Wild Food Plant Popularization and Biocultural Conservation: Challenges and Perspectives

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Contents

1	Introduction.....	341
2	Wild Food Plants and Biocultural Conservation.....	342
3	The Other Side: When WFP Consumption and Popularization Do Not Achieve Sustainable Development Goals.....	344
4	Challenges for WFP Biocultural Conservation: The Case of <i>Açaí</i> (<i>Euterpe oleracea</i> Mart).....	346
5	Final Considerations.....	347
	References.....	348

1 Introduction

The world is facing a continuous process of food homogenization and simplification, as only three crops (corn, wheat, and rice) account for 51% of the world's plant food production (FAO 2019). Such a process may lead to nutrient deficiency and excessive energy consumption (Johns and Eyzaguirre 2006).

For this reason, current policies need to focus on the diversification of food systems, and the popularization of wild food plants (WFPs) can be a promising option to achieve this purpose. This group of plants is widely consumed in many rural communities throughout the world and may play a crucial role in providing food security for these populations (Neudeck et al. 2012). Moreover, its dissemination to novel consumers, for example, in urban areas, could have enormous potential to account for many of the Sustainable Development Goals proposed by the United Nations (UN 2015).

First, studies have shown that wild food plants play an important role in meeting people's nutritional needs (Turan et al. 2003; Flyman and Afolayan 2006);

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therefore, their consumption could improve the nutritional quality of diets in urban areas. Second, as they grow spontaneously in anthropic, agricultural, forest, and other environments, WFPs are usually free from conventional agricultural management based on the use of pesticides and fertilizers. This issue is especially important in countries that still strongly rely on unsustainable food production, such as Brazil (Soares and Porto 2009). Finally, the spread of WFP consumption can increase the income of small producers and extractors around the world (Delang 2006), as they are placed near these resources and have knowledge about WFP management techniques.

Several investigations have demonstrated the WFP potential for sustainable harvest (see, e.g., Holm et al. (2008) and Emanuel et al. (2005)) and human well-being (Kusters et al. 2006). However, this expected contribution may prove wrong under some circumstances, especially in contexts of overharvesting and harmful management techniques.

By adopting a biocultural conservation approach, we discuss the main arguments favorable to the maintenance and increase of WFP harvesting, as well as threats to their sustainable use. We present some examples that are specific to WFP use and others that consider the broader concept of non-timber forest products (NTFP). We also examine the case of the Brazilian *açaí* to discuss challenges to WFP popularization.

2 Wild Food Plants and Biocultural Conservation

Ethnobotanical literature has provided arguments favorable to the maintenance of WFP collection practices, especially in forest environments. These arguments are aligned with the concept of biocultural conservation, which has well-established principles and approaches (Gavin et al. 2015). Its central premise is to consider not only biodiversity maintenance but also the whole body of knowledge, practices, and symbols associated with it (Gama et al. 2018).

The most common hypothesis is that WFP (or, in most cases, general NTFP) harvesting by local communities may contribute to forest conservation since its domestic or commercial importance prevents the suppression of forested areas (Ros-Tonen 2000; Lowore 2020). The central idea is that the practical and economic values generated by the extraction of such resources are more relevant than the benefits that could be produced with deforestation and land-use change. Some studies use the term “conservation by commercialization” to refer to this hypothesis (Evans 1993; Lowore 2020). The main challenge related to this hypothesis is how to effectively test it, which is why most studies can only make inferences or provide anecdotal evidence on the subject.

Another source of relevant information concerning the importance of wild food plants comes from domestication studies. Whether dealing with current management strategies or trying to recover domestication paths of cultivated plants, some investigations have suggested that people may either tolerate plants with desirable

characteristics (e.g., edible species) during deforestation, promote them in other areas, or protect them from herbivores, parasites, and competing plants (Casas et al. 1997). This means that the importance of a species for food purposes may contribute to its own maintenance in the environment. However, little is known regarding the protective effect that food use may have on other (more harmful) plant uses (e.g., wood uses).

In this regard, there is evidence of the protective effects of other non-timber forest products. A study developed with medicinal plants in a semiarid area of north-east Brazil has shown that controlling for the species' availability and perceived efficiency, the most popular medicinal plants are less used for wood purposes (Silva et al. 2021). This phenomenon is even stronger for the top five medicinal species. It is possible that the domestic and commercial importance of wild food plants also prevents species from being harvested for wood purposes, but this hypothesis needs to be formally tested. To date, a previously established association between use categories in another community from the Brazilian semiarid region has not found a correlation between the importance for food and wood purposes and that for medicinal and wood purposes (Barbosa et al. 2020). However, this study was not planned to test the protection hypothesis but rather to find associations between use categories and local perceptions of the decline in plant populations (mostly based on multinomial variables from participatory workshops).

An eventual protective effect of food uses on wood uses, together with strategies to achieve the sustainable use of wild food plants, would contribute to the maintenance of WFP populations. Moreover, the continuity of harvesting practices may also have a protective effect on the whole set of forest species, including those with little or no edible importance. This may be the case since studies have suggested that the abandonment of WFP harvesting may negatively affect income generation in local populations, thereby leading to a higher dependence on other forest resources, which is often more harmful to plant populations than the food use itself (Delang 2006).

In addition to the arguments concerning a protective effect of WFP harvesting, these species may play a fundamental role in reducing the vulnerability of social-ecological systems to climate change. This hypothesis is based on evidence that agricultural and livestock practices, especially those related to small-scale agriculture, are being particularly affected by scenarios of climatic uncertainties since small farmers often rely exclusively on rain-fed agriculture (see, e.g., Gbetibouo et al. 2010). Several wild food plants, in turn, typically occur in natural environments, especially native forests, which are far more efficient than agroecosystems in regard to retaining water (Perry 1994). However, as is the case for the previously introduced hypothesis, although some studies make inferences about the potential contribution of wild food plants in contexts of climate change (Gradé 2012), we need to employ proper research designs to test this hypothesis.

Concerning the human dimension, the popular claim that WFP commercialization may be responsible for positive social, financial, and human assets has been proven correct for several social-ecological contexts. By analyzing 61 case studies (15 with food plants/spices), Kusters et al. (2006) found that, for almost all of them,

trade has a positive impact on local livelihoods. The main challenge in this case is to ensure that significant increases in the popularity of certain WFPs also revert to socioeconomic improvements.

Another common argument favorable to the dissemination of WFP knowledge is that it may contribute to the cultural valuation of the societies that possess knowledge about their management and preparation techniques. This may be even more important under certain circumstances, considering that, in several communities, the consumption of WFP is associated with “tribalness,” poverty, and difficult times (Narayanan et al. 2004; Nascimento et al. 2012; Cruz-Garcia and Howard 2013).

3 The Other Side: When WFP Consumption and Popularization Do Not Achieve Sustainable Development Goals

Although WFP harvesting has the potential to conciliate biodiversity conservation, income generation, and human well-being, under several circumstances, overharvesting, together with harmful harvesting patterns, may lead to structural alterations in plant populations (see, e.g., Sinha and Bawa 2002). A study developed in the Brazilian state of Pará showed that chronic anthropogenic disturbance in forest areas could be as (or even more) harmful as deforestation in terms of biodiversity loss (Barlow et al. 2016). Therefore, the naive general notion that NTFP harvesting is always sustainable must be avoided, and proper diagnostics of social-ecological systems need to be conducted to aid sustainable harvesting.

The conciliation between biodiversity conservation and human well-being may not always take place. The previously mentioned investigation of NTFP performed by Kusters et al. (2006) using 61 case studies (15 with food plants/spices) found that, under certain circumstances, higher livelihood outcomes are associated with lower environmental outcomes. The authors also found that the commercial extraction of NTFP may lead to resource depletion, especially in cases of natural areas without further management strategies (e.g., seed propagation, protection of the target species from competitors, etc.).

The obvious conclusion is that WFP harvesting needs to be accompanied by target species management in natural areas to help achieve sustainability, especially in contexts of commercial use. However, a “management dilemma” may occur. On the one hand, management strategies for the target WFP could help maintain its population. On the other hand, when management is intense toward a single (economically important) species, this may lead to the restructuring of the other components of the community (e.g., floristic and functional simplification of natural environments). We will further use the case of *açaí* as an example of this phenomenon. Such dilemmas indicate that finding the best strategy may be more challenging than what is commonly stated in studies with WFP.

Furthermore, population maintenance itself may not always mean that harvesting strategies are sustainable. When species have dual reproductive strategies (clonal and with seeds), intense fruit harvesting may decrease recruitment and cause clonal reproduction to gain importance. Gaoue et al. (2018), for example, found that the proportion of clonal offspring was higher for moderately and heavily harvested populations of *Pentadesma butyracea* Sabine (Clusiaceae) when compared to those in more lightly harvested areas. Although the population is being maintained, the predominance of clonal reproduction may lead to a decrease in genetic diversity and, consequently, affect the population's ability to cope with environmental change.

In terms of the socioeconomic benefits of WFP extraction, a critical constraint has to do with land use and tenure. Data from communities in 24 developing countries concerning wild foods (including animals and mushrooms) showed, for example, that state land is the primary source of income derived from wild food harvesting in forests (Hickey et al. 2016). Therefore, as they are not private lands, local harvesters may face challenges such as competition with “outsiders” for resource collection and a lack of control under the harvesting area, especially when wild foods are gaining in popularity.

Moreover, some researchers have challenged the general idea that WFP harvesting may increase resilience in social-ecological systems and decrease vulnerability to climate change. A study developed in two South African villages, for example, found that, according to local perceptions, wild food availability suffers seasonal variations and decreases with extreme events (Paumgarten et al. 2018). However, the authors also indicated that some specific fruit species are drought-resistant and perceived as essential when coping with extreme events.

Finally, many studies on NTFP have pointed out challenges for commercialization beyond the local level. Belcher and Schreckenberg (2007), for example, discussed that (1) production is often spread, and markets are poorly developed; (2) markets are faddish, and some “fashion” products may gain and then lose space; (3) sustaining supply could be a problem since volumes are typically small; (4) sometimes high technology is needed to benefit certain products; (5) each destination industry has its own marketing requirements, and it may be difficult to meet all of them; (6) certification (e.g., environmental, health, etc.) requires a high level of social organization, as well as technical sophistication, which may be costly and difficult to acquire; and (7) there is a growing concern with intellectual property rights (e.g., how to compensate the holders of local knowledge about a product in case they are not involved in the commercialization).

4 Challenges for WFP Biocultural Conservation: The Case of *Açaí* (*Euterpe oleracea* Mart)

Açaí (*Euterpe oleracea* Mart.) is an outstanding example of how a wild food plant can reach overseas popularity. *Açaí* is a palm species endemic to South America. Brazil is the country that possesses most of the *açaí* populations, and the Brazilian state of Pará is the leading producer in the country. Although the systematic cultivation of *açaí* is increasing, approximately 80% of fruit production comes from its natural ecosystems (Vaz and Nabout 2016), with different management intensities.

Açaí has only recently reached national and international markets. In terms of consumption spread, it began as an indigenous food in pre-Colombian times. It then became a rural staple food, an urban staple food (in regional urban centers), and an urban fashion food (nationally spread) and finally reached the status of an international fashion food (Brondízio et al. 2002). It is currently the most collected NTFP in Brazil (IBGE 2017).

The species' popularization was strongly influenced by mediatization, and it was one of the first examples of how an Internet-based market can help to spread local products on a global scale (Heinrich et al. 2011). The national spread of *açaí* has also been related to the history of Brazilian Jiu-Jitsu and the Gracie clan, a family of practitioners (and the creators) of this sport (Vanni 2018). As Brazilian Jiu-Jitsu became internationally famous, the association between *açaí* consumption and sports practicing also spread outside the country. The species boom in North American markets also had to do with the mention of its claimed nutritional properties in a popular TV program, The Oprah Winfrey Show (Marcason 2009; Heinrich et al. 2011).

As the fruit is highly perishable, it cannot travel significant distances if traded *in natura*. Therefore, frozen fruit pulp has gained market value. Moreover, *açaí* has been popularized in a mixture with guarana syrup as part of a strategy to overcome food neophobia (aversion to eating unknown foods) by adding popular ingredients to novel foods. This mixture leads to a sweet preparation and removes the “earthy, dense, slightly metallic flavor of *açaí*” (Vanni 2018), thereby increasing its acceptance among new audiences.

Such a process raises the first issue in terms of biocultural conservation: a loss of connection between *açaí* and its cultural inheritance and significance. Therefore, the rise of the *açaí* national and international markets did not contribute much to the valuation of local cultural practices, as new consumers hardly know its biocultural origins (e.g., that it is traditionally consumed with tapioca flour and fish (Oliveira and Schwartz 2018)).

Açaí is also not the best example of how WFP popularization may contribute to sustainable development goals. Current management systems are located at some point between wild gathering and systematic cultivation. Several studies have found that species management intensification has had negative impacts on Amazonian floodplain ecosystems. The studies have suggested, for example, that management practices (e.g., *açaí* planting in natural environments, the suppression of competing

species, and stem cutting to increase fruit production) are converting native flood-plain forests into *açaí*-dominated forests that are quite similar to systematic plantations (Weinstein and Moegenburg 2012). Specific processes include the loss of species diversity, as well as functional and phylogenetic diversity (Freitas et al. 2015; Freitas 2019).

In terms of local livelihoods, *açaí* harvesting intensification has given local dwellers (known as *ribeirinhos*) access to the market economy and increased penetration in the urban-industrial society. Local communities in the state of Pará, for example, have experienced several changes in their livelihoods as a response to the increased market interest in *açaí*. The amplification of their economic gains has led to significant changes in their house and boat structures, thereby making them more modern (Silva 2019).

Although this process has had several positive outcomes, especially regarding poverty reduction, there have been some negative consequences of *açaí* popularization on local livelihoods. Remarkably, the commercialization of a product whose main marketing argument has to do with health claims has led to unhealthier eating behaviors in some contexts. As the *açaí* economy became predominant in several local communities, people abandoned or reduced the cultivation of vegetables that were once important for their subsistence (Silva 2019). Instead, they use their increased economic power to buy industrialized products, which can have negative implications in terms of food and nutrition security and sovereignty.

5 Final Considerations

The different and sometimes contrasting views of whether WFP harvesting can help to achieve sustainable development goals indicate that success and failures are context-dependent. Therefore, the outcomes may be influenced by a set of variables (e.g., natural stocks, biological profile of the target species, ecosystem characteristics, management practices, demand and market dynamics, characteristics of the value chains, land tenure, social organization, public policies). All these factors need to be deeply studied and considered to diagnose whether popularization strategies toward certain WFPs are welcome.

Additionally, to better understand the social-ecological role of WFP, the central hypothesis related to the benefits of these species needs to be addressed with proper research designs. Such analysis would help to strengthen arguments favorable to WFP harvesting or even point out which ways not to pursue.

Finally, most of the concerns regarding WFP popularization have to do with the eventual incorporation of these species into conventional (and unsustainable) agri-food systems, which, in some cases, may have negative environmental, cultural, or socioeconomic outputs. Therefore, we believe that attempts to popularize WFP may not be unrelated to strategies for changing our relationship with food, agriculture, and consumption in ways that help us search for ecological-based alternatives and socially just food economies.

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