Bioeconomy and local value-chain development as a hedge against deforestation in Brazil's Cerrado

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Brazil's Cerrado is South America's second-largest biome after the Amazon, an expanse of savanna, grass and woodlands that has been historically undervalued. It suffered continuous clearing for pasture and monoculture expansion, and by the late 2010s it had lost about half of its original coverage (Rausch et al., 2019; see Figure 1). However, the Cerrado is a global biodiversity hotspot – the world's most biodiverse savannah – and plays vital hydrological functions, besides being home to numerous local communities and traditional cultures (Strassburg et al., 2017; Russo Lopes et al., 2021). In the past, neglect for those actors fueled misconceptions about the Cerrado as a vacant wasteland (see Bastos Lima and Kmoch, 2021), but such communities increasingly have shown that local value-chain development – along with forms of convivial conservation – can both address poverty and form a powerful hedge against unsustainable land-use change.

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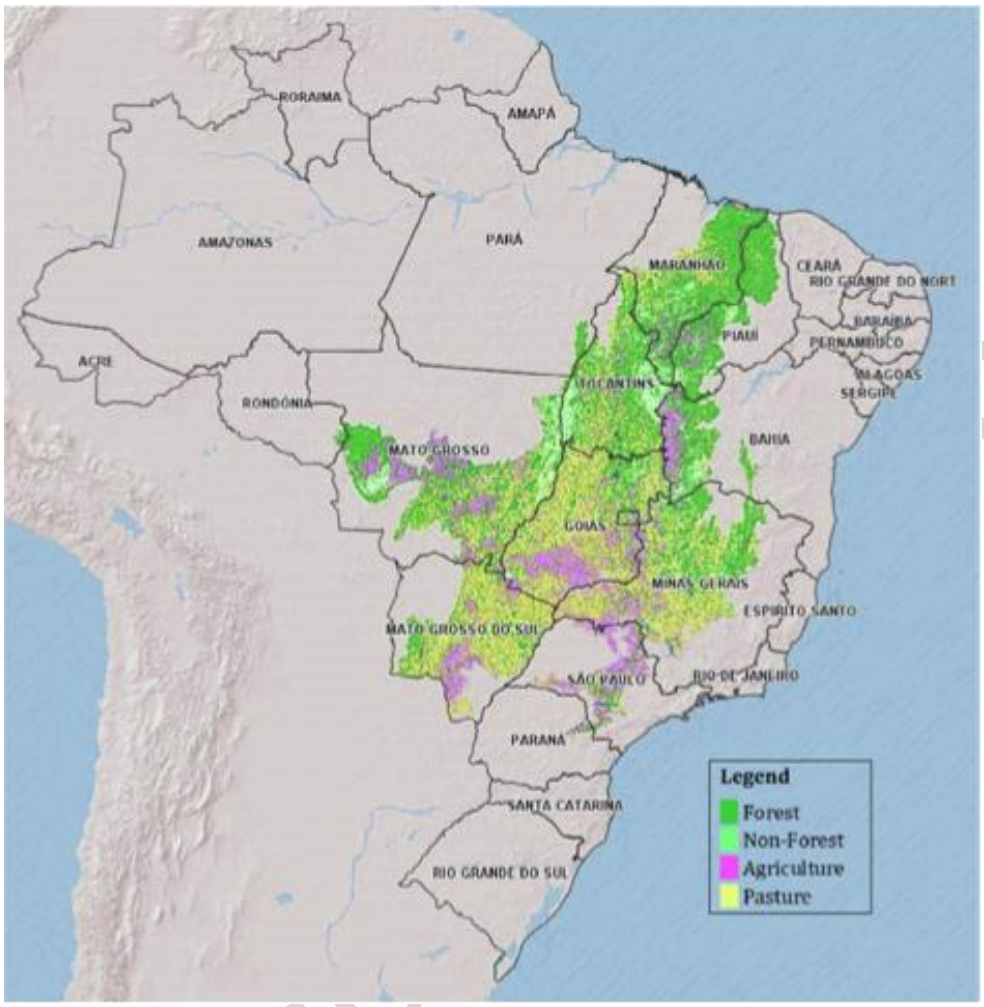

Figure 1. Brazil's Cerrado ecosystem and its key land uses. Various forms of native vegetation are here aggregated as "forest", whereas "agriculture" corresponds mostly to rotated soy and corn monocultures. (Source: Russo Lopes et al., 2021)

Many Cerrado communities have resisted being driven off the land by coalescing around so-called sociobiodiversity chains (*cadeias da sociobiodiversidade*). These are agricultural or non-timber forest product (NTFP) value chains. They are built to recognize and valorize not only the local biodiversity but also ethnic and cultural diversity, social identities linked to particular territories, and the extensive traditional knowledge around native products. As local development enhances the economic viability of their livelihoods, those communities stay on the land and help with the survival of the Cerrado biome along with their own cultural maintenance. Such local communities, alongside civil society organizations, have long sought

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to promote biodiversity-based local value chains. Such efforts gained special momentum through Brazil's National Plan for the Promotion of Sociobiodiversity-Chain Products (*Plano Nacional de Promoção das Cadeias de Produtos da Sociobiodiversidade*), launched in 2009 by the Ministry of Agrarian Development. It weaved together several incentives in the forms of agricultural technical assistance, research and development tuned to smallholder needs, dedicated credit lines at public banks, and support for accessing institutional markets (e.g., school meals, public hospitals). That program has led to numerous success stories as well as the recognition of persistent challenges and lessons learnt over the years. Recently, under a bioeconomy umbrella, such efforts to promote sustainable development based on conserving rather than replacing native vegetation have then gained additional momentum (Abramovay and Ferreira, 2021; Bastos Lima, 2022).

Numerous native products have served as focus of value-chain development efforts. They include staple food crops such as cassava as well as others harvested mostly for market value. The latter group includes baru nut (*Dypterix alata*) and babaçu (*Attalea spp.*), which are native nut types, and typical Cerrado fruits such as bacupari (*Garcinia gardneriana*), murici (*Byrsonima crassifolia*), mangaba (*Hancornia speciosa*), pequi (*Caryocar brasiliense*), turu palm fruit or bacaba (*Oenocarpus bacaba*), moriche palm fruit or buriti (*Mauritia flexuosa*) among others. Various fruits are often used for making frozen organic fruit pulp, which Brazilian consumers regularly utilize. Beyond that, the idea is to emulate the success of certain Amazonian goods such as Brazil nut or açaí palm fruit, now established with large market value and which have helped promote local economic development through standing forests. There is a growing understanding that, while most bioeconomy efforts have historically focused on biofuels and other forms of bioenergy, communities may earn and benefit substantially more by adding value to local products as foods or for the cosmetics industry (Bastos Lima, 2022).

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Baru nut, for example, has long been artisanally used by local communities as a fruit and for handicrafts. However, the coveted hardwood of its tree rapidly threatened the species. The counterforce to that has been the sustainable utilization of its nuts, with increasing value-added by producing vegetable oil, vegan butter, and a protein-rich flour from its crushed nut turned into meal (Carrazza and Ávila, 2010; see Figure 2). Baru meal has been used, for instance, to nutritionally enrich ice cream in Brazil, helping promote food security and the economic viability of local livelihoods (Pinho et al., 2015).

Figure 2. The native baru nut (*Dypterix alata*) being harvested in Brazil's Cerrado and increasingly used as a source of income for local communities. (Photo credit: Instituto Sociedade, População e Natureza).

Simpler forms of value-added that have lower technological (and thus financial) requirements also remain useful, such as to produce dehydrated fruit. Figure 3 shows the use of buriti, now processed and sold both in dehydrated form and as frozen pulp by multiple rural

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communities in the Cerrado. Meanwhile, higher-value goods have also surfaced. They include the Cerrado's native variety of vanilla (*Vanila edwalli*), increasingly sought by chefs in Brazil's high-end restaurants (Garcia et al., 2022); and cumaru (*Dypterix odorata*), a native bean utilized for its aromatic properties in the cosmetics industry that offers significant returns (Benevides Júnior et al., 2020).

Figure 3. Preserving and adding value to moriche palm fruit (*Mauritia flexuosa*), known in Brazil by its indigenous name buriti. Local communities in the Cerrado have helped conserve the species while diversifying and improving their income through local value addition. Dehydrated or frozen fruit pulp

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have been ways to add value while having supplies year-round, not just in season. (Photo credit: Instituto Sociedade, População e Natureza).

From a sustainable development viewpoint, two concepts are key for understanding the importance of such sociobiodiversity chains. The first one is that of bio-based value webs, instead of single-product value chains, as the same product can enter several distinct pathways to meet demands of different downstream markets (Scheiterle et al., 2018; Bastos Lima, 2021). That framing allows for conceiving – and planning for – multiple goods and benefits coming out of one species or product. Many market avenues can exist alongside local uses for livelihood maintenance and biodiversity conservation.

The second concept is that of biorefinery, which suggests industrially processing (i.e., refining) biomass to extract and separate its various compounds. Besides *in natura* products that obtain good market value (e.g., the Cerrado's vanilla) or cases of simple mechanical processing (e.g., as with baru nut), biotechnology and adequate capacity enhancement can allow these native products to underpin increasingly advanced bioeconomy developments. That can include bio-based substitutes for goods today made primarily from oil, such as solvents or lubricants, and they may also produce low-volume high-value chemicals for the food and pharmaceutical industries (Langeveld et al., 2010). Biorefineries thus present an enormous potential to renew the industrial base – moving away from fossil resources and towards biological ones – while creating more development opportunities.

For these socio-economic benefits to be accrued, there is a need for a just transition towards an inclusive and biodiverse bioeconomy (see Bastos Lima, 2022). Such sociobiodiversity chains offer a clear pathway forward, but they still have challenges to overcome. For one, smallholders in the Cerrado and elsewhere typically lack legal expertise or formal managerial and accounting skills that may be critical for agri-entrepreneurship. Guéneau et al. (2020) reveal that lack of sufficient support to local communities on that,

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alongside excessive dependence on government purchases for institutional markets, still leave Brazilian rural communities only with informal or semi-formal supply arrangements and vulnerable to political changes that may dismantle public support policies and leave them unable to continue on their own (Niederle et al., 2022). Much in terms of business capacity enhancement remains needed, particularly for local value-added, which often ends up captured by intermediaries or private companies not linked to the communities.

As the Cerrado continues to be gradually deforested for pastures and plantations that also drive people off the land, such sociobiodiversity value chains offer a potent way forward. They represent the hope of changing the Cerrado's fate for the better in socially inclusive ways through genuine sustainable development. The world's most-biodiverse savanna offers plenty of resources for that, while its communities have their cultures embedded to the land that can help develop it sustainably. How to scale up these efforts and overcome persistent challenges – such as local technological and financial gaps for value addition or improved market access – remain key questions, but experience to date points to a way ahead. As the bioeconomy becomes an increasingly set paradigm, the opportunity that the Cerrado's sociobiodiversity value chains provide become an imperative for Brazil and may offer inspiration also for other developing regions of the world. Unsustainable practices may be, after all, best fought through sustainable development promotion for these critical landscapes.

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