Potentials of Value Chains of Unconventional Food Plants in Brazil

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1 Introduction

The sale of wild food plants, among other biodiversity products, is a topic of multi-disciplinary interest. In the field of ethnobiology, for example, efforts have been made to understand the influence of commercial demands on the collection behaviors of local human populations as well as their impacts on biocultural conservation (Albuquerque et al. 2019).

Undoubtedly, commercial relations around biodiversity products are an exciting topic, mainly for their practical applications (Belcher and Schreckenberg 2007). Existing experiences usually indicate the potential for promoting these commercial relations as a strategy to reconcile the conservation of biodiversity with the generation of income for local populations (Angelsen et al. 2014). However, in order to understand this potential, greater efforts are still needed in studies that address these commercial relationships in the broader perspective of the value chain.

The relevance of studies on the value chain of wild products is acknowledged (Booker et al. 2012; Sardeshpande and Shackleton 2019). By analyzing all the stages involved in the production of a good or service, from its production to final consumption, these studies have helped to reveal recurring weaknesses in the chains of wild food plants (Gomes et al. 2010; Ingram et al. 2012; da Silva et al. 2017).

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These weaknesses refer to organizational and/or institutional characteristics that represent obstacles to sustainable production and marketing and therefore have social, economic, and environmental implications.

In general, the organizational characteristics of a production chain refer to the circulation of information, associations, agreements, management, and production techniques among other factors. The institutional characteristics include the legal apparatus, control bodies, customs, and traditions among others. Together, these characteristics interfere in the relationships between the actors involved and, consequently, in the functioning of the chain (da Silva et al. 2014). In this sense, a central issue in studies on the value chain of wild products consists of the power relationships between the different members of the chain and between them and the production environment (Booker et al. 2012). From this perspective, the vast majority of value chain investigations focus on well-known products or products with a consolidated market – characteristics that do not apply to most of the so-called unconventional food plants (UFP).

In Brazil, the acronym UFP (PANC in Portuguese) became popular when mentioning wild food plants or the food use of unusual parts of widely consumed plants (Kinupp and Lorenzi 2014). In this sense, UFP can vary from herbaceous species to arboreal and palm trees, as they comprise food consumption both of whole plants and of fruits, tubers, and leaves among other edible parts of plant species.

Although the acronym UFP is open to criticism for its subliminal message of ethnocentrism, it is under this label that many species of wild food plants are gaining notoriety and arousing market interest in the Brazilian context. Despite this, little attention has been given to their value chains, as they are generally little known, as well as short and unstable.

Evidently, the consumption and commercialization of UFP in local geographic contexts makes it difficult to identify their value chains and analyze their potential. However, some of these species have proven their value and aroused the interest of the markets (Steward 2013; Guariguata et al. 2017; Gomes et al. 2020). This is probably a path of no return, which leads to scenarios of risks and opportunities.

In this chapter, we will discuss the potential of the production chains of unconventional food plants in Brazil. We understand this terminological and geographic scope as interesting due to the emerging behavior of its market, which allows us to establish relationships with the broader experiences of selling wild food plants in different parts of the world.

2 Evolution of Ideas About the Strategic Role of Value Chains for Wild Food Plants

Conceptually, the sale of wild products always constitutes value chains. However, these chains can vary immensely in terms of geographic scope, volumes sold, values, number of links and institutions involved, and technological development

among other relevant and dynamic aspects, both temporal and geographically. In this way, ideas about the strategic role of value chains for wild food plants have been changing over time and in the geographic space where they are inserted.

For example, in Brazil, the strategic view on the value chains of wild plants has been strongly influenced by the logic of commercial relations and ideas prevalent worldwide. For centuries, the consumption and commercial exploitation of wild plants has played an important role in the country's colonial culture and economy (Dean 1991; Medeiros and Albuquerque 2014; Tomchinsky and Ming 2019). It can be argued that during this long period, the prevailing idea in Brazil and in the world about the strategic role of chains of wild plants was predominantly exploratory. In other words, the commercialized products were extracted from natural environments with the objective of generating profits for explorers, leaving local populations relegated to the role of sources of information and labor, and natural environments as mere stocks of resources for extraction.

Over time, ideas about the economic relevance of the value chains of wild food plants and other biodiversity products matured. The insights came from broader discussions about environmental problems, such as pollution and deforestation, which started to be guided by international debates. In this context, the first United Nations Conference on the Human Environment, held in 1972 in Stockholm, is considered an important milestone.

During this conference, the document "Stockholm Declaration on the Human Environment" was prepared, which established a set of criteria and principles to guide peoples and countries in their relations with the environment. The fourth principle listed in this document highlights "(...) when planning economic development, importance must be given to the conservation of nature, including wild flora and fauna." In this sense, from the 1970s onward, actions aimed at the preservation of charismatic species, usually animals, and the delimitation of protected areas, usually due to their scenic beauty, gained strength. In this period, local human populations and the components of biodiversity consumed and/or traded by them did not yet assume a prominent position in conservation policies.

From the 1980s onward, the economic importance of biodiversity products gained greater political notoriety, due to the rapid technological development and increased biopiracy, patenting, and privatization of biodiversity components. The vulnerability of local populations in poor countries was evident. In light of this, the pressure and the articulation of different sectors of society and governments grew in favor of mechanisms that would ensure the conservation of biodiversity and the rights of traditional populations.

The articulations culminated in the Convention on Biological Diversity (CBD), signed during the United Nations Conference on Environment and Development, which took place in 1992 in the city of Rio de Janeiro, Brazil. The CBD defined the main conditions and legal bases for regulating the sustainable use of biodiversity, which would influence government programs. The Brazilian Federal Senate approved the final text of the CBD in 1994. Since then, more and more biodiversity products have come to be seen as a strategy to generate income for local populations.

Although there is no unanimity, there is a widespread understanding that the economic relevance of value chains for biodiversity products, such as wild food plants, grows on smaller geographic scales. That is, even if they have a secondary or irrelevant role in the global economy, at the local level, situations in which entire communities depend heavily on the marketing of these products to guarantee their livelihood are recurrent (da Silva et al. 2017). This understanding has a strong influence on ideas about the potential of UFP as a strategy to generate income, conserve biodiversity, and strengthen food security.

Within Brazilian policies, some UFP can be identified as a product of sociobiodiversity, an expression adopted by a public policy implemented in Brazil in 2009 (Brasil 2009). The concept of sociobiodiversity represented an advance, as it recognized the social and economic importance that certain products of biodiversity have in Brazil. This allowed these products, as well as the human populations economically and culturally associated with them, to receive special attention from government programs to strengthen their value chains. Examples of policies associated with sociobiodiversity products include access to the Food Acquisition Program (PAA in Portuguese), which allowed the government to invest in these products for inclusion in social programs to fight hunger (e.g., school meals, popular restaurants). Another example is the National Minimum Price Guarantee Policy, which opened the possibility of a public subsidy to extractive communities that may be affected by the drop in the price of sociobiodiversity products below the minimum value defined by the government control body. However, these policies favored the most consumed and known sociobiodiversity products, leaving out many UFP whose value chains are not well known or are not sufficiently developed.

This lack of visibility of many UFP with economic potential, as well as the organizational limitations of many extractive communities, paved the way for another idea of the strategic role of biodiversity-based value chains. This aims to generate commodities from biodiversity and seeks to promote these value chains inspired by the agribusiness model, with a focus on the final product and the optimization of its production process. The biocultural complex in which these “raw materials” are inserted is not taken into account or is used only as a marketing strategy. Under the logic of agribusiness, extractive communities tend to be relegated to the role of labor of companies interested in raw materials for their products.

This demonstrates that a relevant feature of the strategies that seek to promote the UFP value chains should be, in addition to the popularization of these products, the empowerment of the local human populations associated with them, whether extractive, agroextractive, or traditional farmers. This empowerment is one of the most challenging goals for the promotion policies of these chains, as it means the role of these communities in defining objectives, rules for the collection, processing, and negotiation of products. In addition, it is necessary that these strategies ensure land security and resource control for communities, which often represents one of the greatest institutional obstacles. In addition, many communities demand support to develop articulation and negotiation skills with the government, companies, or final consumer.

3 Contributions and Gaps of Value Chain Studies to Income Generation and Biodiversity Conservation Strategies

One of the main goals of many studies on biodiversity-based value chains, such as the UFP, is to suggest strategies to promote and strengthen these chains on a sustainable basis. For this, many studies seek to emphasize the social, economic, and/or environmental weaknesses in the dynamics of production and commercialization of these products.

The situations of social fragilities are verified in products that are not able to consolidate themselves in the market because they do not have institutional support, even though they present a notable commercial potential. In many cases, the lack of promotion policies, contracts, and regulations hinders production and access to markets willing to pay a fair price for the product, causing the chain to operate in a precarious context of informality (da Silva et al. 2015). This is the case of the pequi (*Caryocar coriaceum* Wittm.), a wild tree species whose fruits are commercialized in the south of the state of Ceará, northeast of Brazil. In this context, da Silva et al. (2015) found that pequi collection represented the most profitable productive activity carried out by local extractivists. However, the commercialization of the fruits occurred in a logic of competitive entrepreneurship among the families. This scenario, according to the authors, stimulated the adoption of inadequate collection practices, that is, in which families aimed to increase the amount of fruit extracted, resulting in damage to the natural populations of plants. In the search for greater individual return, extractivists obtained collective losses.

Economic flaws are highlighted in situations where there is a marked asymmetry in profits along the chain, where extractivists are generally the least benefited (Gomes et al. 2010). Among the examples is the case of *Schinus terebinthifolius* Raddi (aroeira), a tree species very abundant in the region of Baixo São Francisco (Northeast Brazil), where its food use is still little known and unconventional. According to de Jesus and Gomes (2012), the demand for aroeira fruits, marketed under the label of pink peppercorn, came from processing industries that are located distant from the production sites. After processing, the industries exported pink peppercorn to several countries in the European Union, the United States, Canada, and Argentina. According to the authors, the commercialization of “pink peppercorn” for the international market reached an export value of up to US\$18.00/kg (2008). In the same period, the processing industries paid extractivists up to US\$0.95/kg at the collection sites.

On the other hand, environmental weaknesses are related to situations in which risks of negative impacts on the structure of populations of exploited species are present due to overexploitation pressures (Ingram et al. 2012). In the Congo basin, for example, the leaves of wild lianas of the genus *Gnetum* are consumed and marketed for food purposes. Ingram et al. (2012) found that more than half of the production of *Gnetum* spp. is collected unsustainably in forest areas. According to the authors, the lack of adequate regulation and increased collection pressure led to a

decrease in the availability of leaves and increased prices, resulting in unsustainable trade.

Although urgent and highly relevant, the emphasis of many studies on identifying flaws may not be the most appropriate for many UFP chains, whose potential is still poorly understood. In view of this, it is necessary to direct efforts toward understanding the potential of UFP' value chains.

4 Potentialities to Promote and Strengthen Sustainable UFP Value Chains

In Brazil, countless species that are considered unconventional food plants (Kinupp and Lorenzi 2014) had their production chains expanded due to the increase in demand. Açaí (Steward 2013) and Brazil nut (Guariguata et al. 2017) are examples. These Amazonian products generate income for local communities and contribute to forest conservation. To have an idea, in 2018, the production of açaí yielded R\$592 million (US\$ 152,774,193.55) and Brazil nuts R\$130.9 million (US\$ 33,780,645.16) (IBGE 2018).

It is likely that there are species of great economic potential in the different Brazilian biomes. In the northeastern region of Brazil, for example, scientific evidence indicated various native UFP tree species (e.g., *Genipa americana* L., *Myrciaria floribunda* (H. West ex Willd.) O. Berg, *Attalea funifera* Mart., *Syagrus coronata* Becc., *Schinus terebinthifolia* Raddi, *Spondias purpurea* L.) with high commercial potential in areas of coastal vegetation called *restinga* (Gomes et al. 2020). Also according to this study, although these UFP do not constitute the nutritional base of local communities, they are widely consumed locally due to the pleasant "taste." This evidence suggests that these products have the potential to please the palate of different consumer markets.

However, most UFP are represented by wild species acquired in an extractive manner. This reality has implications for the conservation of its natural populations. One of the ideas that circulate about extraction indicates a fateful trend that the growth in demand generates a disorderly increase in collection, resulting in the depletion of resources (Homma 2000). However, the accumulated experiences have indicated that the sustainability of extractive activities results from the interaction of several factors of an ecological, social, economic, and technological nature (Fig. 1).

In some cases, easily accessible information such as the part of the plant used is essential for assessing the sustainability potential of extractivism. There is a tendency that the collection of certain parts of the plant that cause no lethality to the plant, such as fruits, causes less damage to the conservation of wild populations (Emanuel et al. 2005). It is evident that, even in these situations, extraction requires monitoring and adequate management as a way to prevent damage in the near term (Murali et al. 1996; Ticktin 2004; Ndangalasi et al. 2007).

Fig. 1 Flow of basic information to promote UFP productive chains on a sustainable basis

Many UFP species are fruitful (Kinupp and Lorenzi 2014). If, on the one hand, this generates positive expectations regarding the sustainability potential of fruit extraction, on the other hand, it results in serious problems in the production process. Fruits are highly perishable food products that require careful storage, handling, and rapid transportation to the processing or fresh consumption site. This means that the extraction of UFP must be limited to sufficient volumes for economic viability of the stages after collection, avoiding losses. Therefore, the extractive production of perishable food products must be of low intensity, considering not only the conservation of wild populations but also the quality of the products.

In cases where the extraction of wild UFP populations is not sufficient or adequate to promote the value chain, it is recommended to evaluate the viability of the cultivation (Fig. 1). One of the first steps in this direction is the identification of the best propagation techniques for the species, which requires investments in agro-nomic and forestry experiments. Following this, other obstacles will need to be overcome, such as access to credit and technical assistance for incorporating the species in the cultivated areas. However, it should be noted that cultivation alone does not always represent a strategy capable of reducing extraction and contributing to the conservation of wild populations (Trauernicht and Ticktin 2005; Williams et al. 2014).

The fundamental difference between cultivation and extractive production is the need for the existence and conservation of wild areas in the extractive production process. In this perspective, depending on the context of production, the promotion of a UFP value chain may be associated with the strategy of reconciling income generation with biodiversity conservation or with the generation of income from new agricultural commodities.

Regardless of the motivation of the production base driven by commercialization, the necessary relationship between products and the market represents the

point of convergence between extractive and cultivated production. It can even be considered that the success of the UFP value chains on a sustainable basis largely depends on the balance of this relationship (Belcher and Schreckenberg 2007). In general, various storage, processing, and transportation strategies are verified, between and within extractive and cultivated production systems. These variations occur due to the production environment, the intrinsic characteristics of the product, the degree of processing, and the profiles of the producer and the consumer among other aspects. This reinforces the need to understand the relationship with the market from a broad perspective of the value chain, in order to involve the entire UFP commercialization route, from the production environment to the final consumer.

5 Final Considerations

The experiences with value chains of biodiversity products make it possible to enumerate three main goals for reaching its potential: (1) to generate income for the populations that produce UFP, (2) to conserve biodiversity, and (3) to empower populations that produce UFP. It is possible to expect excellent results whenever these three goals can be achieved together.

The vast majority of value chain investigations focused on well-known products with an established market, which does not apply to most UFP. Generally, these investigations highlight the relations of power between the actors and institutions involved in the chain, addressing their weaknesses. Despite the great relevance of this approach, studies on UFP production chains require methodological adjustments in order to direct the focus toward the identification of the potential for promoting these chains on a sustainable basis.

References

- Albuquerque UP, Nascimento ALB, Soldati GT et al (2019) Ten important questions/issues for ethnobotanical research. *Acta Bot Brasilica* 33:376–385. <https://doi.org/10.1590/0102-33062018abb0331>
- Angelsen A, Jagger P, Babigumira R et al (2014) Environmental income and rural livelihoods: a global-comparative analysis. *World Dev* 64:S12–S28. <https://doi.org/10.1016/j.worlddev.2014.03.006>
- Belcher B, Schreckenberg K (2007) Commercialisation of non-timber forest products: a reality check. *Dev Policy Rev* 25:363
- Booker A, Johnston D, Heinrich M (2012) Value chains of herbal medicines – research needs and key challenges in the context of ethnopharmacology. *J Ethnopharmacol* 140:624–633. <https://doi.org/10.1016/j.jep.2012.01.039>
- Brasil (2009) Plano nacional de promoção das cadeias de produtos da sociobiodiversidade. MDA, MMA, MDS, Brasília
- da Silva RRV, Gomes LJ, Albuquerque UP (2014) Methods and techniques for research on the supply chains of biodiversity products. In: Albuquerque UP, Lucena RFP, Cunha LVFC (eds)

- Methods and techniques in ethnobiology and Ethnoecology. Springer Protocols Handbooks, New York, pp 335–347
- da Silva RRV, Gomes LJ, Albuquerque UP (2015) Plant extractivism in light of game theory: a case study in northeastern Brazil. *Ethnobiol Ethnomedicine* 11:1–7. <https://doi.org/10.1186/1746-4269-11-6>
- da Silva RRV, Gomes LJ, Albuquerque UP (2017) What are the socioeconomic implications of the value chain of biodiversity products? A case study in Northeastern Brazil. *Environ Monit Assess* 189:1–11. <https://doi.org/10.1007/s10661-017-5772-2>
- de Jesus NB, Gomes LJ (2012) Conflitos socioambientais no extrativismo da aroeira (*Schinus terebinthifolius raddii*), baixo são francisco – sergipe/alagoas. *Ambient e Soc* 15:55–73. <https://doi.org/10.1590/S1414-753X2012000300005>
- Dean W (1991) A botânica e a política imperial: a introdução e a domesticação de plantas no Brasil. *Rev Estud Históricas* 4:216–228
- Emanuel PL, Shackleton CM, Baxter JS (2005) Modelling the sustainable harvest of *Sclerocarya birrea* subsp. *caffra* fruits in the South African lowveld. *For Ecol Manag* 214:91–103. <https://doi.org/10.1016/j.foreco.2005.03.066>
- Gomes JL, Gomes MAO, Jesus NB (2010) Aspectos socioambientais da atividade extrativista de produtos florestais não-madeireiros: os casos da fava-d’anta (*Dimorphandra* sp.) e da aroeira-da-praia (*Schinus terebinthifolius* Raddi). In: Albuquerque UP HN (ed) *Árvores de valor e o valor das árvores: pontos de conexão*, 1st edn. NUPEEA, Recife, pp 61–106
- Gomes DL, dos Santos Ferreira RP, da Costa Santos EM et al (2020) Local criteria for the selection of wild food plants for consumption and sale: a case study in rural settlements in Alagoas, Brazil. *Ethnobiol Conserv* 10:1–15. <https://doi.org/10.15451/ec2020-04-9.10-1-15>
- Guariguata MR, Cronkleton P, Duchelle AE, Zuidema PA (2017) Revisiting the ‘cornerstone of Amazonian conservation’: a socioecological assessment of Brazil nut exploitation. *Biodivers Conserv* 26:2007–2027. <https://doi.org/10.1007/s10531-017-1355-3>
- Homma AKO (2000) Amazônia: os limites da opção extrativa. *Ciência Hoje* 27:70–73
- IBGE (2018) Produção da extração vegetal e da silvicultura. Instituto Brasileiro de Geografia e Estatística, Rio de Janeiro
- Ingram V, Ndunde LN, Ewane ME (2012) Small scale, high value: *Gnetum africanum* and *buchholzianum* value chains in Cameroon. *Small-scale For* 11:539–556. <https://doi.org/10.1007/s11842-012-9200-8>
- Kinupp VF, Lorenzi H (2014) *Plantas Alimentícias Não Convencionais (PANC) no Brasil*, 1st edn. Instituto Plantarum de Estudos, Nova Odessa
- Medeiros MFT, Albuquerque UP (2014) Food flora in 17th century northeast region of Brazil in *Historia Naturalis Brasiliae*. *J Ethnobiol Ethnomed* 10:1–20. <https://doi.org/10.1186/1746-4269-10-50>
- Murali KS, Shankar U, Shaanker RU et al (1996) Extraction or non-timber forest products in the forests of Biligiri Rangan Hills, India. 6. Fuelwood pressure and management options. *Econ Bot* 52:320–336. <https://doi.org/10.1007/BF02862151>
- Ndangalasi HJ, Bitariho R, Dovie DBK (2007) Harvesting of non-timber forest products and implications for conservation in two montane forests of East Africa. *Biol Conserv* 134:242–250. <https://doi.org/10.1016/j.biocon.2006.06.020>
- Sardeshpande M, Shackleton C (2019) Wild edible fruits: a systematic review of an under-researched multifunctional NTFP (non-timber forest product). *Forests* 10:1–24. <https://doi.org/10.3390/f10060467>
- Steward A (2013) Reconfiguring agrobiodiversity in the Amazon estuary: market integration, the Açaí trade and smallholders’ management practices in Amapá, Brazil. *Hum Ecol* 41:827–840. <https://doi.org/10.1007/s10745-013-9608-6>
- Ticktin T (2004) The ecological implications of harvesting non-timber forest. *J Appl Ecol* 41:11–21. <https://doi.org/10.1111/j.1365-2664.2004.00859.x>
- Tomchinsky B, Ming LC (2019) As plantas comestíveis no Brasil dos séculos XVI e XVII segundo relatos de época. *Rodriguésia* 70:1–16. <https://doi.org/10.1590/2175-7860201970040>

- Trauernicht C, Ticktin T (2005) The effects of non-timber forest product cultivation on the plant community structure and composition of a humid tropical forest in southern Mexico. *For Ecol Manag* 219:269–278. <https://doi.org/10.1016/j.foreco.2005.09.005>
- Williams SJ, Jones JPG, Annewandter R, Gibbons JM (2014) Cultivation can increase harvesting pressure on overexploited plant populations. *Ecol Appl* 24:2050–2062. <https://doi.org/10.1890/13-2264.1>