarly, the Pirarucu management by UNIVAJA in Rio Javari, involving indigenous communities, faces financial difficulties, market access issues, and climate impacts. Private initiatives like Pescados Solimões, which indirectly involve 60-100 people and have a market capacity of 800-1,000 tons annually, also encounter regulatory challenges and lack of support. Across these initiatives, opportunities include strengthening inter-institutional support, implementing public policies, promoting fair trade, and forming strategic partnerships.

**Ecotourism:** The Municipal Tourism and Culture Secretariat of Tabatinga highlights the untapped potential for community-based tourism, attracting 12,000 tourists annually and 79,000 airport passengers. However, challenges such as differing legislation, restrictions on indigenous tourism, and lack of resources hinder growth. Forming coalitions and securing public policy support are essential to unlocking this potential and fostering sustainable tourism development.

**Agriculture and Fruit Cultivation:** Agricultural initiatives in the region, such as the Novo Paraíso Rural Producers Association and the Benjamin Constant Production Secretariat, face issues related to product access, political representation, poor infrastructure, pest problems, and environmental licensing. Opportunities for these associations include political advocacy, economic investment, local market development, infrastructure improvement, and fostering bilateral trade with Peru. These measures can enhance productivity and sustainability in agriculture and fruit cultivation.

**Handicrafts:** Indigenous artisans, represented by organizations like ACIU and AMIT, encounter organizational and resource challenges, with climate change affecting material availability. Opportunities in this sector include accessing public policies, revitalizing cultural practices, ensuring land rights and territorial protection, and linking handicrafts with ecotourism. These steps can help maintain traditional knowledge and improve the economic well-being of artisans.



**Solid Waste Recycling:** The Association of Recyclable Material Collectors of Tabatinga, predominantly composed of women, faces prejudice and lack of support. Opportunities for this group include public support for legalization, addressing gender issues, and fostering inter-institutional cooperation. These efforts can enhance the effectiveness and sustainability of solid waste recycling initiatives in the region.

By addressing these challenges and leveraging the identified opportunities, the Upper Solimões region can advance its bioeconomic initiatives, contributing to sustainable development and improved livelihoods for local communities.

## **Recommendations**

To advance sociobioeconomies in the Upper Solimões triple frontier region, several key recommendations have been identified. Establishing an open-access database for value chains, maintained by local organizations and institutions, is crucial for enhancing data and information accessibility. Addressing cross-border influences on value chains is essential for managing transboundary dynamics effectively. Integrating climate adaptation strategies into socio-bioeconomic policies will help mitigate the impacts of climate change on local communities and ecosystems. Investing in ecotourism can create synergies that benefit multiple value chains, promoting diversified economic opportunities.

Equitable connections and confluences between Indigenous, local, and academic knowledge systems are crucial for the success of sociobioeconomy initiatives in the Amazon<sup>6</sup>. Baniwa et al. (2024)<sup>7</sup> emphasize that respectful and reciprocal connections between these diverse knowledge systems can foster social and technological innovations, ensuring that bioeconomic practices are culturally relevant and ecologically sound.

Strengthening local institutions and forming strategic partnerships are vital for institutional enhancement. Aligning socio-bioeconomic networks with regional, national, and international policies, while emphasizing diversity, inclusion, and equity, will ensure comprehensive policy integration.





**Figure 3.** Collaborative research and training activities supporting local institutions and sociobioeconomies in the Triple Amazonian region, with support of the Fulbright Amazonia Program. Photos by Simone Athayde and InPactas (Incubadora de Negócios de Impacto Socioambiental no Alto Solimões).

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## **Case Study: The Potential for Materials Bioeconomies in the Amazon**

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The Amazon is one of the ecologically richest and most biodiverse regions in the world, offering a myriad of natural resources from medicines to foods to natural materials. In fact, one of the most influential conservationists in the world, Chico Mendes of Xapuri, Brazil, was engaged in a fight involving rubber tappers and their participation in one of the world's biggest materials bioeconomies that originated in the Amazon: rubber. Beyond rubber, the Amazon is famous for its production of a wide variety of different sustainable fibers, leathers, and wood products. The sustainable development of these different materials provides a powerful foundation for bioeconomies that can concentrate the value chain within local communities to provide economic development and increase services (i.e. health care), displace the importation of petroleum-based products that contribute to global warming, and strengthen the preservation of natural ecosystems.

There is a profound opportunity for the development of a high-tech economy based around these sustainable materials that can provide important solutions to support the sustainable and circular Amazonian economy. One particular example is packaging. Chocolate is emerging as a major sustainable product in the Amazon, but it requires packaging to protect it against spoilage after manufacture. Currently, the materials used are metal/plastic hybrids based on imported, polluting materials. Different cellulosic materials or materials made by fermentation of Amazonian feedstocks provide potential alternatives for these packaging barriers that would be both bio-sourced and biodegradable and could be produced locally. In this way, Amazonian communities could concentrate the value chain by producing both product and package. By leveraging not only natural products but also agricultural residues and the residues of other bioeconomies such as Brazil nuts, the productivity of the standing forest can be enhanced, leading to sustainable development. To implement these technology-driven bioeconomies, Amazonian communities need help with education and capacity building to develop the necessary human capital, infrastructure, and entrepreneurial culture.

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